Specifications for

Columbus County 911 Center

Whiteville, North Carolina

April 12, 2024

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Project No.
22001

Project Manual

including

Contract Documents & Specifications

for the Construction of

COLUMBUS COUNTY 911 CENTER

WHITEVILLE, NORTH CAROLINA

PREPARED BY:

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FOR

COLUMBUS COUTY 911 CENTER

WHITEVILLE, NORTH CAROLINA

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INVITATION TO BIDS

BIDS for the renovations of the Columbus County 911 Center, will be received by the Owner until 2:00PM on Wednesday May 15, 2024 and then opened and publicly read.

The CONTRACT DOCUMENTS may be obtained from Architects website, www.coastalarchitecture.net or purchased from the Architect for a sum of $300.00 each per set.

The Owner reserves the unqualified right to reject any and/or all bids.

Bids will be received at:

The Columbus County Admin Building
127 W. Webster Street
3rd Floor Commissioners Chambers
Whiteville, NC

A **5% Bid Bond will be required**, and a **100% Performance and Payment Bond will be required as** part of the bid.

There will be a pre-bid meeting on site on Thursday May 2, 2024, at 11:00AM.
All bidders are encouraged to attend.

SINGLE PRIME
FORM OF PROPOSAL FOR:

Date: _____
Bid: **Single Prime**
Contractor: _____
License #: _____
Addenda Received: _____

Renovations to
Columbus County 911 Center
Whiteville, NC

Indicate your firm's name and date by filling in the above blanks and note the same items on your Proposal envelope or email transmittal.

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

The Bidder further declares that he has examined the site of the work and informed himself fully in regard to all conditions pertaining to the place where the work is to be done; that he has examined the Plans for the work and the Contract Documents relative thereto, and has read all special provisions furnished prior to the opening of bids; that he has satisfied himself relative to the work to be performed. The Bidder proposes and agrees if this Proposal is accepted to contract with the Owner in the form of agreed upon Contract , to furnish all necessary materials, equipment, machinery, tools, apparatus, means of transportation and labor necessary to complete the construction of this project as defined in these Contract Documents, in full and in complete accordance with the plans of the Owner and the Architect/Engineer, with a definite understanding that no money will be allowed for extra work except as desired and approved by the owner in advance and Contract Documents for the sum of:

Base Bid **SINGLE PRIME CONTRACT:**

_____ Dollars $_____
(written amount) (number amount)

The Bidder further proposes and agrees hereby to commence work under his Contract on a date to be specified in a written order of the Architect/Engineer and shall fully complete all work within 365 consecutive calendar days from the notice to proceed. Applicable liquidated damages shall be as stated in Supplementary General Conditions.

Respectfully submitted this _____ day of _____, 2024.

WITNESS:

_____
Name of Firm or Corporation making Bid)

By: _____

_____
(Proprietorship or Partnership)

Title: _____
(Owner, Partner, or Corporate President or Vice President only)

ATTEST:

Address: _____

By: _____

Title: _____ License No.: _____
(Corporate Secretary or Assistant Secretary only)

(Corporate Seal)

Addenda Received and Used in Computing Bids: (Initial as Appropriate)

Addendum No.1 _____

Addendum No.2 _____

Addendum No.3 _____

Addendum No.4 _____

End of Proposal Form

Identification of HUB Certified/ Minority Business Participation

I,_____,
(Name of Bidder)
do hereby certify that on this project, we will use the following HUB Certified/ minority business as construction subcontractors, vendors, suppliers or providers of professional services.

Firm Name, Address and Phone #	Work Type	*Minority Category	**HUB Certified (Y/N)

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

**** HUB Certification with the state HUB Office required to be counted toward state participation goals.**

The total value of minority business contracting will be ($)_____.

State of North Carolina AFFIDAVIT A – Listing of Good Faith Efforts

County of _____

(Name of Bidder)

Affidavit of_____

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

Bidders must earn at least 50 points from the good faith efforts listed for their bid to be considered responsive. (1 NC Administrative Code 30 I.0101)

- ❑ **1 – (10 pts)** Contacted minority businesses that reasonably could have been expected to submit a quote and that were known to the contractor, or available on State or local government maintained lists, at least 10 days before the bid date and notified them of the nature and scope of the work to be performed.
- ❑ **2 --(10 pts)** Made the construction plans, specifications and requirements available for review by prospective minority businesses, or providing these documents to them at least 10 days before the bids are due.
- ❑ **3** – **(15 pts)** Broken down or combined elements of work into economically feasible units to facilitate minority participation.
- ❑ **4 – (10 pts)** Worked with minority trade, community, or contractor organizations identified by the Office of Historically Underutilized Businesses and included in the bid documents that provide assistance in recruitment of minority businesses.
- ❑ **5** – **(10 pts)** Attended prebid meetings scheduled by the public owner.
- ❑ **6** – **(20 pts)** Provided assistance in getting required bonding or insurance or provided alternatives to bonding or insurance for subcontractors.
- ❑ **7 – (15 pts)** Negotiated in good faith with interested minority businesses and did not reject them as unqualified without sound reasons based on their capabilities. Any rejection of a minority business based on lack of qualification should have the reasons documented in writing.
- ❑ **8** – **(25 pts)** Provided assistance to an otherwise qualified minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letters of credit, including waiving credit that is ordinarily required. Assisted minority businesses in obtaining the same unit pricing with the bidder's suppliers in order to help minority businesses in establishing credit.
- ❑ **9** – **(20 pts)** Negotiated joint venture and partnership arrangements with minority businesses in order to increase opportunities for minority business participation on a public construction or repair project when possible.
- ❑ **10** - **(20 pts)** Provided quick pay agreements and policies to enable minority contractors and suppliers to meet cash-flow demands.

The undersigned, if apparent low bidder, will enter into a formal agreement with the firms listed in the Identification of Minority Business Participation schedule conditional upon scope of contract to be executed with the Owner. Substitution of contractors must be in accordance with GS143-128.2(d) Failure to abide by this statutory provision will constitute a breach of the contract.

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

Date:_____ Name of Authorized Officer:_____

Signature:_____

Title:_____

SEAL

State of_____, County of_____

Subscribed and sworn to before me this _____day of _____20____

Notary Public_____

My commission expires _____

State of North Carolina --AFFIDAVIT B-- Intent to Perform Contract with Own Workforce.

County of _____

Affidavit of _____
(Name of Bidder)

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

_____ contract.
(Name of Project)

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

The Bidder agrees to provide any additional information or documentation requested by the owner in support of the above statement. The Bidder agrees to make a Good Faith Effort to utilize minority suppliers where possible.

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

Date: _____ Name of Authorized Officer: _____

Signature: _____

Title: _____

SEAL

State of _____, County of _____

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

Notary Public _____

My commission expires _____

Do not submit with bid Do not submit with bid Do not submit with bid Do not submit with bid

State of North Carolina - AFFIDAVIT C - Portion of the Work to be Performed by HUB Certified/Minority Businesses

County of _____

(Note this form is to be submitted only by the apparent lowest responsible, responsive bidder.)

If the portion of the work to be executed by HUB certified/minority businesses as defined in GS143-128.2(g) and 128.4(a),(b),(e) is equal to or greater than 10% of the bidders total contract price, then the bidder must complete this affidavit.
This affidavit shall be provided by the apparent lowest responsible, responsive bidder within **72 hours** after notification of being low bidder.

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

_____
(Project Name)

Project ID#_____ Amount of Bid $_____

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

Name and Phone Number	*Minority Category	**HUB Certified Y/N	Work Description	Dollar Value

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

**** HUB Certification with the state HUB Office required to be counted toward state participation goals.**

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

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

Date:_____ Name of Authorized Officer:_____

SEAL

Signature:_____

Title:_____

State of _____, County of _____
Subscribed and sworn to before me this _____day of _____20____
Notary Public_____
My commission expires_____

State of North Carolina AFFIDAVIT D – Good Faith Efforts

County of _____

(Note this form is to be submitted only by the apparent lowest responsible, responsive bidder.)

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

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

_____
(Project Name)

Project ID#_____ Amount of Bid $_____

I will expend a minimum of _____% of the total dollar amount of the contract with HUB certified/ minority business enterprises. Minority businesses will be employed as construction subcontractors, vendors, suppliers or providers of professional services. Such work will be subcontracted to the following firms listed below. (Attach additional sheets if required)

Name and Phone Number	*Minority Category	**HUB Certified Y/N	Work Description	Dollar Value

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

****** HUB Certification with the state HUB Office required to be counted toward state participation goals.**

Examples of documentation that may be required to demonstrate the Bidder's good faith efforts to meet the goals set forth in these provisions include, but are not necessarily limited to, the following:

A. Copies of solicitations for quotes to at least three (3) minority business firms from the source list provided by the State for each subcontract to be let under this contract (if 3 or more firms are shown on the source list). Each solicitation shall contain a specific description of the work to be subcontracted, location where bid documents can be reviewed, representative of the Prime Bidder to contact, and location, date and time when quotes must be received.

B. Copies of quotes or responses received from each firm responding to the solicitation.

C. A telephone log of follow-up calls to each firm sent a solicitation.

D. For subcontracts where a minority business firm is not considered the lowest responsible sub-bidder, copies of quotes received from all firms submitting quotes for that particular subcontract.

E. Documentation of any contacts or correspondence to minority business, community, or contractor organizations in an attempt to meet the goal.

F. Copy of pre-bid roster

G. Letter documenting efforts to provide assistance in obtaining required bonding or insurance for minority business.

H. Letter detailing reasons for rejection of minority business due to lack of qualification.

I. Letter documenting proposed assistance offered to minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letter of credit, including waiving credit that is ordinarily required.

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

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

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

Date:_____ Name of Authorized Officer:_____

Signature:_____

Title:_____

SEAL

State of _____, County of _____

Subscribed and sworn to before me this _____day of _____20____

Notary Public_____

My commission expires _____

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

In accordance with G.S. 143-128.2 (effective January 1, 2002) these guidelines establish goals for minority participation in single-prime bidding, separate-prime bidding, construction manager at risk, and alternative contracting methods, on State construction projects in the amount of $300,000 or more. The legislation provides that the State shall have a verifiable ten percent (10%) goal for participation by minority businesses in the total value of work for each project for which a contract or contracts are awarded. These requirements are published to accomplish that end.

SECTION A: INTENT

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

SECTION B: DEFINITIONS

1. Minority - a person who is a citizen or lawful permanent resident of the United States and who is:
   a. Black, that is, a person having origins in any of the black racial groups in Africa;
   b. Hispanic, that is, a person of Spanish or Portuguese culture with origins in Mexico, South or Central America, or the Caribbean Islands, regardless of race;
   c. Asian American, that is, a person having origins in any of the original peoples of the Far East, Southeast Asia and Asia, the Indian subcontinent, the Pacific Islands;
   d. American Indian, that is, a person having origins in any of the original peoples of North America; or
   e. Female

2. Minority Business - means a business:
   a. In which at least fifty-one percent (51%) is owned by one or more minority persons, or in the case of a corporation, in which at least fifty-one percent (51%) of the stock is owned by one or more minority persons or socially and economically disadvantaged individuals; and
   b. Of which the management and daily business operations are controlled by one or more of the minority persons or socially and economically disadvantaged individuals who own it.

3. Socially and economically disadvantaged individual - means the same as defined in 15 U.S.C. 637. "Socially disadvantaged individuals are those who have been subjected to racial or ethnic prejudice or cultural bias because of their identity as a member of a group without regard to their individual qualities". "Economically disadvantaged individuals are those socially disadvantaged individuals whose ability to compete in the free enterprise system has been impaired due to diminished capital and credit opportunities as compared to others in the same business area who are not socially disadvantaged".

4. Public Entity - means State and all public subdivisions and local governmental units.

5. Owner - The State of North Carolina, through the Agency/Institution named in the contract.

6. Designer – Any person, firm, partnership, or corporation, which has contracted with the State of North Carolina to perform architectural or engineering, work.

7. Bidder - Any person, firm, partnership, corporation, association, or joint venture seeking to be awarded a public contract or subcontract.

8. Contract - A mutually binding legal relationship or any modification thereof obligating the seller to furnish equipment, materials or services, including construction, and obligating the buyer to pay for them.

9. Contractor - Any person, firm, partnership, corporation, association, or joint venture which has contracted with the State of North Carolina to perform construction work or repair.

10. Subcontractor - A firm under contract with the prime contractor or construction manager at risk for supplying materials or labor and materials and/or installation. The subcontractor may or may not provide materials in his subcontract.

SECTION C: RESPONSIBILITIES

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

   The HUB Office has established a program, which allows interested persons or businesses qualifying as a minority business under G.S. 143-128.2, to obtain certification in the State of North Carolina procurement system. The information provided by the minority businesses will be used by the HUB Office to:
   a. Identify those areas of work for which there are minority businesses, as requested.
   b. Make available to interested parties a list of prospective minority business contractors and subcontractors.
   c. Assist in the determination of technical assistance needed by minority business contractors.

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

2. State Construction Office
   The State Construction Office will be responsible for the following:

   a. Furnish to the HUB Office a minimum of twenty-one days prior to the bid opening the following:
      (1) Project description and location;
      (2) Locations where bidding documents may be reviewed;
      (3) Name of a representative of the owner who can be contacted during the advertising period to advise who the prospective bidders are;
      (4) Date, time and location of the bid opening.
      (5) Date, time and location of prebid conference, if scheduled.

   b. Attending scheduled prebid conference, if necessary, to clarify requirements of the general statutes regarding minority-business participation, including the bidders' responsibilities.

c. Reviewing the apparent low bidders' statutory compliance with the requirements listed in the proposal, that must be complied with, if the bid is to be considered as responsive, prior to award of contracts. The State reserves the right to reject any or all bids and to waive informalities.
d. Reviewing of minority business requirements at Preconstruction conference**.**
e. Monitoring of contractors' compliance with minority business requirements in the contract documents during construction.
f. Provide statistical data and required reports to the HUB Office.
g. Resolve any protest and disputes arising after implementation of the plan, in conjunction with the HUB Office.

3. Owner
Before awarding a contract, owner shall do the following:

a. Develop and implement a minority business participation outreach plan to identify minority businesses that can perform public building projects and to implement outreach efforts to encourage minority business participation in these projects to include education, recruitment, and interaction between minority businesses and non-minority businesses.
b. Attend the scheduled prebid conference.
c. At least 10 days prior to the scheduled day of bid opening, notify minority businesses that have requested notices from the public entity for public construction or repair work and minority businesses that otherwise indicated to the Office for Historically Underutilized Businesses an interest in the type of work being bid or the potential contracting opportunities listed in the proposal. The notification shall include the following:
    1. A description of the work for which the bid is being solicited.
    2. The date, time, and location where bids are to be submitted.
    3. The name of the individual within the owner's organization who will be available to answer questions about the project.
    4. Where bid documents may be reviewed.
    5. Any special requirements that may exist.
d. Utilize other media, as appropriate, likely to inform potential minority businesses of the bid being sought.
e. Maintain documentation of any contacts, correspondence, or conversation with minority business firms made in an attempt to meet the goals.
f. Review, jointly with the designer, all requirements of G.S. 143-128.2(c) and G.S. 143-128.2(f) – (i.e. bidders' proposals for identification of the minority businesses that will be utilized with corresponding total dollar value of the bid and affidavit listing good faith efforts, or affidavit of self-performance of work, if the contractor will perform work under contract by its own workforce) - prior to recommendation of award to the State Construction Office.
g. Evaluate documentation to determine good faith effort has been achieved for minority business utilization prior to recommendation of award to State Construction Office.
h. Review prime contractors' pay applications for compliance with minority business utilization commitments prior to payment**.**
i. Make documentation showing evidence of implementation of Owner's responsibilities available for review by State Construction Office and HUB Office, upon request

4. Designer
Under the single-prime bidding, separate prime bidding, construction manager at risk, or alternative contracting method, the designer will:

a. Attend the scheduled prebid conference to explain minority business requirements to the prospective bidders.
b. Assist the owner to identify and notify prospective minority business prime and subcontractors of potential contracting opportunities.
c. Maintain documentation of any contacts, correspondence, or conversation with minority business firms made in an attempt to meet the goals.
d. Review jointly with the owner, all requirements of G.S. 143-128.2(c) and G.S.143-128.2(f) – (i.e. bidders' proposals for identification of the minority businesses that will be utilized with

corresponding total dollar value of the bid and affidavit listing Good Faith Efforts, or affidavit of self-performance of work, if the contractor will perform work under contract by its own workforce) - prior to recommendation of award.

e. During construction phase of the project, review "MBE Documentation for Contract Payment" – (Appendix E) for compliance with minority business utilization commitments. Submit Appendix E form with monthly pay applications to the owner and forward copies to the State Construction Office.
f. Make documentation showing evidence of implementation of Designer's responsibilities available for review by State Construction Office and HUB Office, upon request.

5. Prime Contractor(s), CM at Risk, and Its First-Tier Subcontractors
Under the single-prime bidding, the separate-prime biding, construction manager at risk and alternative contracting methods, contractor(s) will:

a. Attend the scheduled prebid conference.
b. Identify or determine those work areas of a subcontract where minority businesses may have an interest in performing subcontract work.
c. At least ten (10) days prior to the scheduled day of bid opening, notify minority businesses of potential subcontracting opportunities listed in the proposal. The notification will include the following:
   (1) A description of the work for which the subbid is being solicited.
   (2) The date, time and location where subbids are to be submitted.
   (3) The name of the individual within the company who will be available to answer questions about the project.
   (4) Where bid documents may be reviewed.
   (5) Any special requirements that may exist, such as insurance, licenses, bonds and financial arrangements.

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

k. If during the construction of a project additional subcontracting opportunities become available, make a good faith effort to solicit subbids from minority businesses.
l. It is the intent of these requirements apply to all contractors performing as prime contractor and first tier subcontractor under construction manager at risk on state projects.

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

SECTION 4: DISPUTE PROCEDURES
It is the policy of this state that disputes that involves a person's rights, duties or privileges, should be settled through informal procedures. To that end, minority business disputes arising under these guidelines should be resolved as governed under G.S. 143-128(g).

SECTION 5: These guidelines shall apply upon promulgation on state construction projects. Copies of these guidelines may be obtained from the Department of Administration, State Construction Office, (physical address) 301 North Wilmington Street, Suite 450, NC Education Building, Raleigh, North Carolina, 27601-2827, (mail address) 1307 Mail Service Center, Raleigh, North Carolina, 27699-1307, phone (919) 807-4100, Website: www.nc-sco.com

SECTION 6: In addition to these guidelines, there will be issued with each construction bid package provisions for contractual compliance providing minority business participation in the state construction program.

MINORITY BUSINESS CONTRACT PROVISIONS (CONSTRUCTION)

APPLICATION:

The **Guidelines for Recruitment and Selection of Minority Businesses for Participation in State Construction Contracts** are hereby made a part of these contract documents. These guidelines shall apply to all contractors regardless of ownership. Copies of these guidelines may be obtained from the Department of Administration, State Construction Office, (physical address) 301 North Wilmington Street, Suite 450, NC Education Building, Raleigh, North Carolina, 27601-2827, (mail address) 1307 Mail Service Center, Raleigh, North Carolina, 27699-1307, phone (919) 807-4100, Website: http://www.nc-sco.com

MINORITY BUSINESS SUBCONTRACT GOALS:

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

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

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

OR

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

OR

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

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

MINIMUM COMPLIANCE REQUIREMENTS:

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

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

(1) Contacting minority businesses that reasonably could have been expected to submit a quote and that were known to the contractor or available on State or local government maintained lists at least 10 days before the bid or proposal date and notifying them of the nature and scope of the work to be performed.

(2) Making the construction plans, specifications and requirements available for review by prospective minority businesses, or providing these documents to them at least 10 days before the bid or proposals are due.

(3) Breaking down or combining elements of work into economically feasible units to facilitate minority participation.

(4) Working with minority trade, community, or contractor organizations identified by the Office for Historically Underutilized Businesses and included in the bid documents that provide assistance in recruitment of minority businesses.

(5) Attending any prebid meetings scheduled by the public owner.

(6) Providing assistance in getting required bonding or insurance or providing alternatives to bonding or insurance for subcontractors.

(7) Negotiating in good faith with interested minority businesses and not rejecting them as unqualified without sound reasons based on their capabilities. Any rejection of a minority business based on lack of qualification should have the reasons documented in writing.

(8) Providing assistance to an otherwise qualified minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letters of credit, including waiving credit that is ordinarily required. Assisting minority businesses in obtaining the same unit pricing with the bidder's suppliers in order to help minority businesses in establishing credit.

(9) Negotiating joint venture and partnership arrangements with minority businesses in order to increase opportunities for minority business participation on a public construction or repair project when possible.

(10) Providing quick pay agreements and policies to enable minority contractors and suppliers to meet cash-flow demands.

APPENDIX E

MBE DOCUMENTATION FOR CONTRACT PAYMENTS

Prime Contractor/Architect: _____

Address & Phone: _____

Project Name: _____

Pay Application #: _____ Period: _____

The following is a list of payments made to Minority Business Enterprises on this project for the above-mentioned period.

MBE FIRM NAME	* INDICATE TYPE OF MBE	AMOUNT PAID THIS MONTH	TOTAL PAYMENTS TO DATE	TOTAL AMOUNT COMMITTED

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

Date: _____ Approved/Certified By: _____
Name

_____
Title

_____
Signature

SUBMIT WITH EACH PAY REQUEST & FINAL PAYMENT

(Revised on 3/14/2003)

APPENDIX E

MBE DOCUMENTATION FOR CONTRACT PAYMENTS

Prime Contractor/Architect: _____

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Date: _____ Approved/Certified By: _____
Name

_____
Title

_____
Signature

SUBMIT WITH EACH PAY REQUEST & FINAL PAYMENT

(Revised on 3/14/2003)

GENERAL CONDITIONS

AIA Document A201 – 2017 – General Conditions of the Contract for Construction is referenced in these contract documents and is to be part of this contract.

This document can be obtained by contacting:

AIA North Carolina
115 West Morgan Street
Raleigh, North Carolina 27601
919-833-6656 phone
919-833-2015 fax order line

STANDARD FORM OF AGREEMENT

AIA Document A101 – 2017 – Standard Form of Agreement Between Owner and Contractor *where the basis of* payment is a Stipulated Sum Price is referenced in these contract documents and is to be part of this contract.

This document can be obtained by contacting:

AIA North Carolina
115 West Morgan Street
Raleigh, North Carolina 27601
919-833-6656 phone
919-833-2015 fax order line

SECTION 00800 - SUPPLEMENTARY GENERAL CONDITIONS AND GENERAL REQUIREMENTS

SUPPLEMENTS TO AIA DOCUMENT A-201: 2017 Edition

The following supplements modify, delete from or add to the "General Conditions of the Contract for Construction", AIA Document A-201, 2007. Where any Article of the General Conditions is modified or any Paragraph, Subparagraph or Clause thereof is modified or deleted by these Supplementary Conditions, the unaltered provisions of that Article, Paragraph, Subparagraph or Clause shall remain in effect. If in the event any articles of the Construction Contract are in direct conflict with Articles of the General Conditions, the Contract shall override for that portion that may be in conflict.

ARTICLE 1:

Add the following definitions:

- ”Product” includes materials, systems, and equipment.
- "Provide" shall mean furnish and install complete in place, operational and ready for use.
- “Building Code” and “Code” refer to regulations of governmental agencies having jurisdiction
- "Or approved equal" and "equal to" shall mean substitute products by manufacturers other than those specified in the project manual, addenda, and on the drawings and which may be incorporated in the work after review and concurrence by the designer and the Owner.
- “Approved”, “required”, and “as directed” refer to and indicate the work or materials that may be approved, required or directed by the Architect acting as the agent for the “Owner
- "Indicated" and "shown" shall mean as detailed, or called for and reasonably implied in the contract documents.
- "Latest edition" shall mean the current printed document issued up to 30 calendar days prior to date of receipt of bids, unless specified otherwise.
- "Drawings" or "plans" mean the drawings enumerated in the contract documents, as well as all the information in the detail manual when applicable, addenda, and designer prepared field drawings and clarification drawings.
- "Specifications" mean this project manual and addenda thereto.
- “Similar” means in its general sense and not necessarily identical.
- “Shown”, “indicated”, “detailed”, “noted”, “scheduled” and terms of similar import, refer to the requirements contained in the Contract Documents.

ARTICLE 2:

2.2.5 Add: Drawings and Specification furnished to contractors:

Final Plans, Specifications and any Addendum will be posted on the Architect’s website.

ARTICLE 3:

3.1.1 Add: The General Contractor shall be the “Project Expediter” and shall be responsible for proper coordination of all work.

3.12.11 Add: Product Data, and Samples - Each contractor shall submit electronic copies of all shop drawings, and any required samples for approval.

3.12.12 Add: The contractor shall make any corrections required by the Architect and file with him electronic) copies, when requested. Additional copies shall be furnished to other trades and prime contractors where necessary to coordinate their work.

3.12.13 Add: The Contractor shall keep at the site a current set of shop drawings that bear the stamped approval of the Architect or Engineer.

3.15.1 Add: Prior to final inspection and acceptance of the building, the General Contractor shall clean the building, including but not limited to, glass, hardware, fixtures, equipment, masonry, clean floors as specified, and completely prepare the building for use by the Owner with no cleaning required by the Owner.

ARTICLE 5:

ARTICLE 7:

7.2.1 Add: The allowances for overhead and profit combined shall not exceed fifteen (15)% of net cost except where the change involves a subcontractor; allowances shall not exceed fifteen (15)% for the subcontractor and five (5)% for the prime contractor. No allowances shall be made for overhead and profit. In the case of deductible change orders, the contractor shall include not less than seven (7)% profit, but no allowance for overhead.

At the time of signing a change order, the contractor shall certify as follows, "I certify that my bonding company will be notified forthwith that my contract has been increased or decreased by the amount of this change order, and that a copy of the approved change order will be mailed upon receipt by me to my surety".

All requests for Change Orders must be in writing and be supported by a breakdown showing method of arriving at net costs. Breakdown shall include materials, labor, taxes, profit & overhead.

ARTICLE 8:

8.1.2 Add: The Contractor shall commence work to be performed under this agreement on a date to be specified in a written Notice to Proceed and shall fully complete work hereunder within **365** consecutive calendar days from said date. For each day in excess of the above number of days, the Contractor(s) shall pay to the Owner the sum of as $500.00 per consecutive calendar day liquidated damages, reasonably estimated in advance to cover losses to be incurred by the Owner by reason of failure of said Contractor(s) to complete work within the time specified, such time being in the essence of this Contract and a material consideration thereof.

8.2.1 Add: In planning his construction schedule within the agreed Contract Time, it shall be assumed that the Contractor has anticipated the amount of adverse weather conditions normal to site of the Work for the season or seasons of the year involved. Only those weather delays attributable to other than normal weather conditions will be considered by the Architect, which affect the critical path schedule.

ARTICLE 9:

9.2 Add: Schedule of Values shall separate labor and material for each phase of the work.

The phases of work shall be broken down per each section of the specifications. Where a section includes two or more major items of work, they shall also be broken out separately including labor and material.

Each item in the Schedule of Values and Application for Payment shall be complete including its total cost and proportionate share of general overhead and profit margin.

At the Contractor's option, temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown as separate line items in the Schedule of Values or distributed as general overhead expense.

Submit five (5) copies, within 10 days of Notice to Proceed.

9.3.1 Add: Type of Form: Application and Certificate for Payment AIA Document G 702 and Continuation Sheet G 702A, latest edition. (The contractor may purchase these certificates from the American Institute of Architects, 1735 New York Avenue, NW, Washington, D.C.).

Number of copies: Five (5) unless otherwise noted. Must have original signatures.

Cut off for each application shall be the 25th of each month.

Application shall be in Architect's office no later than the last day of each month and shall be signed and notarized.

Retainage: Each certificate shall show, and the Owner will retain 5% of the amount of each estimate until final completion and acceptance of all work covered by the contract.

9.6.1 Add: The Owner shall make payment of each certificate no later than the last day of the following month.

ARTICLE 11:

Add: All Certificates of Insurance required by the Contract Documents shall contain a provision that coverage's afforded under the policies will not be canceled, reduced in amount or coverage's eliminated until at least thirty (30) days after mailing written notice, by certified mail, return receipt requested, to the insured and the Owner of such alteration or cancellation.

Full contract amount shall appear on each document as necessary.

Effective date on each document shall be the same as the contract document date.

Expiration date shall be sufficient to complete the project.

An authorized individual agent, licensed to do business in North Carolina, shall countersign each policy.

The title "Licensed Resident Agent" shall appear after the signature.

11.1 Add:

Shall be furnished and maintained by contractor as outlined with the following adjustments and additions.

General Liability shall include: Comprehensive forms, premises- operations, independent contractor's protective, products and completed operations broad form property damaged, and explosion and collapse hazard.

Automobile liability shall include: Comprehensive form, owned, hired, and non-owned.

Worker's Compensation and Employer's Liability in accordance with North Carolina Statutory requirements.

11.1.2 Limits shall be as follows:

Combined Single Limit
General Liability - For Bodily Injury and Property Damage
Each Occurrence = $1,000,000
General Aggregate = $2,000,000

Auto Liability - For Bodily Injury and Property Damage
Combined Single Limit = $300,000

Employer Liability for each accident = $100,000

Subcontractor's Insurance Coverage - The Contractor shall either:

1. Require each of his subcontractors to procure and to maintain during the life of his subcontract, Subcontractor's Comprehensive General Liability, Automobile Liability, and Property Insurance of the type and the same amount as specified in paragraph above; or

2. Insure the activity of his subcontractors in his own policy.

11.3 Revise To: Contractor to Purchase and Supply Builders Risk Insurance

11.4.1 Performance bond and payment bond will be required for 100% of the contract price.

ARTICLE 13: MISCELLANOUS PROVISIONS

The Project Expediter shall provide temporary power required for construction for all trades and disciplines unless otherwise stated in the specifications.

The Contractor will pay for electricity and water usage. The Contractor shall assure that temporary power and water are used in a responsible manner.

ARTICLE 15:

15.1.5.1 Add: When Contract Time has been extended, as provided under this Paragraph 4.3.7.1, such extension of time shall not be considered as justifying extra compensation to the Contractor for Administrative costs or other such reasons.

15.1.5.2 Add: In planning his construction schedule within the agreed Contract Time, it shall be assumed that the Contractor has anticipated the amount of adverse weather conditions normal to site of the Work for the season or seasons of the year involved. Only those weather delays attributable to other than normal weather conditions will be considered by the Architect if critical path of schedule is affected. A five year average will be used for calculating adverse weather. The Newport Weather Station will be used as a reporting station.

15.1.2 Add: Mediation will be the first step in solving claims. Arbitration shall be used to settle disputes or claims only if both parties agree to arbitration, otherwise, all disputes and claims shall be settled by normal legal means.

If arbitration is agreed by both parities, then after appointment of the arbitrator or arbitrators, the parties to the arbitration shall have the right to take depositions and to obtain discovery regarding the subject matter of the arbitration and, to that end, to use and exercise all of the same rights, remedies, and procedures, and be subject to all of the same duties, liabilities, and obligations in the arbitration with respect to the subject matter thereof, as if the matter of the arbitration were pending in a civil action before a Superior Court of the State.

END OF SECTION 00800

SECTION 00820 – SPECIAL CONDITIONS

1. **General:** The existing facility shall remain secure during the construction period. The remainder of the building shall be maintained for occupancy during construction. All contractors shall conduct their operations so as to cause the least possible interference with the normal operations of the facility. All contractors shall limit use of the site for access and storage of materials to those areas approved by the Owner. All access to the area of work must be through designated areas approved by the Owner. Contractors shall not be allowed access to any area other than the immediate area of work.

2. **On Site Parking:** Parking is not permitted on the Owner's property except for construction vehicles used in the performance of the work and only where approved by the Owner.

3. **Building Security:** The present level of security for the existing facility shall not be reduced in any way, due to work of this contract.

4. **Personnel Safety:** Contractor shall provide barricades and similar types of safety items required to protect anyone in the area of work from the hazards of construction activities. Roadways, walks, paths, entrances, exits, etc. shall remain unobstructed and shall be maintained in a safe and satisfactory manner.

5. **Site Protection**: Contractor shall be responsible for and shall protect building, landscaping (all trees, shrubs, lawns, etc.) vehicles, etc. on or near the site from damage due to the work of this contract. Any damage shall be fully corrected to the satisfaction of the Architect. Sidewalks and paved areas shall be protected from damage prior to vehicular traffic use. If during the construction, public or private property is damaged or destroyed, during the course of the work, the responsible contractor shall, at his own expense, restore such property to a condition equal to that existing before such damage or injury was done, by repairing, rebuilding or replacing it, or otherwise making good such damage or destruction in an acceptable manner.

6. Access to the building and site shall be only between the hours of 8:00am – 5:00pm unless otherwise approved in advance. No work on Sunday, Easter or Christmas will be permitted.

7. No smoking will be permitted on site at any time.

8. The Contractor will be responsible for all permits (application and costs).

9. No dump fees will be charged at county landfill. The Contractor will be responsible for coordination of schedule with transfer station.

END OF SECTION 00820

SECTION 01010 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 DESCRIPTION

A. The Contractor shall, unless otherwise specified, supply all labor, transportation, materials, apparatus, fuel, water, energy, light and tools necessary for entire, proper and substantial completion of his work and shall install, maintain, and remove all equipment for the construction, other utensils or things and shall be responsible for the safe, proper and lawful construction, maintenance and use of same and shall construct in the best and most workmanlike manner a complete structure and everything properly incidental thereto as shown on plans, stated in specifications or reasonably implied there from, all in accordance with the Contract Documents.

B. Contract type

The work will be accomplished under:

1. The Single Prime Contract will be Stipulated Sum Contract covering general, mechanical, plumbing and electrical construction. All General Condition items will be clearly identified in the contract and will be a fixed amount.

C. Scope of Work - scope of the work is, but not limited to as follows:

1. General Construction
2. Plumbing System
3. HVAC System
4. Electrical work
5. All related work
6. All related site work
7. Selective Demo
8. Fire Alarm
9. Camera/Security System

PART 2 & 3 - NOT USED.

END OF SECTION 01010

SECTION 01020 - ALLOWANCES

PART 1 - GENERAL

1.1 DESCRIPTION

A. General: All allowances considered in the Contract Price shall be clearly identified in the Contract and approved before signing. If the actual cost is more than, or less than the allowance, the Contract Price will be adjusted up or down accordingly when the actual cost is determined. Adjustments in the Allowances will be made by Change Order. Unless specified otherwise, the allowance amounts include the net cost of materials, and shipping charges.

B. Cash Allowance and Contingency Cash Allowance: The Contractor's overhead, profit, shipping costs, glue and adhesive, underlayment's, etc. and taxes shall be included in the Base Bid Contract Price, but not in the allowance. All allowances agreed upon shall clearly indicate materials only or materials and labor included as the case may be. For allowance listed as materials only, the Contractor shall include in his base bid price all labor and associated installation costs. The contractor shall submit to the Architect for approval all bills for materials under Cash Allowances.

1.2 SCHEDULE OF CASH ALLOWANCES

A.	Ceramic Tile Allowance:	$ 8.00/sq ft (tile only)
B.	Card Access/Camera/Security (Conduit System Included in Base Bid)	$ 65,000.00 (materials and labor)
C.	Hardware Allowance:	$ 85,000.00 (materials only)
D.	Signage	$ 15,000.00 (materials only)

1.3 CONTINGENCY CASH ALLOWANCE

A. Contingency Cash Allowance $100,000.00 Portions of this allowance can only be authorized for use by the Architect's approval.
Please note: The General Contractor shall include profit and overhead in their base bid and not within the allowance figure. Therefore, when portions of this allowance is used and deviated from this allowance figure, no additional overhead and profit will be allowed.

PARTS 2 & 3 - NOT USED.

END OF SECTION 01020

SECTION 01027 – APPLICATIONS FOR PAYMENT

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work included: Comply with procedures described in this Section when applying for progress payment and final payment under the Contract.

B. Related work
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.2 QUALITY ASSURANCE

A. Prior to start of construction, secure the Architect's approval of the Schedule of Values required to be submitted under Paragraph 9.2 of the General conditions, and further described in Section 01370 of these Specifications.

B. During progress of the work the Schedule of Value are to remain unchanged as approved by the Architect. Changes in the Contract Sum due to Change Orders or other modifications of the Contract shall be added to the Schedule of Values as Change Orders.

C. Base requests for payment on the approved schedule of values.

1.3 SUBMITTALS

1. Make this preliminary submittal to the Architect at the last regular job meeting of each month.
2. Make submittal of request for payment by filling in the agreed data on AIA Document G702, "Application and Certificate for Payment," plus continuation sheet or sheets.
3. Sign and notarize the Application and Certificate for Payment.
4. Submit (5) originals of the Application and Certificate for Payment
5. Cut off period is the 25th of the month.
6. Submittals are due in Architect's office by the 28th of each month.
7. For allowance items furnish all invoices, receipts, time records, etc. with all requests for payment.

END OF SECTION 01027

SECTION 01045 – CUTTING AND PATCHING

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work included: This Section establishes general requirements pertaining to cutting (including excavating), fitting, and patching of the work required to:
   1. Make the several parts fit properly.
   2. Uncover work to provide for installing, inspecting, or both, of ill-timed work.
   3. Remove and replace work not conforming to requirements of the Contract Documents.
   4. Remove and replace defective work.

B. Related work
   1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
   2. In addition to other requirements specified, upon the Architect's request uncover work to provide for inspection by the Architect of covered work, and remove samples of installed materials for testing.
   3. Do not cut or alter work performed under separate contracts without the Architect's written permission.

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.3 SUBMITTALS

A. Request for Architect's consent
   1. Prior to cutting which effects structural safety, submit written request to the Architect for permission to proceed with cutting.
   2. Should conditions of the work, or schedule, indicate a required change of materials or methods for cutting and patching, so notify the Architect and secure his written permission and any required Change Order prior to proceeding.

B. Notices to the Architect
   1. Prior to cutting and patching performed pursuant to the Architect's instructions, submit cost estimate to the Architect. Secure the Architect's approval of cost estimates and type of reimbursement before proceeding with cutting and patching.
   2. Submit written notice to the Architect designating the time the work will be uncovered, to provide for the Architect's observation.

PART 2 – PRODUCTS

2.1 MATERIALS

A. For replacement of items removed, use materials complying with pertinent Sections of these Specifications.

PART 3 – EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection
   1. Inspect existing conditions, including elements subject to movement or damage during cutting, excavating, patching, and backfilling.
   2. After uncovering the work, inspect conditions affecting installation of new work.

B. Discrepancies
   1. If uncovered conditions are not as anticipated, immediately notify the Architect and secure needed directions.
   2. Do not proceed until unsatisfactory conditions are corrected.

3.2 PREPARATION PRIOR TO CUTTING

A. Provide required protection including, but not necessarily limited to, shoring, bracing, and support to maintain structural integrity of the work.

3.3 PERFORMANCE

A. Perform required excavating and backfilling as required under pertinent other Sections of these Specifications.
   1. Perform cutting and demolition by methods, which will prevent damage to other portions of the work and provide proper surfaces to receive installation of repair and new work.
   2. Perform fitting and adjusting of products to provide finished installation complying with the specified tolerances and finishes.

END OF SECTION 01045

SECTION 01050 - FIELD ENGINEERING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included: Provide such field engineering services as are required for proper completion of the Work including, but not necessarily limited to:
   1. Establishing and maintaining lines and levels.
   2. Structural design of shores, forms, and similar items provided by the Contractor as a part of his means and methods of construction.

B. Related work:
   1. Additional requirements for field engineering also may be described in other Section of these Specifications.
   2. See also General Conditions.

1.2 SUBMITTALS

A. Comply with pertinent provisions of Section 01340.

B. Upon request of the Architect, submit:
   1. Certification, signed by the Contractor's retained field engineer, certifying that elevations and locations of improvements are in conformance or non-conformance with requirements of the Contract Documents.

1.3 PROCEDURES

A. In addition to procedures directed by the Contractor for proper performance of the Contractor's responsibilities:
   1. Locate and protect control points before starting work on the site.
   2. Preserve permanent reference points during progress of the Work.
   3. Do not change or relocate reference points or items of the Work without specific approval from the Architect.
   4. Promptly advise the Architect when a reference point is lost or destroyed or requires relocation because of other changes in the Work.
      a. Upon direction of the Architect, require the field engineer to replace reference stakes or markers.
      b. Locate such replacements according to the original survey control.

B. The General Contractor shall employ a locator service to locate and mark all underground utilities as required.

PART 2 & 3 - NOT USED.

END OF SECTION 01050

SECTION 01090 - ABBREVIATIONS AND SYMBOLS

PART 1 - GENERAL

1.1 REFERENCE TO APPLICABLE STANDARDS

A. Wherever reference is made to Codes, Standards Specifications or other data published by regulating agencies or accepted organizations, it shall be understood that such reference is made to the latest edition, (including addenda) published prior to the date of Contract Documents, except as noted specifically otherwise by date in the contract documents.

B. Abbreviations and symbols used in the Specifications can be grouped into three (3) basic categories:
1. Abbreviations of reference symbols.
2. Abbreviations of words and phrases.
3. Symbols.

C. Among those, which may be used in the Contract Documents, are the following (with respective abbreviation used):

AA	Aluminum Association
AAMA	Architectural Aluminum Manufacturers Association
AASHTO	American Association of State Highway and Transportation Officials
ABMA	American Boiler Manufacturers Association
ACI	American Concrete Institute
ACRI	Air Conditioning and Refrigeration Institute
ADC	Air Diffusion Council
AFI	Air Filter Institute
AGA	American Gas Association
AGCA	Associated General Contractors of America, Inc.
AIA	American Institute of Architects
AIMA	Acoustical and Insulating Materials Association
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
ALS	American Lumber Standards
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute, Inc.
APA	American Plywood Association
API	American Petroleum Institute
ARI	Air Conditioning and Refrigeration Institute
ASAHC	American Society of Architectural Hardware Consultants
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for testing and Materials
ATI	Asphalt Tile Institute
AWI	Architectural Woodwork Institute
AWPA	American Wood Preservers Association
AWPI	American Wood Preservers Institute
AWS	American Welding Society
BHMA	Builders Hardware Manufacturers Association
BIA	Brick Institute of America
BRI	Building Research Institute
CABRA	Copper and Brass Research Association
CAGI	Compressed Air and Gas Institute

CE	Corps of Engineers (Army)
CRSI	Concrete Reinforcing Steel Institute
CSI	Construction Specifications Institute
CTI	Cooling Tower Institute
DFPA	Douglas Fir Plywood Association
ETL	Electrical Testing Laboratories
FGMA	Flat Glass Marketing Association
FHA	Federal Housing Administration
FM	Factory Mutual Engineering Division, Association of Factory Mutual Fire Insurance Companies
FPL	Forest Products Laboratory
FS	Federal Specifications
FTI	Facing Tile Institute
GA	Gypsum Association
GTA	Glass Tempering Association
HPMA	Hardwood Plywood Manufacturers Association
IBRM	Institute of Boiler and Radiator Manufacturers
IEEE	Institute of Electrical and Electronics Engineering
IES	Illuminating Engineering Society
JAN	Joint Army-Navy Specifications
MAC	Masonry Advisory Council
MIA	Marble Institute of America
MLMA	Metal Lath Manufacturers Association
MS	Military Specifications
MSS	Manufacturers Standardization Society of the Valves and Fitting Industries
MSTD	Military Standard
NAAMM	National Association of Architectural Metal Manufacturers
NAFM	National Association of Fan Manufacturers
NAPF	National Association of Plastic Manufacturers
NBHA	National Builders Hardware Association
NBS	National Bureau of Standards
NCMA	National Concrete Masonry Association
NEC	National Electric Code (NFPA Pamphlet No. 70)
NEMA	National Electric Manufacturers Association
NEMI	National Elevator Manufacturing Industry, Inc.
NFC	National Fire Code
NFPA	National Fire Protection Association
NFPA	National Forest Products Association
NHLA	National Hardwood Lumber Association
NHPMA	Northern Hardwood and Pine Manufacturers Association
NPA	National Particleboard Association
NPCA	National Paint and Coatings Association
NRMCA	National Ready Mixed Concrete Association
NSC	National Safety Council
NSF	National Sanitation Foundation
NTMA	The National Terrazzo and Mosaic Association, Inc.
NWMA	National Woodwork Manufacturers Association
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
PCI	Prestressed Concrete Institute
PEI	Porcelain Enamel Institute, Inc.
PS	Product Standard, U.S. Department of Commerce
RIS	Redwood Inspection Service
RTI	Resilient Tile Institute
SAE	Society of Automotive Engineers
SBI	Steel Boiler Institute
SCMA	Southern Cypress Manufacturers Association
SDI	Steel Deck Institute

SDI	Steel Door Institute
SJI	Steel Joint Institute
SMACCNA	Sheet Metal and Air Conditioning Contractors National Association
SMFMA	Sprayed Mineral Fiber Manufacturers Association, Inc.
SPIB	Southern Pine Inspection Bureau
SSPC	Steel Structures Painting Council
SWFPA	Structural Wood Fiber Products Association
TCA	Tile Council of America
TEMA	Tubular Exchange Manufacturing Association
TIMA	Thermal Insulation Manufacturers Association
TPI	Truss Plate Institute
UL	Underwriter's Laboratories, Inc.
UPC	Uniform Plumbing Code
WRI	Wire Reinforcement Institute
WWPA	Western Wood Products Association

1.2 ABBREVIATIONS OF WORDS AND PHRASES

A. Abbreviations of words and phrases applicable to this Project; other than listed above for reference standards, shall be as per Architect’s interpretation on request..

1.3 SYMBOLS

A. Symbols representing construction materials and the equipment applicable to this Project shall be as shown on the Drawings.

PART 2 & 3 - NOT USED.

END OF SECTION 01090

SECTION 01200 - PROJECT MEETINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included: To enable orderly review during progress of the Work, and to provide for systematic discussion of problems, the Owner will conduct project meetings throughout the construction period.

B. Related work:
1. The Contractor's relations with his subcontractors and materials suppliers, and discussions relative thereto, are the Contractor's responsibility and normally are not part of project meetings content. If subcontractor's issues are of a concern, it can be communicated at this meeting, but management of the subcontractor will remain the responsibility of the Contractor.

1.2 SUBMITTALS

A. Agenda items: To the maximum extent practicable, advise the Owner at least 24 hours in advance of project meetings regarding items to be included in or added to the agenda.

B. Minutes:
1. The Architect will compile minutes of each project meeting, and will furnish one copy to Contractor, Architect and required copies to the Owner.
2. Recipients of copies may make and distribute such other copies as they wish.

1.3 QUALITY ASSURANCE

A. For those persons designated by the Contractor to attend and participate in project meetings, provide required authority to commit the Contractor to solutions agreed upon in the project meetings.

PART 2 - PRODUCTS

(No products are required in this Section)

PART 3 - EXECUTION

3.1 GENERAL

A. Except as noted below for Pre-construction Meeting, project meetings will be held monthly, unless project dictates differently.

B. Coordinate as necessary to establish mutually acceptable schedule for meetings.

3.2 PRECONSTRUCTION MEETING

A. Pre-construction Meeting will be held as soon as possible after the written Notice to Proceed.
1. Provide attendance by authorized representatives of the Contractors and major subcontractors.
2. The Owner will advise other interested parties, including the Architect, and request their attendance.

B. Minimum agenda: Data will be distributed and discussed on at least the following items:

1. Organizational arrangement of Contractor's forces and personnel, and those of subcontractors, materials suppliers.
2. Channels and procedures for communication.
3. Construction schedule, including sequence of critical work.
4. Contract Documents, including distribution of required copies of original Documents and revisions.
5. Processing of Shop Drawings and revisions.
6. Processing of Bulletins, field decisions, and Change Orders.
7. Rules and regulations governing performance of the Work
8. Procedures for safety and first aid, security, quality control, housekeeping, and related matters.

3.3 PROJECT MEETINGS

A. Attendance:

1. To the maximum extent practical, assign the same person or persons to represent the Contractor at project meetings throughout progress of the Work.
2. Subcontractors, materials suppliers, and others may be invited to attend those project meetings in which their aspect of the Work is involved.

B. Minimum agenda:

1. Review progress of the Work since last meeting, including status of submittals for approval.
2. Identify problems, which impede planned progress.
3. Develop corrective measures and procedures to regain planned schedule.
4. Complete other current business.

END OF SECTION 01200

SECTION 01310 - SCHEDULES AND REPORTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions and other Division 1 specifications sections, apply to work of this section.

1.2 DESCRIPTION

A. Post Award Requirements
1. Draft of Construction Schedule: Within two weeks of Date of Commencement of the Work, Contractor shall complete draft of time-scaled CPM Construction Schedule. (Bar chart is acceptable.)
2. Level of Detail: Except for procurement and General Conditions requirements, differentiate activities on schedule so that no single activity shown requires more than twenty-one (21) calendar days to complete.

B. Schedule of Values
1. Within seven (7) days after completion of CPM Construction Schedule and before first pay request, Contractor shall submit Schedule of Values (see Section 01370) for review by the Architect allocating a dollar value for each activity on Construction Schedule. Dollar value for each activity will include cost broken into labor, materials, and pro rata contribution to overhead and profit. Subcontract sums will be identified on the Schedule of Values and broken down as described above.

C. Approval
1. Approval of Construction Schedule and Schedule of Values will be signified by the Architect and Contractor's joint signatures on one copy of each document. Thereafter, Project will be monitored with Construction Schedule, which Contractor shall use in planning, organizing, directing, coordinating, and executing the Work and which shall be the basis for evaluating the progress of the Work.

D. Schedule Revisions
1. General: Revisions to approved Construction Schedule must be approved in writing by Architect and Contractor.
2. Contractor: Submit requests for revisions to schedule to Architect together with written rationale and description of logic for rescheduling work to maintain Specific Contractual Milestone Dates.
a. Proposed revisions acceptable to the Architect will be incorporated into next update of Construction Schedule by the Contractor.
3. Owner: Changes initiated by Owner and implemented by Change Orders which have potential to affect critical dates will require Contractor to prepare revised schedule for the Architect's concurrence. The Architect's approved revisions will be incorporated into the Construction Schedule. Adjustments in scheduled completion dates, either for intermediate activities or for Contract as a whole, will be considered only to extent that there is not sufficient float to absorb the revisions accepted.

E. Recovery Schedule
1. General: Should updated Construction Schedule show Contractor to be four-teen (14) or more days behind schedule at any time during construction, the Architect may require Contractor to prepare Recovery Schedule, displayed in

CPM format, which will display Contractor's plan for returning to schedule within subsequent pay period.

2. Schedule Preparation: Within seven (7) days after notice from the Architect, prepare and submit to the Architect a Recovery Schedule, incorporating best available information from Subcontractors and others which will permit return to Construction Schedule within subsequent pay period. Prepare Recovery Schedule to same level of detail as Construction Schedule.
3. Schedule Assessment: Seven (7) days prior to expiration of Recovery Schedule, confer with the Architect to assess effectiveness of Recovery Schedule. As a result of this conference, the Architect will direct Contractor as follows:
4. Behind Schedule: If the Architect determines Contractor is still behind schedule, the Architect will direct Contractor to prepare another Recovery Schedule for subsequent pay period.
5. On Schedule: If the Architect determines Contractor has successfully complied with provisions of Recovery Schedule, the Architect will direct Contractor to return to use of Construction Schedule.

PARTS 2 & 3 - NOT USED.

END OF SECTION 01310

SECTION 01340 - SUBMITTALS AND SUBSTITUTIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included: Make submittals required by the Contract Documents, and revise and resubmit as necessary to establish compliance with the specified requirements.

B. Related work:
1. Documents affecting work of this Section include but are not necessarily limited to General Conditions Amendments to General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Individual requirements for submittals also may be deceived in pertinent Sections of these Specifications.

C. Work not included:
1. Unrequired submittals will not be reviewed by the Architect/Owner.
2. The Contractor may require his subcontractors to provide drawings, setting diagrams, and similar information to help coordinate the Work, but such data shall remain between the Contractor and his subcontractors and will not be reviewed by the Architect/Owner.

1.2 SUBMITTALS

A. Make submittals of Shop Drawings, Samples, substitution requests, and other items in accordance with the provisions of this Section.

B. Coordination of Submittals:
1. Prior to each submittal, carefully review and coordinate all aspects of each item being submitted.
2. Verify that each item and the submittal for it CONFORMS IN ALL RESPECTS to the specified requirements.
3. By affixing his signature to each submittal, the Contractor certifies that THIS COORDINATION HAS BEEN PERFORMED.
4. The Contractor shall stamp the shop drawings as "Approved" or "Approved as Noted" before submitting to Architect/Owner for review.
5. **The Architect and Engineer is under NO obligation to participate with Construction Management Software such as Procore or similar software.**

1.3 QUALITY ASSURANCE

A. "Equals" and "Substitutions"
1. The Contract is based on the standards of quality established in the Contract Documents. Requests for substitutions will be considered when submitted according to the procedures set forth below.
a. Particularly with regard to MAJOR materials, equipment or methods proposed for the Work as set forth in the Contract Documents, Contractor's request(s) for approvals of "equals" not specifically named in the Contract Documents MUST BE SUBMITTED IN WRITING with supporting documentation, and in the hands of the Architect/Owner prior to contract award. Telephone requests for consideration of proposed "equals" will not be accepted.

b. On other items of Work, Contractor may request consideration of

substitution, when submitted in writing with supporting documentation within thirty (30) days following the Notice to Proceed.

B. Where the phrase "or equal" or "equal as approved by Architect/Owner" occurs in the Contract Documents, do not assume that the Contractor's choice of materials, equipment, or methods will be approved as equal unless the item has been specifically approved for this Work by the Architect/Owner.

C. Do not substitute materials, equipment, or methods unless such substitution has be specifically approved in writing for this Work by the Architect/Owner.

PART 2 - PRODUCTS

2.1 SHOP DRAWINGS

A. Scale and Measurements: Make Shop Drawings accurately to a scale sufficiently large to show all pertinent aspects of the item and its methods of connection to the Work.

B. Types of prints required:
1. Submit Shop Drawings in electronic format.

C. Review comments of the Architect/Owner will be shown in red on prints and returned to the Contractor. The Contractor may make and distribute such copies as are required for his purposes.

D. Please note ALL shop drawings MUST be approved and stamped by the G.C. before submitting to the Architect. Any unreviewed and approved by the G.C. shop drawings will be returned to the Contractor unreviewed.

2.2 MANUFACTURER'S LITERATURE

A. Where contents of submitted literature from the manufacturers includes data not pertinent to the submittal, clearly show which portions of the contents are being submitted for review.

2.3 SAMPLES

A. Provide Sample or Samples identical to the precise article proposed to be provided. Identify as described under "Identification of Submittals" below.

B. Number of Samples required:
1. Unless otherwise specified, submit one sample in the quantity, which is required to be returned, plus one which will be retained by the Architect/Owner.
2. By prearrangement in specific cases, a single Sample may be submitted for review and, when approved, be installed in the Work at a location agreed upon by the Architect/Owner.
3. Except as noted in 2.3.B.2 above, no selections of color, texture or finish will be approved by the Architect/Owner until ALL substitutions have been approved by the Architect/Owner, and ALL necessary samples and color, texture, finish proposals have been submitted in their entirety by the Contractor, in order that a coordinated, total scheme may be developed by the Architect/Owner.

PART 3 - EXECUTION

3.1 IDENTIFICATION OF SUBMITTALS

A. Consecutively number all submittals. (ie: G-1, G-2.....etc. for General Construction, P-1, P-2, ... etc. for Plumbing; M-1, M-2, ...etc. for Mechanical (HVAC); E-1, E-2, ...etc. for Electrical; SP-1, SP-2....etc for Sprinkler System; SU-1, SU-2, ... etc. for Site/Utilities.

1. When material is resubmitted of any reason, transmit under a new letter of transmittal and with a shop drawing number. (G-1r)
2. On resubmittals, cite the original submittal number for reference.

B. Accompany each submittal with a letter of transmittal showing all information required for identification and checking.

C. On at least the first page of each submittal, and elsewhere as required for positive identification, show the submittal number in which the item was included.

D. Maintain an accurate submittal log for the duration of the Work, showing current status of all submittals at all times. Make the submittal log available to the Architect/Owner for his review upon request.

3.2 GROUPING OF SUBMITTALS

A. Unless otherwise specified, make submittals in groups containing all associated items to assure that information is available for checking each item when it is received.
1. Partial submittals may be rejected as not complying with the provisions of the Contract.

3.3 TIMING OF SUBMITTALS

A. Make submittals far enough in advance of schedule dated for installation to provide time required for reviews, for securing necessary approvals, for possible revisions and resubmittals, and for placing orders and securing delivery. All submittals shall be submitted within sixty (60) days of the notice to proceed.

3.4 ARCHITECT/OWNER REVIEW

A. Review by the Architect/Owner does not relieve the Contractor from responsibility for errors, which may exist in the submitted data.

B. Revisions
1. Make revisions required by Architect/Owner.
2. If the Contractor considers any required revision to be a change, he shall so notify the Architect/Owner as provided in the General Conditions.
3. Make only those revisions directed or approved by the Architect/Owner.

C. Reimbursement of Architect/Owner's Costs
1. In the event substitutions are proposed to the Architect/Owner after the Contract has been awarded, the Architect/Owner will record all time used by him and by his consultants in evaluation of each such proposed substitution.
2. Whether or not the Architect/Owner approves a proposed substitution, the Contractor, promptly upon receipt of the Architect/Owner's billing, reimburse the Architect/Owner at the rate of two and one-half times the direct cost to the Architect/Owner and his consultants for all the time spent by them in evaluating the proposed substitution.

END OF SECTION 01340

SECTION 01370 - SCHEDULE OF VALUES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included: Provide a detailed breakdown of the agreed Contract sum showing values allocated to each of the various parts of the Work, as specified herein and in other provisions of the Contract Documents.

B. Related work:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Amendments to General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Schedule of values may be described on the continuation sheet of AIA document G702 accompanying applications for payment.
3. Schedule of values is required under Paragraph 9.2 of the General Conditions.

1.2 QUALITY ASSURANCE

A. Use required means to assure arithmetical accuracy of the sums described.

B. When so required by the Architect/Owner, provide copies of the subcontracts or other data acceptable to the Architect/Owner, substantiating the sums described.

1.3 SUBMITTALS

A. Prior to first application for payment, submit a proposed schedule of values to the Architect/Owner. See Section 01310.
1. Meet with the Architect/Owner and determine additional data, if any, required to be submitted.
a. Mobilization, Submittal Review, Material Delivery, Execution of the Work, and Punchlisting shall be included in the schedule.
b. Mobilization shall be billed on a monthly basis equally distributed throughout construction contract time.
c. Materials and Labor breakdowns should be provided for each portion of work.

2. Secure the Architect/Owner's approval of the schedule of values prior to submitting first application for payment.

PART 2 & 3 - NOT USED.

END OF SECTION 01370

SECTION 01410 - TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 DESCRIPTION

A. The Owner shall select a testing laboratory qualified in accordance with ASTM E329.

B. The Contractor shall pay for all testing and inspection services as are specified in this Section and/or elsewhere in the Contract Documents, except as otherwise noted.

C. Related work:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Amendments to General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Requirements for testing may be described in various Sections of these Specifications.
3. where no testing requirements are described, but the Owner decides that testing is required, the Owner may require such testing to be performed under current pertinent standards for testing. Payment for such testing will be made as described in this Section.

D. Work not included:
1. Selection of testing laboratory: The Owner will select a prequalified independent testing laboratory.
2. Payment for initial testing: The Contractor will pay for all initial services of the testing laboratory as further described in Artcle 2.1 of this Section.

1.2 QUALITY ASSURANCE

A. The testing laboratory will be qualified to the Owner's approval in accordance with ASTM E329.

B. Testing, when required, will be in accordance with all pertinent codes and regulations, and with selected standards of the American Society for Testing and Materials.

C. Approved agencies are as follows:
1. ECS, Ltd.
2. Terracon
3. S&ME

1.3 PRODUCT HANDLING

A. Promptly process and distribute required copies of test reports and related instructions to assure necessary retesting and replacement of materials with the least possible delay in progress of the Work.

PART 2 - PRODUCTS

2.1 PAYMENT FOR TESTING

A. The Contractor will pay for initial testing services required.

B. When initial tests indicate non-compliance with the Contract Documents, subsequent retesting occasioned by the non-compliance shall be performed by the same testing

agency, and costs shall be the sole responsibility of the Contractor.

C. Where no testing requirements are described, but the Owner decides that testing is required, the Owner may require such testing be performed under current pertinent standards for testing. If testing reveals the work to be in compliance with Contract requirements, Owner will pay for these testing services. If work is found to be in non-compliance with Contract requirements, Contractor shall pay for these testing services.

D. Inspections and tests required by codes or ordinances, or by a plan approval authority, and which are made by a legally constituted authority, shall be the responsibility of and shall be paid for by the Contractor, unless otherwise provided in the Contract Documents.

2.2 CONTRACTOR'S CONVENIENCE TESTING

A. Inspecting and testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.

PART 3 - EXECUTION

3.1 COOPERATION WITH TESTING LABORATORY

A. Representatives of the testing laboratory shall have access to the Work at all times and at all locations where the Work is in progress. Provide facilities for such access to enable the laboratory to perform its function properly. All testing shall be coordinated by the Architect.

3.2 TAKING SPECIMENS

A. All specimens and samples for testing, unless otherwise provided in the Contract Documents, shall be taken by the testing personnel. All sampling equipment and personnel will be provided by the testing laboratory. All deliveries of specimens and samples to the testing laboratory will be performed by the testing laboratory.

3.3 SCHEDULES FOR TESTING

A. Establishing schedule: (Contractor shall be responsible for scheduling Testing Laboratory.)
   1. By advance discussion with the testing laboratory approved by the Owner, determine the time required for the laboratory to perform its tests and to issue each of its findings.
   2. Provide all required time within the construction schedule.

B. Revising schedule: When changes of construction schedule are necessary during construction, coordinate all such changes with the testing laboratory as required.

C. Adherence to schedule: When the testing laboratory is ready to test according to the established schedule, but is prevented from testing or taking specimens due to incompleteness of the Work, all extra charges for testing attributable to the delay may be back-charged to the Contractor and shall not be borne by the Owner.

END OF SECTION 01410

SECTION 01500 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included: Provide temporary facilities and controls needed for the Work including, but not necessarily limited to:

1. Temporary utilities such as heat, water, electricity, facsimile machine and telephone
2. Sanitary facilities
3. Enclosures such as tarpaulins, barricades, and canopies
4. Project sign
5. Field office for the Contractor's personnel
6. Temporary fencing of the construction site

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Amendments to General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

2. Except that equipment furnished by subcontractors shall comply with requirements of pertinent safety regulations, such equipment normally furnished by the individual trades in execution of their own portions of the Work are not part of this Section.

3. Permanent installation and hookup of the various utility lines are described in other Sections.

1.2 PRODUCT HANDLING

A. Maintain temporary facilities and controls in proper and safe condition throughout progress of the Work.

1.3 LOCAL REGULATIONS

A. Comply with all local ordinances including local and temporary facilities, parking and storage.

PART 2 - PRODUCTS

2.1 UTILITIES

A. Water:

1. The Contractor and his Plumbing Subcontractor to provide necessary temporary piping and water supply and, upon completion, remove such temporary facilities. Owner will pay the water bill for reasonable usage of water.

B. Electricity:

1. The Contractor and his Electrical Subcontractor to provide necessary temporary wiring and, upon completion of the Work, remove such temporary facility.

2. Provide area distribution boxes so located that the individual trades may furnish and use 100’ maximum length extension cords to obtain power and lighting at points where needed for work, inspection, and safety.

3. Owner will pay electric bill for reasonable usage of electricity.

C. Heating: Provide and maintain temporary heat necessary for proper conduct of operations needed in the Work.

D. Telephone:

1. Make necessary arrangements and pay costs for installation and operation of telephone service to the Contractor's office at the site.

E. E-MAIL:

1. Make necessary arrangements and pay costs for installation and operation of email to the contractor’s office at the site.
2. Contractor shall maintain a digital camera at the site for minimum 10 progress photos weekly to be emailed to Architect/Owner.

F. Temporary Fire Protection:

1. Contractor to provide any and all temporary construction fire extinguishers and standpipes required for the duration construction.

2.2 FIELD OFFICES AND SHEDS

A. Contractor’s Facilities:

1. Provide a field office building and sheds adequate in size and accommodation for Contractor’s offices, supply and storage.

2. Within the Contractor's facilities, provide enclosed space adequate for holding project meetings. Furnish with table, chairs, and utilities.

B. Sanitary facilities:

1. Provide temporary sanitary facilities in the quantity required for use by all personnel.

2. Always maintain in a sanitary condition.

2.3 ENCLOSURES

A. Provide and maintain for the duration of construction all scaffolds, tarpaulins, canopies, warning signs, steps, platforms, bridges, and other temporary construction necessary for proper completion of the Work in compliance with pertinent safety and other regulations.

1. All apparatus, equipment, temporary and permanent construction shall meet all local and State labor laws and safety regulations applicable thereto.

2.4 TEMPORARY FENCING

A. Contractor will provide a temporary fence of design and type needed to prevent entry onto the Work by the public. Contractor shall coordinate installation and location. It shall be the Contractor's responsibility to maintain the fence for the duration of the construction.

2.5 PROJECT SIGN

A. Project signs shall only be installed where approved by Architect/Owner.
B. Upon completion of the Work, demount the project signs.
C. Except as otherwise specifically approved by the Architect/Owner, do not permit other signs or advertising on the job site.

PART 3 - EXECUTION

3.1 MAINTENANCE AND REMOVAL

A. Maintain temporary facilities and controls as long as needed for safe and proper completion of the Work.

B. Remove such temporary facilities and controls as rapidly as progress of the Work will permit, or as directed by the Architect/Owner.

3.2 TRAFFIC COORDINATION

A. Any construction related activities, such as receiving, loading, unloading, or other activities which may be an interruption to normal vehicular traffic flow on the site shall be coordinated in advance by the Contractor with the Owner or public authority having jurisdiction.

END OF SECTION 01500

SECTION 01620 - PRODUCT HANDLING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Protect products scheduled for use in the Work by means including, but not necessarily limited to, those described in this Section.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to the General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Additional procedures also may be prescribed in other Sections of these Specifications.

1.2 QUALITY ASSURANCE

A. Include within the Contractor's quality assurance program such procedures as are required to assure full protection of work and materials.

1.3 MANUFACTURER'S RECOMMENDATIONS

A. Except as otherwise approved by the Architect/Owner, determine and comply with manufacturer's recommendations on product handling, storage and protection.

1.4 PACKAGING

A. Deliver products to the job site in the manufacturer's original containers with labels intact and legible.

1. Maintain packaged materials with seals unbroken and labels intact until time of use.
2. Promptly remove damaged material and unsuitable items from the job site, and promptly replace with material meeting the specified requirements at no additional cost to the Owner.

B. The Architect/Owner may reject as non-complying, material and products that do not bear identification satisfactory to the Architect/Owner as to manufacturer, grade, quality, and other pertinent information.

1.5 PROTECTION

A. Protect finished surfaces, including jambs and soffits of openings used as passageways, through which equipment and materials are handled.

B. Provide protection for finished floor surfaces in traffic are prior to allowing equipment or materials to be moved over such surfaces.

C. Maintain finished surfaces clean, unmarred, and suitably protected until accepted by the Owner.

1.6 REPAIRS AND REPLACEMENTS

A. In the event of damage, promptly make replacement sand repairs to the approval of the Architect/Owner, and at no additional cost to the Owner.

B. Additional time required to secure replacements and to make repairs will not be considered by the Architect/Owner to justify an extension in the Contract Time of Completion.

END OF SECTION 01620

SECTION 01710 - CLEANING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included: Throughout the construction period, maintain the building and site in a standard of cleanliness as described in this Section.

B. Related work:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Amendments to General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. In addition to standards described in this Section, comply with requirements for cleaning as described in pertinent other Sections of these Specifications.

1.2 QUALITY ASSURANCE

A. Conduct daily inspection to verify that requirements for cleanliness are being met.

B. In addition to the standards described in this Section. Comply with pertinent requirements of governmental agencies having jurisdiction.

PART 2 - PRODUCTS

2.1 COMPATIBILITY

A. Use only the cleaning materials and equipment, which are compatible with the surface being cleaned, as recommended by the manufacturer of the material.

PART 3 - EXECUTION

3.1 PROGRESS CLEANING

A. General:
1. Retain stored items in an orderly arrangement allowing maximum access, not impeding traffic or drainage, and providing required protection of materials.
2. Do not allow accumulation of scrap, debris, waste material, and other items not required for construction of this Work.
3. At least twice each month, and more often if necessary, completely remove all scrap, debris, and waste material from the job site.
4. Provide adequate storage for all items awaiting removal from the job site, observing requirements for fire protection and protection of the ecology.
5. The building shall be cleaned daily of all debris and waste material resulting from the construction operations.

END OF SECTION 01710

SECTION 01720 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RECORD DRAWINGS

A. Contractors shall maintain a set of Record Drawings at the project site. These shall be kept legible and current, and shall be available at all times for the inspection of the Architect/Owner. All differences or changes in the contract work, or work added, shall be recorded daily on these Record Drawings in a contrasting color.

B. The Architect/Owner shall approve the Record Drawings.

C. Receipt and approval of Record Drawings are prerequisites for final payment.

1.2 MANUALS

A. Each Contractor shall submit to the Architect/Owner before final acceptance electronic copies of all installation, operating instructions, and maintenance instructions on the equipment and materials furnished under his contract. Each set shall be organized into electronic folders. Label folders designating the name of the project, the names of the Owner, the name of the Contractor, and the equipment or materials included in the manual.

1.3 GUARANTEES AND WARRANTIES

A. Contractors shall submit to the Architect/Owner before final acceptance three originals of all warranties, guarantees, and surety bonds. All such documents shall show the name and location of the project and the name of the Owner.

PART 2 & 3 - NOT USED.

END OF SECTION 01720

SECTION 02050 – SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

B. Related Documents:

1. Division 0 - Bidding and General Conditions, Division 1 - General Requirements, all applicable provisions in the technical specifications section of Division 2 through 16 and applicable drawings.

2. Demolition plans.

C. Related Sections:

1. Division 1, Cutting and Patching.
2. Division 1, Temporary Facilities and Services.

1.2 PROJECT CONDITIONS

A. Occupancy:

1. The General contractor will be responsible for installing a physical barrier between the occupants and the construction area.

B. Existing Conditions:

1. The Contractor shall be responsible for all selective demolition required to perform the work.

2. After the project is begun, the contractor is responsible for the condition of areas to be demolished. The owner does not warrant that the condition of structures to be demolished will not have changed since the time of inspection for bidding purposes.

C. General Demolition Notes:

1. The Contractors will provide all demolition services.

2. The Contractors are to notify the Architect of any unforeseen conditions, and of any conditions that differ from those described in the drawings.

3. All Contractors should survey the site and building prior to submitting a bid.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and sealed.

B. Survey existing conditions and correlate with drawings and specifications to determine extent of demolition required.

C. Insofar as is practicable, arrange operations to reveal unknown or concealed structural conditions for examination and verification before removal or demolition.

3.2 PREPARATION

A. Traffic: Do not obstruct walks or public ways without the written permission of governing authorities and of the owner. Where routes are permitted to be closed, provide alternate routes if required.

B. Protection:

1. Provide for the protection of persons passing around or through the area of demolition.

2. Perform demolition so as to prevent damage to adjacent improvements and facilities to remain.

3. Provide protective measures to ensure free and safe passage of persons to and from occupied areas.

4. Protect existing site appurtenances and landscaping to remain.

C. Structural Support:

1. Construct and maintain shoring, bracing, and supports as necessary to ensure the stability of structures.

D. Damages: Without cost to the owner and without delay, repair any damages caused to utilities to remain.

3.3 UTILITY SERVICES

A. Arrange with utility companies and shut off indicated utilities serving portion of structures to be removed.

B. Disconnect and cap indicated utilities before starting demolition operations.

C. Identify location of capped utilities on project record documents.

D. Existing utilities to be maintained for portion of building to remain.

3.4 EXPLOSIVES

A. Do not use explosives.

3.5 POLLUTION CONTROLS

A. Observe environmental protection regulations.

3.6 DEMOLITION - GENERAL

A. Perform work in a systematic manner.

B. Use any methods permitted by governing regulations and the requirements of the

contract documents.

3.7 DEMOLITION ON OR BELOW GRADE

A. Contractor is to be sure all scrap materials are removed from the soil, and the site.

B. Where the new slabs, sidewalks, and parking areas occur, the Contractor is to use suitable compacted fill as replacement soil.

3.8 DISPOSAL OF DEMOLISHED MATERIALS

A. Promptly dispose of materials resulting from demolition operations. Do not allow materials to accumulate on site.

B. Transport materials resulting from demolition operations and legally dispose of off-site.

C. Do not burn removed materials on project site.

D. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.

3.9 CLEANING

A. Remove tools and equipment. Dispose of scrap properly.

B. Leave exterior areas free of debris.

C. Return surfaces to remain to condition existing prior to commencement of demolition.

END OF SECTION 02050

SECTION 02220 - EXCAVATING, BACKFILLING AND COMPACTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General Conditions, Amendments to General Conditions, Supplementary Conditions and Sections in Division 1 of the Specifications apply to work of this Section.

1.2 DESCRIPTION

A. Work included: Excavate, backfill, compact, and grade the site to the surrounding elevations shown on the drawings, as specified herein, and as needed to meet the requirements of the construction shown in the Contract Documents.

B. Related Work:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.3 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specific requirements and methods needed for proper performance of the work of this Section.

B. Comply with requirements of governmental agencies having jurisdiction. Comply with the directions of the Geotechnical Engineer. All excavations shall be in accordance with current OSHA excavations standards.

C. Use equipment adequate in size, capacity, and numbers to accomplish the work of this Section in a timely manner.

D. Testing and Inspection Service: Contracts shall employ (from approved firms) and pay for a qualified independent geotechnical testing and inspection firm to perform soil testing and inspection services during earthwork operations. Costs associated with re-testing of areas not passing design criteria shall be paid by the Contractor.

1.4 PROJECT CONDITIONS

A. Site Information:

1. Test borings and other exploratory operations may be provided by the Contractor, at the Contractor's option, at no additional cost to the Owner.

1.5 PRODUCT HANDLING

A. Comply with pertinent provisions of Section 01620.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Fill and backfill materials:

1. Provide soil materials free from organic matter and deleterious substances, containing no rocks or lumps over 2" in greatest dimension, and with not more than 15% of the rocks or lumps larger than 2" in their greatest dimension.

2. Fill is that material removed from excavations or imported from off-site borrow areas, predominantly granular, non-expansive solid free from roots and other deleterious matter and subject to the approval of the geotechnical engineer.

3. Do not permit rocks having a dimension greater than 1" in the upper 12" of fill or embankment.

4. Cohesionless material used for structural backfill: Provide sand free from organic material and other foreign matter, and as approved by the geotechnical engineer.

5. Where granular base is called for under building slabs, provide aggregate complying with requirements of Section 03300 of these Specifications.

B. Fill and Backfill Materials: Materials classified as satisfactory.

1. Satisfactory Soil Material (ASTM D 2487): Free of stones larger than 2 inches in dimension, trash, debris, organic material, other objectionable material and classified as follows:
   a. GW (well-graded gravel)
   b. GP (poorly graded gravel)
   c. CM (silty gravel)
   d. SW (well-graded sand)
   e. SP (poorly graded sand)
   f. SM (silty sand)

2. Unsatisfactory Soil Material (ASTM D 2487):
   a. GC (clayed gravel)
   b. SC (clayed sand)
   c. CL (lean clay)
   d. ML (silt)
   e. OL (organic clay)
   f. OL (organic silt)
   g. CH (fat clay)
   h. MH (elastic silt)
   i. OH (organic clay)
   j. OH (organic silt)
   k. PT (peat)

2.2 WEED KILLER

A. Provide a dry, free-flowing, dust-free chemical compound, soluble topsoil consisting of friable, fertile soil of loamy character, containing an amount of organic matter normal to the region, capable of sustaining healthy plant life, and reasonably free from subsoil, roots, heavy or stiff clay, stones larger than 2" greatest dimension, noxious weeds, sticks, brush, litter, and other deleterious matter.

2.3 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect/Engineer.

B. Obtain topsoil from sources within the project limits, or provide imported topsoil obtained

from approved sources outside the project limits, or from both sources.

PART 3 – EXECUTIONS

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.2 FINISH ELEVATIONS AND LINES

A. Comply with pertinent provisions of Section 01050.

3.3 PROCEDURES

A. Utilities:

1. Unless shown to be removed, protect active utility lines shown on the drawings or otherwise made known to the Contractor prior to excavating. If damaged, repair or replace at no additional cost to the Owner.

2. If active utility lines are encountered, and are not shown on the drawings or otherwise made known to the Contractor, promptly take necessary steps to assure that service is not interrupted.

3. If service is interrupted as a result of work under this Section, immediately restore service by repairing the damaged utility at no additional cost to the Owner.

4. If existing utilities are found to interfere with the permanent facilities being constructed under this Section, immediately notify the Architect and secure his instructions.

5. Do not proceed with permanent relocation of utilities until written instructions are received from the Architect.

B. Protection of persons and property:

1. Barricade open holes and depressions occurring as part of the work, and post warning lights on property adjacent to or with public access.

2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.

3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, washout, and other hazards created by operations under this Section.

4. Protect and maintain erosion and sedimentation controls.

5. Provide protective insulating materials to protect sub-grades and foundation soils against freezing temperatures or frost.

C. Dewatering:

1. Remove all water, including rainwater; encountered during trench and sub-

structure work to an approved location by pumps, drains, and other approved methods.

2. Keep excavations and site construction area free from water. Do not allow water to accumulate in excavations. Remove water to prevent damage to foundation bottoms, undercutting footings and soil changes detrimental to the stability of sub-grades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines and other dewatering system components necessary to convey water away from the excavations.

D. Use means necessary to prevent dust becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.

E. Maintain access to adjacent areas at all times.

3.4 EXCAVATING

A. Perform excavating of every type of material encountered within the limits of the Work to the lines, grades, and elevations indicated and specified herein.

B. Satisfactory excavated materials:

1. Transport to, and place in, fill or embankment areas within the limits of the work.

C. Unsatisfactory Excavated Materials:

1. Excavate to a distance below grade as directed by the geotechnical engineer, and replace with satisfactory materials as approved by the geotechnical engineer.

2. Include excavation of unsatisfactory materials, and replacement by satisfactory materials, as parts of the work of this Section.

D. Surplus Materials:

1. Dispose of unsatisfactory excavated material, and surplus satisfactory excavated material, away from the site at disposal areas arranged and paid for by the Contractor.

E. Excavation of Rock:

1. Where rocks, boulders, granite, or similar material is encountered, and where such material cannot be removed or excavated by conventional earth moving or ripping equipment, take required steps to proceed with the general grading operations of the work, and remove or excavate such material by means which will neither cause additional cost to the Owner nor endanger buildings or structures whether on or off the site.

2. Do not use explosives without written permission from the Architect.

F. Excavate and backfill in a manner and sequence that will provide proper drainage at all times.

G. Borrow:

1. Obtain material required for fill or embankment in excess of that produced within the grading limits of the work from borrow areas selected and paid for by the

Contractor and approved by the Architect.

H. Ditches and Gutters:

1. Cut accurately to the cross sections, grades, and elevations shown.

2. Maintain excavations free from detrimental quantities of leaves, sticks, trash, and other debris until completion of the work.

3. Dispose of excavated materials as shown on the drawings or directed by the soil engineer; except do not, in any case, deposit materials less than 3' – 0" from the edge of a ditch.

I. Unauthorized Excavation:

1. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific instruction from the Architect.

2. Under footings, foundations, or retaining walls:

a. Fill unauthorized excavations by extending the indicated bottom elevation of the footing or base to the excavation bottom, without altering the required top elevation.

b. When acceptable to the Architect, lean concrete fill may be used to bring the bottom elevation to proper position.

3. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations, unless otherwise directed by the geotechnical engineer.

J. Stability of Excavations:

1. Slope sides of excavations to 1:1 or flatter, unless otherwise directed by the geotechnical engineer and in compliance with local codes, ordinances, and agencies having jurisdiction.

2. Shore and brace where sloping is not possible because of space restrictions or stability of the materials being excavated.

3. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.

K. Shoring and Bracing:

1. Provide materials for shoring and bracing as may be necessary for safety of personnel, protection of work, and compliance with requirements of governmental agencies having jurisdiction.

2. Maintain shoring and bracing in excavations regardless of the time period excavations will be open.

3. Carry shoring and bracing down as excavation progresses.

L. Excavating for Structures:

1. Conform to elevations and dimensions shown within a tolerance of 0.04 ft., and extending a sufficient distance from footings and foundations to permit placing and

removing concrete formwork, installation of services, other construction required and for inspection.

2. In excavating for footings and foundations, take care not to disturb bottom of excavations.

   a. Excavate by hand tools to final grade just before concrete is placed.
   b. Trim bottoms to required lines and grades to leave solid base to receive concrete.

3. Excavate for footings and foundations only after general site excavating, filling, and grading are complete.

M. Cold weather Protection:
   1. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

N. Excavation:
   1. Excavations are to be considered "unclassified" and the base bid is to include removal of any rock, muck, etc. which is encountered.

O. Excavating for pavements:
   1. Cut surface under pavements to comply with cross sections, elevations, and grades.

3.5 FILLING AND BACKFILLING

A. General:

   1. For each classification listed below, place acceptable soil material in layers to required subgrade elevations.

   2. In Excavations:
      a. Use satisfactory excavated or borrow material.

   3. Under asphalt pavements:
      a. Use sub-base materials.

   4. Under building slabs:
      a. Use granular fill, if so called for on the Drawings, complying with aggregate acceptable under Section 03300 of these Specifications.

B. Backfill excavations as promptly as progress of the Work permits, but not until completion of the following:

C.
   1. Acceptance of construction below finish grade including, where applicable, dampproofing and waterproofing.

   2. Inspecting, testing, approving, and recording locations of underground utilities.

   3. Removing concrete formwork.

   4. Removing shoring and bracing, and backfilling of voids with satisfactory materials.

   5. Removing trash and debris.

   6. Placement of horizontal bracing on horizontally supported walls.

D. Ground Surface Preparations:

1. Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious matter from ground surface prior to placement of fills.

2. Plow, strip, or break up sloped surfaces steeper than one vertical to four horizontal so that fill material will bond with existing surface.

3. When existing ground surface has a density less than that specified under "compacting" for the particular area, break up the ground surface, pulverize, moisture-condition to the optimum moisture content, and compact to required depth and percentage of maximum density.

E. Placing and Compacting:

1. Place backfill and fill materials in layers not more than 8" in loose depth.

2. Before compacting, moisten or aerate each layer as necessary to provide the optimum moisture content.

3. Compact each layer to required percentage of maximum density for area.

4. Do not place backfill or fill material on surfaces that are muddy, frozen, or containing frost or ice.

5. Place backfill and fill materials evenly adjacent to structures, to required elevations.

6. Take care to prevent wedging action of backfill against structural by carrying the material uniformly around the structure to approximately the same elevations in each lift.

7. Where the construction includes basement or other underground walls having structural floor over them, do not backfill such walls until the structural floors are in place and have attained sufficient strength to support the walls.

3.6 GRADING

A. General:

1. Uniformly grade the areas within limits of grading under this Section, including adjacent transition areas.

2. Smooth the finished surfaces within specified tolerances.

3. Compact with uniform levels or slopes between points where elevations are shown on the Drawings, or between such points and existing grades.

4. Where a change of slope is indicated on the Drawings, construct a rolled transition section having a minimum radius of approximately 8’ 0”, unless adjacent construction will not permit such a transition, or if such a transition defeats positive control of drainage.

B. Grading outside building lines:

1. Grade areas adjacent to buildings to achieve drainage away from the structures, and to prevent ponding.

2. Finish the surface to be free from irregular surface changes and shape the surface of areas scheduled to be under walks to line, grade, and cross-section, with finished surface not more than 0.10 ft. above or below the required subgrade elevation.

3. Shape the surface of areas scheduled to be under pavement to line, grade, and cross-section, with finished surface not more than 0.05 ft. above or below the required subgrade elevation.

3.7 COMPACTING

A. Control soil compaction during construction to provide the minimum percentage of density specified for each area as determined according to ASTM D698.

B. Provide at least the following maximum density of soil material compacted at optimum moisture content for the actual density of each layer of soil material in place and as approved by the Architect.

1. Structures:
   a. Compact the top 8" of subgrade and each layer of fill material or backfill material at 98% of maximum density.

2. Lawn and Unpaved Areas:
   a. Compact the top 8" of subgrade and each layer of fill material or backfill material at 95% of maximum density.

   b. Compact the upper 12" of filled areas, or natural soils exposed by excavating, at 90% of maximum density.

3. Walks:
   a. Compact the top 8" of subgrade and each layer of fill material or backfill material at 95% of maximum density.

4. Pavements:
   a. Compact the top 12" of subgrade at 98% of maximum density and each layer of fill material or backfill material at 95% of maximum density. Compact top 6" base course to 100% density of AASHTO T 180.

C. Moisture Control:
1. Where sub-grade or layer of soil material must be moisture-conditioned before compacting, uniformly apply water to surface of subgrade or layer of soil material to prevent free water appearing on surface during compacting operations.

2. Remove and replace, or scarify and air dry, soil material that is too wet to permit compacting to the specified density.

3. Soil material that has been removed because it is too wet to permit compacting 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 as determined by moisture-density relation tests approved.

3.8 FIELD QUALITY CONTROL

A. Secure the Architect's/Engineer's inspection and approval of subgrades and fill before subsequent construction is permitted thereon.

B. Quality control testing during construction: Contractor to employ, coordinate and allow testing services firm to inspect and approve each subgrade and fill layer before further backfill or construction work is performed.

C. Provide at least the following tests to the approval of the Architect: (Contractor to coordinate timing)

1. At paved areas, at least one field density test for every 2,000 sq. ft. of paved area, but not less than three tests.

2. In each compacted fill layer, one field density test for every 2,000 sq. ft. of overlaying paved area, but not less than three tests.

3. Testing to be by an independent testing company selected from and Owner approved list and paid for by the Contractor.

4. At each ramp area, two field density tests.

3.9 MAINTENANCE

A. Protection of newly graded areas:

1. Protect newly graded areas from traffic and erosion, and keep free from trash and weeds.

2. Repair and reestablish grades in settled, eroded, and rutted areas to the specified tolerances.

B. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify the surface, reshape, and compact to the required density prior to further construction.

3.9 CERTIFICATION

A. Upon completion of this portion of the Work, and as a condition of its acceptance, deliver to the Architect/Engineer a written report from the Geotechnical Engineer certifying that the compaction requirements have been obtained. State in the report the area of fill or embankment, the compaction density obtained, and the type or classification of fill material placed.

B. Should the Contractor encounter any rock or unforeseen objects, he is to notify the Architect /Engineer immediately.

END OF SECTION 02220

SECTION 02620 - CONCRETE SIDEWALKS AND PADS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, Amendments to General Conditions, and Supplementary Conditions and Sections in Division 1 of the Specifications apply to work of this Section.

1.2 DESCRIPTION

A. The Work included in this Section includes, but is not limited to:
1. Furnish and install poured-in-place sidewalks and aprons where shown on Drawings or called for in these Specifications.

1.3 QUALITY ASSURANCE

A. Use adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work in this Section.

1.4 SCHEDULING

A. Notify Architect seven days minimum prior to placing concrete.

PART 2 - PRODUCTS

2.1 FORMWORK

A. Meet requirements specified in Section 03300.

2.2 CONCRETE

A. Meet requirements specified in Section 03300 for exterior concrete.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Sidewalk and walkway paving: Provide 4 inches think (minimum). Provide contraction joints spaced every 5 feet, unless otherwise indicated. Cut contraction joints 3/4-inch deep with a jointing tool after the surface has been finished. Provide 1/2-inch thick transverse expansion joints every 25 feet (maximum) apart. Provide walks and paving with a nonslip broom finish. Provide sidewalks with a transverse slope of 1/4-inch per foot; limit variation in cross section to 1/4-inch in 5 feet. Paved areas shall be sloped as indicated and subject to Architect's acceptance.

B. Pads: Provide 6 inches thick, unless otherwise indicated. Pads shall have a sloped surface of 1/4-inch per foot and a non-slip broom finish.

END OF SECTION 02620

SECTION 03300 - CAST-IN-PLACE 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 this Section.

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcing, mix design, placement procedures, and finishes.
B. Concrete paving and walks are specified in Division 2.
C. Finishes and concrete floor toppings are specified in Division 9.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:
   1. Shop drawings for reinforcement, showing bending, and placement of concrete reinforcement. Comply with ACI 315 “Manual of Standard Practice for detailing Reinforced Concrete Structures” showing bar schedules, bar spacing, diagrams of bent bars, and arrangement of concrete reinforcement. Copies of the contract drawings shall not be marked and submitted as shop drawings.
   2. Concrete Mix Design for each type and strength of concrete shown on the plans.
   3. Laboratory test reports for the following:
      a. Aggregate gradation tests
      b. Concrete mix design tests - Submit test records in accordance with the requirements of ACI 301 and the provisions of this specification.
   4. Materials certificates or manufacturer’s literature signed by manufacturer and Contractor, certifying that each material item complies with the provisions of this specification for the following:
      a. Aggregates
      b. Admixtures
      c. Reinforcement
      d. Cement
      e. Waterstops
   5. Product data for embedded and drilled in place anchors.

1.4 QUALITY ASSURANCE

A. Codes and Standards: Comply with the applicable provisions of the following standards except as modified by the supplemental requirements specified in this section:
   1. ACI 318, "Building Code Requirements for Reinforced Concrete."
   2. ACI 301, “Standard Specification for Structural Concrete”
   3. Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice."

B. Concrete Testing Service: The independent testing agency, including branch office used, referred to in this section shall meet the requirements of ASTM E 329 and shall have been inspected within the past 3 years by the Cement and Concrete Reference Laboratory of the NBS and shall have corrected any deficiencies noted.

C. Materials and installed work may require testing and retesting at any time during progress of work. All retesting of rejected materials for installed work shall be done at Contractor's expense.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on 4 edges. Structural design of formwork is contractor's responsibility.

B. Form Coatings: Provide commercial formulation form-coating compounds with a maximum VOC of 350 mg/l that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Welded Wire Fabric: ASTM A 185, welded steel wire fabric.

C. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire-bar-type supports complying with CRSI specifications.
   1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
   2. Where concrete will be exposed to view in the finished structure, the portions of all bar supports within 1/2 inch of the concrete surface shall be non-corrosive or protected against corrosion.

2.3 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I. Use one brand of cement throughout project unless otherwise acceptable to the Engineer.

B. Fly Ash: If used, it shall conform to the following requirements:
   1. Maximum substitution of fly ash for Portland cement shall not exceed 20 percent of cement content by weight.
   2. Fly ash shall meet the requirements of ASTM C 618, Type F, except loss on ignition shall not exceed 4 percent.
   3. Use of fly ash shall be indicated on the mix design submittal.
   4. Submit a Materials Certification to the Engineer indicating the fly ash meets the stated requirements.

C. Aggregates:
   1. General:
      a. Provide hardrock aggregate complying with ASTM C33, with additional attributes as specified herein.
      b. For making grading tests of fine and coarse aggregate, use square mesh wire cloth complying with ASTM E11.
   2. Fine aggregate:
      a. Provide washed natural sand having strong, hard, durable particles, and containing not more than 2% by weight of deleterious matter such as clay lumps, mica, shale, or schist.
      b. Grade from coarse to fine within the following limits for percentage by weight passing sieve:

Sieve Size:	Minimum:	Maximum:
3/8"	100	----
No. 4	95	100
No. 8	65	95
No. 16	45	75
No. 30	30	50
No. 50	10	22
No. 100	2	8

3. Coarse Aggregate:

a. Provide coarse aggregate consisting of clean, hard, fine grained, sound crushed rock or washed gravel, or a combination of both, containing not more than 5% by weight flat, chip-like, thin, elongated, friable, or laminated pieces, not more than 2% by weight of shale or cherty material. Any piece having a length in excess of five times the average thickness shall be considered flat or elongated.

b. Use coarse aggregate of the largest practicable size for each condition of placement, except: Do not exceed ¾ of the clear distance between reinforcing bars, 1/5th of the narrowest dimension between sides of forms, of 1/3rd the depth of any slab section.

c. Grade combined aggregate within the following limits for percentage by weight passing sieve:

Sieve	1-1/2" Aggr.		1" Aggr.		3/4" Aggr.	
Size:	Min	Max	Min	Max	Min	Max
1-1/2"	95	---	---	---	---	---
1"	75	90	90	100	---	---
3/4"	55	77	70	90	90	100
3/8"	40	55	45	65	60	80
No. 4	30	40	31	47	40	60
No. 8	22	35	23	40	30	45
No. 16	16	30	17	35	20	35
No. 30	10	20	10	23	13	23
No. 50	2	8	2	10	5	15
No. 100	0	3	0	3	0	5

D. Water: Drinkable, clean and free from deleterious amounts of acid alkali, salts, and organic materials.

E. Admixtures: Provide admixtures for concrete that contain not more than 0.1 percent chloride ions.
1. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
2. Water-Reducing Admixture: ASTM C 494, Type A.
3. High-Range Water-Reducing Admixture (Super Plasticizer): ASTM C 494, Type F or Type G.
4. The use of set control additives may only be used with the prior approval of the Engineer. The additives shall only be added at the point of batching.

2.4 OTHER MATERIALS

A. Waterstops: Provide flat, dumbbell-type or centerbulb-type waterstops at all construction joints and other joints as required. Size to suit joints.
1. Rubber Waterstops: Corps of Engineers CRD-C 513.
2. Polyvinyl Chloride Waterstops: Corps of Engineers CRD-C 572.

B. Vapor Barrier: Moistop reinforced or equal.

C. Liquid Membrane-Forming Curing Compound: Liquid-type membrane- forming curing compound complying with ASTM C 309, Type I, Class A. Moisture loss not more than 0.055 gr./sq. cm. when applied at 200 sq. Ft./gal.

D. Expansion Joint Material: Self-expanding, non-extruding, 1/2", cork complying with ASTM D 1751.

E. Isolation Joint Material: Shall be the thickness shown on the drawings and shall comply with ASTM D 1751.

2.5 PROPORTIONING AND DESIGN OF MIXES

A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method used, use an independent testing facility acceptable to Engineer for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing.

B. Submit written reports to Engineer of each proposed mix for each type and strength of concrete at least 15 days prior to start of work. Do not begin concrete production until proposed mix designs have been reviewed by the Engineer.

C. Design mixes to provide normal weight concrete with the following properties, unless otherwise indicated on drawings and schedules:
   1. Floor Slabs: 4000-psi, 28-day compressive strength; W/C ratio, 0.40 maximum.
   2. Footings and grade beams; 3000-psi, 28-day compressive strength.
   3. Cast-in-place walls, columns; 4000psi, 28 day compressive strength.

2.6 ADMIXTURES

A. Use water-reducing admixture or high-range water-reducing admixture (Superplasticizer) in concrete as required for placement and workability.

B. Use high-range water-reducing admixture (HRWR) in pumped concrete, concrete for industrial slabs, architectural concrete, parking structure slabs, concrete required to be watertight, and concrete with water/cement ratios below 0.50.

C. Use air-entraining admixture in all concrete exposed to freezing and thawing. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content of 5 percent with a tolerance of plus or minus 1-1/2 percent. Other concrete not exposed to freezing, thawing, or hydraulic pressure or to receive a surface hardener shall have 2 percent to 4 percent air content.

D. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:
   1. Footings and slabs on grade: Not more than 3 inches.
   2. Concrete containing HRWR admixture (Superplasticizer): Not more than 6 inches after addition of HRWR to site-verified 2-inch slump concrete.
   3. Other concrete: Not more than 4 inches.

2.7 CONCRETE MIXING

A. Job-Site Mixing: not allowed for this project
B. Ready-Mix Concrete:
   1. Comply with requirements of ASTM C 94, and as specified.

2. When air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.
3. Provide batch ticket for each batch discharged and used in work, indicating project identification name and number, date, mix type, mix time, quantity.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate the installation of joint materials and vapor retarders with placement of forms and reinforcing steel.

3.2 FORMS

A. General: Design, erect, support, brace, and maintain formwork to support vertical and lateral, static and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances complying with ACI 347.

B. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, sinkages, keyways, recesses, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent leakage of cement paste.

C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces.

D. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

E. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

F. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed. Retighten forms and bracing before concrete placement as required to prevent mortar leaks and maintain proper alignment.

3.3 VAPOR BARRIER INSTALLATION

A. General: Following leveling and tamping of granular base for slabs on grade, place vapor barrier sheeting with longest dimension parallel with direction of pour.

B. Lap joints 6 inches and seal vapor barrier joints with manufacturers' recommended mastic and pressure-sensitive tape.

C. After placement of vapor barrier, cover with sand cushion and compact to depth as shown on drawings.

3.4 PLACING REINFORCEMENT

A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as herein specified.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, required. Avoiding cutting or puncturing vapor barrier during reinforcement placement and concreting operations.

D. Place reinforcement to obtain at least minimum coverage for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

E. Welding of bar reinforcement will not be permitted unless otherwise indicated on the drawings.

F. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.5 JOINTS

A. Construction Joints: Locate and install construction joints as indicated or, if not indicated, locate so as not to impair strength and appearance of the structure, as acceptable to the Engineer.

B. Provide keyways at least 1-1/2 inches deep in construction joints in walls and slabs and between walls and footings. Accepted bulkheads designed for this purpose may be used for slabs.

C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as otherwise indicated.

D. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.

E. Waterstops: Provide waterstops in all construction joints and/or as required. Install waterstops to form continuous diaphragm in each joint. Make provisions to support and protect exposed waterstops during progress of work. Field-fabricate joints in waterstops in accordance with manufacturer's printed instructions.

F. Isolation Joints in Slabs-on-Ground: Construct isolation joints in slabs-on-ground at points of contact between slabs-on-ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.

G. Contraction (Control) Joints in Slabs-on-Ground: Construct contraction joints in slabs-on-ground to form panels of patterns as shown. Use saw cuts 1/8 inch wide by 1/4 slab depth or inserts 1/4 inch wide by 1/4 of slab depth, unless otherwise indicated.
   1. Form contraction joints by inserting premolded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.
   2. Contraction joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.
   4. Joint sealant material is specified in Division 7 Sections of these specifications.

3.6 INSTALLATION OF EMBEDDED ITEMS

A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached thereto.

B. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to obtain required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

3.7 CONCRETE PLACEMENT

A. Changes in the approved mix design including the addition of mix water at the job site is prohibited.

B. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work.

C. General: Comply with ACI 304, "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete," and as herein specified.

D. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
   1. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
   2. Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
   3. Maintain reinforcing in proper position during concrete placement.

E. Cold-Weather Placing: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

F. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
   1. Do not use-frozen materials or materials containing ice or snow. Do not place concrete on frozen sub grade or on sub grade containing frozen materials.
   2. Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators.

G. Hot-Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.
   1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F (32 deg C). Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is Contractor's option.
   2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
   3. Fog spray forms, reinforcing steel, and sub grade just before concrete is placed.

3.8 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
   1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
   1. Apply to concrete surfaces to receive a rubbed finish, and to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where exposed to public view.

D. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

E. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.9 SLAB FINISHES

A. Trowel Finish: After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to tolerances of Ff 20 - Fl 17. Grind smooth surface defects that would telegraph through applied floor covering system.

B. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming.

C. Non-Slip Broom Finish: Apply to exterior concrete ramps, platforms and steps, and elsewhere as indicated. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to the main traffic route. Coordinate required final finish with Architect before application.

3.10 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply in accordance with manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting; keep continuously moist for not less than 7 days.

C. Curing Methods: Perform curing of concrete by moisture retaining cover. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3.11 SHORES AND SUPPORTS

A. General: The structural design, fabrication, and placement of shoring shall be the responsibility of the contractor.

B. Shores shall remain in place until the concrete slab has attained 75% of its 28-day design compressive strength.

3.12 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

D. Reinforced Masonry: Provide concrete grout for reinforced masonry lintels and bond beams where indicated on drawings and as scheduled. Maintain accurate location of reinforcing steel during concrete placement.

3.13 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Engineer.
   1. Cut out honeycomb, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts, down to solid concrete but in no case to a depth of less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched

with specified bonding agent. Place patching mortar before bonding compound has dried.

2. For exposed-to-view surfaces, blend white portland cement and standard portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

B. Repair of Slab Surfaces: Test surfaces for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having required slope.
1. Repair finished surfaces that contain defects that affect durability of concrete. Surface defects, as such, include crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, spalling, popouts, honeycomb, rock pockets, and other objectionable conditions.
2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.
3. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with patching compound. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Engineer.
4. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

D. Perform structural repairs with prior approval of Engineer for method and procedure, using specified epoxy adhesive and mortar.

3.14 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. Concrete testing services will be performed and paid for by the Contractor. Testing services shall be performed by an independent testing agency approved by the Engineer. The testing agency shall be responsible for making, handling and curing the specimens in addition to testing the concrete.

B. Sampling and testing for quality control during placement of concrete may include the following, as directed by Engineer, for Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
1. Slump: ASTM C 143; one test at point of discharge for each truck delivered to the job site
2. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231 pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.
3. Concrete Temperature: Test hourly when air temperature is 40 deg F (4 deg C) and below, when 80 deg F (27 deg C) and above, and each time a set of compression test specimens is made.
4. Compression Test Specimen: ASTM C 31; one set of 4 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store

cylinders for laboratory-cured test specimens except when field-cure test specimens are required.

5. Compressive Strength Tests: ASTM C 39; one set for each 50 cubic yards (or each day's pour if less than 50 cubic yards placed during a day) of each type and strength of concrete; two specimens tested at 7 days and two specimens tested at 28 days.

C. Test results will be reported in writing to Architect, Structural Engineer, Ready-Mix Producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.

D. If additional testing, curing, or other measures are required to confirm or verify the strength of any concrete in question, cost shall be paid by the contractor.

END OF SECTION 03300

SECTION 04100 - MORTAR

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General Conditions, Amendments to General Conditions, and Supplementary Conditions and Sections in Division 1 of the Specifications apply to work of this Section.

1.2 DESCRIPTION

A. Work included in this Section:

1. The work required under this specification consists of all Mortar and Grout for the masonry work under various sections of the specifications.

1.3 QUALITY ASSURANCE

A. A representative sample of the sand shall be obtained for each job and tested as specified herein below by an independent testing laboratory selected by the Architect, and paid for by the Owner.

1.4 DELIVERY AND STORAGE OF MATERIALS

A. Portland Cement, lime, and/or pre-packaged mortar cement mixes shall be delivered to the site and stored in unbroken bags or other approved containers. These materials shall be stored in dry, weather tight sheds or enclosures with elevated floors, which will prevent the inclusion of foreign materials and damage by water or dampness. Masonry sand shall be delivered and stored in a manner to prevent inclusion of foreign materials. Concrete masonry which is chipped, cracked, broken, or marred in other manner shall not be used where exposed to view.

1.5 ENVIRONMENTAL CONDITIONS

A. Hot Weather Installation: The following precautions shall be taken if masonry is erected when the ambient air temperature is more than 37 degrees C (99 degrees F) in the shade and the relative humidity is less than 50 percent.

1. All masonry materials shall be shaded from direct sunlight; mortar beds shall be spread no more than 1.2 m (4 feet) ahead of masonry; masonry units shall be set within one minute of spreading mortar; and after erection, masonry shall be protected from direct exposure to wind and sun for 48 hours.

B. Cold Weather Installation: Before erecting masonry when ambient temperature or mean daily air temperature falls below 4 degrees C, (40 degrees F,) a written statement of proposed cold weather construction procedures shall be submitted for approval. The following precautions shall be taken during all cold weather erection.

1. Preparation: Ice or snow formed on the masonry bed shall be thawed by the application of heat. Heat shall be applied carefully until the top surface of the masonry is dry to the touch. Sections of masonry deemed frozen and damaged shall be removed before continuing construction of those sections.

2. Air Temperature 4 to 0 degrees C (40 to 32 Degrees F): Sand or mixing water shall be heated to produce mortar temperatures between 4 degrees C and 49 degrees C. (40 degrees F and 120 degrees F).

3. Air Temperature 0 to minus 4 degrees C (32 to 25 Degrees F): Sand and mixing water shall be heated to produce mortar temperatures between 4 degrees C and 49 degrees C. (40 degrees F and 120 degrees F.) Temperature of mortar on boards shall be maintained above freezing.

4. Air Temperature minus 4 to minus 7 degrees C (25 to 20 Degrees F): Sand and mixing water shall be heated to provide mortar temperatures between 4 degrees C and 49 degrees C. (40 degrees F and 120 degrees F.) Temperature of mortar on boards shall be maintained above freezing. Sources of heat shall be used on both sides of walls under construction. Windbreaks shall be employed when wind is in excess of 24 km/hour. (15 mph.)

5. Air Temperature minus 7 degrees C (20 Degrees F) and Below: Sand and mixing water shall be heated to provide mortar temperatures between 4 degrees C and 49 degrees C. (40 degrees F and 120 degrees F.) Enclosure and auxiliary heat shall be provided to maintain air temperature above 0 degrees C. (32 degrees F.) Temperature of units when laid shall not be less than minus 7 degrees C. (20 degrees F.)

6. Completed Masonry and Masonry Not Being Worked On:

   a. Mean daily air temperature 4 degrees C to 0 degrees C. (40 degrees F to 32 degrees F.) Masonry shall be protected from rain or snow for 24 hours by covering with weather-resistive membrane.

   b. Mean daily air temperature 0 degrees C to minus 4 degrees C. (32 degrees F to 25 degrees F.) Masonry shall be completely covered with weather-resistive membrane for 24 hours.

   c. Mean daily air temperature minus 4 degrees C to minus 7 degrees C. (25 degrees F to 20 degrees F.) Masonry shall be completely covered with insulating blankets or equally protected for 24 hours.

   d. Mean daily temperature minus 7 degrees C (20 degrees F) and below. Masonry temperature shall be maintained above 0 degrees C (32 degrees F) for 24 hours by enclosure and supplementary heat, by electric heating blankets, infrared heat lamps, or other approved methods.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cement shall be Portland Cement, Type I or II, meeting Standard Specifications for Portland Cement (ASTM C-150).

B. Sand shall meet the requirements of Standard Specifications for Aggregate for Masonry Mortar (ASTM C-144-81), with the gradation to satisfy paragraph 3, Grading, and with the omission of subparagraph 3.4.

C. Hydrated Lime shall meet the requirements of the Standard Specifications for Hydrated Lime for Masonry Purposes (ASTM C-207), Type S.

D. Hydraulic Hydrated Lime shall meet the requirements of the Standard Specifications for Hydraulic Hydrated Lime for Structural Purposed (ASTM C-141).

E. Water shall be potable.

F. Air-entraining admixtures may be utilized and shall conform to ASTM C-260, as shall admixture workability.

G. Provide water resistant admixture.

2.2 PRE-PACKAGED MORTAR MIXES

A. Pre-packaged mortar cements may be used with prior approval of the Architect. To be considered, the mortar cement manufacturer shall submit a request to the Architect in sufficient time for the proposed material to be tested and evaluated prior to its approval for a specific project. The mortar cement shall be in accordance with ASTM C-91-83, and meet the following minimum requirements:

1. Type S Mortar Cement. The masonry mortar made from the mortar cement shall have a compressive strength of 1800 psi minimum at 28 days when tested in accordance with ASTM C-270, with maximum air volume of 16%.
2. The mortar cement shall contain Portland Cement, hydrated lime, plasticizing admixtures, and/or hydraulic hydrated lime. Mortar cement mixes that contain other materials, including ground limestone, ground slag or other cementitious or non-cementitious materials, are not acceptable.

B. Instructions for mixing the mortar mix shall be published and accompany all shipments. The instructions shall be volumetric measurements, and shall be developed to show proper proportions of sand to one (1) bag of the prepackaged mortar cement with volume of water to produce a flow of the proper consistency.

C. Freeze-thaw Resistance: The mortar cement shall comply with the following requirements when subjected to 50 cycles of the freeze-thaw test:

1. Loss of compressive strength: 35% maximum
2. Loss in dry weight: 1.0% maximum

D. The test specimen shall be made in accordance with ASTM C-91, Paragraph 18, 19 and 20 and be tested in accordance with ASTM C-01, Paragraphs 22.1 and 22.2.1 and ASTM C-67, Paragraph 8.1, 8.3 and 8.4.

1. Colored mortar will be required for all rock-cast concrete masonry. Colored mortar shall be field batched mortar with coloring agent added in field. Tests will be required to insure the coloring agent does not affect properties of the mortar. No pre-packaged mortar with coloring agents is acceptable. Colored mortar is to match rock-cast.

2.3 ON-THE-JOB-MORTAR CEMENT

A. Type S. mortar shall have a compressive strength of 1800 psi minimum at 28 days. The mortar shall be proportioned within the following volumetric limits:

1. 1 part Portland Cement
2. 1/2 part Hydrated Lime
3. Masonry sand measured in a damp loose condition is to be not less than 2-1/4 and not more than 3 times the sum of the volumes of cement plus lime used.
4. Plasticizer per instructions of the manufacturer, the quantity of which is not to exceed 2% by volume of the cement and lime combination.

2.4 MEASUREMENT AND MIXING

A. The method of measuring material shall be by volume and shall be such that the specified proportions of the mortar materials can be controlled and accurately maintained. A measuring device to make consistent volume measurements shall be used throughout the project. Measurement of sand by shovel will not be permitted.

B. Mortar Mixer shall be paddle-type mechanical mixer. It shall be of such design and size to accommodate the mix without overloading, and be adequately powered to vigorously mix the ingredients.

C. The mortar mixer shall be charged in this order: add approximately one-half the water required, one-half the sand, the cement and lime (or prepackaged mortar cement), the remaining amount of sand, and then sufficient water to bring the mix to desired consistency. Mortar shall be mixed for a minimum of five minutes after all materials have been charged into the mixer with all batches being mixed to the same consistency.

D. Mortars that have stiffened because of evaporation of water from the mortar may be retempered by adding water as frequently as needed to restore the required consistency. Mortars shall be used and placed in their final position within 2 hours after mixing. When the temperature is over 80 degrees F., the mortar shall be used within 1-1/2 hours of mixing. Mortar not used within these time periods shall be discarded.

END OF SECTION 04100

SECTION 04150 - MASONRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, Amendments to General Conditions, and Supplementary Conditions and Sections in Division 1 of the Specifications apply to work of this section.

1.2 DESCRIPTION

A. Work Included in this Section:
   1. Metal joint-reinforcement and anchors as specified herein.
B. Related Work Specified Elsewhere:
   1. Mortar (Section 04100)
   2. Concrete Unit Masonry (Section 04220)

1.3 SUBMITTALS

A. Samples: Submit samples of the following:
   1. Joint Reinforcement:
      a. Submit one piece of joint-reinforcement for wall intersections.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver materials for work of this Section in Manufacturer's original packaging and protection. Labels shall be intact and legible.
B. Store materials under cover, and off the ground to protect from wetting, dirt and physical damage.
C. For joint-reinforcement, anchors and ties, remove any loose rust, scale, dirt and other coatings that would reduce the bond to mortar. Remove by wire brushing prior to installation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Masonry Joint Reinforcement:
   1. Types specified herein are as manufactured by AA Wire Products Co., Chicago, Illinois. Equivalent reinforcement will be acceptable as manufactured by Dayton Sur-Grip and Shore Co.; Conover Steel and Wire Co., Inc.; Dur-O-Wal, Inc., or approved equal.
   2. Reinforcement for concrete-unit-masonry walls and partitions of single thickness of masonry units shall be Blok-Lok (AS500), Extra Heavy, hot-dipped galvanized after fabrication.
   3. Width of reinforcement shall be 2" less than the nominal wall thickness.
   4. Provide prefabricated "Tees" at all abutting walls.

PART 3 - EXECUTION

3.1 ACCESSORY INSTALLATION

A. Installation of masonry accessories shall be as specified in Section of the Project Manual on unit masonry.

END OF SECTION 04150

SECTION 04220 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, Amendments to General Conditions, and Supplementary Conditions and Sections in Division 1 of the Specifications apply to work of this section.

1.2 DESCRIPTION

A. The work required under this Section consists of all concrete masonry.

B. Related Work

1. Mortar is specified under Section 04100.
2. Masonry accessories are specified under Section 04150.
3. Insulation is specified in Division 7.

1.3 SUBMITTALS

A. The Contractor shall submit a certificate signed by the concrete unit masonry manufacturer of compliance with the ASTM C 90 and Non Load Bearing C 129.

B. When requested by the Architect, the Contractor shall submit to the Architect for approval duplicate samples of each and every kind and/or size of structural concrete block the proposes to use. Each sample shall bear a label indicating the size, kind and quality of the product and the name of the manufacturer.

1.4 QUALITY ASSURANCE

A. The manufacturer of the structural concrete block shall be subject to the approval of the Architect.

B. Certificates:

1. Prior to delivery of the concrete masonry units to Project Site, submit certificates from manufacturer of concrete masonry units stating compliance with requirements of the Contract Documents. Certificate shall be on firm's letterhead, signed by an officer of the company.

2. At the completion of the job, the Contractor shall furnish a certificate acceptable to the North Carolina Fire Insurance Rating Bureau, certifying that these units meet their requirements.

1.5 ENVIRONMENTAL CONDITIONS

A. Cold Weather and Hot Weather Installations: Comply with requirements specified in Section 04100, "Mortar".

PART 2 - PRODUCTS

2.1 CONCRETE BLOCK

A. Units for "Regular Unit Masonry" shall be 2-cell and designed for stacked cells to allow for filling of cores where required on the drawings, except where other shapes, or solid masonry units are called for. See Drawings for size and specific cell arrangement where such is required.

1. ASTM C-90

B. Split Face CMU: Adams products or approved equal. Submit color samples for approval. Also submit grout colors for selection.

C. Deliver concrete-masonry-units on pallets. Handle at Project Site on flat-bed wheelbarrows or pallets and forklift.

2.2 WALL REINFORCEMENT

A. All exterior walls, foundations and back-up walls shall be reinforced with Dur-O-Wal, American or Wal-Lock truss-design deformed reinforcement hot-dip galvanized after fabrication with zinc coating ASTM A 116, Class 3. It shall be installed in every other course of block. Use corner and tee sections around corners and at intersections with other walls.

B. Reinforcing Bars: ASTM A 615, Grade 60 deformed.

2.3 EMBEDDED ITEMS

A. The Contractor shall furnish and install all bolts, anchors, etc., which are to be built into masonry. Coordinate all conduits, pipes etc. with other trades.

PART 3 - EXECUTION

3.1 LAYING

A. All masonry shall be laid true to dimensions, plumb, square, in bond and properly anchored. All courses shall be level with joints of uniform width. No joints shall exceed the size specified. Faces of walls shall be laid to a line. All masonry shall be laid uniformly one scaffold-height at a time except when otherwise specially approved. Whether masonry is laid from an outside or an inside scaffold rests with the Contractor, but the governing requirement shall be a first class job of masonry in every respect.

B. Work required to be built into the masonry including loose lintels, angles, special metal work, flashings, anchors, wall plugs, grounds blocking, and other accessories shall be built in as the masonry work progresses. Unless otherwise shown all spaces about built-in work shall be completely and solidly filled in with masonry. Bucks, frames, and similar built-in items shall be maintained in their proper positions, and no braces or stays shall be removed from same until they are securely supported and fastened by the masonry.

C. Carefully cover all walls each night during inclement weather or during delays in the work to prevent water from rains getting into the masonry. When starting work at a new level, the existing masonry shall be cleaned of all loose mortar, or other materials, and shall be thoroughly welded.

D. Pickets, chases, recesses and other breaks in masonry shall be constructed where and as shown on the drawings or in accordance with instructions given prior to the laying of the masonry.

E. Cutting of Units: Where cuffing is necessary, make all cuts with a motor driven masonry saw. Units with chips or irregular cuts will not be accepted.

F. Coursing: Masonry work is laid out on a nominal 3/8" wide joint for concrete-unit-masonry work.

G. Where masonry units are disturbed, or must be moved after the mortar has begun to lose its moisture, the masonry unit and all adjacent mortar shall be removed and reset completely.

3.2 EXPANSION MATERIAL

A. Install as masonry work proceeds, and as shown on drawings. Joints are to be kept clean and free of all mortar as work progresses.

3.3 BUILT-IN WORK

A. Consult other trades in advance and make provisions for installation of their work in order to avoid cutting and patching. Build in work specified under other sections of the specifications as the work progresses.

B. Set steel lintels in beds of mortar.

C. Grout heads and jambs of hollow metal frames fully. Observe requirements of UL for grouting frames in Fire-Rated opening assemblies.

3.4 BOND AND JOINTS

A. All blocks, unless otherwise shown on the Drawings or herein excepted, shall be laid in running bond with all intersections of walls bonded every second course or keyed every course with galvanized corrugated steel wall ties. Blocks shall be cut accurately to fit around all pipe, ducts, openings, etc., and all voids slushed full. Unless otherwise shown or directed, all blocks shall be laid with the cells vertical. All walls and webs of blocks shall be carefully buttered, full-joint, with mortar. All solid blocks shall be laid in full beds of mortar. All blocks shall be laid with 3/8" bed and head joints. Except where plaster occurs, as shown on details and in Finish Schedule masonry block walls shall have concave mortar joints. Where plaster is to be applied, mortar joints shall not be tooled, but shall be flush with face of block. Wherever concentrated loads occur, all cells of blocks shall be carefully and solidly filled with concrete or mortar. Units shall be set tightly against the inside of bucks and all voids slushed full.

3.5 DISTURBED UNITS

A. Where concrete masonry units are disturbed or must be moved after the mortar has begun to lose its moisture, the masonry units and all adjacent mortar shall be removed and reset completely.

3.6 TOOLING

A. Where joints are to be tooled they shall be tooled to a uniform concave, head joints first and the bed joints. All joints shall be tooled at approximately the same degree of moisture content and firmness to achieve a uniform color and texture.

3.7 CONSTRUCTION TOLERANCES

A. Variations from Plumb: For lines and surfaces of columns, walls and arises do not exceed 1/4" in 10', 3/8" in a story height of 20' maximum, nor 1/2" in 40' or more. Except for external corners, expansion joints and other conspicuous lines, do not exceed 1/4" in any story of 20' maximum, nor 1/2" in 40' or more.

B. Variations from Level: For grades shown for exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines do not exceed 1/4" in any bay of 20' maximum, nor 3/4" in 40' or more.

3.8 POINTING OF MASONRY

A. At the completion of the masonry work, all holes in the exposed masonry shall be pointed. Defective joints shall be cut out and tuck-pointed solidly with mortar. Pointing and tuck-pointing shall be done with a pre-hydrated mortar. The mortar cement shall be controlled so that after curing of the mortar no difference in texture or color exists with that of adjacent masonry.

3.9 COLD WEATHER

A. No laying of masonry units shall be performed unless the temperature of the surrounding air is 40 degrees F and rising. The use of "anti-freeze" or accelerating admixtures is not permitted. Provide temporary protection of masonry to ensure a minimum 48 hours curing at a minimum 40 degrees F.

3.10 MASONRY CLEANING

A. While laying the concrete masonry, good workmanship and job housekeeping practices shall be used so as to minimize the need for cleaning the concrete masonry. Protect the base of the wall from mud splashes and mortar droppings, protect the wall by setting scaffolding boards so that mortar is not deflected on the wall, and at end of each day set the scaffolding boards so they do not deflect rainfall onto newly laid masonry. The concrete masonry technique shall be such that mortar does not run down the face of the wall, or smear the mortar onto the brick face. After the joints are tooled, cut off mortar tailings with the trowel and brush excess mortar burrs and dust from the face of concrete masonry. Do not bag or sack the wall, but use a bricklayer's brush made with medium soft hair.

B. Remove all large mortar particles with a hardwood scraper.

C. If, after using the above outlined techniques, additional cleaning of the walls is found necessary, allow the walls to cure one month prior to initiating further cleaning processes.

D. Saturate the wall with clean water. The wall shall be thoroughly saturated prior to and at the time the cleaning solution is applied.

E. Clean the wall only with an approved cleaning solution applied with a brush, starting at the top of the wall. Approved cleaning solutions are: Sure-Klean 600, Vanatrol, Superior 800, or approved equal. Approved cleaners shall be composed primarily of detergents, wetting agents, buffering agents, and a maximum of 10% muriatic acid. The use of any of the above cleaning agents shall first be approved in writing by the manufacturer of the concrete masonry being cleaned, and by the Architect. The concentration, method of application of the cleaning solution, and method of scraping shall be as outlined on the container by the manufacturer.

F. High pressure water and sandblasting shall not be used for cleaning except with the recommendations of the concrete masonry manufacturer, and the written approval of the Architect.

G. Immediately after cleaning a small area, the wall shall be rinsed thoroughly with quantities of water.

H. Protect adjacent surfaces and materials during brick cleaning operations.

1. After the walls are cleaned, take necessary precautions to ensure that other contractors and subcontractors do not damage or soil the walls. Mud protection around the base of walls shall be left in place until the final grading work is done.

END OF SECTION 04220

SECTION 05500 - METAL FABRICATIONS

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 this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Steel lintels and shelf angles.
   2. Pipe and tube railings.
   3. Steel framing and supports for applications where framing and supports are not specified in other Sections.

1.3 SUBMITTALS

A. Shop Drawings: For each fabricated item, show the following:
   1. Plans and elevations.
   2. Jointing and connections. Indicate welded connections using standard AWS symbols; indicate net weld length.
   3. Profiles of sections and reinforcing.
   4. Fasteners and anchors.
   5. Accessories.
   6. Location of each finish.

B. Product Data: Manufacturer's specifications and installation instructions. Submit for:
   1. All manufactured products used in fabrications.

C. Samples of products and materials when requested.

1.4 QUALITY ASSURANCE

A. Definitions in ASTM E 985 for railing-related terms apply to this section.

B. Structural Performance of Handrails and Railing Systems: Comply with ASTM E 985 based on testing per ASTM E 894 and E 935.

C. Structural Performance of Handrails and Railing Systems: Provide handrails and railing systems capable of withstanding the following structural loads without exceeding the allowable design working stress of the materials involved.
   1. Top Rail of Guardrail Systems: Concentrated load of 200 lbf (890 N) applied at any point and in any direction and a uniform load of 50 lbf per linear foot (730 N/m) applied horizontally and concurrently with a uniform load of 100 lbf per linear foot (1460 N/m) applied vertically downward. Concentrated and uniform loads need not be assumed to act concurrently.
   2. Handrails Not Serving as Top Rails: Concentrated load of 200 lbf (890 N) applied at any point and in any direction and a uniform load of 50 lbf per linear foot (730 N/m) applied in any direction. Concentrated and uniform loads need not be assumed to act concurrently.
   3. Infill Area of Guardrail Systems: Horizontal concentrated load of 200 lbf (890 N) applied to 1 sq. ft. (0.09 sq. m) at any point in the system including panels, intermediate rails, balusters, or other elements composing the infill area. Loads on infill area need not be assumed to act concurrently with loads on top rails.

D. Where fabrications are specified to comply with specific structural performance

requirements, provide design sealed by a professional engineer registered in the state in which the project is located.

1.5 PROJECT CONDITIONS

A. Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinated fabrication schedule with construction progress to avoid delaying the Work.

B. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1. MATERIALS - METALS

A. Steel Shapes:
1. Plates, bars, angles, channels, and H-sections: ASTM A 36.
2. Grating bars: ASTM A 36 or ASTM A 569.
3. Galvanizing: Hot-dip galvanizing after fabrication in accordance with ASTM A 123.
4. Tube: Cold-formed: ASTM A 500, Grade B.
5. Pipe: ASTM A 53, standard weight.

B. Steel Sheet:
1. For structural uses: Hot-rolled, ASTM A 570; cold-rolled, ASTM A 611.
2. For nonstructural uses: Cold-rolled, ASTM A 366; hot-rolled, ASTM A 569.

C. Galvanized Steel Sheet:
1. For structural uses: ASTM A 446.
2. For nonstructural uses: ASTM A 526.
3. Galvanizing: In accordance with ASTM A 525, G90, unless otherwise indicated.

D. For metal fabrications exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

2.2 MANUFACTURED COMPONENTS

A. Bar Gratings: Manufacture in accordance with "Standard Specifications for Metal Bar Grating and Metal Bar Grating Treads" (part of NAAMM MBG 531), except for specific requirements specified here.
1. Where load and deflection requirements are indicated, select member sizes and materials using manufacturer's published load tables.
2. Spacing: 1-1/2 inches
3. Cross bar spacing: 4 inches.
4. Top surface: Plain.

2.3 MATERIALS - MISCELLANEOUS

A. Grout: Nonmetallic, noncorrodible, nonshrink, factory blended and packaged; complying with ASTM C 1107. Use type recommended by manufacturer for exterior use where required.

B. Fasteners: Use fasteners suitable for the material being fastened and for the type of connection required.

1. For exterior use or built into exterior walls: Nonferrous stainless steel, zinc coated or cadmium plated.
2. Use fasteners of same material as items being fastened unless otherwise indicated.
3. Bolts and studs: ASTM A 307.
4. Nuts: ASTM A 563.
5. Plain washers: Round, carbon steel, ASME B18.22.1 (ASME B18.22M).
6. Lock washers: Helical, spring type, carbon steel, ASME B18.21.1 (ASME B18.21M).
7. Expansion shields: FS FF-S-325.

C. Galvanizing Repair Paint: Zinc dust paint complying with SSPC-Paint 20 or MIL P-21035B, Type I or II.

D. Shop Primer: Fabricator's standard, fast-curing, lead-free, universal modified alkyd primer; resistant to normal atmospheric corrosion, compatible with finish paint systems indicated, capable of providing a sound foundation for field-applied topcoats despite prolonged exposure; complying with performance requirements of FS TT-P-645.

2.4 FABRICATION - GENERAL

A. Fabricate and shop-assemble in largest practical sections for delivery to site.
1. Prepare and reinforce fabrications as required to receive applied items.
2. Fabricate items with joints tightly fitted and secured.
3. Make exposed joints tight, flush, and hairline.

B. Fasteners: Use concealed fasteners if possible.
1. Exposed fasteners: Flathead, countersunk type unless otherwise indicated.

C. Anchors: Fabricate to suit conditions indicated; use anchors of same material and finish as item except where specifically indicated otherwise.

D. Welding:
1. Welding of steel: Comply with AWS D1.1 recommendations.
2. Provide continuous welds at welded corners and seams.
3. Exposed welds: Grind flush and smooth.

E. Joints Exposed to Weather: Fabricate to keep water out, or provide adequate drainage of water that penetrates.

2.5 FABRICATION - SHEET METAL

A. Comply with general fabrication requirements.

B. Bend sheet metal corners to smallest practical radius.

C. Welding Steel Sheet: Comply with AWS D1.3 recommendations.

2.6 FABRICATION - GRATINGS

A. Metal Bar Gratings: Produce metal bar gratings indicated per NAAMM marking system that comply with the following:
1. Metal Bar Grating Standard "Standard Specifications for Metal Bar Grating and Metal Bar Grating Treads" published in ANSI/NAAMM A202.1 "Metal Bar Grating Manual."

2. Heavy Duty Metal Bar Grating Standard: "Guide Specifications for Heavy Duty Metal Bar Grating" published in NAAMM "Heavy Duty Metal Bar Grating Manual."

3. Welded Steel Gratings: W-15-4 (welded with bearing bars 15/16 inch o.c. and cross bars 4 inches o.c.)/bearing bar sizes as indicated.
4. Welded Heavy Duty Steel Gratings: W-19-4 (welded with bearing bars 1-3/16 inch o.c. and cross bars 4 inches o.c.)/bearing bar sizes as indicated.
5. Traffic Surface for Steel Bar Gratings: As follows:
    a. Plain.
    b. Serrated.
    c. Knurled.
    d. Applied abrasive finish consisting of aluminum oxide aggregate in an epoxy resin adhesive.
6. Steel Finish: As follows:
    a. Shop prime paint applied in accordance with manufacturer's standard practice.
    b. Hot-dip galvanized with a coating weight of not less than 1.8 oz. per sq. ft. of coated surface.

2.7 FABRICATION - SHOP COATINGS

A. Hot-dip galvanize steel and iron assemblies set in concrete and masonry.

B. Shop prime all iron and steel fabrications.

C. Prepare surfaces to be coated as follows:
1. Solvent-clean in accordance with SSPC-SP 1.
2. Exterior fabrications: Clean in accordance with SSPC-SP 5.
3. Interior fabrications: Clean in accordance with SSPC-SP 5.

D. Shop Priming: Comply with SSPC-PA 1.
1. Apply primer immediately following surface preparation.
2. Do not prime surfaces to be welded.
3. Do not prime surfaces in direct contact bond with concrete.
4. Apply extra coat to corners, welds, edges, and fasteners.

E. Shop Painting: Apply shop primer to surface of metal fabrications except those embedded in concrete or galvanized; comply with SSPC-PA1 and requirements indicated below:
1. Surface Preparation: Comply with SSPC-SP6 "Commercial Blast Cleaning" for exterior work, and with SSPC-SP3 "Power Tool Cleaning" for interior work.
2. Stripe paint edges, corners, crevices, bolts, welds and sharp edges.

F. Galvanizing: ASTM A 123 for fabricated and unfabricated steel products made of uncoated rolled, pressed and forged steel shapes, plates, bars and strip 0.0229 inch and thicker.

2.8 FABRICATION - MISCELLANEOUS

A. Loose Bearing and Leveling Plates: Provide for steel items bearing on masonry or concrete, as indicated. Drill plates to receive anchor bolts.

B. Loose Steel Lintels: Fabricate from shapes and to sizes indicated. Galvanize after fabrication.

C. Miscellaneous Framing and Supports: Provide as required to complete work and not included with structural steel framework. Fabricate of welded construction in as large units as possible; drill and tap as required to receive hardware and similar items. Include required anchors for building into other work.

D. Miscellaneous Steel Trim: Fabricate to shapes and sizes as required for profiles shown; continuous welded joints and smooth exposed edges. Use concealed field splices

wherever possible. Provide cutouts, fittings, and anchorages; coordinate assembly and installation with other work.

E. Nosings: Fabricate of shapes as indicated; miter corners and weld joints. Provide anchors 6 inches from ends of corners and 24 inches o.c.

F. Shelf and Relieving Angles: Fabricate to sizes indicated for attachment to support framing. Provide slotted holes to receive anchor bolts, spaced not more than 6 inches from ends and 24 inches o.c. Galvanize shelf angles to be installed on exterior concrete.

G. Steel Pipe Railings: Fabricate to dimensions shown, with smooth bends and welded joints using steel pipe of diameter and finish indicated. Secure posts and rail ends to building construction as indicated.
1. Galvanize exterior steel railings, including pipe, fittings, brackets, fasteners and other ferrous metal components.
2. Provide steel pipe with black finish for interior railings, primed after fabrication.

H. Cast Treads and Thresholds: Cast-iron units with integral abrasive finish, of size and configuration indicated; with manufacturers's standard anchors for type of application indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Perform cutting, drilling and fitting required for installation; set work accurately in location, alignment and elevation, measured from established lines and levels. Provide anchorage devices and fasteners where necessary for installation to other work.

B. Set loose items on cleaned bearing surfaces, using wedges or other adjustments as required. Solidly pack open spaces with bedding mortar, consisting of 1-part portland cement to 3-parts sand and only enough water for packing and hydration, or use commercial non-shrink grout material.

C. Touch-up shop paint after installation. Clean field welds, bolted connections and abraded areas, and apply same type paint as used in shop. Use galvanizing repair paint on damaged galvanized surfaces.

D. Perform all welding in accordance with AWS requirements and procedures for appearance, quality of welds, and correction of welding work.

E. Allow for thermal movement resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening up of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

G. Verify handrail and railing dimensions by field measurements before fabrication and indicate measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.

H. Coordinate installation fo anchorages for handrails and railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Anchor posts in concrete by inserting into preset sleeves or core-drilled holes and grouting space between post and sleeve.

J. Secure handrails to wall with wall brackets and end fittings.
   1. Use brackets with flange tapped for concealed hanger bolt.
   2. Use brackets with predrilled hole for exposed bolt anchorage.

END OF SECTION 05500

SECTION 06100 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
1. Carpentry work not specified as part of other sections and which generally is not exposed, except as otherwise indicated.
2. Rough carpentry for:
a) Miscellaneous lumber for attachment and support of other work.
b) Construction panels for miscellaneous uses.
3. Preservative treatment.

1.2 SUBMITTALS

A. Treated Wood: Treating plant's instructions for use, including storage, cutting, and finishing.
1. Pressure preservative treatment
a) Treating plant's certification of compliance with specified standards and stating process employed and preservative retention values.
b) Treatment for above-ground use
c) Certification of kiln drying after treatment.

1.3 QUALITY ASSURANCE

A. Lumber
1. Comply with NIST PS 20 and approved grading rules and inspection agencies.
B. Grade Stamps for Concealed Lumber
1. Each piece of lumber, applied by inspection agency and showing compliance with each specified requirement. (All lumber/blocking, etc. concealed in wall or partition construction shall be fire retardant.
C. Construction Panels
1. 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.

1.4 DELIVERY, STORAGE AND HANDLING

A. Protect wood products against moisture and dimensional changes. Support stacks at several uniformly spaced points to prevent deformation. Store stacks raised above ground. Cover to protect from rain and snow. Select and arrange cover to allow air circulation under and all around stacks to prevent condensation. Maintain and restore displaced coverings. Remove from the site any wood products that have been subjected to moisture or that do not comply with the specified moisture requirements.

PART 2 - PRODUCTS

2.1 DIMENSION LUMBER

A. Size
1. Provide nominal sizes indicated, complying with NIST PS 20 except where actual sizes are specifically required.
B. Miscellaneous Lumber
1. Provide dimension lumber and boards necessary for the support of work specified in other sections, whether or not specifically indicated, and including but not limited to blocking, nailers, etc.
a) Moisture content: 19 percent maximum (kiln-dry).
b) Lumber: S4S, No. 2 or standard grade.
c) Boards: Standard, 3 common, or No. 3 grade.

2.2 CONSTRUCTION PANELS

A. Construction Panels/Plywood:
   1. Miscellaneous uses
      a) C-C Plugged exterior.

2.3 MISCELLANEOUS MATERIALS

A. Fasteners
   1. Provide as required by applicable codes and as otherwise indicated.

2.4 WOOD TREATMENT BY PRESSURE PROCESS

A. Aboveground Lumber: AWPB LP-2 (waterborne preservatives).
   1. Kiln dried after treatment to 19 percent maximum moisture content.
   2. Treat the following:
      a) Wood in contact with roofing or flashing.
      b) Wood in contact with masonry or concrete.
      c) Other members indicated.

B. Fasteners for Preservative Treated Wood: Hot-dip galvanized steel (ASTM A153).

2.5 NONCOMBUSTIBLE BLOCKING TO BE USED IN RATED WALLS

PART 2 - EXECUTION

2.1 INSTALLATION - GENERAL

A. Arrange work to use full-length pieces except where lengths would exceed commercially available lengths. Discard pieces with defects that would lower the required strength or appearance of the work.
B. Cut and fit members accurately. Install plumb and true to line and level.
C. Fasten carpentry in accordance with applicable codes and recognized standards.
D. Where exposed, countersink nails and fill flush with suitable wood filler.
E. Use fasteners of appropriate type and length. Predrill members when necessary to avoid splitting wood.

2.2 MISCELLANEOUS CARPENTRY

A. Provide miscellaneous blocking, nailers, and framing as shown and as required for support of facing materials, fixtures, specialty items, and trim. Cut and shape to the required size. Provide in locations required by other work.
B. Use countersunk fasteners appropriate to applied loading.

END OF SECTION 06100

SECTION 06200 - FINISH CARPENTRY

PART 1 - PUBLICATIONS:

1.1 Applicable publications: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

A. Federal Specification (Fed.Spec.):
   1. FF-N-105B; Nails, Brads, Staples and Spikes: Notice 1 Wire, Cut and Wrought

B. U. S. Department of Commerce, National Bureau of Standards, Product Standards (Prod. Std.):
   1. PS 20-70 American Softwood Lumber Standard Amended 1986

C. Architectural Woodwork Institute (AWI) Publication:
   1. Architectural Woodwork Quality Standards, Guide Specifications and Quality Certification Program (1984)

D. Northern Hardwood and Pine Manufacturers Association, Inc. (NHPMA) Publication:
   1. Standard Grading Rules for Northern and Eastern Lumber (Dec 1978: Rev Mar 10, 1982)

E. Southern Pine Inspection Bureau (SPIB) Publication:
   1. Grading Rules (Mar 15,1977; including Suppl. 1 through 12)

1.2 GENERAL REQUIREMENTS:

A. Grading and Marking: Materials shall bear the grade mark, stamp or other identifying marks indicating grades of material and rules or standards under which produced. Such identifying marks on a material shall be in accordance with the rule or standard under which the material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification. The inspection agency for lumber shall be certified by the Board of Review, American Lumber Standards Committee, to grade the species used. Except for plywood and lumber, bundle marking or certificates will be permitted in lieu of marking each individual piece.

B. Sizes and Patterns: Lumber sizes and patterns shall conform to Prod. Std. PS 20, and unless otherwise specified, shall be surfaced on four sides. Sizes and patterns for materials other than lumber shall conform to requirements of the rules or standards under which produced. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced.

C. Moisture Content: The maximum moisture content of trim shall be 8% to 12% at the time of delivery to the job site and when installed. Moisture content of all other materials shall be in accordance with the standard under which the product is produced.

1.3 SUBMTTALS:

A. Samples: Samples of each design of wood molding shall be submitted for approval. Samples shall be of sufficient size to show pattern, as applicable.

1.4 DELIVERY AND STORAGE:

A. Materials shall be delivered to the site in undamaged condition, stored in fully covered, well-ventilated areas, and protected from extreme changes in temperature and humidity.

1.5 MATERIALS:

A. Nails: Nails shall be the size and type best suited for the project requirements, hot-dip galvanized or aluminum for exterior use, in accordance with Fed. Spec. FF-N-105B when applicable. Screws for use where nailing is impracticable shall be size best suited for purpose.

B. Trim: Trim shall be species and grade in accordance with paragraph 1.6. Design shall be as shown on the drawings. Trim shall be assembled and sanded at the mill in so far as practicable in maximum practicable lengths. Finger joints are permitted when finish is paint.

1.6 INSTALLATION OF TRIM:

A. Interior Trim: Trim shall be installed straight, plumb, level and with closely fitted joints. Exposed surfaces shall be machine sanded at the mill. Molded work shall be coped at returns and interior angles and mitered at external corners. Intersections of flatwork shall be shouldered to ease any inherent changes in plane. Window and door trim shall be provided in single lengths. Blind nailing shall be used to the extent practicable, and face nailing shall be set and stopped with no staining putty to match the finish applied. Predrill as required to eliminate splitting. Screws shall be used for attachment to metal; setting and stopping of screws shall be of the same quality as required where nails are used. All trim to be No. 1 popular suitable for painting. (Provide all miscellaneous blocking or attachments required.

B. Contractor shall be responsible for field measurements of all dimensions required.

C. Any chipped, split or damaged trim to be replaced at no additional cost to the Owner.

D. Install trim with respect to adjoining finishes so no gaps result.

END OF SECTION 06200

SECTION 06400 - ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Interior architectural woodwork.
      a. Cabinets.
      b. Cabinet hardware.
      c. Countertops.
      d. Shelving.

1.2 REFERENCES

A. Architectural Woodwork Quality Standards; Architectural Woodwork Institute; 1994.

1.3 SUBMITTALS

A. Shop Drawings: Plans and elevations; details at a large scale; show location of each item, identify components used, and indicate method of attachment.

B. Factory Finishes:
   1. Samples: 8- by 10-inch step samples, finished, for each finish and color, showing each coat required.

C. Solid Surfacing:
   1. Product data.
   2. Samples for selection: Approximately 2- by 3-inch pieces of manufacturer's full type, pattern, and color range.

D. Cabinet Hardware:
   1. Product data.
   2. Samples showing each finish on each item of hardware exposed to view.

E. Fabricator Qualifications: For information only.

1.4 QUALITY ASSURANCE

A. Quality of Materials and Workmanship: Provide woodwork that complies with requirements of "Architectural Woodwork Quality Standards," published by Architectural Woodwork Institute (AWI) (hereinafter referred to as "woodworking standard").

B. Quality of Factory Finishing: Provide factory finishes that comply with Section 01500, "Architectural Woodwork Quality Standards."

C. Where contract documents indicate requirements, which are less restrictive than the woodworking standard, comply with the minimum requirements of the woodworking standard.

D. Fabricator Qualifications:
   1. A single firm shall fabricate all work of this section.

E. Installer Qualifications: Experienced in installing woodwork of similar quality.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials for interior woodwork indoors in air-conditioned spaces maintained within design temperature and humidity range.

1.6 PROJECT CONDITIONS

A. Maintain final design temperature and humidity in areas where woodwork is installed.

B. Fit woodwork to actual construction. Take field measurements before fabricating.

C. Coordinate installation of woodwork with other work to avoid damage.

PART 2 - PRODUCTS

2.1 WOOD MATERIALS

A. Lumber - General: Species and grade as specified in woodworking standard, unless otherwise indicated.
   1. Comply with applicable requirements of AWI Section 100.
   2. Moisture content at time of fabrication: Not greater than optimum moisture content as specified in woodworking standard.
   3. Provide lumber dressed on all exposed faces, unless otherwise indicated.
   4. Do not use twisted, warped, bowed, or otherwise defective lumber.
   5. Sizes indicated are nominal, unless otherwise indicated.
   6. Do not mark or color lumber, except where such marking will be concealed in finish work.

B. Trim, Molding and Finish Lumber: No. 1 Popular or approved substitution. Exposed edges of boards shall be eased. Trim to receive opaque finish may be finger jointed.

C. Plywood: Types, grades, and cores as specified in the woodworking standard, except as otherwise specified in this section.
   1. Comply with applicable requirements of AWI Section 200.
   2. Face grade for plywood to receive laminates: Grade A, minimum.
   3. Plywood for Shelving: A-B or B-B Grade, Exterior.
   4. Veneer for clear or stain finish: Birch veneer or as per drawings. Red Oak Veneer where called for on plans.

2.2 MISCELLANEOUS MATERIALS

A. Wood Filler for Transparent Finish Woodwork: Match final finish color.

B. Fasteners: Style, size, material, and finish as required for the purpose.

2.3 CABINET HARDWARE

A. Cabinet Hardware: Provide hardware and accessories indicated.
   1. Finishes on exposed hardware: Comply with BHMA A156.18.
      a. Match hardware for wood doors, unless otherwise indicated.
   2. Concealed hardware: Manufacturer's standard finish, complying with applicable requirements of BHMA A156.9.
   3. Hinges: Totally concealed style, self-closing, and opening 180 degrees.
   4. Pulls: Wire pulls.
   5. Catches: Heavy duty.

6. Drawer slides: Side-mounted, 75-pound capacity, full extension, with nylon ball-bearing rollers; positive pullout stop, self-closing, lift-out feature.
7. Cabinet-mounted adjustable shelf supports: Full height of cabinet, with adjustable shelf support clips.

B. Hardware Quantities:
1. Hinges: Two per door up to 36 inches high; three per door over 36 inches high.
2. Pulls: One per door, drawer.
3. Catches: One per door.
4. Drawer slides, side mounted: Two per drawer.
5. Locks: Where requested by Owner.
6. Cabinet-mounted adjustable shelf supports: Four standards for each cabinet to receive adjustable shelving and four shelf support clips for each shelf.

2.4 FABRICATION

A. Wall and Base Cabinets: Fabricate cabinets in profiles and sizes indicated. Provide each wall cabinet with 2 adjustable, full depth, shelves and each door type base cabinet (except sink base cabinet) with one fixed, half depth, shelf.
B. See plans for cabinet finishes and courtertops.

2.5 FACTORY FINISHING

A. Factory Finish: As specified for individual item.

B. Apply entire finish in shop; touch-up and cleaning only may be performed after installation.

C. Prepare for finishing in accordance with the woodworking standard.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that blocking and backings have been installed at appropriate locations for anchorage.

B. If shop-fabricated items are not fully fabricated, complete fabrication.

3.2 INSTALLATION - GENERAL

A. Do not begin installation of interior woodwork until potentially damaging construction operations are complete in the installation area.

B. Field Joinery: Comply with requirements of the woodworking standard for shop joinery.

C. Make joints neatly, with uniform appearance.

D. Install woodwork in correct location, plumb and level, without rack or warp.
1. Install with no variation in flushness of adjoining surfaces.

E. Shim as required with concealed shims.

F. Where cabinets abut other finished work, scribe and cut for accurate fit. Provide filler strips, scribe strips and moldings as indicated or required for a complete finished installation.

G. Touch-up shop finishes at field cuts.

H. Secure woodwork to structural support members or use anchors required.
   1. Where anchorage method is not indicated, conceal all fasteners where possible.
   2. Where exposed nailing is required or indicated, use finishing nails, countersink, and fill.

I. Repair damaged and defective woodwork to eliminate visual and functional defects; where repair is not possible, replace woodwork.

J. Touch up shop-applied finishes where damaged or soiled.

K. Cabinets:
   1. Install so drawers operate smoothly.
   2. Install all hardware not installed in shop.
   3. Anchor tops securely.
   4. Install tops level, within 1/8 inch in 8 feet.

L. Countertops: Attach countertops securely to base units. Conceal fastenings where practicable, fit the counter level, install in a rigid manner, and scribe to adjoining surfaces. Provide counter sections in the longest lengths practicable; keep joints in tops to a minimum. Provide cutouts for fixtures and appliances; drill pilot holes at corners before making cutouts.

   Install back and end splashes with concealed fastening.

M. Adjustable Shelving: Set standards at 32 inches on-center maximum and not greater than 6 inches from each end of shelf. Set top of standards at 7.5 feet above floor, unless otherwise indicated.

N. Anchorage of Millwork: Anchor securely in place with appropriate fasteners, anchored into structural support members of wall construction.

3.3 ADJUSTING

A. Adjust and lubricate cabinet hardware for smooth operation.

3.4 CLEANING

A. Clean exposed and semi-exposed surfaces.

3.5 PROTECTION

A. Protect woodwork from damage and maintain design environmental conditions.

END OF SECTION 06400

SECTION 07210 - BUILDING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Partition wall insulation
2. Sound Insulation
3. See also drawings for other requirements.

1.2 DEFINITIONS

A. Thermal Resistance (R-value): The temperature difference in degrees F between the two surfaces of a material of given thickness, required to make 1 BTU of energy flow through 1 square foot of the material in 1 hour.

1.3 SUBMITTALS

A. Product Data: Submit for each product specified in this section.

1.4 DELIVERIES, STORAGE, AND HANDLING

A. Insulation: Minimize period between product delivery and actual installation. Protect against exposure to flame, sparks, or excessive heat. Minimize exposure to sunlight.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Exterior walls at area of removed windows R-15 Batt with vapor barrier.

B. Unfaced Sound Insulation Batts (at interior partitions)
1. Provide unfaced sound batt insulation in interior partitions floor to ceiling
2. Provide unfaced sound batts insulation above Mothers/Quiet Room and Toilets.

2.2 ACCESSORIES

A. Provide accessories as necessary to properly install specified products.
B. Provide intumescent coating/thermal barrier on all exposed insulation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that conditions conform to requirements of contract documents.

B. Verify that related work to be performed within indicated spaces before installation of insulation has been completed.

B. Verify that substrates are in satisfactory condition to receive insulation.

C. Do not proceed until unsatisfactory conditions have been corrected. Commencement of installation indicates acceptance of conditions.

3.2 PREPARATION

A. Clean substrates of any substances, which might damage materials to be installed.

B. Remove harmful projections capable of puncturing vapor retarder.

3.3 INSTALLATION

A. Do not install insulation which is damaged, wet, soiled, or which has been covered at any time with ice or snow.

B. Comply with insulation manufacturer's recommendations and installation sequence. Provide permanent placement and support of insulation.

C. Install materials in a manner, which will maximize continuity of thermal or sound attenuation envelope, as applicable. Use a single layer of insulation wherever possible to achieve indicated requirements, unless otherwise indicated.

D. Insulation Blankets/Batts: (At all Interior Partitions)

1. Unfaced Sound Attenuation Insulation, Stud Partitions: Friction-fit blanket insulation between partition framing members. Stuff pieces of insulation into cracks between framing and into miscellaneous voids and cavity spaces (e.g., perimeter of wall openings). Provide unfaced blankets/batts on ceiling of Toilets and Mothers/Quiet Room.

3.4 PROTECTION

A. Protect installed materials from damage until permanent concealing work is completed.

B. Where concealing work is not performed immediately after installation work of this section is completed, erect suitable temporary coverings or enclosures to prevent damage.

END OF SECTION 07210

SECTION 07600 - FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, Amendments to General Conditions, and Supplementary Conditions and Sections in Division I of the Specifications apply to work of this section.

1.2 DESCRIPTION

A. Extent of each type of flashing and sheet metal work is indicated on drawings and by provisions of this Section.

B. Types of work specified in this Section include the following:

1. Metal counter flashing and base flashing.
2. Exposed metal trim.
3. Miscellaneous sheet metal accessories.

C. Related Work:

1. Section 07900 - Joint Sealants

1.3 SUBMITTALS

A. Comply with pertinent provisions of Section 01620.

B. Product Data; Sheet Metal, Accessories: Submit manufacturer's product data, installation instructions and general recommendations for each specified sheet material and fabricated product.

C. Samples; Flashing, Sheet Metal, Accessories: Submit 8" square samples of specified sheet materials to be exposed as finished surfaces.

1. Submit 12" long, completely finished units of specified factory-fabricated products exposed as finished work.

D. Shop Drawings; Flashing, Sheet Metal, Accessories: Submit shop drawings showing layout, joining, profiles, and anchorages of fabricated work, including major counter flashing, trim/fascia units, etc.; layouts at 1/4" scale, detail at 3" scale.

1.4 QUALITY ASSURANCE

A. Comply with industry standards and recommendations of SMACNA Architectural Sheet Metal Manual except as specifically indicated otherwise.

1.5 JOB CONDITIONS

A. Coordinate work of this Section with interfacing and adjoining work for proper sequencing of each installation. Insure best possible weather resistance and durability of work and protection of materials and finishes.

B. Surfaces to which flashing and sheet metal are applied shall be even, smooth, sound, thoroughly clean and dry and free from all defects that might affect the application. Report any unsatisfactory surfaces to the General Contractor.

C. Do not proceed with installation of sheet metal work until curb and substrate

construction, blocking, roofing, regrets, and other construction that will receive the work are completed. Proceeding with application of sheet metal work will be evidence of substrate acceptance by Installer.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 01620.

B. Materials furnished by this Section, which are to be built-in by other trades, shall be delivered to the Site in time to avoid delays in construction schedule.

PART 2 - PRODUCTS

2.1 FLASHING AND SHEET METAL MATERIALS

A. .032 Aluminum minimum (Pre-Finished to Match Existing)
B. Flashing exposed to view, prefinished color to be selected to match surrounding conditions.

2.2 MISCELLANEOUS MATERIALS AND ACCESSORIES

A. Fasteners: Same metal as flashing/sheet metal or other noncorrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.

B. Bituminous Coating: SSPC-Paint 12, solvent type bituminous mastic, nominally free of sulfur, compounded for 15-mil dry film thickness per coat.

C. Mastic Sealant: Polyisobutylene; nonhardening nonskinning, noncorrosive metal seam cementing compound, recommended by metal manufacturer for exterior/interior non-moving joints including riveted joints.

D. Adhesives: Type recommended by flashing sheet manufacturer for waterproof weather-resistant seaming and adhesive application of flashing sheet.

E. Metal Accessories: Provide sheet metal clips, straps, anchoring devices and similar accessory units as required for installation work, matching or comparable with material being installed. They shall be noncorrosive, in sizes and gauges required for proper performance.

PART 3 - EXECUTION

3.1 INSTALLATION REQUIREMENTS

A. General: Except as otherwise indicated, comply with manufacturer’s installation instructions and recommendations, and with SMACNA "Architectural Sheet Metal Manual". Anchor units of work securely in place by methods indicated. Provide for thermal expansion of metal units. Conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints and seams, which will be permanently watertight and weatherproof.

B. Underlayment: Where aluminum is to be installed directly on cementitious or wood substrates, apply a coating or other permanent separation as recommended by manufacturer/fabricator to concealed aluminum surfaces.

3.2 CLEANING AND PROTECTION

A. Clean exposed metal surfaces, removing substances, which might cause corrosion of metal or deterioration of finishes.

B. Protection: Installer shall advise Contractor of required procedures for surveillance and protection of flashing and sheet metal work during construction, to ensure that work be without damage or deterioration, other than natural weathering, at time of substantial completion.

END OF SECTION 07600

SECTION 07900 - JOINT SEALANTS

PART 1- GENERAL

1.1 SUMMARY

A. Section Includes:
1. The sealing of exterior and interior joints.

1.2 SUBMITTALS

A. Product Data: Manufacturer's data on each joint sealer, with instructions for substrate preparation and installation.

B. Samples for Color Selection: Cured samples of actual products showing manufacturer's full range of colors.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original containers or bundles with labels showing manufacturer, product name or designation, color, shelf life, and installation instructions.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Do not install sealers if any of the following conditions exist:
1. Air or substrate temperature exceeds the range recommended by sealer manufacturer or is below 40 degrees F (4.4 degrees C).
2. Substrate is wet, damp, or covered with snow, ice, or frost.

B. Dimensional Limitations: Do not install sealers if joint dimensions are less than or greater than that recommended by sealer manufacturer; notify the architect and get sealer manufacturer's recommendations for alternative procedures.

PART 2 - PRODUCTS

2.1 MATERIALS - GENERAL

A. General: Provide only products which are recommended and approved by their manufacturer for the specific use to which they are put and which comply with all requirements of the contract documents.
1. For each generic product, use only materials from one manufacturer.
2. Provide only materials which are compatible with each other and with joint substrates.
3. Colors of exposed sealers: As selected by the Architect from manufacturer's standard colors.

2.2 ELASTOMERIC SEALANTS

A. Elastomeric Sealants - General: Chemically curing elastomeric sealants of types indicated, complying with ASTM C 920, including specific Type, Grade, Class, and Uses indicated, as well as all other requirements specified.
1. Exterior, Non-Traffic Areas: Type S, Grade NS, Class 25, Use NT. Provide one of the following Polyurethane or Silicone Sealants or an approved substitution:
a. Polyurethane:
(1) Bostik/Chem-Calk 900.
(2) Pecora Corp./Dynatrol I.
(3) Sonneborn-ChemRex, Inc./Sonolast NPI.
(4) Tremco, Inc./Dymonic.
b. Silicone:

(1) Bostik/Chem-calk 2200.
(2) Pecora Corp./895 Silicone.
(3) Sonneborn-ChemRex, Inc./Sonolastic Omniseal.
(4) Tremco, Inc./Spectrum 2.

2. Exterior, Traffic Areas: Type S, Grade P, Class 25, Use T. Provide one of the following silicone sealants or an approved substitution:
   a. Silicone:
      (1) Bostik/Chem-calk 950.
      (2) Pecora Corp./NR-201 Urexpan.
      (3) Sonneborn-ChemRex, Inc./Sonolastic SLI.

3. Interior, Non-Traffic Areas: Type S, Grade NS, Class 12.5 or 25, Use NT. Provide one of the following polyurethane or silicone sealants or an approved substitution:
   a. Polyurethane:
      (1) Bostic/Chem-calk 915.
      (2) Pecora Corp./Dynatrol I.
      (3) Sonneborn-ChemRex, Inc./Sonolast NPI.
      (4) Tremco, Inc./Dymonic.
   b. Silicone:
      (1) Bostik/Chem-calk 2200.
      (2) Pecora Corp./895 Silicone.
      (3) Sonneborn-ChemRex, Inc./Sonolastic Omniseal.
      (4) Tremco, Inc./Spectrum 2.

4. Interior, Traffic Areas: Type S, Grade P, Class 25, Use T. Provide one of the following silicone sealants or an approved substitution:
   a. Silicone:
      (1) Bostik/Chem-calk 950.
      (2) Pecora Corp./NR-201 Urexpan.
      (3) Sonneborn-ChemRex, Inc./Sonolastic SLI.

5. Expansion/ Control Joints in Concrete walls: Pecora 890

2.2 LATEX SEALANTS

A. Latex Sealant - General: One-part, nonsag, mildew-resistant, paintable latex sealant complying with ASTM C 834.
   1. Exterior: Do not use for exterior applications.
   2. Interior: Use only on non-working joints. Provide one of the following or an approved substitution:
      a. Pecora Corp./AC-20.
      b. Sonneborn-ChemRex, Inc./Sonolac.
      c. Tremco, Inc./Acrylic Latex 834.

2.3 SEALANT BACKERS

A. Backers - General: Nonstaining; recommended or approved by sealant manufacturer for specific use.

B. Backer Rods: Flexible, nonabsorbent, compressible polyurethane foam, either open-cell or non-gassing closed-cell, unless otherwise restricted by sealant manufacturer; preformed to appropriate size and shape.

C. Bond-Breaker Tape: Self-adhesive, polyethylene or other plastic tape, unless otherwise electricted by sealant manufacturer; suitable for preventing sealant adhesion.

2.4 MISCELLANEOUS MATERIALS

A. Primers: As recommended by sealer manufacturer.

B. Cleaners: As recommended by sealer manufacturer and not damaging to substrates.

C. Masking Tape: Nonabsorbent, nonstaining.

D. Tooling Agents: Approved by sealant manufacturer; nonstaining to sealant and substrate.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints for characteristics that may affect sealer performance, including configuration and dimensions.

B. Do not begin joint sealer work until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Cleaning: Just before starting sealer installation, clean out joints in accord with recommendations of sealer manufacturers and as follows:
1. Remove all material that could impair adhesion, including dust, dirt, coatings, paint, oil, and grease. Exception: Materials tested to show acceptable adhesion and compatibility.
2. Dry out damp and wet substrates thoroughly.
3. Remove loose particles by vacuuming or by blowing with oil-free compressed air.
4. Concrete: Remove laitance and form-release coatings.
5. Clean substrates with methods recommended by sealant manufacturer which will not damage the substrate.
6. Use methods which will not leave residues that will impair adhesion.

B. Priming: Prime substrates as recommended by sealer manufacturer.

C. Masking Tape: Use masking tape to keep primers and sealers off of adjacent surfaces which would be damaged by contact or by cleanup. Remove tape as soon as practical.

D. Install fillers where needed to provide proper joint depth or support for sealant backers.

E. Provide caulk joints at all exterior exposed concrete construction/pour joints.

3.3 INSTALLATION

A. Comply with sealer manufacturers' installation instructions and recommendations, except where more restrictive requirements are specified.

B. Gunnable and Pourable Sealants: Comply with recommendations of ASTM C 1193.

C. Backers:
1. Install backers at depth required to result in shape and depth of installed sealant which allows the most joint movement without failure.
a. Make backers continuous, without gaps, tears, or punctures.
b. Do not stretch or twist backers.
2. If backers become wet or damp before installation of sealant, dry out thoroughly before proceeding.
3. Use bond-breaker tape where indicated and wherever it is necessary to keep sealant from adhering to back or third side of joint.

D. Sealants: Use methods recommended by manufacturer; completely fill the joint; make full contact with bond surfaces; tool nonsag sealants to smooth surface eliminating air pockets.

1. Use concave joint shape shown in Figure 5A in ASTM C 1193, where not otherwise indicated.

3.4 PROTECTION AND CLEANING

A. Clean surfaces adjacent to joints as work progresses and before sealants set using methods and materials approved by manufacturers of sealers and of surfaces to be cleaned.

B. Protect joint sealers from contamination and damage.

C. Remove and replace damaged sealers.

3.5 WARRANTY

A. Provide 20 year caulking warranty.

END OF SECTION 07900

SECTION 08111 - STANDARD STEEL DOOR FRAMES

PART 1 - GENERAL:

1.1 SUMMARY:

A. Work in this section includes:

1. Hollow Metal Frames

B. Related work includes:

1. Wood doors (section 08211)
2. Glazing (section 08800)
3. Joint sealers (section 07900)

1.2 SUBMITTALS: With manufacturer's standard details and specifications for steel doors and frames, submit shop drawings showing application to project, as required.

1.3 STANDARDS: In addition to other specified requirements, comply with Steel Door Institute "Recommended Specifications for Standard Steel Doors and Frames" ANSI/SDI-100.

PART 2 - PRODUCTS

2.2 MANUFACTURER: One of the following:

A. Ceco Corp.

B. Curries

C. Steelcraft Manufacturing Co.

2.2 MATERIALS

A. Supports and Anchors: Fabricate of not less than 18-gage sheet steel; galvanized where used with galvanized frames.

B. Shop Applied Primer: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints complying with ANSI A224.1.

C. Fire-Rated Assemblies: Provide units that display appropriate UL or FM labels for fire-rating indicated.

D. Fabrication: Fabricate units to be rigid, neat in appearance, and free from defects, warp or buckle. Weld exposed joints continuously, grind, dress, and make smooth, flush and invisible.

E. Prepare steel door frames to receive finish hardware, including cutouts, reinforcing, drilling and tapping, complying with ANSI A 115 "Specifications for Door and Frame Preparation for Hardware."

F. Frames: Comply with ANSI/SDI-100, of the types and styles indicated, for materials quality, metal gages, and construction details.

1. Provide standard hollow metal frames for doors, transoms, sidelights, borrowed lights, and other openings as indicated.
2. Fabricate frames with mitered, coped, or welded corners.
3. Prepare frames to receive 3 silencers on strike jambs of single-door frames and on heads of double-door frames.
4. Provide 26-gage steel plaster guards or mortar boxes, welded to frame, at back of hardware cutouts where installed in concrete, masonry or plaster openings.

5. Protect inside faces of frames in plaster or masonry wall construction, which are placed with anti-freeze additives, using high-build fibered asphalt emulsion coating.

PART 3 - EXECUTION

3.1 INSTALLATION: Install hollow-metal units in accordance with manufacturer's instructions and final shop drawings (if any). Fit doors to frames and floors with clearances specified in ANSI/SDI-100.

A. Install frames in accordance with SDI 105.
B. Doors and frames shall be installed plumb, true and in alignment with each other. Frames shall be securely anchored, filled solid with grout and completely rigid in walls.
C. Install fire-rated units in accordance with NFPA Std. No. 80.
D. Finish hardware is specified in another Division 8 section. Coordinate all hardware requirements with shop drawings.

END OF SECTION 08111

SECTION 08120 - ALUMINUM DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glazed aluminum swinging doors.
2. Aluminum door frames and sidelights.

B. Related work includes:

1. Glazing (08800)

1.2 PERFORMANCE REQUIREMENTS

A. Exterior Assemblies: Design to comply with the performance criteria listed below.

B. Air Infiltration:

1. Single doors: Not more than 0.6 cfm per linear foot of crack.
2. Doors: Measure at 1.56 psf.

C. Condensation Resistance:

1. Door frames: Not less than 60.

D. Thermal Transmittance (U-Value):

1. Door frames: Not more than 0.58.

1.3 SUBMITTALS

A. Product Data: Manufacturer's material specifications, drawings of standard components, and installation recommendations.

B. Shop Drawings: Show elevations, field measurements, composite members, reinforcement, anchorages, expansion provisions, hardware mounting, and glazing.

C. Samples for Verification of Anodized Finishes: For each type and color of anodized finish, submit 12-inch-long sections of extrusions and formed sections and 6-inch-square sheets. Submit at least 2 pieces for each color showing full range of color variation.

1.4 QUALITY ASSURANCE

A. Standard for Air Infiltration Testing: ASTM E 283; report result as cubic feet per minute per unit of measurement indicated, at pressure differential indicated.

B. Standard for Condensation Resistance Testing: AAMA 1503.1; report result as CRF.

C. Standard for Thermal Transmission Testing: AAMA 1503.1; report result as U-value (Btu per hour per square foot per degree F).

D. Design Criteria: The drawings indicate the size, profile, and dimensional requirements of aluminum entrance and storefront work required and are based on the specific types

and models indicated. Aluminum entrance and storefront by other manufacturers may be considered, provided deviations in dimensions and profiles are minor and do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.

1. Exterior Entrance Door Frame and Sidelight: To be TSS Bullet Proof Doors or Approved Equal.

1.5 PROJECT CONDITIONS

A. Take field measurements as required for correct fit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Interior Aluminum Doors and Frames:

1. Provide products complying with requirements of the contract documents and made by one of the following or and approved equal:

a. Kawneer Company, Inc.
b. PPG Industries, Inc.
c. Tubelite Architectural Products Division/Indal, Ltd.
d. United States Aluminum Corporation.
e. Old Castle
f. See plans for Level 4 Security Door Requirements.

2.2 FRAMING SYSTEMS

A. Interior Aluminum Door and Storefront Frames: Extruded tube or channel frames with either mechanical or welded joints.

1. Finish:
   a. Clear Anodized
2. Interior Storefront System:
   a. 2”x4 ½” non thermal with 3/8” tempered glazing.

2.3 INTERIOR SWINGING DOORS

A. Stile and Rail Doors: Glazed doors with tubular extruded aluminum frame members.

1. Frame joints: Either concealed mechanically fastened, using tie rods or j-bolts and reinforcing plates; or welded.

2. Thickness: 1-3/4 inches.

3. Stile width: 3-1/2 inches nominal.

4. Full glazed, with no intermediate mullions.

5. Glazing Stops: Snap-on extruded aluminum, designed to allow replacement of glazing without disassembly of frame. Provide non-removable exterior stops.

6. Glaze doors in factory.

7. Finish: Clear Anodized

a. Class I - Color to be clear anodized

B. Silencers: Neoprene bumpers.

1. Provide on all interior doors.

C. Hardware for Aluminum Doors: Provide all hardware as required for proper operation, in accordance with the hardware schedule.

1. Finish: Match doors.

2.4 MATERIALS - GENERAL

A. Aluminum Members: ASTM B 221 for extrusions, ASTM B 209 for sheet/plate; alloy and temper recommended by the manufacturer for the strength required, for corrosion resistance, and for the finish required.

1. Class I color anodized finish: AA-M12C22A42/A44 (non-specular, as-fabricated mechanical finish; medium matte etched chemical finish; integral or electrolytically deposited color, architectural Class I anodic coating minimum 0.7 mil thick). Finish color to be white.

B. Fasteners: Compatible with aluminum; aluminum, non-magnetic stainless steel, or other non-corrosive, non-corrodible material.

1. Do not use exposed fasteners.

C. Concealed Flashing: Fully annealed, soft stainless steel, 26 gage minimum; or extruded aluminum, 0.032 inch minimum.

D. Miscellaneous Concealed Metal Members: High-strength aluminum or nonmagnetic stainless steel; hot-dip galvanized steel complying with ASTM A 123 may be used for members which are not exposed to weather or abrasion.

E. Concrete Inserts: Cast iron, malleable iron, or steel hot-dip galvanized in accordance with ASTM A 123.

F. Dissimilar Metal Coating: Cold-applied asphalt mastic, or other nonconductive, non-absorptive material.

G. Interior Glass and Glazing Accessories: Provide products specified elsewhere in Division 8.

a. 3/8” Clear tempered glazing

2.5 FABRICATION

A. Framing System: Pre-cut and perform all finishing in factory or shop.

1. When it is necessary to begin fabrication without actual field measurements, provide adequate fabrication tolerances for correct fit.

2. Fit joints tightly with adjacent members in correct relationship.

3. Select members for fabrication so that adjacent anodized extruded aluminum members do not have color or texture variation greater than half of the range indicated in the submitted samples.

B. Doors: Factory-fabricate doors and factory-install all hardware except surface-mounted items.

1. Perform fabrication required for hardware before finishing.

C. Welding: Perform welding before finishing; use methods which do not discolor metal; grind exposed welds flush; match original finish.

D. Reinforcing: Provide as required to comply with performance requirements for rigidity and to support hardware; isolate dissimilar metals as specified in "Installation."

E. Avoid damage to finishes.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine structures; report conditions in writing which will adversely affect installation.

3.2 INSTALLATION

A. Install in accordance with manufacturer's recommendations and instructions.

B. Install plumb and level, square and true, in correct location; support adequately and securely anchor.

C. Separate aluminum exposed to weather from dissimilar metals; coat dissimilar metals that are in drainage cavities using one of the materials specified. Aluminum, stainless steel, zinc, cadmium, and small areas of white bronze are not considered dissimilar from each other.

D. Coat all metals that come into contact with masonry, concrete, and treated wood, using one of the materials specified.

E. Install surface-mounted hardware in accordance with hardware manufacturer's instructions.

F. Install glass using methods specified elsewhere in Division 8. Factory install to greatest extent possible.

G. Set threshold units level and accurately in seal strip of butyl rubber sealant or polyisobutylene mastic sealant. Cope and align with frames and doors, and at proper elevation for door operation. Shim, if necessary, for full continuous support of threshold at each edge and intermediate legs, if any. Use non-corrosive shims of metal or plastic, set in adhesive or otherwise anchored against dislocation from impact or traffic upon threshold.

3.3 ADJUST AND CLEAN

A. Adjust each operable unit for correct function and smooth, free operation and so doors close tightly.

B. Clean exterior and interior soon after installation of glass, taking care to avoid damage to finishes.

C. Clean glass surfaces as specified elsewhere.

END OF SECTION 08120

SECTION 08211 - WOOD DOORS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section includes:

1. Wood Doors

B. Related work:

1. Standard Steel Door Frames (08111)
2. Door Hardware (08710)
3. Painting (09900)
4. See plans for Level 4 Door Requirements

1.2 QUALITY STANDARDS

A. Comply with NWWDA I.S.1 and AWI "Architectural Woodwork Quality Standards".

B. Comply with WIC "Manual of Millwork" for requirements in the door grade comparable to AWI grade indicated and exceeding those in other referenced standards.

1.3 SUBMITTALS: In addition to product data, submit the following:

A. Shop Drawings indicating location, size, face material, and finishes of each door required.

B. Samples 1-0" square, of each type of core construction, face material and finish required.

PART 2 - PRODUCTS:

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide wood doors by one of the following or approved equal:

1. Allegany Wood Works
2. Fortress Door C
3. Weyerhaeuser Doors
4. See plans for Level 4 Door Requirements

2.2 GENERAL WOOD DOOR PRODUCT REQUIRMENTS:

A. Provide doors with same exposed surface material on both faces of each door, unless otherwise indicated.

B. Interior solid core doors for finish as follows:

1. Faces: Panel, Stain Grade - Birch

C. Interior fire-rated solid core doors:

1. Labeled and listed for rating indicated, by testing and inspection agency acceptable to authorities having jurisdiction, complying with the following requirements:

a. Faces and AWI Grade: Match faces of non-rated doors in same area of building, unless otherwise indicated.

b. Edge Construction: Solid hardwood, no finger joints, matching edge.

D. Fabricate flush wood doors to produce doors complying with following requirements:

1. In sizes indicated for job site Fitting.

2. Factory pre-fit and pre-machine doors to fit frame opening sizes indicated and complying with AWI pre-fitting tolerances.

3. Metal Astragals: Pre-machine astragals and formed steel edges for hardware where required for pairs of fire rated doors.

4. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of doors required.

a. Light Openings: Trim openings with moldings of material and profile indicated.

E. Shop seal faces and edges of doors for field-applied transparent finish with stain.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install wood doors to comply with manufacturer's instructions and of referenced AWI standard and as indicated.

B. Install fire rated doors in corresponding fire-rated frames in accordance with requirements of NFPA No. 80.

C. Align and fit door in frames with uniform clearances and bevels. Machine doors for hardware. Seal cut surfaces after fitting and machining.

D. Pre-fit Doors: Fit to frames for uniform clearance at each edge.

E. Existing openings for new doors in existing openings, new door to accommodate opening. Field Verify.

END OF SECTION 08211

SECTION 08710 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Definition
1. "Finish Hardware" includes items known commercially as finish hardware which are required for swing, sliding and folding doors, except special types of unique and non-matching hardware specified in the same section as the door and door hardware. For any door not shown to receive hardware, provide hardware as shown for a similar opening. If there is no similar opening, provide three (3) butt hinges, one (1) mortise lockset, one (1) door closer, one (1) kick plate, and one (1) doorstop per leaf.

C. Submittals: Submit through Contractor required product data, final hardware schedule, separate keying schedule, and samples as specified in this Section, unless otherwise indicated.

D. Construction Schedule: Inform Contractor promptly of estimated times and dates that will be required to process submittals, to furnish templates, to deliver hardware, and to perform other work associated with furnishing door hardware for purposes of including this data in construction schedule. Comply with this schedule.

E. Coordination and Templates: Assist Contractor as required to coordinate hardware with other work in respect to both fabrication and installation. Furnish Contractor with templates and deliver hardware to proper locations.

F. Product Handling: Package, identify, deliver, and inventory door hardware specified in this Section.

G. Discrepancies: Based on requirements indicated in Contract Documents in effect at time of door hardware selection, furnish types, finishes, and quantities of door hardware, including fasteners, and Owner's maintenance tools required to comply with specified requirements and as needed to install and maintain hardware. Furnish or replace any items of door hardware resulting from shortages and incorrect items at no cost to the Owner or Contractor. Obtain signed receipts from Contractor for all delivered materials.

H. Fire-Rated Openings: Provide hardware for fire-rated openings in compliance with NFPA Standard No. 80 and local building code requirements. Provide only hardware, which has been tested and listed by UL or FM types and sizes of doors, required and complies with requirements of door and doorframe labels.
1. Where emergency exit devices are required on fire-rated doors (with supplementary marking on doors UL or FM labels indicating "fire door to be equipped with fire exit hardware") provide UL or FM label on exit devices indicating "fire exit hardware."
2. Provide hardware as required to meet label requirements whether scheduled or not.

1.2 CONTRACTOR'S RESPONSIBILITIES SHALL BE AS FOLLOWS:

A. Submittals: Coordinate and process submittals for door hardware in same manner as submittals for other work.

B. Construction Schedule: Cooperate with door hardware supplier in establishing schedules dates for submittals and delivery of templates and door hardware. Incorporate in construction schedule the times and dates related to furnishing hardware by door hardware supplier.

C. Coordination: Coordinate door hardware with other Work. Furnish Hardware supplier or manufacturer with shop drawings of other work where required or requested. Verify completeness and suitability of hardware with supplier.

D. Product Handling: Provide secure lock-up for hardware delivered to the site. Inventory hardware jointly with representative of hardware supplier and issue signed receipts for all delivered materials.

E. Installation Information: The general types and approximate quantities of hardware required for this Project are indicated at the end of this Section in order to establish Contractor's costs for installation and other work not included in allowance.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification section.
1. Product data including manufacturer's technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Final hardware schedule coordinated with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
3. Final Hardware Schedule Content: Based on hardware indicated, organize schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:
4. Type, style, function, size, and finish of each hardware item.
5. Name and manufacturer of each item.
6. Fastenings and other pertinent information.
7. Location of each hardware set cross-referenced to indications on Drawings both on floor plans and in door and frame schedule.
8. Explanation of all abbreviations, symbols, and codes contained in schedule.
9. Mounting locations for hardware.
10. Door and frame sizes and materials.
11. Keying information.

B. Submittal Sequence: Submit final schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work that is critical in the Project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by door hardware, and other information essential to the coordinated review of schedule.

C. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.

D. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawing of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.4 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain each type of hardware (latch and lock sets, hinges, closers, etc.) from a single manufacturer.

B. Fire-Rated Openings: Provide door hardware for fire-rated openings that complies with NFPA Standard No. 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by UL, Warnock Hersey, FM, or other testing and inspecting organization acceptable to authorities having jurisdiction for use on types and sizes of doors indicated in compliance with requirements of fire-rated door and door frame labels.

1.5 PRODUCT HANDLING

A. Tag each item or package separately with identification related to final hardware schedule, and include basic installation instructions with each item or package.

B. Packaging of door hardware is responsibility of supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Two more identical sets may be packed in same container.

C. Inventory door hardware jointly with representative of hardware supplier and hardware installer until each is satisfied that count is correct.

D. Deliver individually packaged door hardware items promptly to place of installation (shop or Project site).

E. Provide secure lock-up for door hardware delivered to the Project, but not yet installed. Control handling and installation of hardware items that are not immediately replaceable so that completion of the Work will not be delayed by hardware losses both before and after installation.

1.6 MAINTENANCE

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.

PART 2 - PRODUCTS

2.1 The following types of hardware will be used generally, but are not restricted to same: All hardware to be approved by Architect and Owner. See also Summary of Allowances.

A. Hardware Schedule:
AB ABH
GL Glynn Johnson
HA Hager Hinge
MA Markar
MC McKinney
NA National Guard
RO Rockwood
SA Sargent
YA Yale
SC Schlage

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount hardware units at heights indicated in following applicable publications, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by Architect.

B. "Recommended Locations for Builders Hardware for Standard Steel doors and Frames" by the Door and Hardware Institute.

C. "Recommended Locations for Builders Hardware for Custom Steel Doors and Frames" by the Door and Hardware Institute. NWWDA Industry Standard I.S.1.7, "Hardware Locations for Wood Flush Doors".

D. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Division 9 Sections. Do not install surface-mounted items until finishes have been completed on the substrates involved.

E. Set units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

G. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements specified in Division 7 Section "Joint Sealers".

H. Weather-stripping and Seals: Comply with manufacturer's instructions and recommendations to the extent installation requirements are not otherwise indicated.

3.2 ADJUSTING, CLEANING, AND DEMONSTRATING

A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made. Where door hardware is installed more than one month prior to acceptance or occupancy of a space or area, return to the installation during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

B. Clean adjacent surfaces soiled by hardware installation.

C. Instruct Owner's personnel in the proper adjustment and maintenance of door hardware and hardware finishes.

D. Six-Month Adjustment: Approximately six month after the date of Substantial Completion, the Installer, accompanied by representatives of the manufacturers of latch sets and locksets and of door control devices, and of other major hardware suppliers, shall return to the Project to perform the following work:

1. Examine and re-adjust each item of door hardware as necessary to restore function of doors and hardware to comply with specified requirements.

2. Consult with and instruct Owners personnel in recommended additions to the maintenance procedures.

3. Replace hardware items that have deteriorated or failed due to faulty design, materials, or installation of hardware units.

4. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

B. Hardware Schedule:

1. Submit hardware schedule for Architect approval.
2. Hardware to match existing building type and style except where noted on drawings; otherwise, such as but not limited to thresholds, weather-stripping and automatic door bottoms, etc.
3. Base Bid to include all automatic door bottoms; however, ship one unit first before final decision on installation of remaining is made.

3.3 KEYING

A. Provide master keying system. Provide 4 keys to each door and 4 master keys.

3.4 KEY FOB CONTROL ACCESS

A. See plans for doors to receive key fob and mag locks.

END OF SECTION 08710

SECTION 08800 - GLAZING

PART 1 -GENERAL

1.1 SUMMARY:

A. Work included in this section includes:
1. All glass as shown on drawings

B. Work related includes
1. Aluminum doors and frames (Section 08120)
2. Steel door frames (Section 08111)

1.2 STANDARDS:

A. Install glazing with dry glazing system.

B. Glazing Standard: Comply with FGMA "Glazing Manual" and "Sealant Manual".

C. Safety Glazing Standard: Comply with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for category II materials.

D. Fire Resistance Rated Wire Glass: Provide UL-labeled and listed products, identical with those tested per ASTM E 163 (UL 9).

E. Insulating Glass Certification Program: Provide insulating glass units complying with requirements indicated which are permanently marked with certification label of the following inspecting and testing agency:
1. Insulating Glass Certification Council.

F. Preconstruction Sealant-Substrate Tests: Submit glass and glazing substrate materials to manufacturer of glazing sealants for testing to determine if primers are required and for sealant compatibility.

1.3 SUBMITTALS: Submit shop drawings on dry glazing systems with physical sample 6" long.

A. Comply with requirements of section 01340

B. See page 3 for 2.1 manufacturers

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. LOF, Libby-Ownes-Ford Co.

B. PPG Industries, Inc.

C. CE, Combustion Engineering, Inc.

D. Guardian Industries

2.2 GLAZING SCHEDULE:

A. Tempered Glass
1. Provide tempered glass where required by code.

B. Interior Glass to be 3/8” Tempered.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Meter frame shall not be in contact with installed glass.

B. Setting blocks: Lites larger than 6 sq. ft., and all glass thicker than 1/8", shall be installed on 2 setting blocks at the bottom quarter points.

C. Edge Blocks: In dry glazing systems, one 3" neoprene edge block shall be installed in each jamb, allowing 1/8" space between edge block and glass edge.

D. Watershed: Glass shall be installed in frames with sealant forming a 1/16" watershed, both sides.

E. Glass shall be installed clean, free of chips, cracks, scratches, blemishes, oil, dirt, stains or visible waves or distortions.

F. All glass shall be cleaned immediately prior to final inspection.

3.2 PERFORMANCE:

A. System to provide for expansion and contraction within system components caused by a cycling temperature range of 170 F degrees without causing detrimental effects to system or components.

B. Design and size members to withstand dead loads and live loads caused by pressure and suction of wind acting normal to plane of wall as calculated in accordance with the requirements of the N. C. Building Code, and as measured in accordance with ANSI/ASTM E330.

C. Limit air infiltration through assembly of 0.06 cu. ft./min./sq. ft. of assembly surface area, measured at a reference differential pressure across assembly of 0.3 inches water gage, measured in accordance with ANSI/ASTM E283.

D. System to accommodate, without damage to system or components, or deterioration of perimeter seal: Movement within system; movement between system and perimeter framing components; dynamic loading and release of loads; and deflection of structural support framing.

E. Maintain continuous air and vapor barrier throughout assembly primarily in line with inside pane of glass.

F. Maintain: Vapor seal with Interior Atmospheric Pressure of One Inch (25 mm) sp, 72 degrees F (22 degrees C), 40 percent RH: no failure.

END OF SECTION 08800

SECTION 08 34 53

BR DOOR AND FRAME ASSEMBLY – ALUMINUM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Bullet resistant aluminum door and frame assembly.

1.2 REFERENCES

A. Underwriters Laboratory UL 752-Standard for Bullet Resisting Equipment.

B. ASTM C 1172 - Standard Specification for Laminated Architectural Flat Glass.

C. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

D. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

1.3 ACTION SUBMITTALS

A. Refer to Section 01340.

B. Product Data: For each type of framing and glass including manufacturer recommended installation instructions.

C. Shop Drawings: Include plans, elevations, sections, details, attachment to other work.

D. Samples: For each exposed finish.

1.4 INFORMATION SUBMITTALS

A. Product Test Reports: Indicating compliance with requirements

B. Warranty: Sample of finish warranty

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the project site with the manufacturer's UL Listed Labels intact and legible. Handle the materials with care to prevent damage. Store materials inside and under cover, stack flat and off floor. Project conditions (temperature, humidity, and ventilation) shall be within the maximum limit recommendations provided by manufacturer. Do not install products stored in conditions outside manufacturer's recommended limits.

1.7 WARRANTY

(**Specifier Note**: The 5 year finish warranty applies to the Class I anodic finishes and the 10 year applies to the 70% PVDF coating finish.)

A. Workmanship Warranty: All materials shall be warranted against defects for a period of 1 year for the date of receipt at the project site. Provide certificates of manufacturer's standard limited warranty with closeout documents.

1.6.1.1.1 Finish Warranty: Manufacturer's warranty against deterioration of factory finishes for the period of 10 years from the date of Substantial Completion.

(**Specifier Note**: Product information is proprietary to TSS If additional products are required for competitive procurement, contact TSS for assistance in listing competitive products that may be available.)

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Basis of Design:

1. Subject to compliance with requirements, provide products by the following:

a. Total Security Solutions, Inc., 935 Garden Lane, Fowlerville, MI 48836, 866 734-6277. Attn: Sales Department, sales@tssbulletproof.com. Web: www.tssbulletproof.com.

2. Subject to compliance with requirements, manufacturers of products of equivalent design may be acceptable if approved in accordance with Section 01340.

B. Design Performance:

1. Through the design, manufacturing techniques and material application the TSS BL3-DR Bullet Resistant Aluminum Door and Frame Assembly shall be constructed of extruded aluminum in 6061-T6 alloy/tempered.

2. Door and shall to have no exposed fasteners.

3. Corner joints shall consist of extruded and keyed aluminum spline with continuous 3/8" diameter steel tie rod at door top and bottom rails.

4. All joints and connections shall be tight, providing hairline points and true alignment of adjacent members.

5. Panels shall not be removable from threat side.

6. Door assembly swing: See plans.

C. Door and Frame Assembly Dimensions: As indicated on the Drawings.

D. Door and Frame Performance:

1. Level 4.

2. Door assembly stiles, top rails and bottom rails shall be lined with hardened steel to meet Level 4 and 5 UL standards.

E. Standard Aluminum Doors:

1. Top rail and stile: 2-3/4".

2. Bottom rail, including glass stops: 5-1/4".

3. Aluminum Door and Sidelight Frames and Extrusions: 1-3/4" x 4" with structural section .125" thick.

4. Glazing: LP-1250 Polycarbonate/Acrylic Laminate, 1-1/4" thick, 7.7lbs/sf to comply with UL 752, Level 4 protection.

5. Door Hardware:

a. Hinges: Select SL-11HD continuous aluminum gear hinge.

b. Deadlock: Adams Rite MS1850 deadlock.

c. Thumb Turn: Adams Rite 4510 Series mortise thumb turn.

d. Keyed Mortise Cylinder: Adams Rite 4510 Series.

e. Door Pull and Push Bar: 9" aluminum pull handle and door width push bar as selected by Architect from manufacturer's standard options.

f. Door Closer: LCN 400 series Heavy Duty.

g. Optional Door Hardware Upgrades: exit devices, electric strike plate, and custom security hardware, as selected by Architect from manufacturer's standard options.

F. Door Frame Construction:

1. Frame assembly shall provide UL Level 4 protection level to match bullet resistance of door.

2. Non-ricochet type, ballistic extruded aluminum in 6061-T6 alloy, aluminum finish.

3. Sizes: 2 3/8" thick medium stile door rails with 1-3/4" x 4" BR aluminum jamb.

G. Factory-applied finish:

1. **Clear Anodic Finish**: Architectural Class I, clear coating AA-M10C22A41 Mechanical Finish Chemical Finish: etched, medium matte; 0.70 mils minimum complying with AAMA 611 "Voluntary Specification for Anodized Architectural Aluminum"

H. Field alterations to the construction of the assembly fabricated under the acceptable standards are not allowed unless approved in writing by the manufacturer and the Architect.

I. Standard manufacturing tolerances +/- 1/16" shall be maintained.

2.2 PERFORMANCE CRITERIA

A. Ballistic Resistant: anu

1. Level 4 in accordance with UL 752 – Testing for Ballistic Resistance for the complete assembly including framing, glazing and panels.

2.3 FABRICATION

A. Aluminum sections to be manufactured in accordance with ASTM B209, Extruded aluminum alloy 6063 T5 Anodized to match the existing décor and be free of sharp edges or burrs when in place.

B. Glazing Channel: U-Channel specifically designed for securing transparencies tightly in place. Angles and stops are only acceptable for top attachment. All exposed aluminum edges shall be clean cut and have no burrs. Exposed corners shall be rounded and sanded.

C. Tolerances: All joints and connections shall be tight, providing hairline joints and true alignment of adjacent members

2.4 ACCESSORIES

A. Anchors: Fully concealed manufacturer recommended.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prior to beginning installation, verify that all supports have been installed as required by the Contract Documents and architectural drawings, and Shop Drawings have been approved.

B. Notify Architect of any unsatisfactory preparation that is responsibility of others.

C. Clean and prepare all surfaces per manufacturers recommendations as required for achieving the best results for the substrate under the project conditions.

D. Verify field dimensions of openings prior to fabrication of framing.

E. Coordinate structural requirements to ensure proper attachment and support.

F. Do not begin installation of material until all unsatisfactory conditions have been resolved and approved by Architect.

3.2 INSTALLATION

A. Do not begin installation until openings have been verified and surfaces properly prepared in accordance with Drawings.

B. Install in accordance with manufacturer’s instructions and UL 752. Set all equipment plumb.

C. All products shall be installed per installation instructions provided by manufacturer.

D. Door and frame assembly shall arrive on site completely pre-fabricated to field dimensions approved by Shop Drawings.

E. Install framing and secure to structure in accordance with manufacturer's recommendations and approved shop drawings.

F. Provide required support and securely fasten and set doors and frame plumb, square, and level without twist or bow.

G. Apply sealant in accordance with manufacturer's recommendations as indicated in installation instructions.

H. Remove excess sealant and leave exposed surfaces clean and smooth

3.3 PROTECTION

A. Clean and protect door and frame assembly from damage during ongoing construction operations. If damage occurs, remove and replace as required to provide assembly in their original, undamaged condition.

B. Inspection and Cleaning: Verify installation is complete and complies with manufacturer's requirements.

C. Provide final cleaning of product and accessories, removing excess sealant, labels and protective covers.

D. Touch-up, repair or replace damaged products prior to Substantial Completion.

END OF SECTION

SECTION 08 34 54

BR DOOR AND FRAME ASSEMBLY – WOOD

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Bullet resistant wood door and frame assembly.

1.2 REFERENCES

A. Underwriters Laboratory UL 752-Standard for Bullet Resisting Equipment.

B. ASTM C 1172 - Standard Specification for Laminated Architectural Flat Glass.

1.3 ACTION SUBMITTALS

A. Refer to Section 01340.

B. Product Data: For each type of door and glass including manufacturer recommended installation instructions.

C. Shop Drawings: Include plans, elevations, sections, details, attachment to other work.

D. Samples: For each exposed finish.

1.4 INFORMATION SUBMITTALS

A. Product Test Reports: Indicating compliance with requirements

B. Warranty: Sample of finish warranty.

1.5 CLOSEOUT SUBMITTALS

A. Refer to Section 01340.

B. Maintenance data.

1.6 DELIVERY, STORAGE AND HANDLING

A. Refer to Section 01620.

B. Deliver materials to the project site with the manufacturer's UL Listed Labels intact and legible. Handle the materials with care to prevent damage. Store materials inside and under cover, stack flat and off floor. Project conditions (temperature, humidity, and ventilation) shall be within the maximum limit recommendations provided by manufacturer. Do not install products stored in conditions outside manufacturer's recommended limits.

1.7 WARRANTY

A. Workmanship Warranty: All materials shall be warranted against defects for a period of 1 year for the date of receipt at the project site. Provide certificates of manufacturer's standard limited warranty with closeout documents.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Basis of Design:

1. Subject to compliance with requirements, provide products by the following:

a. Total Security Solutions, Inc., 935 Garden Lane, Fowlerville, MI 48836, 866 734-6277. Attn: Sales Department, sales@tssbulletproof.com. Web: www.tssbulletproof.com.

2. Subject to compliance with requirements, manufacturers of products of equivalent design may be acceptable if approved in accordance with Section 01340.

B. Design Performance:

1. Through the design, manufacturing techniques and material application the TSS Bullet Resistant Wood Door and Frame Assembly shall be constructed of a wood core lined with a sheet of fiberglass.

2. Door assembly to have no exposed fasteners.

3. Joint connections to have concealed clips to provide rigid assembly when installed.

4. Frames shall be non-rated.

5. All joints and connections shall be tight, providing hairline points and true alignment of adjacent members.

6. Door assembly swing: As per drawings.

C. Door and Frame Assembly Dimensions: As indicated on the Drawings.

D. Door and Frame Performance:

1. Standard door and frame assembly to defeat ballistic assaults from 9mm medium power through 7.62 Rifle as tested with UL Standard 752 at Underwriters Laboratories, Levels 1 through 8.

2. Door Size: 36” x 84” (finish opening 40” x 86”), Jamb Tube 1 3/” x 4”

3. Door Frame Construction: Frames shall be.

a. Knocked Down Hollow Metal Frame] primed in fabrication.

E. Door Hardware:

1. Hinges: Heavy Duty continuous hinge, clear anodized coating.

2. Security: Anti-Jimmy plate.

3. Closer: Overhead surface as selected from manufacturer's standard range of options.

4. Lockset: Schlage ND80 lever lockset.

F. Factory-applied finish:

1. Frame:

a. Prime painted gray in fabrication.

2. Factory Finished Exterior:

a. Wood Venee: As selected from manufacturer's standard range of options.

G. Bullet-Resistant Glazing:

1. Level **4** in accordance with UL 752 – Testing for Ballistic Resistance for the complete assembly including framing and panels.

H. Field alterations to the construction of the assembly fabricated under the acceptable standards are not allowed unless approved in writing by the manufacturer and the Architect.

I. Standard manufacturing tolerances +/- 1/16" shall be maintained.

2.2 FABRICATION

A. Units shall be completely shop-fabricated by manufacturer ready for installation.

B. Tolerances: All joints and connections shall be tight, providing hairline joints and true alignment of adjacent members

PART 3 - EXECUTION

3.1 PREPARATION

A. Prior to beginning installation, verify that all supports have been installed as required by the Contract Documents and architectural drawings, and Shop Drawings have been approved.

B. Notify Architect of any unsatisfactory preparation that is responsibility of others.

C. Clean and prepare all surfaces per manufacturers recommendations as required for achieving the best results for the substrate under the project conditions.

D. Verify field dimensions of openings prior to fabrication of framing.

E. Coordinate structural requirements to ensure proper attachment and support.

F. Do not begin installation of material until all unsatisfactory conditions have been resolved and approved by Architect.

3.2 INSTALLATION

A. TSS FV Bullet Resistant Wood Door and Frame Assembly can be installed using, industrial adhesive, mastic, screws and bolts. Method of application shall maintain bullet resistive rating at junctures with concrete floor, door and window frames and other penetrations.

B. Maintain installation tolerance to not exceed 1/16th for squareness, alignment, twist and plumb. Install hardware as specified per manufacturer’s instructions.

C. Do not begin installation until openings have been verified and surfaces properly prepared in accordance with Drawings.

D. All products shall be installed per installation instructions provided by manufacturer.

E. Door and frame assembly shall arrive on site completely pre-fabricated to field dimensions approved by Shop Drawings.

F. Install framing and secure to structure in accordance with manufacturer's recommendations and approved shop drawings.

3.3 PROTECTION

A. Clean and protect door and frame assembly from damage during ongoing construction operations. If damage occurs, remove and replace as required to provide assembly in their original, undamaged condition.

B. Inspection and Cleaning: Verify installation is complete and complies with manufacturer’s requirements.

C. Provide final cleaning of product and accessories, removing excess dust, labels and protective covers.

D. Touch-up, repair or replace damaged products prior to Substantial Completion.

END OF SECTION

SECTION 09110 – INTERIOR METAL STUD SYSTEM

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work included: Provide metal studs and accessories as indicated on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related work:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. In addition to complying the pertinent codes and regulations of governmental agencies having jurisdiction, comply with pertinent recommendations contained in “Specification for Metal Lathing and Furring” published by the Metal Lath/Steel Framing Association.

1.3 SUBMITTALS

A. Comply with pertinent provisions of Section 01340

B. Product data: Within 45 calendar days after the Contractor has received the Owner’s Notice to Proceed, submit:
1. Materials list of items proposed to be provided under this Section.
2. Manufacturer’s specifications and other data needed to prove compliance with the specified requirements.
3. Manufacturer’s recommended installation procedures which, when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.

1.4 PRODUCT HANDLING

A. Comply with pertinent provisions of Section 01620.

PART 2 – PRODUCTS

2.1 METAL STUDS AND ACCESSORIES

A. Meet or exceed minimum requirements of Fed Spec QQ-S-698 and Fed Spec QQ-S-775d, class d, for the item and use intended.

B. Metal studs
1. At interior metal stud partitions, unless otherwise shown on the Drawings, provide standard punched steel studs 22 gauge or as otherwise shown on the Drawings, hot-dip galvanized.

C. Accessories: Provide all accessories including, but not necessarily limited to, tracks, clips, anchors, fastening devices, sound attenuation pencil rods and resilient clips, and other accessories required for a complete and proper installation, and as recommended by the manufacturer of the steel studs used.

2.2 GROUT

A. Provide a good grade of commercial grout for leveling the floor runner member of steel stud partitions as required.

PART 3 – EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Accurately layout partition and wall lines from the dimensions shown on the Drawings. Contractor to inspect all partitions before drywall is applied.

B. Install metal studs and accessories in strict accordance with the manufacturer's recommendations as approved by the Architect, anchoring all components firmly into position.

C. Align partition and wall assemblies to a tolerance of one in 200 horizontally and one in 500 vertically.

D. Coordination:
   1. Space the studs as required for compliance with pertinent regulations, to give proper support for the covering material, and as indicated on the Drawings.
   2. Coordinate and provide required backing and other support for items to be mounted on the finished covering.
   3. Coordinate requirements for pipes and other items designed to be housed within the partition and wall systems.

3.3 LEVELING

A. By use of the specified grout, or by other means approved by the Architect, provide continuous solid bearing under floor runner members of steel stud partitions and walls.

B. Level in a manner to provide uniform interface with ceilings and other overhead construction.

3.4 SOUND ATTENUATING PARTITIONS

A. At all partitions, set floor runners in two ¼" diameter continuous beads of sealant complying with provisions of Section 07900 of these Specifications.

3.5 U.L.

A. Conform to all required U.L. requirements.

3.6 BRACING

A. All metal stud partitions are to be braced to the structure.

END OF SECTION 09110

SECTION 09260 - GYPSUM WALLBOARD SYSTEMS

PART 1- GENERAL:

1.1 SUMMARY

A. Work included in this section: Provide gypsum drywall and accessories where shown on the drawings, as specified herein, and as needed for a complete and proper installation.

B. Related work includes
1. Painting (section 09900)
2. Building insulation (section 07200)
3. Metal Studs (section 09110)
4. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.3 SUBMITTALS

A. Comply with pertinent provisions of Section 01340.

B. Product data: Within 45 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
1. Materials list of items proposed to be provided under this Section.
2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
3. Manufacturer's recommended installation procedures which, when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the work.

C. Mock-ups
1. At an area on the site where approved by the Architect, provide a mock-up gypsum wallboard panel.
   a. Make the panel approximately 8'-0" x 8'-0".
   b. Provide one mock-up panel for each gypsum wallboard finish used on the work.
   c. The mock-ups may be used as part of the work, and may be included in the finished work, when so approved by the Architect.
   d. Revise as necessary to secure the Architect's approval.
2. The mock-up panels, when approved by the Architect, will be used as datum points for comparison with the remainder of the work of this Section for the purpose of acceptance or rejection.
3. If the mock-up panels are not permitted to be part of the finished work, completely demolish and remove them from the job site upon completion and acceptance of the work of this Section.
4. The mock panel shall be completely finished including painting.

1.4 PRODUCT HANDLING

A. Comply with pertinent provisions of Section 01620.

PART 2 -PRODUCTS:

2.1 MANUFACTURERS: Subject to compliance with requirements, provide gypsum board and related products by one of the following, or pre-approved equal:

A. National Gypsum Co.

B. Georgia-Pacific Corp.

C. Gold Bond Building Products Div., National Gypsum Co.

D. United States Gypsum Co.

E. Louisiana-Pacific

2.2 COMPONENTS FOR SUSPENDED CEILING:

A. Concrete Inserts: ASTM E 488
   1. Embedded type capable of sustaining a load equal to 3 times that imposed by ceiling construction.

B. Steel Rigid Furring Channels: ASTM C 645
   1. Where shown as “Furring” provide manufacturer’s 7/8” furring channels.

C. Steel Studs for Furring Channels: ASTM C 645.

D. Submit proposed suspension system for approval

2.3 GYPSUM BOARD: Provide gypsum board of types indicated in maximum lengths available to minimize end joints:

A. General
   1. Provide mildew resistant/water resistant gypsum wallboard complying with ASTM D3273, in 48” widths and in such lengths as will result in a minimum of joints.
   2. Regular wallboard: Provide mildew resistant/water resistant, 5/8” thick except as may be shown otherwise on the drawings.
   3. Fire-retardant wallboard: Provide grade XD, 5/8” thick.
   4. Ceilings/Soffits: 5/8” mildew / water resistant or as shown on the drawings.
   5. National Gypsom sound break XP – see plans for locations.

2.4 TRIM ACCESSORIES: ASTM C 840: Mfr's standard trim accessories, including cornerbead and edge trim of beaded type with face flanges for concealment in joint compound except where semi-finishing or exposed type is indicated.

A. Provide corner bead formed from zinc alloy, Series 800.

B. Provide one-piece control joints with 1/4 inch wide by 7/16 inch deep vee-shaped slot, covered with removable tape, of roll- formed zinc or extruded vinyl as recommended by gypsum board Mfr. space not more than 20 feet on centers.

C. Edge beads for use at perimeter of ceilings:
   1. Provide angle shapes with wings not less than ¾” wide.
   2. Provide concealed wing perforated for nailing, and exposed wing edge folded flat.

3. Exposed wing may be factory finished in white color.

2.5 GYPSUM BOARD JOINT TREATMENT MATERIALS: ASTM C 475 and ASTM C 840, and as allows:

A. Joint Tape: Paper reinforcing tape, unless otherwise indicated.
   1. Use open-weave glass fiber tape where recommended by gypsum board Mfr. with use of setting-type joint compound.
   2. Provide a jointing system, including reinforcing tape and compound, designed as a system to be used together and as recommended for this use by the manufacturer of the gypsum wallboard approved for use on this work.

B. Drying-Type Joint Compounds: Factory-prepackaged vinyl-based products complying with the following requirements:
   1. Ready-Mix Formulation: Factory-premixed.
   2. All-purpose compound formulated for use as both taping and topping compound.
   3. Jointing compound may be used for finishing if so recommended by its manufacturer.

C. Miscellaneous Materials: As follows, recommended by gypsum board Mfr.
   1. Gypsum Board Screws: ASTM C 1002.
   2. Sound Attenuation Blankets: ASTM C 665, Type I, unfaced mineral fiber blanket insulation.

2.6 FASTENING DEVICES

A. For fastening gypsum wallboard in place on metal studs and metal channels, use flat-head screws, shouldered, specially designed for use with power-driven tools, not less than 1” long, with self-tapping threads and self-drilling points.

2.7 ACCESS DOORS

A. In partitions and ceilings installed under this Section, provide doors where required for access to mechanical installations and electrical installations.

B. Types
   1. Unless otherwise required, provide 24” x 24” (or as required by code) metal access doors with concealed hinges to metal frame, and with Allen key lock.
   2. For piercing fire-rated surfaces, provide access doors having the same fire rating as the surface being pierced.
   3. For tile surfaces and toilet rooms, provide stainless steel access doors and frames, with satin finish.
   4. For other installations, provide prime-coated steel access doors and frames for finish painting to be performed at the job site under Section 09900 of these Specifications.

2.8 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 - EXECUTION:

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. General
1. Install the gypsum wallboard to ceilings with the long dimension of the wallboard at right angles to the supporting members.
2. Wallboard may be installed with the long dimensions parallel to supporting members that are spaced 16” on centers when attachment members are provided at end joints.
3. Do not bridge building expansion joints. Leave space of the width indicated between boards, and trim both edges for installation of sealant or gasket.

B. Install and finish gypsum board to a level 5 finish and to comply with ASTM C 840 and as follows:
1. Form "Floating" construction for gypsum boards at internal corners, except where special isolation or edge trim is indicated.
2. Isolate drywall construction from abutting structural and masonry work; provide edge trim and acoustical sealant as recommended by Mfr.
3. Install sound attenuation blankets where indicated, without gaps; and support where necessary to prevent movement or dislocation.

C. Ceilings
1. Install the gypsum wallboard to ceilings with the long dimension of the wallboard at right angles to the supporting members. (Suspension System)
2. Wallboard may be installed with the long dimension parallel to supporting members that are spaced 16” on centers when attachment members are provided at end joints.

D. Walls
1. Install the gypsum wallboard to studs at right angles to the furring or framing members.
2. Make end joints, where required, over framing or furring members.

E. Attaching
1. Drive the specified screws with clutch-controlled power screwdrivers, spacing the screws 12” on centers at ceilings and 16” on centers at walls.
2. Where framing members are spaced 24” apart on walls, space screws 12” on centers.
3. Attach double layers in accordance with the pertinent codes and the manufacturer’s recommendations as approved by the Architect.
4. Screw gypsum board to metal supports.

F. Access doors
1. By careful coordination with the drawings and with trades involved, install the required access doors where required.
2. Anchor firmly into position, and align properly to achieve an installation flush with the finished surface.

3.3 JOINT TREATMENT

A. General
1. Inspect areas to be joint treated, verifying that the gypsum wallboard fits snugly against supporting framework.

2. In areas where joint treatment and compound finishing will be performed, maintain a temperature of not less than 55 degrees for 24 hours prior to commencing the treatment, and until joint and finishing compounds have dried.
3. Apply the joint treatment and finishing compound by machine or hand tool.
4. Provide a minimum drying time of 24 hours between coats, with additional drying time in poorly ventilated areas.

B. Embedding compounds
1. Apply to gypsum wallboard joints and fastener heads a thin uniform layer.
2. Spread the compound not less than 3" wide at joints, center the reinforcing tape in the joint, and embed the tape in the compound. Then spread a thin layer of compound over the tape.
3. After this treatment has dried, apply a second coat of embedding compound to joints and fastener heads, spreading in a thin uniform coat to not less than 6" wide at joints, and feather edged.
4. Sandpaper between coats as required.
5. When thoroughly dry, sandpaper to eliminate ridges and high points.

C. Finishing compounds
1. After embedding compound is thoroughly dry and has been completely sanded, apply a coat of finishing compound to joints and fastener beads.
2. Feather the finishing compound to not less than 12" wide.
3. When thoroughly dry, sandpaper to obtain a uniformly smooth surface, taking care to not scuff the paper surface of the wallboard.
4. Drywall Finishing: Apply joint tape and joint compound at joints between gypsum boards. Apply compounds indicated below at accessory flanges, penetrations, fastener heads and surface defects. All drywall to be a level 4 finish. Except in the Courtroom which is to be level 5 finish.

3.4 CORNER TREATMENT

A. Internal corners: Treat as specified for joints, except fold the reinforcing tape lengthwise through the middle and fit neatly into the corner.
B. External corers
1. Install the specified corner bead, fitting neatly over the corner and securing with the same type fasteners used for installing the wallboard.
2. Space the fasteners approximately 6" on centers, and drive through the wallboard into the framing or furring member.
3. After the corner bead has been secured into position, treat the corner with joint compound and reinforcing tape as specified for joints, feathering the joint compound out from 8" to 10" on each side of the corner.

3.5 OTHER METAL TRIM
A. General
1. The drawings do not purport to show all locations and requirements for metal trim.
2. Carefully study the drawings and the installation, and provide all metal trim normally recommended by the manufacturer of the gypsum wallboard approved for use in this work.

3.6 CLEANING UP
A. In addition to other requirements for cleaning, use necessary care to prevent scattering gypsum wallboard scraps and dust, and to prevent tracking gypsum and joint finishing compound onto floor surfaces.
B. At completion of each segment of installation in a room or space, promptly pick up and remove from the working area all scrap, debris, and surplus material of this Section.

END OF SECTION 09260

SECTION 09660 - VINYL PLANKS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Vinyl Planks

1.2 SUBMITTALS

A. Comply with the requirements of section 01340.

B. Product Data: Submit technical data from each manufacturer of resilient products required.

C. Initial Samples: Submit manufacturer's standard color selection samples for resilient products required, including all available colors and patterns.

1.3 PROJECT CONDITIONS

A. Environmental Requirements: At least 48 hours prior to beginning work, move resilient flooring materials to areas of installation and maintain at minimum 70 degrees F until 48 hours after completing installation and at minimum 55 degrees F thereafter.

B. Sequencing: Do not begin installation of resilient flooring products until painting has been completed for each area.

C. Existing Conditions: Do not install resilient flooring on concrete substrates until testing has been conducted to assure that moisture levels are acceptable.

1.4 MAINTENANCE

A. Extra Materials: At time of completing installation, deliver stock of maintenance materials to the owner. Furnish products matching those actually installed, packaged for storage and clearly labeled.

B. Vinyl planks: 10 planks of each variety.

PART 2 - PRODUCTS

2.1 VINYL PLANK

A. ShawContract, Solitude, French Grey 48599 V3-Moderate Variation

B. Colors to be selected.

2.2 MISCELLANEOUS ACCESSORIES

A. Resilient Edge Strips: Solid rubber or vinyl edging, in tapered or rounded profile, nominally 1 inch in width and 1/8 inch in thickness.

B. Color: Matching flooring.

C. Adhesive: Type recommended by manufacturer of resilient product for specific substrate conditions.

2.3 COLORS AND PATTERNS

A. Provide colors and patterns of resilient flooring materials as selected by the architect from manufacturer's standard product line.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Comply with manufacturer's published recommendations for installation in each area, extending resilient flooring into spaces which are partially concealed. Cut and fit tightly to fixtures, pipes, and other obstructions, as well as to walls and partitions.

B. Tightly adhere resilient flooring to substrate with no open joints or cracks, and without raised or blistered areas. Spread adhesive evenly, so that final installation will be without telegraphed markings from adhesive or substrate.

C. Verify conditions ready to receive all work of this section. Do not proceed until unsatisfactory conditions are corrected.

3.2 TILE INSTALLATION

A. Layout: Establish center of each space and lay tile from center point, so tiles at each edge will be not less than 1/2 tile and equal in width.

B. Matching: In each space, use tiles from same production run, and lay tiles in same sequence as removed from cartons. Discard broken, chipped, or otherwise damaged tiles.

C. Lay tile square to room axis.

D. Lay tile to achieve monolithic appearance, with pattern in all tiles oriented in same direction.

3.3 INSTALLATION OF MISCELLANEOUS ACCESSORIES

A. Resilient Edge Strips: At locations shown on drawings, or where otherwise required to protect edge of resilient flooring, install resilient edge strips securely with recommended adhesive, to achieve tightly butted joint.

3.4 CLEANING

A. Initial Cleaning: Remove excess and waste materials promptly, and sweep or vacuum clean resilient flooring as soon as installation has been completed in each area. After adhesive has had adequate time to set, mop each area with damp mop and mild detergent.

B. Final Cleaning: Remove scuff marks, excess adhesive, and other foreign substances, using only cleaning products and techniques recommended by manufacturer of resilient products. The contractor shall provide final waxing and buffing at the completion of the project.

C. Provide Owner with manufacturer's standard cleaning procedures.

END OF SECTION 09660

SECTION 09680 – CARPETING

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work included: Provide carpeting accessories where shown on the Drawings, as specified herein, and as needed for a complete and proper glue-down installation.

B. Related work:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions Supplementary Conditions, and Sections in Division 1 of this Section.

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.3 SUBMITTALS

A. Comply with pertinent provisions of Section 01340.

B. Product data: Within 60 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
1. Materials list of items proposed to be provided under this Section.
2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
3. Shop Drawings showing location of seams and locations and types of carpet metal and accessories.
4. Samples of the full range of colors and patterns of carpet and of exposed accessories available from the proposed manufacturers in the specified qualities.
5. Manufacturer's recommended installation procedures which, when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.

B. After the Architect has selected the color and pattern, submit three Samples of each specified color and pattern from the stock proposed to be installed. Secure the Architect's approval of these Samples prior to installation.

1.4 PRODUCT HANDLING

A. Comply with pertinent provisions of Section 01620.

PART 2 - PRODUCTS

2.1 CARPET

A. StaticSmart, Colonial Series, PENN

PART 3 – EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completing of the work. Do not proceed until unsatisfactory conditions are corrected.

3.2 SURFACE PREPARATION

A. Immediately prior to installation of the work of this Section, thoroughly clean substrata and remove oil, grease, paint, varnish, hardeners, and other items, which would adversely affect the bond of adhesive.

B. Make substrata level and free from irregularities. Assure one constant floor height after carpet is installed, filling low spots and grinding high spots as required.

3.3 INSTALLATION

A. General:
1. Install as per manufacturers recommendations.
2. Scribe the carpet accurately to vertical surfaces.
3. Align the lines of carpet, as woven; using no fill strips less than 6” wide, laying all carpet in the same direction unless specifically directed otherwise by the Architect.

B. Seams:
1. Locate seams to the maximum extent practicable out of the way of traffic. Fabricate seams by the compression method, using a butt joint, and properly bead and seal.
2. Do not stretch seams.
3. No visible seams to the eye will be allowed.

C. In addition to the cleaning requirement stated elsewhere, thoroughly clean carpet and adjacent surfaces prior to final acceptance of the carpeted areas by the Owner.

3.4 PROTECTION

A. Carpet Installation: provide a heavy non-staining paper or plastic walkway as required over carpeting in direction of traffic, maintaining intact until carpet space is accepted by the Owner.

3.5 SURPLUS MATERIAL

A. Allow the Owner to inspect and select from scrap carpet remaining after the installation. Bundle, wrap in burlap and deliver to the Owner the carpet scraps selected by him.

END OF SECTION 09680

SECTION 09900 - PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, Amendments to General Conditions, and Supplementary Conditions and Sections in Division 1 of the Specifications apply to work of this section.

1.2 DESCRIPTION

A. Work included: Paint and finish the exterior and interior exposed surfaces listed on the Painting Schedule in Part 3 of this Section, as specified herein, and as needed for a complete and proper installation.

B. Related work:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Priming or priming and finishing of certain surfaces may be specified to be factory-performed or installer-performed under pertinent other Sections.

C. Work not included:
1. Unless otherwise indicated, painting is not required on surfaces in concealed areas and inaccessible areas such as furred spaces, foundation spaces, utility tunnels, pipe spaces, and duct shafts.
2. Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze, and similar finish materials will not require painting under this Section unless otherwise indicated.
3. Do not paint moving parts of operating units; mechanical or electrical parts such as valve operators; linkages; sensing devices; and motor shafts, unless otherwise indicated.
4. Do not paint over required labels or equipment identification, performance rating, name, or nomenclature plates.
5. Do not paint concrete which has been sandblasted.

D. Definitions:
1. "Paint," as used herein, means coating systems materials including primers, emulsions, epoxy, enamels, sealers, fillers, and other applied materials whether used as prime, intermediate, or finish coats.

1.3 SUBMITTALS

A. Comply with pertinent provisions of Section 01340.

B. Product data: Within 45 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
1. Materials list of items proposed to be provided under this Section;
2. Manufacturers specifications and other data needed to prove compliance with the specified requirements.

C. Samples:
1. Colors are to be selected. Follow the selection of colors and glosses by the Architect , as described under “Color Schedules” in Part 2 of this Section, submit Samples for the Architect’s review.
a. Provide three samples of each color and each gloss for each material on which the finish is specified to be applied.

b. Except as otherwise directed by the Architect, make samples approximately 8" x 10" in size.
c. If so directed by the Architect, submit samples during progress of the Work in the form of actual application of the approved materials on actual surfaces to be painted.

2. Revise and resubmit each Sample as requested until the required gloss, color, and texture is achieved. Such Samples, when approved, will become standards of color and finish for accepting or rejecting the work of this Section.
3. Do not commence finish painting until approved samples are on file at the job site.

1.4 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1. Paint shall be tinted by the Paint Company; on-site tinting is not permitted.

B. Paint coordination:
1. Provide finish coats which are compatible with the prime coats actually used.
2. Review other Sections of these specifications as required, verifying the prime coats to be used and assuring compatibility of the total coating system for the various substrate.
3. Upon request, furnish information on the characteristics of the specific finish materials to assure that compatible prime coats are used.
4. Provide barrier coats over non-compatible primers, or remove the primer and re-prime as required.
5. Notify the Architect in writing of anticipated problems in using the specified coating systems over prime-coatings supplied under other Sections.

C. Provide 8’ x8’ wall and 8’ x 8’ ceiling mock-up panel for approval of finishes.

1.5 PRODUCT HANDLING

A. Comply with pertinent provisions of Section 01620.

1.6 JOB CONDITIONS

A. Do not apply solvent-thinned paints when the temperature of surfaces to be painted and the surrounding air temperatures are below 45 degrees F, unless otherwise Permitted by the manufacturers' printed instructions as approved by the Architect.

B. Weather conditions:
1. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85%; or to damp or wet surfaces, unless otherwise permitted by the manufacturers' printed instructions as approved by the Architect.
2. Applications may be continued during inclement weather only within the temperature and humidity limits specified by the paint manufacturer as being suitable for use during application and drying periods.

1. 7 EXTRA STOCK

A. Upon completion of the Work of this Section, deliver to the Owner an extra stock equaling one gallon of each color, type, and class of paint used in the Work. Tightly seal each container, and clearly label, stating contents and location(s) where used.

PART 2 - PRODUCTS

2.1 PAINT MATERIALS

A. Acceptable materials:
   1. The Painting Schedule in Part 3 of this Section is based, in general, on products of the Glidden Paint Company, equal products by Sherwin Williams, Olympic or approved equal will be acceptable.
   2. Where products are proposed other than those specified by name and number in the Painting Schedule, provide under the product data submittal required by Article 1.3 of this Section a new painting schedule compiled in the same format used for the Painting Schedule included in this Section.

B. Undercoats and thinners:
   1. Provide undercoat paint produced by the same manufacturer as the finish coat.
   2. Use only the thinners recommended by the paint manufacturer, and use only to the recommended limits.
   3. Insofar as practicable, use undercoat, finish coat, and thinner material as parts of a unified system of paint finish.

2.2 COLOR SCHEDULES

A. The Architect or Owner will prepare a color schedule with samples for guidance in painting.

B. The Architect may select, allocate, and vary colors on different surfaces throughout the work, subject to the following:
   1. Interior work:
      a. Walls – 4 color
      b. Ceiling – 2 color
      c. Doors – 2 color
      d. Casing/Trim – 2 color
   2. Exterior :
      a. 2 colors.

2.3 APPLICATION EQUIPMENT

A. For application of the approved paint, use only such equipment as is recommended for application of the particular paint by the manufacturer of the particular paint, and as approved by the Architect.

B. Prior to use of application equipment, verify that the proposed equipment is actually compatible with the material to be applied, and that integrity of the finish will not be jeopardized by use of the proposed equipment.

2.4 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. General:
1. Mix and prepare paint materials in strict accordance with the manufacturers' recommendations as approved by the Architect.
2. When materials are not in use, store in tightly covered containers.
3. Maintain containers used in storage, mixing, and application of paint in a clean condition, free from foreign materials and residue.
4. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

B. Stirring:
1. Stir materials before application, producing a mixture of uniform density.
2. Do not stir into the material any film which may form on the surface, but remove the film and, if necessary, strain, the material before using.

3.2 SURFACE PREPARATION

A. General:
1. Perform preparation and cleaning procedures in strict accordance with the paint manufacturers' recommendations as approved by the Architect.
2. Remove removable items which are in place and are not scheduled to receive paint finish; or provide surface-applied protection prior to surface preparation and painting operations.
3. Following completion of painting in each space or area, reinstall the removed items by using workmen who are skilled in the necessary trades.
4. Clean each surface to be painted prior to applying paint of surface treatment.
5. Remove oil and grease with clean cloths and cleaning solvent of low toxicity and flash point in excess of 200 degrees F. prior to start of mechanical cleaning.
6. Schedule the cleaning and painting so that dust and other contaminants from the cleaning process will not fall onto wet newly painted surfaces.

B. Preparation of wood surfaces:
1. Clean wood surfaces until free from dirt, oil, and other foreign substance.
2. Smooth finish wood surfaces exposed to view, using the proper sandpaper. Where so required, use varying degrees of coarseness in sandpaper to produce a uniformly smooth and unmarred wood surface in preparation for the application of stain.
3. Unless specifically approved by the Architect, no not proceed with painting of wood surfaces until the moisture content of the wood is 12% or less as measured by a moisture meter approved by the Architect.

C. Preparation of metal surfaces:
1. Thoroughly clean surfaces until free from dirt, oil, and grease.
2. On galvanized surfaces, use solvent for the initial cleaning, and then treat the surface thoroughly with phosphoric acid etch. Remove etching solution completely and allow to dry thoroughly before application of paint.
3. Allow to dry thoroughly before application of paint.

3.3 PAINT APPLICATION

A. General:
   1. Touch-up shop-applied prime coats which have been damaged, and touch-up bare areas prior to start of finish coats application.
   2. Slightly vary the color of succeeding coats.
      a. Do not apply additional coats until the completed coat has been inspected and approved.
      b. Only the inspected and approved coats of paint will be considered in determining the number of coats applied.
   3. Sand and dust between coats to remove defects visible to the unaided eye
   4. On removable panels and hinged panels, paint the back sides to match the exposed sides.

B. Drying:
   1. Allow sufficient drying time between coats, modifying the period as recommended by the material manufacturer to suit adverse weather conditions.

C. Brush applications:
   1. Brush out and work the brush coats onto the surface in an even film.
   2. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, and other surface imperfections will not be acceptable.

D. Spray application:
   1. Except as specifically otherwise approved by the Architect, confine spray application to concrete masonry surfaces, metal framework and similar surfaces where hand brush work would be inferior.
   2. Where spray application is used, apply each coat to provide the hiding equivalent of brush coats.
   3. Do not double back with spray equipment to build up film thickness of two coats in one pass.

E. For completed work, match the approved Samples as to texture, color, and coverage. Remove, refinish, or repaint work not in compliance with the specified requirements.

3.4 PAINTING SCHEDULE

A. Provide the following paint finishes:

B. Exterior metal, ferrous:
   1. First coat: Primer, 5206.
   2. Second coat: Gloss Alkyd Enamel, 4550 Series.
   3. Third coat: Gloss Alkyd Enamel, 4550 Series.

C. Exterior metal, galvanized:
   1. First coat: Primer, 5206.
   2. Second coat: Gloss Alkyd Enamel, 4550 Series.
   3. Third coat: Gloss Alkyd Enamel, 4550 Series.

D. Interior metal, ferrous:
   1. First Coat: Primer 5206.
   2. Second Coat: Semigloss, odorless, Alkyd Enamel, 4600 Series.
   3. Third Coat: Semigloss, odorless, Alkyd Enamel, 4600 Series.

E. Interior concrete masonry:

1. First Coat: High-Performance Latex Block Filler, 5317.
2. Second Coat: Semigloss, latex based, 3700 Line.
3. Third Coat: Semigloss, latex based, 3700 Line.

F. Exterior concrete (Elastomeric Coating):
1. Wash Surfaces, repair cracks, fill voids, apply concrete conditioner, level concrete with Finestone Fine Build.
2. Finestone Sanded Primer
3. Finestone Pebbletex (Limestone) to a minimum thickness of 1.6mm (2 coats minimum)
4. Horizontal Surfaces: Finestone Top Coat to a minimum thickness of 3 mils.
5. Vertical Surfaces: FineLastic to a minimum dry film thickness of 15 mils. (minimum 2 coats)
6. Apply as per manufacturer's recommendations

G. Interior flat wall paint ("F")
1. On concrete, use:
   a. First coat: Pigmented sealer #890
   b. Second coat: sinwall vinyl latex #1700
   c. Third coat: Sinwall vinyl latex #1700
2. On gypsum drywall, use:
   a. First coat:: Pigmented PVA sealer #1770
   b. Second coat: Sinwall vinyl latex #1700
   c. Third coat: Sinwall vinyl latex #1700

H. Interior semi-gloss enamel ("SGE")
1. On wood use:
   a. First coat: Sinco prime undercoater #975
   b. Second coat: Sinco satin enamel #1800
   c. Third coat: Sinco satin enamel #1800

END OF SECTION 09900

SECTION 10270 – RAISED ACCESS FLOORING

PART 1- GENERAL

1.01 Summary

A. The access floor system is comprised of access floor panels, understructure and accessories; and is to include all material, equipment and labor for installation.

B. Related Work Specified Elsewhere:

1. Division 3 – Concrete work specified including concrete floor sealer.
    a. Concrete sealer must be compatible with pedestal adhesive.
2. Division 9 – Carpet and carpet tile work specified.
3. Division 15 – Mechanical work specified.
4. Division 16 - Electrical work specified.

1.02 Quality Assurance

A. Floor installation shall be performed by a company which specializes in access flooring, with a minimum of 5 years of successful documented experience.

B. Tolerances

1. Nominal panel size ± 0.020” or less.
2. Panel flatness ± 0.020” or less.
3. Panel squareness ± 0.015” or less.
4. Panel interchangeability-all panels, except those modified for special conditions.
5. Finishes installation shall be level within ± 0.060” in 10 feet and ± 0.100” for the entire floor.

C. Test methods for concentrated, ultimate, rolling and axel loads will be in accordance with the “Recommended Test Procedures for Access Flooring” as set forth by CISCA, the Ceilings and Interiors System Construction Association.

1.03 Description

A. Access floor systems are portable assemblies of modular floor panels (raised floor panels) supported by adjustable pedestals creating accessible under floor air space to accommodate electrical, mechanical and HVAC services.

B. Raised floor panels are interchangeable with each other with exception of panels with cuts made for special conditions.

1.04 Performance

A. Testing as outlined in CISCA “Recommended Test Procedures for Access Floors”

1. Concentrated Load: 1250Ib on one square inch load at any location with top surface deflection not to exceed +/- 0.080” and a permanent set not to exceed .10”.
2. Ultimate Load: Panel shall be designed to withstand load of 3,750Ib minimum at weakest point with stringer.
3. Rolling Load: Panels shall withstand a rolling load of 1,000Ibs applied through a 3” dia. X 1-13/16” wide caster for 10 cycles over the same path with less than 0.040” top surface permanent set. Panels shall withstand a rolling load of 800Ibs applied through a hard rubber-surfaced wheel 6” dia. X 1-1/2” wide for 10,000 cycles over the same path. Permanent set at the conclusion of the test shall not exceed 0.040”.
4. Flame spread of 5 or less and smoke developed of 10 or less when tested according to ASTM E-84.

1.05 Submittals

A. Samples: Submit a sample of the floor panels and understructure components.

B. Shop Drawings: Submit drawing indicating panel layout, ramp(s), step(s), railing locations, details of assembly components, edge details and anchoring.

C. Certificates: Submit independent testing organization certificates indicating compliance with specified design criteria when tested and reported according to CISCA “Recommended Test Procedures for Access Floors”.

1.06 Project Conditions

A. General Contractor shall provide a clean subfloor which is free of dust, level, dry and protected from weather.
B. Access flooring storage and installation area shall be secure and maintained at a temperature between 40 to 90 def F, and between 20% to 70% relative humidity for 24 hours a day before, during and after installation.
C. Substrate must be level to within 1/8” in 10ft.

PART 2 - PRODUCTS

2.01 Manufacturer: The access flooring system shall be supplied by AFS, Inc. or approved equal.

2.02 Materials

A. Floor Panels are cementitious filled panels structurally bonded to hard steel top and bottom sheets. Thickness of steel sheet shall be as required to meet specific load requirements.
    1. Panels are 24” square with manufacturer’s factory applied finish to protect against corrosion.
    2. See room finish schedule for floor finish.
    3. Panels have a maximum electrical resistance of 10 ohms or less from the top edge of the panel, less surface covering and pedestal pad, to the understructure.
B. Pedestals complete includes steel base with head.
    1. The base will be a minimum of 16 square inches will be adhered to the subfloor with adhesive recommended by the access flooring manufacturer. (If mechanical anchors are required for seismic zones, consult manufacture for approved system.)
    2. Threaded stud will be 3/4’” diameter steel.
    3. Head assembly will be designed to allow rigid grid stringers fastened in place with 1/4” – 20 machine screws.
    4. The entire assembly will provide a minimum of +/- 1” of vertical adjustment, when finished floor height is 6” or more, adjustable to 1/64” increments, without rotating pedestal head.
    5. The assembly will provide a mechanical means to lock the floor in a level plane and adjustments are able to be made without special tools.
    6. Pedestal assembly will be able to support no less than 5,000Ib axial load and resist an average 1,000 inch-pound overturning moment when bonded to a clean concrete slab.
C. Stringers will be roll formed 18 gauge steel with an integrated gasket.
    1. Stringer will nest between the panels and capable of supporting a 450Ib concentrated load at mid span with less than 0.010” permanent set.
    2. Stringer will be either 2’x2’ or 4’x4’ pattern and will be secured with fastener.
D. Accessories are ramps, steps, lateral bracing, fascia, handrails and cutouts and will meet manufacturer’s standard and be furnished where indicated. Provide shop drawings for approval.

PART 3 – EXECUTION

3.01 Inspection

A. Examine the subfloor which is to receive access flooring for dryness, unevenness, or any irregularities which will affect the quality of the access flooring.
B. Do not commence installation of access flooring until subfloor is clean and dry, temperature controlled (40F below or above), and protected from the weather.

3.02 Installation

A. Install the access floor to the manufacturer’s instructions. All construction debris must be removed as work progresses. Subfloor and all soiled or discolored access floor surfaces will be clean upon completion of installation. All damaged or permanently soiled material will be replaced.

3.03 Acceptance

A. General Contractor or Owner must accept completed access floor in whole or in part, prior to allowing other trades to perform work with affects the installed access floor.

B. General Contractor must suitable protect the accepted access floor and accessories from damage, contamination or overloading.

END OF SECTION 10270

SECTION 10400 – IDENTIFYING DEVICES (Signage)

PART 1- GENERAL

1.1 DESCRIPTION

A. Work included: Provide identifying devices where shown on the Drawings, as specified herein, and as needed for a complete and proper installation including, but not necessarily limited to:

1. Door Signs

B. Related Work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.3 SUBMITTALS

A. Comply with pertinent provisions of Section 01340 - Submittals and Substitutions.

B. Product Data: Within 30 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:

1. Materials list of items proposed to be provided under this Section.

2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.

3. Details of installation and anchorage sufficient to enable proper interface of the work of this Section with the work of other trades.

4. Manufacturer's recommended installation procedures which, when approved by the Architect will become the basis for accepting or rejecting actual installation procedures used on the work.

5. The Contractor is to submit a sample of <u>each</u> type of sign in the specified color and size and a sample of the Grip-A-Strip Smart Strip showing its attachment to the appropriate sign type.

1.4 GUARANTEE

A. Any signs that do not remain securely bonded to the substrate for a period of 1 year after acceptance of the project shall be removed and properly reinstalled at no additional cost to the owner.

1.5 PRODUCT HANDLING

A. Comply with pertinent provisions of Section 01620.

PART 2 – PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Acceptable Manufactures:
1. Best Sign System
2. Corum Sign
3. ASI Sign System
4. Signature Sign, Inc.
5. 290 Sign System

B. Except as otherwise approved by the Architect, provide all products of this Section from a single manufacturer. (See Summary of Allowances)

C. ADA: All signage on the project that falls under the jurisdiction of the American with Disabilities Act shall be provided as required to comply with all applicable requirements of ADA. It shall be the responsibility of the Contractor and the signage manufacturer to ensure that all signage complies with ADA.

D. Materials: Provide signage manufactured by a photomechanical etching process, leaving the copy and Braille raised. The plaque is then laminated to a 1/8" opaque acrylic base cut to size and finished with a professional coat of acrylic polyurethane enamel in a selected color. Signs are to be unframed with a square corner.

E. Braille and text are to be raised 1/32".

F. Room Numbers are to be 1" high.

G. Text is to be 5/8" high on all signs except Sign Type #5. On Sign Type #5 the text is to be 1" high.

H. Letter Style is to be: Standard Bold Condensed – Upper Case Letters

I. Finished signs are to be ¼" thick.

J. Edge Treatment: Beveled.

K. The signs are to have a square corner with no border.

L. The color of the sign is to be chosen from standard selection.

M. The Grip-A-Strip Smart Strip is to be clear anodized aluminum finish with black plastic end caps.

N. The Contractor is to supply and install all the graphic inserts (pre-cut and printed) for the Type 1 and Type 2 signs. The inserts are to be on paper.

O. Attachment: Vinyl Tape or Silicone.

P. Signs are to be mounted so that they are ADA compliant.

Q. The Grip-A-Strip Smart Sign is to be mounted to the plastic sign and not directly to the wall.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install the work of this Section in strict accordance with the manufacturer's recommendations as approved by the Architect, using only the approved mounting materials, and locating all components firmly into position, level and plumb.

B. Prior to the installation, the contractor is to supply in duplicated the signage finish schedule and shop drawings showing the colors, words, numbering and other information to be included on the signage as it is to be installed.

C. Installation:

1. The Contractor is to install the signage in accordance with the Drawings, the Specifications, approved Shop Drawings and in accordance with manufacturer's printed instructions.

2. Include all accessories to provide a proper installation.

3. Work shall be level, plumb and in true plane.

4. Work shall be secure and rigid.

5. Installation accessories shall be furnished by the signage manufacturer.

6. Do not use installation materials from any other source.

7. Signs adhered to glass shall have a blank plate attached to the back of the glass so that the tape is not visible.

8. The color of the blank plate shall match the sign color.

9. The size of the blank plate shall match the size of the sign.

END OF SECTION 10400

SECTION 10520 – FIRE EXTINGUISHERS AND CABINETS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work included: Provide fire extinguishes and cabinets where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related work:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.3 SUBMITTALS

A. Comply with pertinent provisions of Section 01340.

B. Product data: Within 45 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
1. Materials list of items proposed to be provided under this Section.
2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements;
3. Dimensioned drawings as needed to depict the space required for these items, and their interface with the work of other trades.
4. Manufacturer's recommended installation procedures which, when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the work.

1.4 PRODUCT HANDLING

A. Comply with pertinent provisions of Section 01620.

PART 2 – PRODUCTS

2.1 CABINETS

A. Where shown on the Drawings or specified elsewhere, provide Larsen's, or equal products of other manufacturers approved in advance by the Architect.
1. Semi-Recessed, FS 2409-R3 complying with ADA requirements.

2.2 FIRE EXTINGUISHERS

A. At each fire extinguisher cabinet, provide one multi-purpose chemical fire extinguisher with UL rating of 2A-10B; C, Larsen model, "MP5", (verify compatibility with cabinet) or equal products by J-L Industries or Potter Roemer.

B. Service, charge, and tag each fire extinguisher not more than five calendar days prior to the Date of Substantial Completion of the work as that date is established by the Architect.

C. Surface mounted with standard wall bracket as located on plans.

PART 3 – EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

B. Install the work of this Section in strict accordance with the original design, the approved Shop Drawings, pertinent requirements of governmental agencies having jurisdiction, and the manufacturer's recommended installation procedures firmly into position for long life under hard use.

C. Coordinate all locations with local Fire Inspector before blocking out cabinet locations.

3.3 LOCATION:

A. Provide fire extinguishers and cabinets as located on drawings.

B. Provide fire extinguishers and standard mounting bracket as located on drawings.

END OF SECTION 10520

SECTION 10800 – TOILET ROOM ACCESSORIES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work included: Provide toilet room accessories where indicated on the Drawings, as specified herein, and as needed for a compete and proper installation.

B. Related work

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.3 PRODUCT HANDLING

A. Comply with pertinent provisions of Section 01620.

PART 2 - PRODUCTS

2.1 TOILET ROOM ACCESSORIES

A. See Toilet Accessory Schedule on plans.

2.2 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 – EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

B. Install each item in its proper location, firmly anchored into position, level and plumb, and in accordance with the manufacturer's recommendations.

C. Provide non-combustible blocking in walls for toilet accessories and all handicap grab bars, etc. in all locations as required by code.

END OF SECTION 10800

DIVISION 15A - PLUMBING

15010	Basic Plumbing Requirements
15140	Hangers and Supports
15190	Plumbing Identification
15250	Plumbing Piping Insulation
15410	Plumbing Piping
15430	Plumbing Specialties
15440	Plumbing Fixtures
15450	Water Heaters

SECTION 15010 - BASIC PLUMBING REQUIREMENTS

PART I - GENERAL

1.1 GENERAL CONDITIONS

A. The stipulations and conditions stated in this Section, together with all provisions of the "Instructions to Bidders", "General Conditions", "Supplemental General Conditions", and "Special Conditions", hereinbefore set forth, shall apply to this and the other Sections of Division 15A.

1.2 GENERAL REQUIREMENTS

A. The General Requirements hereinafter listed apply to the Plumbing Work Division. If there is any conflict between the General Requirements and the General Conditions, the General Conditions shall take precedence.

1.3 ALTERNATES

A. Carefully examine all alternates at the back of this specification to determine if any work described under the Plumbing Section will be affected thereby.

1.4 INTENT

A. The intent of these drawings and specifications are to describe the installation of a complete, fully adjusted and operational system. Therefore, any items shown on drawings and not specifically called for in the specifications, or any items specified and not specifically indicated or detailed on the drawings, or any items neither specified or shown, but which are reasonably incidental to and commonly required to make a complete job, will be furnished and installed by the Plumbing Contractor at his own expense.

1.5 DEFINITIONS

A. The Plumbing Contractor shall provide all supervision, labor, material equipment, machinery, plant, and any and all other items necessary to complete the plumbing systems. All items of equipment are specified in the singular; however, the Plumbing Contractor shall provide the number of items of equipment as indicated on the drawings, and as required for complete systems.

Where the word "provide" is used, it shall mean "furnish and install complete and ready to use".

1.6 VISIT TO THE SITE

The Plumbing Contractor shall visit the site before submitting his bid so as to be thoroughly familiar with the job conditions and/or peculiarities. No extra payment will be allowed for anything which could have been anticipated from a visit to the site.

1.7 REGULATORY REQUIREMENTS

A. All work under this Section shall be accomplished in strict accordance with State codes. Where these plans and specifications conflict with such codes, the codes shall govern. The Plumbing Contractor shall notify the Architect or Engineer of such conflicts in writing prior to receipt of bids.

1.8 PERMITS AND FEES

A. NA

1.9 DRAWINGS AND SPECIFICATIONS

A. The Plumbing Drawings and Specifications are intended to cover all the work enumerated under the respective headings. The drawings are diagrammatic only. No Contractor shall take advantage of conflict or error between Drawings and Specifications, or between General Drawings and Mechanical, Plumbing and/or Electrical Drawings, but shall request a clarification of such from the Architect/Engineer, should this condition exist. If there is insufficient time to issue an Addendum for this clarification, the Plumbing Contractor shall figure on the most expensive of the items in conflict.

B. The Plumbing Contractor shall refer to the Architectural and Structural Drawings and Specifications for the general construction of the building, for floors and ceiling heights, for locations of walls, partitions, beams, etc., and shall be guided accordingly for setting of all sleeves, inserts and equipment. The Plumbing Contractor shall not under any circumstances scale drawings for the location of equipment. The Plumbing Contractor shall verify the locations of all utility services.

C. The Plumbing Contractor shall keep at least one set of corrected Shop and Design Drawings at the site. Drawings are to be current, denoting approved modifications and actual installed departure. Submit drawings to Architect/Engineer before final payment is made.

1.10 SUPERVISION

A. The Plumbing Contractor performing the work specified shall be required to employ a qualified Superintendent or Foreman to continuously supervise the installation of their work, with authorization to act as agent. Contractors: He shall be capable of checking layouts, coordinating and supervising the work, establishing grades and levels, and locating chases, openings, hangers, inserts, sleeves, etc.

PART II - PRODUCTS

2.1 STANDARD PRODUCTS

A. Unless otherwise indicated in writing by the Architect/Engineer, the materials to be provided under this Specification shall be standard products of manufacturers regularly engaged in the production of such equipment and shall be the manufacturer's latest design. All items of the same type or rating shall be identical.

2.2 SUBMITTAL

A. The Plumbing Contractor shall submit, for approval, detailed shop drawings on all major equipment and where requested. No materials or equipment may be delivered to the job site or installed until the Plumbing Contractor has in his possession the approved shop drawing for the particular material or equipment. The Plumbing Contractor shall furnish the number of copies required by the General or Special Conditions of the contract, but no case less than six (6) copies.

B. Submitted material shall be properly labeled indicating specific service for which material or equipment to be used, section and article number of specifications governing, Contractor's name and name of job.

C. Approval of equipment will not relieve the Plumbing Contractor of compliance with the

Specifications even if such approval is made in writing, unless the attention of the Engineer is called to the non-complying features by letter accompanying the submittal data. Approval of Submittal Data by the Engineer shall not be construed as a complete check of approval of detailed dimensions, weights, gauges, and similar details with the proposed articles. The conformance with the necessary coordination between the various other Contractors and suppliers shall be solely the responsibility of the Plumbing Contractor and with no additional expense to the Owner.

2.3 SUBSTITUTIONS

A. Manufacturer's lists are to establish a standard of quality and not intended to limit the selection to these manufacturers. All materials and equipment which are essential and have not been specified or shown, shall be new and of the highest grade and quality and free from defect or other imperfections. It should be understood that where the words "furnished and installed" are used, it is intended that the Plumbing Contractor shall purchase and install all materials required.

B. All materials and equipment proposed as substitutes for these specified shall require a ten (10) day prior approval from the Engineer prior to the bid date. No substitutions will be allowed after the ten (10) day period before the bid date.

2.4 PRODUCT HANDLING

A. Equipment and materials shall be properly stored, adequately protected, and carefully handled to prevent damage before and during installation. Equipment and materials shall be handled, stored and protected in accordance with the manufacturer's recommendations and as approved by the Architect/Engineer. Equipment installed with a factory finish shall be fully protected during construction and shall be maintained free of dust, dirt, and foreign matter. Dents and other surface damage shall be repaired or replaced to the satisfaction of the Architect/Engineer at no additional cost to the Owner.

B. The Plumbing Contractor shall clean up and remove from the job site all waste materials, packaging, crating, and refuse resulting from his work on a daily basis.

2.5 MATERIALS AND WORKMANSHIP

A. The Plumbing Contractor shall perform a first class job, both in material and workmanship. None other will be accepted. Deviations from either will be corrected by the Plumbing Contractor at the Plumbing Contractor's expense.

B. The material used throughout the work, except when otherwise noted, shall be new and of the best of its kind. No substitutes shall be used unless approved by the Architect/Engineer. All work shall be executed with a maximum speed consistent with safety and good workmanship.

C. Any equipment furnished by the Plumbing Contractor that is larger than those indicated on the drawings and described in these Specifications or have different electrical characteristics, the increase in cost to the Electrical Contractor for larger wires, conduit, circuit breakers, switches, etc. or for changes in work already installed shall be borne by the instigating Contractor.

PART III - EXECUTION

3.1 EXCAVATION AND BACKFILL

A. The Plumbing Contractor shall preform any and all trench and pit excavation and backfilling required for the installation of his work. Trenches shall be made with the sides

vertical and shall be shored where necessary for the protection of men and equipment. All excavation work shall be done in a careful manner to avoid damage to footers and foundations. The backfilling shall be placed in layers not exceeding 4 inches in depth, wetting each layer as it is placed, and thoroughly compacting each layer with mechanical tamper or other approved means. Any damage done during excavation and backfilling operations to roads, sidewalks, curbs, shrubs, sod, footers, foundations, etc. shall be replaced to its condition prior to construction at no expense to the Owner.

3.2 SCAFFOLDING, RIGGING AND HOISTING

A. The Plumbing Contractor shall furnish all necessary scaffolding, staging, rigging and hoisting required for the completion of his work. All such scaffolding, etc., shall be removed from the premises when its use is no longer required on the job.

3.3 CUTTING AND PATCHING

A. The Plumbing Contractor shall provide all cutting and patching necessary to install the work specified in this section. The patching shall match adjacent surfaces.

B. No structural member shall be cut without the approval of the Engineer, and all such cutting shall be done in a manner directed by him.

3.4 EQUIPMENT SPACE AND ARRANGEMENT

A. The equipment shall fit into the space allotted and shall allow adequate clearance for entry, installation, replacement, servicing, and maintenance. The Plumbing Contractor shall coordinate the work to ensure that equipment may be moved into place without altering building components or other installations. Access space shall not be less than the equipment manufacturer's requirements.

B. These drawings indicate the extent and general arrangement of equipment, piping, and ductwork. If any departures are deemed necessary by the Plumbing Contractor, details of such departures and the reasons therefore shall be submitted to the Architect/Engineer for approval as soon as practicable and within 30 days after award of the contract. No departure shall be made without written approval of the Architect/Engineer.

3.5 DAMAGE TO WORK ALREADY IN PLACE

A. The Plumbing Contractor shall assume full responsibility for any damage done by him, his agents or employees, to any work already in place. Any such damage done shall be repaired at the Contractor's expense by mechanics skilled at their respective trades to the approval of the Architect/Engineer.

3.6 JURISDICTION OF WORK

A. It may become necessary for the Plumbing Contractor to furnish labor or materials which is not generally accepted as part of this trade. In cases of this type, he shall contract the work or shall furnish materials and employ workmen of the trade involved in order not to cause any delay or stoppage of work caused by infringement of trade agreements as to jurisdiction, alleged or actual.

3.7 COORDINATION WITH OTHER TRADES

A. All work shall be coordinated with other trades involved in the construction project. All work shall be carefully laid out in advance to coordinate Architectural, Structural, Mechanical, Plumbing and Electrical features of construction. The Plumbing Contractor shall verify at the site all locations, grades, elevations, and utility service connections

indicated. Any conflicts due to lack of proper coordination shall be brought to the attention of the Architect/Engineer for resolution. The Plumbing Contractor shall make required changes or relocations at no additional cost to the Owner.

B. Installation, inspection, and testing of work above ceilings shall be completed and approved by the Architect/Engineer prior to installation of the specified finished ceilings. However, ceiling suspension system may be installed as required for coordination.

C. The Plumbing Contractor shall consult with the other trades at the start of the work and periodically thereafter, as required to properly coordinate the various items of work, and to avoid interferences. Should any interferences of any nature develop as the work progresses, such interferences shall be resolved and eliminated as directed. The cost of any work directed shall be borne by the Subcontractor or Contractors directed to do this work.

3.8 DIVISION OF WORK

A. This paragraph is intended to show exactly the point of division of work between the Electrical Division and the Plumbing Division.

B. All equipment covered in the Plumbing Division of the specifications shall be furnished, mounted, and aligned under the Plumbing Division. All individual motor starters, unless indicated as part of a motor control center, for this equipment shall be furnished and installed by the Plumbing Contractor.

C. All final electrical connections to equipment covered in the Plumbing Division of the specifications shall be completed under the Plumbing Division.

D. The Electrical Contractor shall provide a disconnect switch or junction box for each item of equipment under Division 16.

E. Electrical equipment and wiring that is provided by the Plumbing Contractor shall be in accordance with the Electrical specification.

3.9 EQUIPMENT INSTALLATION

A. Final connections to equipment, including pipe, duct, and controls, shall be provided under applicable sections of this Division, unless otherwise specified or indicated.

B. Manufacturer's Instructions: Equipment shall be installed as recommended by the manufacturer to conform to the requirements of the particular application, in accordance with these drawings and specifications.

3.10 OPERATION AND MAINTENANCE MANUALS

A. One complete manual as outlined herein shall be submitted for approval before conducting instruction sessions in operation, before systems or equipment tests are performed, and before final or beneficial occupancy.

B. Manuals shall have rigid covers and index tabs for each major piece of equipment, auxiliaries, and systems. The following shall be inscribed on the cover: the words "OPERATION AND MAINTENANCE MANUAL", the name and location of the building, the name of the Section, such as "Plumbing" and the name of the Plumbing Contractor. Two copies of each approved manual shall be submitted to the Owner and one copy shall be submitted to the Architect/Engineer.

C. Each piece of equipment shall be listed and identified with the same name, mark,

number, or other identification as noted or scheduled in the Contract Documents.

D. Manuals shall include the following:

1. Complete operating installations, covering start-up and shutdown for all components installed.

2. Legible copies of all shop drawings. Any comments incorporated in "as noted" approvals of shop drawings shall be recorded on the drawings included in the manuals.

3. All equipment Maintenance and Service Manuals.\

E. A complete parts list for each piece of equipment.

F. All descriptive literature for the equipment.

G. Operating characteristics, performance data, ratings, and curves for each piece of equipment.

H. Internal wiring and control diagrams.

I. All other information pertinent to the maintenance and servicing of equipment and systems provided in the project.

J. Name, address, and telephone number for service on each manufacturer's equipment.

3.11 OPERATING INSTRUCTIONS

A. After all equipment and services are in operation, and the Operation and Maintenance Manuals are available, an instruction and training session shall be conducted for the Owner's operating personnel.

B. Instruction sessions shall be conducted during the Owner's normal working periods, and at times and locations satisfactory to the Owner.

3.12 EQUIPMENT START-UP

A. No equipment shall be placed in operation until it has been inspected by a qualified representative of the manufacturer and Certified to be ready for operation. The manufacturer's representative shall supervise the start-up operation and shall be responsible for all adjustments required to meet design conditions. Such services shall be at no additional cost to the Owner.

3.13 GUARANTEE

A. The Plumbing Contractor shall present to the Owner a written guarantee covering his work, including all equipment, material and workmanship. This guarantee shall be against all defects in any of the above work, and shall run for a period of one (1) year from the date of written acceptance of the Contractor's work.

B. Any defective work, equipment, material and/or workmanship that develops within the guarantee period, which is not caused by ordinary wear or abuse by other persons, shall be replaced by the Plumbing Contractor without cost to the Owner.

3.14 FINAL INSPECTION

A. When the entire Contract has been completed and the work is ready for final inspection, the Architect/Engineer or his duly authorized representative will make the inspection. At the time of inspection, the Plumbing Contractor shall demonstrate to the Architect/Engineer that the various systems and pieces of equipment have been adjusted to operate in accordance with the requirements of the Contract.

3.15 FINAL PAYMENTS

A. All final payments are contingent upon all necessary Certificates and/or Approvals cited above, together with the written Guarantee being presented to the Owner.

END OF SECTION 15010

SECTION 15140 - HANGERS AND SUPPORTS

PART I - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and General Provisions of the Contract, including the General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes Hangers and Supports for Plumbing Systems Piping and Equipment.

PART II - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Hangers: Galvanized carbon steel, adjustable, clevis

B. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

C. Vertical Support: Steel riser clamp

D. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

C. Shield for Insulated Piping 2 Inches and Smaller: 18 gauge galvanized steel shield over insulation in 180 degree segments, minimum 12 inches long at pipe support.

D. Sheet metal saddles must be ½ the circumference of the insulation, turned up or rounded at the corners to avoid damage to the vapor barrier.

2.2 HANGER RODS

A. Galvanized Steel Hanger Rods: Threaded both ends or continuous threaded.

2.3 FLASHING

A. Metal Flashing: 26 gauge galvanized steel

B. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.

C. Flashing shall be compatible with the roofing material and be coordinated with the General Contractor.

2.4 SLEEVES

A. Sleeves for Pipes: Form with schedule 40, galvanized steel pipe

B. Fire Stopping Insulation: Glass fiber type, non-combustible

C. Caulk: Fire Barrier type sealant

2.5 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized

B. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel, hex-head, track bolts and nuts

C. Washers: ASTM F 844, steel, plain, flat washers

D. Grout: ASTM C 1107, Grade B, non-shrink, non-metallic

1. Characteristics include post-hardening, volume-adjusting, dry, hydraulic cement-type grout that is non-staining, non-corrosive, non-gaseous and is recommended for both interior and exterior applications.

2. Design Mix: 5000-psi (34.5MPa), 28-day compressive strength

3. Water: Potable

4. Packaging: Pre-mixed and factory-packaged

2.6 ATTACHMENTS

A. Mechanical Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used. Permitted in concrete over four (4) inches thick.

B. Weld: Type 22

C. Beam clamps: Types 20, 21, 28 or 29

D. Wood: Wood screws or lag bolts

PART III - EXECUTION

3.1 HANGERS AND SUPPORTS INSTALLATION

A. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Install building attachments within concrete or to structural steel. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, expansion joints ,and at changes in direction of piping.

C. Install hangers and support complete with necessary inserts, bolts, rods, nuts, washers and other accessories.

D. Install hangers and supports to allow controlled movement of piping systems, permit freedom of movement between pipe anchors, and facilitate action of expansion joints, expansion loops, expansion bends and similar units.

E. Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

F. Support horizontal piping as follows:

PIPE SIZE	HANGER SPACING	MAXIMUM DIAMETER
1/2 to 1-1/4 inch	6'-6"	3/8"
1-1/2 to 2 inch	10'-0"	3/8"
2-1/2 to 3 inch	10'-0"	1/2"
4 to 6 inch	10'-0"	5/8"
Waste Pipe	5'-0"	3/8"

G. Install hangers to provide minimum ½ inch space between finished covering and adjacent work

H. Place a hanger within 12 inches of each horizontal elbow.

I. Use hangers with 1½ inch minimum vertical adjustment

J. Support riser piping independently of connected horizontal piping.

K. Hangers shall be galvanized steel or copper.

3.2 FLASHING

A. Provide flashing and counter-flashing where piping penetrates weather-proofed walls, floors and roofs.

B. Flash vent and soil pipes projecting six (6) inches minimum above finished roof surface with lead worked one (1) inch minimum into hub. For pipes through outside walls, turn flanges back into wall and caulk, metal counter-flash and seal.

3.3 SLEEVES

A. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

B. Design hangers without disengagement of supported pipe

C. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with fire stopping insulation and caulk seal air-tight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

D. Install chrome plated steel or stainless steel escutcheons at finished surfaces.

E. Pipe strapping will not be allowed.

END OF SECTION 15140

SECTION 15190 - PLUMBING IDENTIFICATION

PART I - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes plumbing identification materials and devices.

1.3 QUALITY ASSURANCE

A. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.4 SEQUENCING AND SCHEDULING

A. Coordinate installation of identifying devices after completion of covering and painting where devices are applied to surfaces. Install identifying devices prior to installation of acoustical ceilings and similar concealment.

PART II - PRODUCTS

2.1 MATERIALS

A. Color: Unless specified otherwise, conform with ANSI/ASME A13.1.

1. Plastic Nameplates: Laminated three-layer plastic with engraved black letters on light contrasting background color.

2. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1½ inch diameter.

3. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

4. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape of not less than 6 inch wide by 4 mil thick, manufactured for direct burial service.

PART III - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Plastic Nameplates: Install with corrosive-resistant mechanical fasteners.

B. Plastic Tags: Install with corrosive-resistant chain.

C. Plastic Tape Pipe Markers: Install complete around pipe in accordance with the manufacturer's instructions

D. Underground Plastic Pipe Markers: Install 6 to 8 inches below finished grade, directly above the buried pipe.

E. Equipment: Identify pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may by identified with plastic tags

F. Controls: Identify control panels and major control components outside panels with plastic nameplates.

G. Piping: Identify piping, concealed or exposed, with plastic tape pipe markers. Tags may be used on small diameter piping. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and "T", at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION 15190

SECTION 15250 - PLUMBING PIPING INSULATION

PART I - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes Plumbing Pipe Insulation.

1.3 QUALITY ASSURANCE

A. Fire Performance Characteristics: Conform to the following characteristics for insulation including facings, cements, and adhesives, when tested according to ASTM E 84, by UL or other testing or inspecting organization acceptable to the authority having jurisdiction. Label insulation with appropriate markings of testing laboratory.

1. Interior Insulation: Flame spread rating of 25 or less and a smoke developed rating of 50 or less.

2. Exterior Insulation: Flame spread rating of 75 or less and a smoke developed rating of 150 or less.

1.4 SEQUENCING AND SCHEDULING

A. Schedule insulation application after testing of piping systems.

B. Schedule insulation application after installation and testing of heat trace tape.

PART II - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Flexible Elastomeric Cellular:
   a. Armstrong World Industries, Inc.
   b. Halstead Industrial Products
   c. IMCOA
   d. Rubatex Corporation

2.2 FLEXIBLE ELASTOMERIC CELLULAR

A. Material: Flexible expanded closed-cell structure with smooth skin on both sides.

B. Form: Tubular materials conforming to ASTM C 534, Type I.

C. Thermal Conductivity: 0.30 average maximum at 75 degrees F.

D. Coating: Water based latex enamel coating recommended by insulation manufacturer.

2.3 ADHESIVES

A. Flexible Elastomeric Cellular Insulation Adhesive: Solvent-based, contact adhesive

recommended by insulation manufacturer.

B. Lagging Adhesive: MIL-A-3316C, non-flammable adhesive in the following Classes and Grades.

1. Class 1, Grade A for bonding glass cloth and tape to un-faced glass fiber insulation, sealing edges of glass fiber insulation, and bonding lagging cloth to un-faced glass fiber insulation.

2. Class 2, Grade A for bonding glass fiber insulation to metal surfaces.

PART III - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean, dry, and remove foreign materials such as rust, scale, and dirt.

3.2 INSTALLATION - GENERAL

A. Select accessories compatible with materials suitable for the service. Select accessories that do not corrode, soften, or otherwise attack the insulation or jacket in either the wet or dry state.

B. Apply insulation material, accessories, and finishes according to the manufacturer's printed instructions.

C. Keep insulation materials dry during application and finishing.

D. Apply insulation continuously over fittings, valves and specialties.

E. Apply insulation with a minimum number of joints.

F. Interior Walls and Partitions Penetrations: Apply insulation continuously through walls and partitions, except fire rated walls and partitions.

G. Fire Rated Walls and Partitions Penetrations: Terminate insulation at penetrations through fire rated walls and partitions. Seal insulation ends with vapor barrier coating. Seal around penetration with fire stopping or fire resistant joint sealer.

H. Hangers and Anchors: Apply insulation continuously through hangers and around anchor attachments. Install saddles, shields, and inserts as specified.

1. Inserts and Shields: Cover hanger inserts and shields with jacket material matching adjacent pipe insulation.

3.3 FLEXIBLE ELASTOMERIC CELLULAR INSULATION INSTALLATION

A. Slip insulation on the pipe before making connections wherever possible. Seal joints with adhesive. Where the slip-on technique is not possible, cut one side longitudinally and apply to the pipe. Seal seams and joints with adhesive.

B. Valves, Fittings, and Flanges: Cut insulation segments from pipe or sheet insulation. Bond to valve, fitting, and flange and seal joints with adhesive.

1. Miter cut materials to cover soldered elbows and tees.

2. Fabricate sleeve fitting covers from flexible elastomeric cellular insulation for

screwed valves, fittings, and specialties. Miter cut materials. Overlap adjoining pipe insulation.

3.4 FINISHES

A. Flexible Elastomeric Cellular Insulation: After adhesive has fully cured, apply 2 coats of protective coating to exposed insulation.

3.5 PIPE INSULATION SCHEDULES

PIPING	THICKNESS TYPE	INSULATION IN INCHES
Domestic Hot Water Supply	ELASTOMERIC	1/2
Domestic Hot Water Re-Circulating	ELASTOMERIC	1
Domestic Cold Water	ELASTOMERIC	1/2
"P" Trap at Handicapped Fixtures	ELASTOMERIC	1/2 *

(* provide pre-formed insulation kits for the drain and supply lines)

END OF SECTION 15250

SECTION 15250 - PLUMBING PIPING INSULATION

PART I - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes Plumbing Pipe Insulation.

1.3 QUALITY ASSURANCE

A. Fire Performance Characteristics: Conform to the following characteristics for insulation including facings, cements, and adhesives, when tested according to ASTM E 84, by UL or other testing or inspecting organization acceptable to the authority having jurisdiction. Label insulation with appropriate markings of testing laboratory.

1. Interior Insulation: Flame spread rating of 25 or less and a smoke developed rating of 50 or less.

2. Exterior Insulation: Flame spread rating of 75 or less and a smoke developed rating of 150 or less.

1.4 SEQUENCING AND SCHEDULING

A. Schedule insulation application after testing of piping systems.

B. Schedule insulation application after installation and testing of heat trace tape.

PART II - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Flexible Elastomeric Cellular:

a. Armstrong World Industries, Inc.
b. Halstead Industrial Products
c. IMCOA
d. Rubatex Corporation

2.2 FLEXIBLE ELASTOMERIC CELLULAR

A. Material: Flexible expanded closed-cell structure with smooth skin on both sides.

B. Form: Tubular materials conforming to ASTM C 534, Type I.

C. Thermal Conductivity: 0.30 average maximum at 75 degrees F.

D. Coating: Water based latex enamel coating recommended by insulation manufacturer.

2.3 ADHESIVES

A. Flexible Elastomeric Cellular Insulation Adhesive: Solvent-based, contact adhesive recommended by insulation manufacturer.

B. Lagging Adhesive: MIL-A-3316C, non-flammable adhesive in the following Classes and Grades.

1. Class 1, Grade A for bonding glass cloth and tape to un-faced glass fiber insulation, sealing edges of glass fiber insulation, and bonding lagging cloth to un-faced glass fiber insulation.

2. Class 2, Grade A for bonding glass fiber insulation to metal surfaces.

PART III - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean, dry, and remove foreign materials such as rust, scale, and dirt.

3.2 INSTALLATION - GENERAL

A. Select accessories compatible with materials suitable for the service. Select accessories that do not corrode, soften, or otherwise attack the insulation or jacket in either the wet or dry state.

B. Apply insulation material, accessories, and finishes according to the manufacturer's printed instructions.

C. Keep insulation materials dry during application and finishing.

D. Apply insulation continuously over fittings, valves and specialties.

E. Apply insulation with a minimum number of joints.

F. Interior Walls and Partitions Penetrations: Apply insulation continuously through walls and partitions, except fire rated walls and partitions.

G. Fire Rated Walls and Partitions Penetrations: Terminate insulation at penetrations through fire rated walls and partitions. Seal insulation ends with vapor barrier coating. Seal around penetration with fire stopping or fire resistant joint sealer.

H. Hangers and Anchors: Apply insulation continuously through hangers and around anchor attachments. Install saddles, shields, and inserts as specified.

1. Inserts and Shields: Cover hanger inserts and shields with jacket material matching adjacent pipe insulation.

3.3 FLEXIBLE ELASTOMERIC CELLULAR INSULATION INSTALLATION

A. Slip insulation on the pipe before making connections wherever possible. Seal joints with adhesive. Where the slip-on technique is not possible, cut one side longitudinally and apply to the pipe. Seal seams and joints with adhesive.

B. Valves, Fittings, and Flanges: Cut insulation segments from pipe or sheet insulation. Bond to valve, fitting, and flange and seal joints with adhesive.

1. Miter cut materials to cover soldered elbows and tees.

2. Fabricate sleeve fitting covers from flexible elastomeric cellular insulation for screwed valves, fittings, and specialties. Miter cut materials. Overlap adjoining pipe insulation.

3.4 FINISHES

A. Flexible Elastomeric Cellular Insulation: After adhesive has fully cured, apply 2 coats of protective coating to exposed insulation.

3.5 PIPE INSULATION SCHEDULES

PIPING	THICKNESS TYPE	INSULATION IN INCHES
Domestic Hot Water Supply	ELASTOMERIC	1/2
Domestic Hot Water Re-Circulating	ELASTOMERIC	1
Domestic Cold Water	ELASTOMERIC	1/2
"P" Trap at Handicapped Fixtures	ELASTOMERIC	1/2 *

(* provide pre-formed insulation kits for the drain and supply lines)

END OF SECTION 15250

SECTION 15410 - PLUMBING PIPING

PART I - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes plumbing piping systems to a point shown on the civil drawings. Systems include the following:

1. Potable water distribution, including cold and hot water supply and hot water circulation.

2. Sanitary Drainage and Vent Systems.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with the following minimum working pressure ratings, except where indicated otherwise:

1. Water Distribution Systems, Below Ground: 150 psig.

2. Water Distribution Systems, Above Ground: 125 psig.

3. Soil, Waste and Vent Systems: 10-foot head of water

PART II - PRODUCTS

2.1 SANITARY SEWER PIPING - BURIED

A. Sch. 40 PVC Pipe: ASTM D2665. Fittings: PVC. Joints: ASTM D2564, solvent weld.

2.2 SANITARY SEWER PIPING - ABOVE GRADE

A. Sch. 40 PVC Pipe: ASTM D2665. Fittings: PVC. Joints: ASTM D2564, solvent weld.

2.3 WATER PIPING - BURIED

A. Copper Tubing: ASTM B88, Type K, annealed. Fittings; ANSI/ASME B16.29, wrought copper. Joints: ANSI/ASTM B32, solder, Grade 95TA.

2.4 WATER PIPING - ABOVE GRADE

A. Copper Tubing: ASTM B88, Type L, hard drawn. Fittings: ANSI/ASME B16.23, cast brass, or ANSI/ASME B16.29, wrought copper. Joints: ANSI/ASTM B32, solder, Grade 95TA.

2.5 MANUFACTURERS

A. Acceptable Manufacturers-Valves:

1. Crane

2. Grinnell

3. Nibco

4. Apollo

2.6 GATE VALVES

A. 150 psig rated, bronze body, lever ball type, Apollo or equal.

PART III - EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

A. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

B. Route piping in orderly manner and maintain gradient.

C. Install piping to conserve building space and not interfere with use of space.

D. Group piping whenever practical at common elevations.

E. Install piping to allow for expansion and contraction without stressing pipes, joints, or connected equipment.

F. Provide clearance for installation of insulation and access to valves and fittings.

G. Slope water piping and arrange to drain at low points

H. Establish elevations of buried piping outside the building to ensure not less than 1 ft of cover.

I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

J. Prepare pipe, fittings, supports, and accessories not pre-finished, ready for finish painting.

K. Establish invert elevations, slopes for drainage to 1/8 inch per foot minimum. Maintain gradients.

L. Excavate in accordance with Sections 15010.

M. Backfill in accordance with Sections 15010

N. Install bell and spigot pipe with bell end upstream

O. Copper piping 2” and larger shall be silver-soldered.

P. Install valves with stems upright or horizontal, not inverted.

3.3 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install brass male adapters each side of valves in copper piped system. Sweat solder adapters to pipe.

C. Install gate or ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

D. Install globe or ball valves for throttling, bypass, or manual flow control services.

3.4 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed and clean.

B. Inject disinfectant solution containing 100 ppm of available chlorine and allow to stand for 2 hours before flushing.

C. Flush disinfectant from system until residual is equal to that of incoming water or 1.0 mg/L.

D. Take samples from outlets and analyze in accordance with AWWA C601. Contractor shall engage an independent laboratory to conduct bacteriological and post chlorination tests certifying that the water meets the quality of drinking water. After acceptance by the Engineer of Record, “The Water Test Report for Use” is required to be submitted to SCO prior to requesting the Occupancy Permit.

3.5 SERVICE CONNECTIONS

A. Provide new sanitary sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

END OF SECTION 15410

SECTION 15430 - PLUMBING SPECIALTIES

PART I - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes Plumbing Specialties for water distribution systems; and soil, waste and vent systems.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Submit product data including rated capacities of selected models and weights (shipping, installation, and operation). Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections.

PART II - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Backflow Preventers:

a. Ames Co., Inc.
b. Hersey Products, Inc., Grinnell Corp.
c. Watts Regulator Co.
d. Wilkins Regulator Div., Zurn Industries, Inc.

2. Water Pressure Regulators:

a. Spence Engineering Co., Inc.
b. Watts Regulator Co.
c. Wilkins Regulator Div., Zurn Industries, Inc.

3. Specialties:

a. Josam Co.
b. Smith by Jay R. Smith Mfg. Co. Div., Smith Industries, Inc.
c. Watts Regulator Co.
d. Woodford Manufacturing Co. Div., WCM Industries, Inc.
e. Zurn by Hydromechanics Div., Zurn Industries, Inc.

2.2 CLEANOUTS

A. Exterior Surfaced Areas: Round cast nickel-bronze access frame and non-skid cover.

B. Exterior Un-Surfaced Areas: Line type with lacquered cast iron body and round epoxy coated gasketed cover.

C. Interior Finished Floor Areas: Lacquered cast iron, two piece body, round with scoriated cover in service areas and round with depressed cover to accept floor finish in finished floor areas.

D. Interior Finished Wall Areas: Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.

2.3 WATER HAMMER ARRESTORS

A. ANSI A112.26.1; sized in accordance with PDI WH-201, pre-charged suitable for operation in temperature range -100 to 300 degrees F and maximum 250 psig working pressure.

2.4 TRAP SEAL PRIMER VALVE:

A. ASSE 1018; water supply fed type, fully automatic 125psig minimum working pressure, Bronze body with atmospheric vented drain chamber, ½ inch threaded or solder joint inlet and outlet connections, Chrome plated, or rough bronze finish. Unit shall be capable of being located on any active water line.

2.5 BACKFLOW PREVENTERS

A. Reduced Pressure Back-flow Preventers: ANSI/ASSE 1013; bronze body with bronze and plastic internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve which opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

PART III - EXECUTION

3.1 PREPARATION

A. Coordinate construction areas to receive drains to the required invert elevations.

3.2 INSTALLATION AND APPLICATION

A. Install specialties in accordance with manufacturer's instructions to permit intended performance.

B. Extend clean-outs to finished floor. Lubricate threaded clean-out plugs Teflon pipe dope. Ensure clearance at clean-out for rodding of drainage system.

C. Encase exterior clean-outs in concrete flush with grade.

D. Install water hammer arrestors complete with accessible isolation valve.

END OF SECTION 15430

SECTION 15440 – PLUMBING FIXTURES

PART I - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes plumbing fixtures and trim, fittings, and accessories, appliances, appurtenances, equipment, and supports associated with plumbing fixtures.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data for each type of plumbing fixture specified, including fixture and trim, fittings, accessories, appliances, appurtenances, equipment, supports, construction details, dimensions of components, and finishes.

PART II - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers (or approved equal):

1. Fixtures and Trim:

a. American Standard, Inc.
b. Eljer; A Household International Co.
c. Kohler Co.

2. Stainless Steel Sinks:

a. Elkay Manufacturing Co.
b. Just Manufacturing Co.
c. Kohler Co.

3. Mop Basins:

a. Crane Plumbing/Fiat Products.
b. Florestone Products Co., Inc.
c. Swan Corp.

4. Water Coolers:

a. Elkay Manufacturing Co.
b. Halsey Taylor
c. Haws Drinking Faucet Co.
d. Sunroc Corporation
e. Oasis

5. Toilet Seats:

    a. Bemis Mfg. Co.
    b. Beneke Division: Sanderson Plumbing Products, Inc.
    c. Church Seat Co.
    d. Kohler Co.
    e. Olsonite Corp.

6. Flushometers:

    a. Coyne & Delaney Co.
    b. Sloan Valve Co.
    c. Zurn Industries, Inc.; Flush Valve Operations.

7. Commercial/Industrial Cast-Brass Faucets:

    a. American Standard, Inc.
    b. Chicago Faucet Co.
    c. Delta Faucet Co.
    d. Eljer; A Household International Co.
    e. T & S Brass and Bronze Works, Inc.
    f. Cambridge Brass
    g. Elkay Manufacturing Co.
    h. Sloan
    i. Speakman Co.

8. Commercial/Institutional Shower and Bathtub Valves and Trim:

    a. Symmons Industries, Inc.
    b. Bradley Corp.
    c. Speakman Co.
    d. Delta Faucet Co.

END OF SECTION 15440

SECTION 15450 - WATER HEATERS

PART I - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes Electric Water Heaters and In-Line Circulators.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data including rated capacities of selected models, weights (shipping, installed, and operating), furnished specialties, and accessories, and indicating dimensions, required clearances, and methods of assembly of components, and piping and wiring connections.

PART II - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Water Heaters:

a. Bradford-White Corp.
b. A.O. Smith Water Products Co. Div.
c. State Industries, Inc.
d. Ruud

2.5 COMMERCIAL ELECTRIC WATER HEATERS

A. Factory assembled and wired, electric, [vertical] [horizontal] storage type, 150 psig maximum working pressure.

B. Glass lined welded steel tank; four (4) inch diameter inspection port, thermally insulated with minimum two (2) inches glass fiber encased in corrosion-resistant steel jacket; baked-on enamel finish.

C. Brass water connections and dip tube, drain valve, high-density magnesium anode, and ASME rated temperature and pressure relief valve.

D. Flange-mounted immersion heating electrical elements; individual elements sheathed with Incoloy corrosion- resistant metal alloy, rated less than 75 Watts per square inch.

2.6 IN-LINE CIRCULATOR PUMPS

A. Casing: Bronze, rated for 125 psig working pressure

B. Impeller: Bronze

C. Shaft: Alloy steel with integral thrust collar and two (2) oil lubricated bronze sleeve bearings.

D. Seal: Carbon rotating against a stationary ceramic seat.

E. Drive: Flexible coupling

2.7 THERMAL EXPANSION TANKS

A. Construction: Welded steel, tested and stamped in accordance with Section 8D of ANSI/ASME Code; supplied with National Board Form U-1, rated for working pressure of 125 psig, maximum operating temperature 210 degrees F., with flexible EPDM diaphragm sealed into tank.

B. Accessories: Pressure gage and air-charging fitting, tank drain; pre-charge to 55 psig.

C. Size: 10.5" diameter, 16" overall length, 5 gallon capacity.

PART III - EXECUTION

3.1 WATER HEATER INSTALLATION

A. Install water heaters in accordance with manufacturer's instructions and to UL requirements.

B. Coordinate with plumbing piping and related [fuel piping] [gas venting] [electrical] work to achieve operating system.

3.2 PUMP INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide air cock and drain connection on horizontal pump casings.

C. Decrease from line size, with long radius reducing elbows or reducers. Support piping adjacent to pump such as that no weight is carried on pump casings.

Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

END OF SECTION 15450

DIVISION 15B: MECHANICAL

15500	Basic Mechanical Requirements
15501	Hangers and Supports
15503	Mechanical Identification
15505	Piping Insulation
15507	Ductwork Insulation
15672	Split System Heat Pump
15674	Variable Refrigerant Flow (VRF) Zoning System
15675A	DOAS Condensers/Condensing Unit
15675B	DOAS Air Handling Units
15870	Power Ventilators
15891	Metal Ductwork
15910	Duct Accessories
15932	Air Outlets and Inlets
15990	Testing, Adjusting and Balancing

SECTION 15501 - HANGERS AND SUPPORTS

PART I - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and General Provisions of the Contract, including the General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

B. This Section includes Hangers and Supports for Mechanical Systems Piping and Equipment.

PART II - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Hangers: Galvanized carbon steel, adjustable, clevis.

B. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

C. Shield for Insulated Piping 2 Inches and Smaller: 18 gage galvanized steel shield over insulation in 180 degree segments, minimum 12 inches long at pipe support.

2.2 HANGER RODS

A. Steel Hanger Rods: Threaded both ends or continuous threaded.

2.3 FLASHING

A. Metal Flashing: 26 gage galvanized steel.

B. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.

2.4 SLEEVES

A. Sleeves for Pipes: Form with schedule 40, galvanized steel pipe

B. Sleeves for Pipes Through Fire Rated and Fire Resistive Floors and Walls, and Fireproofing: Prefabricated fire rated sleeves including seals, UL listed.

C. Sleeves for Round Ductwork: Form with galvanized steel.

D. Sleeves for Rectangular Ductwork: Form with galvanized steel or wood.

E. Fire Stopping Insulation: Glass fiber type, non-combustible.

F. Caulk: Fire Barrier type sealant.

2.5 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.

B. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel, hex-head, track bolts and nuts.

C. Washers: ASTM F 844, steel, plain, flat washers.

2.6 ATTACHMENTS

A. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used. Permitted in concrete over 4 inches thick.

B. Beam Clamps: Types 20, 21, 28 or 29

C. Wood: Wood screws or lag bolts

PART III - EXECUTION

3.1 HANGERS AND SUPPORTS INSTALLATION

A. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Install building attachments within concrete or to structural steel. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping.

C. Install hangers and support complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

D. Install hangers and supports to allow controlled movement of piping systems, permit freedom of movement between pipe anchors, and facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

E. Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

F. Support horizontal piping as follows:

PIPE SIZE	HANGER SPACING	MAXIMUM HANGER DIAMETER
1/2 to 1-1/4 inch	6' - 6"	3/8"
1-1/2 to 2 inch	10' - 0"	3/8"

G. Install hangers to provide minimum ½ inch space between finished covering and adjacent work.

H. Place a hanger within 12 inches of each horizontal elbow.

I. Use hangers with 1½ inch minimum vertical adjustment.

J. Support vertical piping at every floor.

L. Support riser piping independently of connected horizontal piping.

M. All pipe hangers shall be galvanized steel or copper.

N. Pipe strapping, duct tape or zip ties will not be allowed.

3.2 EQUIPMENT BASES AND SUPPORTS

A. Provide equipment bases of concrete.

B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural steel stands to suspend equipment from structure above or support equipment above floor.

B. Grouting: Place grout under supports for equipment, and make a smooth bearing surface.

3.4 METAL FABRICATION

A. Cut, drill, and fit miscellaneous metal fabrications for pipe and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for manual shielded metal arc welding, appearance and quality of welds.

3.5 FLASHING

A. Provide flexible flashing and metal counter-flashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.

B. Provide curbs for mechanical roof installations 14 inches minimum high above roofing surface. Flexible sheet flash and counter-flash with sheet metal; seal watertight.

3.6 SLEEVES

A. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

B. Design hangers without disengagement of supported pipe.

C. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with fire stopping insulation and caulk seal air tight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

D. Install chrome plated steel or stainless steel escutcheons at finished surfaces.

END OF SECTION 15501

SECTION 15505 – PIPING INSULATION

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 this Section.

1.2 SUMMARY

A. This Section includes Mechanical Pipe Insulation.

1.3 QUALITY ASSURANCE

A. Fire Performance Characteristics: Conform to the following characteristics for insulation including facings, cements, and adhesives, when tested according to ASTM E 84, by UL or other testing or inspecting organization acceptable to the authority having jurisdiction. Label insulation with appropriate markings of testing laboratory.

1. Interior Insulation: Flame spread rating of 25 or less and a smoke developed rating of 50or less.

2. Exterior Insulation: Flame spread rating of 75 or less and a smoke developed rating of 150 or less.

1.4 SEQUENCING AND SCHEDULING

A. Schedule insulation application after testing of piping systems.

B. Schedule insulation application after installation and testing of heat trace tape.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers

1. Flexible Elastomeric Cellular:

a. Armstrong World Industries, Inc.
b. Halstead Industrial Products
c. IMCOA
d. Rubatex Corporation

2.2 FLEXIBLE ELASTOMERIC CELLULAR

A. Material: Flexible expanded closed-cell structure with smooth skin on both sides.

B. Form: Tubular materials conforming to ASTM C 534, Type I.

C. Thermal Conductivity: 0.30 average maximum at 75 degrees F.

D. Coating: Water based latex enamel coating recommended by insulation manufacturer.

2.3 ADHESIVES

A. Flexible Elastomeric Cellular Insulation Adhesive: Solvent-based, contact adhesive recommended by insulation manufacturer.

2.4 ACCESSORIES AND ATTACHMENTS

A. Bands: ¾-inch wide, 0.007 inch thick, Aluminum

B. Wire: 16-gauge, soft-annealed stainless steel

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean, dry, and remove foreign materials such as rust, scale, and dirt.

3.2 INSTALLATION - GENERAL

A. Select accessories compatible with materials suitable for the service. Select accessories that do not corrode, soften, or otherwise attack the insulation or jacket in either the wet or dry state.

B. Apply insulation material, accessories, and finishes according to the manufacturer's printed instructions.

C. Keep insulation materials dry during application and finishing.

D. Apply insulation continuously over fittings, valves, and specialties.

E. Apply insulation with a minimum number of joints.

F. Interior Walls and Partitions Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions.

G. Fire-Rated Walls and Partitions Penetrations: Terminate insulation at penetrations through fire rated walls and partitions. Seal insulation ends with vapor barrier coating. Seal around penetration with fire stopping or fire resistant joint sealer.

H. Hangers and Anchors: Apply insulation continuously through hangers and around anchor attachments. Install saddles, shields, and inserts as specified.

1. Inserts and Shields: Cover hanger inserts and shields with jacket material matching adjacent pipe insulation.

3.3 FLEXIBLE ELASTOMERIC CELLULAR INSULATION INSTALLATION

A. Slip insulation on the pipe before making connections wherever possible. Seal joints with adhesive. Where the slip-on technique is not possible, cut one side longitudinally and apply to the pipe. Seal seams and joints with adhesive.

B. Valves, Fittings, and Flanges: Cut insulation segments from pipe or sheet insulation. Bond to valve, fitting, and flange and seal joints with adhesive.

1. Miter cut materials to cover soldered elbows and tees.

2. Fabricate sleeve fitting covers from flexible elastomeric cellular insulation for screwed valves, fittings, and specialties. Miter cut materials. Overlap adjoining pipe insulation.

3.4 FINISHES

A. Flexible Elastomeric Cellular Insulation: After adhesive has fully cured, apply 2 coats of protective coating to exposed insulation. Paint all exterior insulation with UV resistant paint as recommended by Insulation manufacturer.

3.5 PIPE INSULATION SCHEDULES

INTERIOR COLD CONDENSATE DRAINS

PIPE SIZES (NPS)	MATERIALS	THICKNESS IN INCHES
1/2 TO 4	FLEXIBLE ELASTOMERIC	3/4

REFRIGERANT SUCTION

PIPE SIZES (NPS)	MATERIALS	THICKNESS IN INCHES
1/2 TO 1-1/4	FLEXIBLE ELASTOMERIC	3/4
1-1/2 TO 4	FLEXIBLE ELASTOMERIC	1

END OF SECTION 15505

SECTION 15507 - DUCTWORK INSULATION

PART I - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes Duct and Plenum Insulation.

1.3 QUALITY ASSURANCE

A. Fire Performance Characteristics: Conform to the following characteristics for insulation including linings, cements, and adhesives, when tested according to ASTM E 84, by UL or other testing or inspecting organization acceptable to the authority having jurisdiction. Label insulation with appropriate markings of testing laboratory.

1. Interior Insulation: Flame spread rating of 25 or less and a smoke developed rating of 50 or less.

2. Exterior Insulation: Flame spread rating of 75 or less and a smoke developed rating of 150 or less.

PART II – PRODUCTS

2.1 MANUFACTURERS

!. Glass Fiber:

a. Certain Teed Corporation
b. Knauf Fiberglass GmbH
c. Manville
d. Owens-Corning Fiberglass Corporation
e. USG Interiors, Inc. - Thermafiber Division

2.2 INSTALLATION

A. GLASS FIBER

1. Material: Inorganic glass fibers, bonded with a thermosetting resin.

B. Jacket: All purpose, factory-applied, laminated glass fiber reinforced, flame retardant Kraft paper and aluminum foil having self-sealing lap.

C. Blanket: ASTM C 553, Type II, Class F-1, jacketed flexible blankets-2” thick.

1. Thermal Conductivity: 0.32 average maximum, at 75 degrees F mean temperature.

D. Adhesive: Produced under the UL Classification and follow-up service.

1. Type: Non-Flammable, solvent-based.
2. Service Temperature Range: Minus 20 to 180 degrees F.

2.3 ACCESSORIES AND ATTACHMENTS

A. Corner Angles: 28-gauge, 1inch by 1-inch aluminum, adhered to 2-inch by 2-inch Kraft paper.

B. Anchor Pins: Capable of supporting 20 pounds each. Provide anchor pins and speed washers of sizes and diameters as recommended by the manufacturer for insulation type and thickness.

2.4 SEALING COMPOUNDS

A. Vapor Barrier Compound: Water-based, fire-resistive composition

1. Water Vapor Permeance: 0.08 perm maximum
2. Temperature Range: Minus 20 to 180 degrees F

PART III - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean, dry, and remove foreign materials such as rust, scale and dirt.

3.2 INSTALLATION

A. Select accessories compatible with materials suitable for the service. Select accessories that do not corrode, soften, or otherwise attack the insulation or jacket in either the wet or dry state.

B. Apply insulation material, accessories, and finishes according to the manufacturer's printed instructions.

C. Install insulation with smooth, straight, and even surfaces.

D. Seal joints and seams to maintain vapor barrier.

E. Seal penetrations for hangers, supports, anchors and other projections.

F. Keep insulation materials dry during application and finishing.

G. Blanket Insulation: Install tight and smooth. Secure to ducts having long sides or diameters as follows:

1. Smaller Than 24 Inches: Bonding adhesive applied in 6-inch wide transverse strips on 12-inch centers.

2. Twenty-four (24) Inches and Larger: Anchor pins spaced 12 inches apart each way. Apply bonding adhesive to prevent sagging of the insulation.

3. Overlap joints three (3) inches.

4. Seal joints, breaks, and punctures with vapor barrier compound.

END OF SECTION 15507

SECTION 15672 - SPLIT SYSTEM HEAT PUMP

PART I - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and a Division 1 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. Section includes Split System Heat Pumps.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, weights (shipping, installed, and operating), dimensions, required clearances, and methods of assembly of components, furnished specialties and accessories and installation and start-up instructions.

B. Wiring Diagrams: Submit ladder-type wiring diagrams for power and control wiring required for final installation of heat pump units and controls. Clearly differentiate between portions of wiring which are factory-installed and portions to be field-installed.

C. Operation and Maintenance Data: Submit maintenance data and parts list for each heat pump unit, control, and accessory; including "trouble shooting" maintenance guide; plus servicing, and preventative maintenance procedures and schedule. Include this data and product data in maintenance manual in accordance with requirements of Division 1.

1.4 WARRANTY

A. Provide Five (5) Year Warranty.

B. Warranty: Include coverage for Refrigerant Compressors.

PART II - PRODUCTS

2.1 SPLIT SYSTEM HEAT PUMPS

A. Acceptable Manufacturers:

1. Carrier Air Conditioning: Division of Carrier Corp.

2. Trane (The) Co.: Division of American Standard Inc.

3. York: Division of York International

2.2 GENERAL

A. Spilt System: The split-system unit shall be an outdoor heat pump unit and indoor factory-fabricated single-zone draw-through air-handling unit. Both indoor and outdoor unit shall be by the same manufacturer. The net capacities shall be as indicated and shall not exceeded by more than 5%. The minimum efficiency for systems less than 65,000 BTUH shall be 15.0 SEER. The minimum efficiency for systems of 65,000 BTUH or greater shall be in accordance with the 2012 N. C. State Building Code: Energy Conservation Code.

2.3 AIR HANDLER

A. Direct Expansion Coil: Coil shall be provided with pressure-type brass distributors and solder connections. The coil shall be dehydrated after testing and charged with dry air. Maximum working conditions shall be 300 psig at 200 degrees F for cooling. Tests shall be conducted, subjecting the coil to a minimum air pressure of 350 psig with the coil submerged in water. The cooling coil shall be subject to ASHRAE 15-1978 Safety code for Mechanical Refrigeration. Coils shall be of the cartridge type, removable from other side of casing and supported the entire length in tracks. Staggered tube pattern shall be provided for all coils of more than one row deep. Tubing shall have a minimum outside diameter of 1/2 inch. Tubing shall be individually finned with smooth aluminum or copper fins, wound under tension. Tube joints for all coils shall be made with high temperature brazing alloys.

B. Cabinet: Unit shall be provided with baked enamel finish and internally insulated. Fan shall be forward curved, and dynamically and statically balanced at the factory. Fan shall be belt driven. Provide adjustable sheaves for each air handler. Fan and motor bearings shall be permanently lubricated type.

2.4 OUTDOOR HEAT PUMP UNIT

A. Unit shall be factory-assembled and tested. Unit shall provide liquid lift as required to suit installation. Unit shall deliver the specified capacity to the cooling coil with an ambient air temperature of 95 degrees F. Units shall be certified per ARI 240 and 270.

B. Coil shall have aluminum plate fins, mechanically bonded to ½ inch aluminum tubes. Coil shall be circuited for sub-cooling.

C. Outdoor Fans and Motors: Unit shall be furnished with direct-driven, propeller-type fans arranged for vertical discharge. Condenser fan motors shall have Class B motor insulation and built in current and thermal overload protection, and shall be of the permanently lubricated type, resiliently mounted. Each fan shall have a safety guard.

D. Compressor: Unit shall have compressors of serviceable hermetic design with external spring isolators and an automatically reversible oil pump. Compressor motors shall have across-the-line start.

E. Controls shall be factory-wired and located in a separate enclosure. Safety devices shall consist of high and low pressure stats and compressor overload devices. Unit wiring shall incorporate a time delay relay to prevent short-cycling of the compressor. Relay shall prevent compressor from restarting for a 5-minute period. The unit shall include a transformer for 24-volt control circuit, pressure relief valves and circuit breakers.

F. Casing shall make unit fully weatherproof for outdoor installation. Casing shall be of galvanized steel, zinc phosphatized and finished with baked enamel. Openings shall be provided for power and refrigerant connections. Panel shall be removable to provide access for servicing. The unit shall be mounted on manufacturer's standard legs anchored to concrete pedestals with steel bearing plates and neoprene pads.

G. Connections: Only one liquid line, one suction line, required for units under 15 tons in capacity shall be provided. A 15-ton unit shall be dual circuited. Double suction risers for the refrigerant lines shall be provided.

H. Piping shall be sized by the manufacturer.

2.5 TEMPERATURE CONTROL SYSTEM

A. See Section 15973, Direct Digital Controls

2.6 FILTRATION

A. Provide a filter rack and a 1" replaceable pleated throwaway filter. Filter rack size shall be as required by AHU manufacture.

B. Provide additional sets of filters (minimum of 3) as required during construction. Install a clean set of filters for the Final Inspection.

PART III - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide for connection to electrical service.

C. Install units with vibration isolation.

D. Install units on concrete base as indicated.

3.2 MANUFACTURER'S FIELD SERVICES

A. Prepare start systems under provisions of Section 15500.

B. Provide initial start-up.

C. Supply initial charge of refrigerant and oil for each refrigerant circuit. Replace losses of refrigerant and oil.

END OF SECTION 15672

SECTION 15674 VARIABLE REFRIGERANT FLOW (VRF) ZONING SYSTEM

PART I - GENERAL

1.1 SYSTEM DESCRIPTION R2-SERIES (SIMULTANEOUS HEAT/COOL)

A. Per the equipment schedule, the variable capacity, heat pump heat recovery air conditioning system basis of design is Mitsubishi Electric CITY MULTI VRF (Variable Refrigerant Flow) zoning system(s).

B. Acceptable alternative manufacturers, assuming compliance with these equipment specifications, are Daikin, Panasonic, and Hitachi. Contractor bidding an alternate manufacturer does so with full knowledge that that manufactures product may not be acceptable or approved and that contractor is responsible for all specified items and intents of this document without further compensation.

C. Simultaneous heating/cooling (heat recovery) systems shall consist of an outdoor unit, BC (Branch Circuit) Controller (or comparable branch devices), multiple indoor units, and an integral DDC (Direct Digital Controls) system. Each indoor unit or group of indoor units shall be capable of operating in any mode independently of other indoor units or groups. System shall be capable of changing mode (cooling to heating, heating to cooling) with no interruption to system operation. To ensure owner comfort, each indoor unit or group of indoor units shall be independently controlled and capable of changing mode automatically when zone temperature strays 1.8 degrees F from set point for ten minutes.

D. No additional branch circuit controllers (or comparable branch devices) than shown on the drawings/schedule may be connected to any one outdoor unit. Contractors proposing alternate systems requiring more branch devices than those included as the basis of design are responsible for additional piping & electrical costs and are required to identify additional costs & installation time required of other trades with their bid.

1.2 QUALITY ASSURANCE

A. The units shall be listed by Electrical Testing Laboratories (ETL) and bear the ETL label.

B. All wiring shall be in accordance with the National Electrical Code (N.E.C.).

C. The units shall be manufactured in a facility registered to ISO 9001 and ISO14001 which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).

D. All units must meet or exceed the 2010 Federal minimum efficiency requirements and the ASHRAE 90.1 efficiency requirements for VRF systems. Efficiency shall be published in accordance with the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Standard 1230.

E. System start-up supervision shall be a required service to be completed by the manufacturer or a duly authorized, competent representative that has been factory trained in system configuration and operation. The representative shall provide proof of manufacturer certification indicating successful completion within no more than two (2) years prior to system installation. This certification shall be included as part of the equipment and/or controls submittals.

1.3 DELIVERY, STORAGE AND HANDLING

A. Unit shall be stored and handled according to the manufacturer's recommendation.

PART II – WARRANTY

1.1 WARRANTY

A. The CITY MULTI units shall be covered by the manufacturer's limited warranty for a period of one (1) year parts and seven (7) year compressor to the original owner from date of installation.

B. Installing contractor shall meet manufacturer requirements to obtain extended manufacturer's limited parts and compressor warranty for a period of ten (10) years to the original owner from date of installation. This warranty shall not include labor.

C. Manufacturer shall have a minimum of fifteen (15) years continuous experience providing VRF systems in the U.S. market.

D. All manufacturer technical and service manuals must be readily available for download by any local contractor should emergency service be required. Registering and sign-in requirements which may delay emergency service reference are not allowed.

E. The CITY MULTI VRF system shall be installed by a contractor with extensive CITY MULTI install and service training. The mandatory contractor service and install training should be performed by the manufacturer.

PART II – OUTDOOR UNITS

3.1 R2-SERIES STANDARD EFFICIENCY (HEAT RECOVERY), AIR COOLED OUTDOOR UNITS

A. General: The outdoor unit modules shall be air-cooled, direct expansion (DX), multi-zone units used specifically with VRF components described in this section and Part 5 (Controls). The outdoor unit modules shall be equipped with a single compressor which is inverter-driven and multiple circuit boards—all of which must be manufactured by the branded VRF manufacturer. Each outdoor unit module shall be completely factory assembled, piped and wired and run tested at the factory.

1. Outdoor unit systems may be comprised of multiple modules with differing capacity if a brand other than basis of design is proposed. All units requiring a factory supplied twinning kits shall be piped together in the field, without the need for equalizing line(s). If an alternate manufacturer is selected, any additional material, cost, and labor to install additional lines shall be incurred by the contractor. Contractor responsible for ensuring alternative brand compatibility in terms of availability, physical dimensions, weight, electrical requirements, etc

2. Outdoor unit shall have a sound rating no higher than 66.5 dB(A) individually or 69.5 dB(A) twinned. Units shall have a sound rating no higher than 52 dB(A) individually or 55 dB(A) twinned while in night mode operation. Units shall have 5 levels sound adjustment via dip switch selectable fan speed settings. If an alternate manufacturer is selected, any additional material, cost, and labor to meet published sound levels shall be incurred by the contractor.

3. Refrigerant lines from the outdoor unit to the indoor units shall be insulated in accordance with the installation manual.

4. The outdoor unit shall have the capability of installing the main refrigerant piping through the bottom of the unit.

5. The outdoor unit shall have an accumulator with refrigerant level sensors and controls. Units shall actively control liquid level in the accumulator via Linear Expansion Valves (LEV) from the heat exchanger.

6. The outdoor unit shall have a high pressure safety switch, over-current protection, crankcase heater and DC bus protection.

7. VRF system shall meet performance requirements per schedule and be within piping limitations & acceptable ambient temperature ranges as described in respective manufacturers' published product catalogs. Non-published product capabilities or performance data are not acceptable.

8. The outdoor unit shall be capable of operating in heating mode down to -18°F ambient temperatures or cooling mode down to 23°F ambient temperatures, without additional low ambient controls. If an alternate manufacturer is selected, any additional material, cost, and labor to meet low ambient operating condition and performance shall be incurred by the contractor.

9. The outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained. Oil return sequences must be enabled only during extended periods of reduced refrigerant flow to ensure no disruption to correct refrigerant flow to individual zones during peak loads. Systems which might engage oil return sequence based on hours of operation risk oil return during inopportune periods are not allowed. Systems which rely on sensors (which may fail) to engage oil return sequence are not allowed.

10. Unit must defrost all circuits simultaneously in order to resume full heating more quickly during extreme low ambient temperatures (below 23F). Partial defrost, also known as hot gas defrost which allows reduced heating output during defrost, is permissible only when ambient temperature is above 23F.

11. While in hot gas defrost the system shall slow the indoor unit fan speed down to maintain a high discharge air temperature. Systems that keep fans running in same state shall not be allowed as they provide an uncomfortable draft to the indoor zone due to lower discharge air temperatures.

12. In reverse defrost all refrigerant shall be bypassed in the main branch controller and shall not be sent out to the indoor units, systems that flow refrigerant through indoor units during reverse defrost shall not be allowed.

B. Unit Cabinet:

1. The casing(s) shall be fabricated of galvanized steel, bonderized and finished.

2. Panels on the outdoor unit shall be scratch free at system startup. If a scratch occurs the salt spray protection is compromised and the panel should be replaced immediately.

C. Fan

1. Each outdoor unit module shall be furnished with direct drive, variable speed propeller type fan(s) only. Fans shall be factory set for operation at 0 in. WG. external static pressure, but capable of normal operation with a maximum of 0.32 in. WG. external static pressure via dipswitch.

2. All fan motors shall have inherent protection, have permanently lubricated bearings, and be completely variable speed.

3. All fans shall be provided with a raised guard to prevent contact with moving parts.

D. Refrigerant and Refrigerant Piping:

1. R410A refrigerant shall be required for systems.

2. Polyolester (POE) oil—widely available and used in conventional domestic systems—shall be required. Prior to bidding, manufacturers using alternate oil types shall submit material safety data sheets (MSDS) and comparison of hygroscopic properties for alternate oil with list of local suppliers stocking alternate oil for approval at least two weeks prior to bidding.

3. Refrigerant piping shall be phosphorus deoxidized copper (copper and copper alloy seamless pipes) of sufficient radial thickness as defined by the VRF equipment manufacturer and installed in accordance with manufacturer recommendations.

4. All refrigerant piping must be insulated with ½" closed cell, CFC-free foam insulation with flame-Spread Index of less than 25 and a smoke-development Index of less than 50 as tested by ASTM E 84 and CAN / ULC S-102. R value of insulation must be at least 3.

5. Refrigerant line sizing shall be in accordance with manufacturer specifications. Future changes to indoor unit styles or sizes must be possible without resizing/replacing refrigerant piping to any other branch devices or indoor units.

F. Coil:

1. Outdoor Coil shall be constructed to provide equal airflow to all coil face surface are by means of a 4-sided coil.

2. Outdoor Coil shall be elevated at least 12" from the base on the unit to protect coil from freezing and snow build up in cold climates. Manufacturer's in which their coil extends to within a few inches from the bottom of their cabinet frame shall provide an additional 12" of height to their stand or support structure to provide equal protection from elements as Mitsubishi Electric basis of design. Any additional support costs, equipment fencing, and tie downs required to meet this additional height shall be responsibility of Mechanical Contractor to provide.

3. The outdoor coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing.

4. The coil fins shall have a factory applied corrosion resistant blue-fin finish. Uncoated aluminum coils/fins are not allowed.

5. The coil shall be protected with an integral metal guard.

6. Refrigerant flow from the outdoor unit shall be controlled by means of an inverter driven compressor.

7. Unit shall have prewired plugs for optional panel heaters in order to prevent any

residual ice buildup from defrost. Panel heaters are recommended for operating environments where the ambient temperature is expected to stay below -1F for 72 hours.

Condenser coil shall have active hot gas circuit direct from compressor discharge on lowest coil face area to shed defrost condensate away from coil and protect from Ice formation after returning to standard heat pump operation. While in Heat Pump operation this lower section of the Outdoor Evaporator coil shall continually run hot gas from the compressor discharge to protect the coil from ice buildup and coil rupture. Manufacturers who do not have an active hot gas circuit in the lower section of the Outdoor coil to protect coil from freezing shall not be allowed in markets where the outdoor unit will see temperatures below freezing

F. Compressor:

1. Each outdoor unit module shall be equipped with only inverter driven scroll hermetic compressors. Non inverter-driven compressors, which may cause inrush current (demand charges) and require larger generators for temporary power shall not be allowed.

2. Each compressor shall be equipped with a multi-port discharge mechanism to eliminate over compression at part load. Manufacturer's that rely on a single compressor discharge port and provide no means of eliminating over compression and energy waste at part load shall not be allowed.

3. Crankcase heat shall be provided via induction-type heater utilizing eddy currents from motor windings. Energy-wasting "belly-band" type crankcase heaters are not allowed. Manufacturer's that utilize belly-band crankcase heaters will be considered as alternate only.

4. Compressor shall have an inverter to modulate capacity. The capacity for each compressor shall be variable with a minimum turndown not greater than 15%.

5. The compressor shall be equipped with an internal thermal overload.

6. Field-installed oil equalization lines between modules are not allowed. Prior to bidding, manufacturers requiring equalization must submit oil line sizing calculations specific to each system and module placement for this project.

7. Manufacturers that utilize a compressor sump oil sensor to equalize compressor oil volume within a single module shall not be allowed unless they actively shut down the system to protect from compressor failure.

G. Controls:

1. The unit shall be an integral part of the system & control network described in Part 5 (Controls) and react to heating/cooling demand as communicated from connected indoor units over the control circuit. Required field-installed control voltage transformers and/or signal boosters shall be provided by the manufacturer.

2. Each outdoor unit module shall have the capability of 4 levels of demand control based on external input.

H. Electrical:

1. The outdoor unit electrical power shall be 208/230 volts, 3-phase, 60 hertz or 460 volts, 3-phase, 60 hertz per equipment schedule.

2. The outdoor unit shall be controlled by integral microprocessors.

3. The control circuit between the indoor units, BC Controller and the outdoor unit shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

3.2 BRANCH CIRCUIT (BC) CONTROLLERS AS REQUIRED FOR SIMULTANEOUS HEAT/COOL SYSTEMS

A. General

1. BC (Branch Circuit) Controllers (or comparable branch devices) shall include multiple branches to allow simultaneous heating and cooling by allowing either hot gas refrigerant to flow to indoor unit(s) for heating or subcooled liquid refrigerant to flow to indoor unit(s) for cooling. Refrigerant used for cooling must always be subcooled for optimal indoor unit LEV performance; alternate branch devices which do not include controlled refrigerant subcooling risk bubbles in liquid supplied to indoor unit LEVs and are not allowed.

2. BC Controllers (or comparable branch devices) shall be equipped with a circuit board that interfaces to the controls system and shall perform all functions necessary for operation. The unit shall have a galvanized steel finish and be completely factory assembled, piped and wired. Each unit shall be run tested at the factory. This unit shall be mounted indoors, with access and service clearance provided for each controller. BC Controllers (or comparable branch devices) shall be suitable for use in plenums in accordance with UL1995 ed 4.

B. BC Unit Cabinet:

1. The casing shall be fabricated of galvanized steel.

2. Each cabinet shall house a liquid-gas separator and multiple refrigeration control valves.

3. The unit shall house two tube-in-tube heat exchangers.

C. Refrigerant Piping (specifications in addition to those for outdoor unit):

1. All refrigerant pipe connections shall be brazed.

2. Future changes to indoor unit quantities or sizes served by BC Controller or comparable branch device must be possible with no piping changes except between the branch device and indoor unit(s) changing. Systems which might require future piping changes between branch device and outdoor unit—if changes to indoor unit quantities or sizes are made—are not considered equal and are not allowed.

D. Refrigerant valves:

1. Service shut-off valves shall be field-provided/installed for each branch to allow service to any indoor unit without field interruption to overall system operation.

2. Service shut-off valves shall be pre-installed by the equipment vendor and leak tested to the applicable factory specifications for each branch to allow service to any indoor unit without field interruption to overall system operation.

E. Condensate Management:

1. BC Controller (or comparable branch device) must have integral resin drain pan or insulate refrigeration components with removable insulation that allows easy access for future service needs. Cabinets filled with solid foam insulation do not allow for future service and are not allowed.

F. Electrical:

1. The unit electrical power shall be 208/230 volts, 1 phase, 60 Hertz. The unit shall be capable of satisfactory operation within voltage limits of 187-228 (208V/60Hz) or 207-253 (230/60Hz).

2. The BC Controller shall be controlled by integral microprocessors

3. The control circuit between the indoor units and outdoor units shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

PART IV – INDOOR UNITS

4.1 WALL MOUNTED INDOOR UNIT

A. General

1. The wall-mounted indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

B. Unit Cabinet

1. All casings, regardless of model size, shall have the same white finish

2. Multi directional drain and refrigerant piping offering four (4) directions for refrigerant piping and two (2) directions for draining are required.

3. There shall be a separate back plate which secures the unit firmly to the wall.

C. Fan

1. The indoor fan shall be statically and dynamically balanced to run on a single

motor with permanently lubricated bearings.

2. A manual adjustable guide vane shall be provided with the ability to change the airflow from side to side (left to right).

3. A motorized air sweep louver shall provide an automatic change in airflow by directing the air up and down to provide uniform air distribution.

D. Filter

1. Return air shall be filtered by means of an easily removable, washable filter.

E. Coil

1. Basis of design indoor units include factory-installed LEV/EEV. Alternative brands which require field-installed, accessory LEV or EEV kits are permissible only with written Engineer and Architect approval for the location of kits being submitted two weeks prior to bid date. EEV kits mounted in cavities inside fire-rated interior walls shall be mounted inside three hour fire rated enclosures with access panels supplied by the manufacturer. Enclosure type and placement require prior approval.

2. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing. The tubing shall have inner grooves for high efficiency heat exchange. All tube joints shall be brazed with phos-copper or silver alloy.

3. The coils shall be pressure tested at the factory.

F. Electrical:

1. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.

2. The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz)

G. Controls

1. The unit shall include an IR receiver for wireless remote control flexibility.

2. Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.

3. Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8°F – 9.0°F adjustable deadband from set point.

4. Indoor unit shall include no less than four (4) digital inputs capable of being used for customizable control strategies.

5. Indoor unit shall include no less than three (3) digital outputs capable of being used for customizable control strategies.

4.2 4-WAY CEILING-RECESSED CASSETTE WITH GRILLE INDOOR UNIT

A. General:

1. The ceiling-recessed indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, an emergency operation function, a test run switch, and the ability to adjust airflow patterns for different ceiling heights. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory. The unit shall be suitable for use in plenums in accordance with UL1995 ed 4.

B. Unit Cabinet:

1. The cabinet panel shall have provisions for a field installed filtered outside air intake.

2. Branch ducting shall be allowed from cabinet.

3. Four-way grille shall be fixed to bottom of cabinet allowing two, three or four-way blow.

4. The grille vane angles shall be individually adjustable from a wired remote controller to customize the airflow pattern for the conditioned space

C. Fan:

1. The indoor fan shall be an assembly with a statically and dynamically balanced turbo fan direct driven by a single motor with permanently lubricated bearings.

2. The indoor unit shall include an AUTO fan setting capable of maximizing energy efficiency by adjusting the fan speed based on the difference between controller set-point and space temperature. The indoor fan shall be capable of five (5) speed settings, Low, Mid1, Mid2, High and Auto.

3. The indoor unit shall have an adjustable air outlet system offering 4-way airflow, 3-way airflow, or 2-way airflow.

4. The indoor unit fan logic must include multiple setting that can be changed to provide optimum airflow based on ceiling height and number of outlets used.

5. The indoor unit vanes shall have 5 fixed positions and a swing feature that shall be capable of automatically swinging the vanes up and down for uniform air distribution.

6. The vanes shall have an Auto-Wave selectable option in the heating mode that shall randomly cycle the vanes up and down to evenly heat the space.

7. Grille shall include a factory-installed “3D i-see” sensor, or equal, to work in conjunction with indoor unit control sequence to prevent unnecessary cooling or heating in unoccupied areas of the zone without decreasing comfort levels. Sensor must detect occupancy (not simply motion) and location of occupants by measuring size & temperature of objects within a 39’ detecting diameter (based

on 8.8ft mounting height) with 1,856 or more measuring points.

D. Filter:

1. Return air shall be filtered by means of a long-life washable filter.

E. Coil:

1. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing. The tubing shall have inner grooves for high efficiency heat exchange. All tube joints shall be brazed with phos-copper or silver alloy.

2. The coils shall be pressure tested at the factory.

3. The unit shall be provided with an integral condensate lift mechanism that will be able to raise drain water 33 inches above the condensate pan.

F. Electrical:

1. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.

2. The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz).

H. Controls:

1. Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.

2. Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8°F – 9.0°F adjustable deadband from set point.

3. Indoor unit shall include no less than four (4) digital inputs capable of being used for customizable control strategies.

4. Indoor unit shall include no less than three (3) digital outputs capable of being used for customizable control strategies.

5. A factory-installed drain pan sensor shall provide protection against drain pan overflow by sensing a high condensate level in the drain pan. Should this occur the control shuts down the indoor unit before an overflow can occur. A thermistor error code will be produced should the sensor activate indicating a fault which must be resolved before the unit re-starts.

6. Control board shall include contacts for control of no less than two stages of external heat. The first stage of external heat may be energized when the space temperature is 2.7°F from set point for between 10-25 minutes (user adjustable). The second stage of external heat may be energized when the first stage has been active for no less than 5 minutes and the space temperature has not risen by more than 0.9°F.

7. Indoor unit shall include no less than four (4) digital inputs capable of being used for customizable control strategies.

8. Indoor unit shall include no less than three (3) digital outputs capable of being used for customizable control strategies.

PART V – CONTROLS

5.1 OVERVIEW

A. The control system shall consist of a low voltage communication network and a web-based interface. The controls system shall gather data and generate web pages accessible through a conventional web browser on each PC connected to the network. Operators shall be able to perform all normal operator functions through the web browser interface.

B. Furnish energy conservation features such as optimal start, request-based logic, and demand level adjustment of overall system capacity as specified in the sequence.

C. System shall be capable of email generation for remote alarm annunciation.

5.2 ELECTRICAL CHARACTERISTICS

A. General:

1. Controller power and communications shall be via a common non-polar communications bus and shall operate at 30VDC.

B. Wiring:

1. Control wiring shall be installed in a daisy chain configuration from indoor unit to indoor unit, to the BC controller (main and subs, if applicable) and to the outdoor unit. Control wiring to remote controllers shall be run from the indoor unit terminal block to the controller associated with that unit.

2. Control wiring for centralized controllers shall be installed in a daisy chain configuration from outdoor unit to outdoor unit, to the system controllers (centralized controllers and/or integrated web based interface), to the power supply.

C. Wiring type:

1. Wiring shall be 2-conductor (16 AWG), twisted, stranded, shielded wire as defined by the Diamond System Builder output.

2. Network wiring shall be CAT-5 with RJ-45 connection.

5.3 CITY MULTI CONTROLS NETWORK

1. The CITY MULTI Controls Network (CMCN) consists of remote controllers, centralized controllers, and/or integrated web based interface communicating over a high-speed communication bus. The CITY MULTI Controls Network shall support operation monitoring, scheduling, occupancy, error email distribution, personal web browsers, tenant billing, online maintenance support, and integration with Building Management Systems (BMS) using either LonWorks® or BACnet® interfaces.

5.4 TOUCH MA REMOTE CONTROLLER

1. The Backlit Touch MA Remote Controller shall be capable of controlling up to 16 indoor units (defined //'as 1 group).

2. The Backlit Touch MA Remote Controller shall only be the only controller in the group.

3. Coordinate location of controller with Engineer and Owner.

PART VI – OWNER TRAINING

6.1 Provide initial Owner training prior to turn over of building. Provide a minimum of four (4) hours training for up to six (6) persons. Coordinate training session with Owner's schedule.

6.2 Provide an additional four (4) hours of training after ninety (90) days of operation.

6.3 All training shall be conducted by the manufacture's representative. The mechanical contractor shall attend all training sessions.

END OF SECTION 15674

SECTION 15675A – SPLIT SYSTEM DOAS UNITS

PART I - GENERAL

1.1 RELATED DOCUMENTS

1.2 GENERAL DESCRIPTION

A. This section includes the design, controls, and installation requirements for air-cooled condensers / condensing units.

1.3 QUALITY ASSURANCE

A. Unit shall be certified in accordance with UL Standard 1995/CSA C22.2 No. 236, Safety Standard for Heating and Cooling Equipment.

B. Unit and refrigeration system shall comply with ASHRAE 15, Safety Standard for Mechanical Refrigeration.

C. Energy Efficiency Ratio (EER) shall be equal to or greater than prescribed by ASHRAE 90.1, Energy Efficient Design of New Buildings except Low-Rise Residential Buildings.

D. Unit shall be safety certified by ETL and be ETL US and ETL Canada listed. Unit nameplate shall include the ETL label.

1.4 SUBMITTALS

A. Product Data: Literature shall be provided that indicates dimensions, operating and shipping weights, capacities, ratings, factory supplied accessories, electrical characteristics, and connection requirements. Installation, Operation and Maintenance manual with startup requirements shall be provided.

B. Shop Drawings: Unit drawings shall be provided that indicate assembly, unit dimensions, clearances, and connection details. Wiring diagram shall be provided with details for both power and control systems and differentiate between factory installed and field installed wiring.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Unit shall be shipped on a wooden pallet with skeleton crating prior to shipment with doors bolted shut to prevent damage during transport and thereafter while in storage awaiting installation.

B. Follow Installation, Operation and Maintenance manual instructions for rigging, moving, and unloading the unit at its final location.

C. Unit shall be stored in a clean, dry place protected from construction traffic in accordance with the Installation, Operation and Maintenance manual.

1.6 WARRANTY

A. Manufacturer shall provide a limited "parts only" warranty for a period of 12 months from the date of equipment startup or 18 months from the date of original equipment shipment from the factory, whichever is less. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided manufacturer’s written instructions for installation, operation and maintenance have been followed. Warranty excludes parts associated with routine maintenance and refrigerant.

B. Compressors shall carry a 5 year warranty from date of original equipment shipment from the factory.

PART II - PRODUCTS

2.1 MANUFATURER

A. Products shall be provided by the following manufacturers:

1. AAON

2. Substitute equipment may be considered for approval that includes at a minimum:

a. R-410A refrigerant

b. Hinged access doors with lockable handles

c. Variable capacity compressor with 10-100% capacity

d. 2,500 hour salt spray tested exterior corrosion protection

e. Designed, engineered, and manufactured in the United States of America

f. All other provisions of the specifications must be satisfactorily addressed

2.2 CONDENSING UNITS

A. General Description

1. Air-Source heat pump condensing unit shall include compressors, air-cooled condenser coils, condenser fans, suction and liquid connection valves, accumulator, receiver, reversing valve, filter driers with check valves, and thermal expansion valves.

2. Unit shall be factory assembled and tested including leak testing of the coil and run testing of the completed unit. Run test report shall be supplied with the unit in the control compartment.

3. Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel.

4. Unit components shall be labeled, including pipe stub outs, refrigeration system components and electrical and controls components.

5. Installation, Operation and Maintenance manual shall be supplied within the unit.

6. Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment's access door.

7. Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment's access door.

B. Construction

1. Unit shall be completely factory assembled, piped, and wired and shipped in one section.

2. All cabinet walls, access doors, and roof shall be fabricated of 090 galvanized steel panels.

3. Unit shall be specifically designed for outdoor application.

4. Access to compressors and control components shall be through hinged access doors with quarter turn, lockable handles.

5. Access to condenser coils and fans is through removable access panels.

6. Exterior paint finish shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.

7. Unit shall include lifting lugs.

8. Unit shall include forklift slots.

C. Electrical

1. Unit shall be provided with standard power block for connecting power to the unit.

2. Control circuit transformer and wiring shall provide 24 V AC control voltage from the line voltage provided to the unit.

3. Unit shall have a 5kAIC SCCR.

4. Air-source heat pump shall include an optimized start defrost cycle to prevent frost accumulation on the outdoor coil during heat pump heating operation and to minimized defrost cycle energy usage. If the temperature of the outdoor heat exchanger and/or the suction line is less than a predetermined value, a deferred defrost cycle is initiated wherein the defrost cycle starts after a variable, continuously optimizing, time interval has elapsed. The defrost cycle is terminated when the relative temperatures of the outdoor heat exchanger and/or the suction line indicate that sufficient frost is melted from the heat exchanger to insure adequate time between successive defrost cycles for optimizing the efficiency and reliability of the system, or after a predetermined time interval has elapsed, whichever condition occurs first. During defrost cycle all compressors shall energize, reversing valves shall energize, and auxiliary heat shall energize.

5. Unit shall be provided with factory installed and factory wired, non-fused disconnect switch.

6. Unit shall be provided with phase and brown out protection which shuts down all motors in the unit if the electrical phases are more than 10% out of balance on voltage, the voltage is more than 10% under design voltage, or on phase reversal.

D. Refrigeration System

1. Unit shall be provided with two independently circuited R-41 0A scroll compressors with thermal overload protection. Lead compressor shall be a variable capacity scroll capable of modulation from 10-100% of its capacity.

2. Each compressor shall be furnished with a crankcase heater.

3. Compressors shall be mounted in an isolated service compartment which can be accessed without affecting unit operation. Lockable hinged access doors shall provide access to the compressors.

4. Compressors shall be isolated from the base pan with the compressor manufacturer's recommended rubber vibration isolators and mounted on an elevated compressor deck, to reduce any transmission of noise from the compressors into the building area.

5. Each refrigeration circuit shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant safety controls, Schrader type service fittings on both the high pressure and low pressure sides, and service valves for liquid and suction connections. Liquid line filter driers shall be factory provided and installed. Field installed refrigerant circuits shall include the low side cooling components, refrigerant, thermal expansion valve, liquid line, insulated hot gas reheat line, and insulated suction line.

6. Unit shall include a factory holding charge of R-41 0A refrigerant and oil. Adjusting the charge of the system will be required during installation.

7. Lead refrigeration circuit shall be provided with modulating hot gas reheat valve, electronic controller, liquid line receiver, supply air temperature sensor and a dehumidification control signal terminal that enables the dehumidification mode of operation, and includes supply air temperature control to prevent supply air temperature swings and overcooling of the space. The matching indoor air handler must include a hot gas reheat coil and a check valve on the hot gas reheat line.

8. Unit shall be configured as an air-source heat pump. Each refrigeration circuit shall be equipped with a bi-flow liquid line filter drier, reversing valve, suction line accumulator, liquid line receiver, and a bypass loop with check valve around a thermal expansion valve. Reversing valve shall de-energize during the heat pump heating mode of operation. The matching indoor air handler must include a bypass loop with check valve around the thermal expansion valve.

9. The factory installed controls shall include a 3 minute off delay timer to prevent compressor short cycling. The controls shall also include an adjustable, 20 second delay timer for each additional capacity stage to prevent multiple capacity stages from starting simultaneously and adjustable compressor lock out.

E. Fans

1. Condenser fan shall be vertical discharge, axial flow, direct drive fans.

2. Condensing unit shall be provided with an electrically commutated motor (ECM) condenser fan, condenser head pressure controller, and discharge pressure transducers for modulating head pressure control to allow cooling operation down to 35°F. Fan motor shall be weather protected, single phase, direct drive, and totally enclosed air over (TEAO) with electronic protection.

F. Coils

1. Coils shall be designed for use with R-41 0A refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and aluminum end casings. Fin design shall be sine wave rippled.

2. Coils shall be designed for a minimum of 10°F of refrigerant sub-cooling.

3. Coils shall be hydrogen leak tested.

PART III - EXECUTION

3.1 CONDENSING UNITS

A. Installation, Operation, and Maintenance

1. Installation, Operation and Maintenance manual shall be supplied with the unit.

2. Installing contractor shall install unit, including field installed components, in accordance with Installation, Operation and Maintenance manual instructions.

3. Start up and maintenance requirements shall be complied with to ensure safe and correct operation of the unit.

PART IV – OWNER TRAINING

4.1 Provide initial Owner training prior to turn over of building. Provide a minimum of four (4) hours training for up to six (6) persons. Coordinate training session with Owner's schedule.

4.2 Provide an additional four (4) hours of training after ninety (90) days of operation.

4.3 All training shall be conducted by the manufacture's representative. The mechanical contractor shall attend all training sessions.

END OF SECTION 15675A

SECTION 15675B – DOAS AIR HANDLING UNIT

PART I - GENERAL

1.1 RELATED DOCUMENTS

1.2 GENERAL DESCRIPTION

A. This section includes the design, controls, and installation requirements for indoor air handling units.

1.3 QUALITY ASSURANCE

A. Unit shall be certified in accordance with UL Standard 1995/CSA C22.2 No. 236, Safety Standard for Heating and Cooling Equipment.

B. Unit and refrigeration system shall comply with ASHRAE 15, Safety Standard for Mechanical Refrigeration.

C. Unit shall be safety certified by ETL and be ETL US and ETL Canada listed. Unit nameplate shall include the ETL label.

1.4 SUBMITTALS

A. Product Data: Literature shall be provided that indicates dimensions, operating and shipping weights, capacities, ratings, fan performance, filter information, factory supplied accessories, electrical characteristics, and connection requirements. Installation, Operation and Maintenance manual with startup requirements shall be provided. Run test report shall be supplied with the unit in the control compartment's literature packet, and also available electronically after the unit ships.

B. Shop Drawings: Unit drawings shall be provided that indicate assembly, unit dimensions, clearances, and connection details. Computer generated fan curves for each fan shall be submitted with specific design operation point noted. Wiring diagram shall be provided with detail for power and control systems and differentiate between factory installed and field installed wiring.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Unit shall be on a wooden pallet with skeleton crating prior to shipment to prevent damage during transport and thereafter while in storage awaiting installation.

B. Follow Installation, Operation and Maintenance manual instructions for rigging, moving, and unloading the unit at its final location.

C. Unit shall be handled carefully to avoid damage to components, enclosures and finish.

D. Unit shall be stored in a clean, dry place protected from weather and construction traffic in accordance with Installation, Operation and Maintenance manual instructions.

1.6 WARRANTY

A. Manufacturer shall provide a limited "parts only" warranty for a period of 12 months from the date of equipment start up or 18 months from the date of original equipment shipment from the factory, whichever is less. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided manufacturer's written

instructions for installation, operation, and maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts and air filters.

PART II - PRODUCTS

2.1 MANUFATURER

A. Products shall be provided by the following manufacturers:

1. AAON

2. Substitute equipment may be considered for approval that includes at a minimum:

a. R-410A refrigerant

b. ECM driven direct drive backward curved plenum supply fans

c. Double wall cabinet construction

d. Insulation with a minimum R-value of 6.25

e. Double-sloped stainless steel drain pans

f. Hinged access doors with lockable handles

g. LED service lights in the control panel

h. Designed, engineered, and manufactured in the United States of America

i. All other provisions of the specifications must be satisfactorily addressed

2.2 AIR HANDLING UNIT

A. General Description

1. Indoor air handling units shall include filters, supply fans, and the following:

a. DX evaporator coil

b. reheat coil

c. electric heaters

d. mixing box

e. unit controls

2. Unit shall have a draw-through supply fan configuration and discharge air horizontally or vertically depending on configuration.

3. Unit shall be shipped in two sections and factory tested including leak testing of the coils and run testing of the supply fans and factory wired system. Run test report shall be supplied with the unit in the control compartment's literature packet, and also available electronically after the unit ships.

4. Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel.

5. Unit components shall be labeled, including pipe stub outs, refrigeration system components and electrical and controls components.

6. Installation, Operation and Maintenance manual shall be supplied within the unit.

7. Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment's hinged access door.

8. Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment's hinged access door.

B. Construction

1. All cabinet walls, access doors, and roof shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels.

2. Unit insulation shall have a minimum thermal resistance R-value of 6.25. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D 1929-11 for a minimum flash ignition temperature of 610°F.

3. Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moisture accumulation on the insulation, provides a cleanable interior, reduces heat transfer through the panel and prevents exterior condensation on the panel.

4. Unit shall be designed to reduce air leakage and infiltration through the cabinet. Sealing shall be included between panels and between access doors and openings to reduce air leakage. Piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.

5. Horizontal air handling units shall include a 5-inch forklift base.

6. Access doors shall be flush mounted to cabinetry.

7. Units shall include double-sloped 304 stainless steel drain pan. Drain pan connection shall be on the right hand side of unit with a 1" MPT fitting.

8. Cooling coil shall be mechanically supported above the drain pan by multiple supports that allow drain pan cleaning and coil removal.

9. Unit shall be provided with a high condensate level switch that shuts down the unit when a high water level is detected in the drain pan.

10. Unit shall include factory wired control panel compartment LED service lights.

C. Electrical

1. Unit shall be provided with a control panel with separate low voltage control wiring with conduit and high voltage power wiring with conduit between the control panel and the unit. Both side walls of the control panel shall include louvered vents. Control panel shall be field mounted and shall include a piano hinged service access door with tooled entry.

2. Unit shall be provided with standard power block for connecting power to the unit.

3. Unit shall include a factory installed 24V control circuit transformer.

4. Unit shall have a 5kAIC SCCR.

5. Unit shall include high and low voltage quick connects for easy wiring at installation.

D. Supply Fans

1. Unit shall include direct drive, unhoused, backward curved, plenum supply fans.

2. Blower and motor assembly shall be dynamically balanced.

3. Motor shall be a high efficiency electronically commutated motor (ECM).

4. Blower and motor assembly shall utilize neoprene gasket or rubber isolators.

5. ECM driven supply fan speed shall be controlled with the factory installed AAON controller.

6. Access to supply fan shall be through an access door with removable pin hinges and lockable quarter tum handles.

E. Cooling Coil

1. Access to cooling coil shall be through hinged access door with lockable quarter tum handles.

2. Access to reheat coil shall be through hinged access door with lockable quarter tum handles.

3. Evaporator Coil

a. Coil shall be designed for use with R-41 0A refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and aluminum end casings. Fin design shall be sine wave rippled.

b. Coil shall two circuits and interlaced circuitry.

c. Coil shall be 6 row high capacity and 12 fins per inch.

d. Coil shall be hydrogen leak tested.

e. Coil shall be furnished with factory installed thermostatic expansion valves. The sensing bulbs shall be field installed on the suction line immediately outside the cabinet.

f. Coil shall have right hand external piping connections. Liquid and suction connections shall be sweat connection. Coil connections shall be labeled, extend beyond the unit casing, and be factory sealed on both the interior and exterior of the unit casing to minimize air leakage.

F. Refrigeration System

1. Air handling unit and matching condensing unit shall be capable of operation as an R-41 0A split system heat pump.

2. Each refrigeration circuit shall be equipped with thermostatic expansion valve type refrigerant flow control.

3. Modulating hot gas reheat shall be provided on the lead refrigeration circuit. Air handling unit shall be provided with hot gas reheat coil, a check valve on the liquid line, and a check valve on the hot gas reheat line. The matching condensing unit must include modulating 3-way reheat valve, liquid line receiver, electronic controller, supply air temperature sensor and a dehumidification control signal terminal. This allows the system to have a dehumidification mode of operation and includes supply air temperature control to prevent supply air temperature swings and overcooling of the space. Reheat line connections shall be labeled, extend beyond the unit casing and be located near the suction and liquid line connections for ease of field connection. Connections shall be factory sealed on both the interior and exterior of the unit casing to minimize air leakage.

4. Unit shall be configured as heat pump. Refrigeration circuit shall be equipped with a thermal expansion with an external check valve on the indoor coil.

5. Reversing valve, outdoor coil thermal expansion valve, bi-flow filter drier, and liquid line receiver shall be factory installed in the matching AAON condensing unit.

G. Electric Heating

1. Unit shall include an electric heater consisting of electric heating coils, fuses, contactors, and a high temperature limit switch, with capacities as shown on the plans.

2. Electric heating access shall be through service access door with removable pin hinges and lockable quarter turn handle.

3. Electric heating coils shall be located in the reheat position downstream of the supply fan.

4. Electric heater shall have full modulation capacity controlled by an SCR (Silicon Controlled Rectifier). Controller shall provide the heating control signal to control the amount of heating.

H. Filters

1. Unit filter access shall be through service access door with piano hinges and quarter turn button fasteners.

2. Unit shall include 2 inch thick, pleated panel filters with MERV rating of 8, upstream of the cooling coil.

3. Unit shall include a clogged filter switch that senses the pressure drop across the unit filter bank and cooling coil.

I. Mixing Box

1. Damper access shall be through service access door with removable pin hinges and lockable quarter turn handle.

2. Unit shall contain a mixing box with front return air opening and top outside air opening.

3. Unit shall include 0-100% economizer consisting of a motor operated outside air damper and return air damper assembly constructed of extruded aluminum, hollow core, airfoil blades with rubber edge seals and aluminum end seals. Damper blades shall be gear driven and designed to have no more than 20 cfm of leakage per sq ft. at 4 in. w.g. air pressure differential across the damper.

4. Low leakage dampers shall be Class 2 AMCA certified, in accordance with AMCA Standard 511. Dampers shall be controlled by an enthalpy activated fully modulating actuator.

J. Controls

1. Unit shall be provided with a proof of airflow switch. When airflow is not detected, the supply fans will shut down.

2. Unit shall be provided with a control panel with separate low voltage control wiring with conduit and high voltage power wiring with conduit between the control panel and the unit. Control panel shall be field mounted.

3. Access to control panel shall be through hinged access door with tooled entry.

4. Factory Installed and Factory Provided Controller

a. Unit controller shall be capable of controlling all features and options of the unit. Controller shall be factory installed in the unit controls compartment and factory tested.

b. Controller shall be capable of standalone operation with unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling available without dependence on a building management system.

c. Controller shall have an onboard clock and calendar functions that allow for occupancy scheduling.

d. Controller shall include non-volatile memory to retain all programmed values without the use of a battery, in the event of a power failure.

e. Make Up Air Controller

1. Unit shall modulate cooling with constant airflow to meet ventilation outside air loads. Cooling capacity shall modulate based on supply air temperature.

2. Hot gas bypass shall be required on the lead refrigeration circuits of systems without variable capacity compressors.

3. Unit shall modulate heating with constant airflow to meet ventilation outside air loads. Heating capacity shall modulate based on supply air temperature.

f. Unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling shall be accomplished with connection to interface module with LCD screen and input keypad, interface module with touch screen, or with connection to PC with free configuration software. Controller shall be capable of connection with other factory installed and factory provided unit controllers with individual unit configuration, setpoint adjustment, sensor status viewing, and occupancy scheduling available from a single unit. Connection between unit controllers shall be with a modular cable. Controller shall be capable of communicating and integrating with a Lon Works or BACnet network.

PART III - EXECUTION

3.1 CONDENSING UNITS

A. Installation, Operation, and Maintenance

1. Installation, Operation and Maintenance manual shall be supplied with the unit.

2. Installing contractor shall install unit, including field installed components, in accordance with Installation, Operation and Maintenance manual instructions.

3. Start up and maintenance requirements shall be complied with to ensure safe and correct operation of the unit.

PART IV – OWNER TRAINING

4.1 Provide initial Owner training prior to turn over of building. Provide a minimum of four (4) hours training for up to six (6) persons. Coordinate training session with Owner's schedule.

4.2 Provide an additional four (4) hours of training after ninety (90) days of operation.

4.3 All training shall be conducted by the manufacture's representative. The mechanical contractor shall attend all training sessions.

END OF SECTION 15675B

SECTION 15870 - POWER VENTILATORS

PART I - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes Power Ventilators.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:

1. Product data for selected models, including specialties, accessories, and the following:

a. Motor ratings and electrical characteristics plus motor and fan accessories.

b. Materials gauges and finishes.

2. Shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, required clearances, components, and location and size of field connections.

PART II - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Carnes Company, Inc.
2. Cook (Loren) Co.
3. Greenheck Fan Corp.
4. Penn Ventilator Co., Inc.

2.2 ROOF EXHAUSTERS

A. Centrifugal Fan Unit: V-belt driven with spun aluminum housing; resilient mounted motor, ½ inch mesh, 16 gauge aluminum bird screen; square base to suit roof curb with continuous curb gaskets; secured with cadmium plated bolts and screws.

B. Roof Curb: 16 inch high with continuously welded seams and factory installed door nailer strip.

C. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor.

D. Back Draft Damper: Gravity activated, aluminum multiple blade construction, felt edged with nylon bearings.

E. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable

and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

2.3 WALL EXHAUSTERS

A. Centrifugal Fan Unit: V-belt driven with spun aluminum housing; resilient mounted motor, ½ inch mesh, 16 gauge aluminum bird screen; secured with cadmium plated bolts and screws.

B. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor.

C. Back Draft Damper: Gravity activated, aluminum multiple blade construction, felt edged with nylon bearings.

D. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

2.4 CEILING EXHAUST FANS

A. Centrifugal Fan Unit: V-belt or direct drive with galvanized steel housing lined with ½ inch acoustic insulation, resilient mounted motor, gravity back draft damper in discharge.

B. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor.

C. Grille: Molded white plastic or aluminum with baked white enamel finish.

D. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required RPM is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

2.5 IN-LINE CABINET EXHAUST FANS

A. Centrifugal Fan Unit: V-belt or direct driven, with galvanized steel housing lined with ½ inch acoustic insulation, resilient mounted motor, gravity back draft damper in discharge.

B. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor.

C. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required RPM is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

2.6 ROOF SUPPLY FAN

A. Fan Unit: Direct driven axial type, aluminum hood, bird screen, die formed aluminum propeller blades riveted to steel hub, resilient mounted motor square base to suit roof curb.

B. Roof Curbs: 16 inch high, continuously welded seams, and factory door nailed strip. Roof curb shall have same manufacturer as fan and be supplied by Mechanical Contractor and installed by the General Contractor.

C. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor.

PART III - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure roof exhausters with lag screws to roof curb.

END OF SECTION 15870

SECTION 15891 - METAL DUCTWORK

PART I - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes low pressure ducts and plenums for heating, ventilating, and air conditioning systems

PART II - PRODUCTS

2.1 MATERIALS

A. Steel Ducts: ASTM A525 or ASTM A527 galvanized steel sheet, lock-forming quality, having zinc coating of G-90 for each side in conformance with ASTM A90.

B. Insulated Flexible Ducts: Flexible duct wrapped with flexible glass fiber insulation, enclosed by seamless aluminum pigmented plastic vapor barrier jacket; maximum 0.23 K value at 75 degrees F.

C. Fasteners: Rivets, bolts, or sheet metal screws

D. Sealant: Liquid non-hardening, water resistant, fire resistive, compatible with mating materials; liquid used alone or with tape, or heavy mastic.

E. Hanger Rod: Steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.2 LOW PRESSURE DUCTWORK

A. Fabricate and support in accordance with SMACNA Low Pressure Duct Construction Standards and ASHRAE handbooks, except as indicated. Provide duct material, gages, re-inforcing and sealing for operating pressures indicated.

B. No variation of duct configuration or sizes permitted except by written permission.

C. Construct T's, bends, and elbows with radius of not less than 1½ times width of duct on center line. Where not possible and where rectangular elbows are used, provide turning vanes.

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.

E. Connect flexible ducts to metal ducts with liquid adhesive.

F. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.

G. Use double nuts and lock washers on threaded rod supports.

2.3 FACTORY FABRICATED DUCTWORK

A. Duct shall be of standard spiral lock seam or single-rib construction and shall be provided according to the gages given in the following table:

Diameter (inches)	Thickness (inches)
3 - 8	.032
9 - 14	.040
15 - 36	.050

B. Duct shall be provided in continuous, unjoined lengths wherever possible. Except when interrupted by fittings, round duct sections.

C. Fittings shall be round and shall have a wall thickness in accordance with the following table:

Fitting Body Diameters (inches)	Minimum Round Fitting Thickness (inches)
3-14	.040
15-26	.050
27-36	.063

D. Elbows shall be of die-stamped, gored or pleated construction. The bend radius of stamped, gored and pleated elbows shall be 1.5 time the elbow diameter.

E. All round elbows in diameter of 8 inches or less shall be of die-stamped or pleated construction.

F. All round elbows in diameter of 9 inches through 14 inches shall be of gored or pleated construction.

G. All round elbows in diameter greater than 14 inches shall be of gored construction.

H. Diverging-flow fittings shall be constructed with a radiused entrance to all branch taps and with no excess material projecting from the body into the branch tap entrance.

I. All take-off or branch entrances shall be by means of factory fabricated fittings.

J. All fitting ends shall be sized to slip inside mating duct sections. They shall provide a tight fit and have a minimum 2-inch insertion length with a stop bead. No additional coupling shall be required for duct to fitting joints.

PART III - EXECUTION

3.1 INSTALLATION

A. Factory Fabricated ductwork can be substituted for low-pressure field constructed ductwork.

B. All factory fabricated spiral duct and fittings shall be installed in accordance with manufacturer's recommendations.

C. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

D. Connect diffusers or troffer boots to low pressure ducts with 5 feet maximum length of

flexible duct. Hold in place with strap or clamp.

E. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

3.3 ADJUSTING AND CLEANING

A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment that may be harmed by excessive dirt with temporary filters or bypass during cleaning.

B. Clean duct systems with high power vacuum machines. Protect equipment that may be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

END OF SECTION 15891

SECTION 15910 - DUCT ACCESSORIES

PART I - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Not used
2. Turning Vanes
3. Duct Mounted Access Doors and Panels
4. Flexible Connectors
5. Flexible Ducts

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data including details for materials, dimensions of individual components, profiles, and finishes.

C. Shop drawings from manufacturer detailing assemblies: Include dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection.

PART II - PRODUCTS

2.3 AIR TURNING DEVICES

A. Multi-blade device with blades aligned in short dimension; steel or aluminum construction; with individually adjustable blades, mounting straps.

2.4 FLEXIBLE DUCT CONNECTIONS

A. Fabricate in accordance with SMACNA Low Pressure Duct Construction Standards, and as indicated.

B. Provide factory made spin-in starting collars for connections to trunk ducts.

2.5 DUCT ACCESS DOORS

A. Fabricate in accordance with SMACNA Low Pressure Duct Construction Standards and as indicated.

B. Review locations prior to fabrication.

C. Fabricate rigid and close fitting doors of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, install minimum one-inch thick insulation with sheet metal cover.

D. Access doors smaller than 12 inches square may be secured with sash locks.

E. Provide two hinges and two sash locks for sizes up to 18 inches square, three hinges and two compression latches with outside and inside handles for sizes up to 24 x 48 inches. Provide an additional hinge for larger sizes.

F. Access doors with sheet metal screw fasteners are not acceptable.

PART III - EXECUTION

3.1 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions.

B. Provide balancing dampers at points on low pressure supply systems where branches are taken from larger ducts as required for air balancing. Use splitter dampers only where indicated.

C. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment.

D. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, and elsewhere as indicated. Provide minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated.

E. Provide duct test holes where indicated and required for testing and balancing purposes.

END OF SECTION 15910

SECTION 15932 - AIR OUTLETS AND INLETS

PART I - 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 DESCRIPTION OF WORK

A. Extent of air outlets and inlets work is indicated by Drawings and Schedules and by Requirements of this Section.

B. Types of outlets and inlets required for this Project include the following:

1. Ceiling Air Diffusers
2. Wall Registers and Grilles
3. Louvers

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for air outlets and inlets including the following:

1. Schedule of air outlets and inlets indicating drawing designation, room location, number furnished, model number, size and accessories furnished.

2. Data sheet for each type of air outlet and inlet, and accessory furnished; indicating construction, finish and mounting details.

3. Performance data for each type of air outlet and inlet furnished, throw and drop; and noise criteria ratings. Indicate selections on data.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawing for each type of air outlet and inlet, indicating materials and methods of assembly of components.

PART II - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Diffusers & Grilles

1. Titus, Inc.
2. Metalaire, Inc.
3. Carnes, Inc.
4. E. H. Price

B. Louvers

1. Arrow United Industries, Inc.
2. Louvers & Dampers, Inc.
3. Penn Ventilator Co., Inc.
4. Ruskin Mfg. Co.
5. Safe-Air Inc.
6. Vent Products Co., Inc.

7. NCA
8. Cesco Products

2.2 RECTANGULAR CEILING DIFFUSERS

A. Rectangular, extruded aluminum, multi-core type diffuser to discharge air in 360 degree pattern.

B. Provide inverted T-bar type frame. In plaster ceilings, provide plaster frame and ceiling frame.

C. Fabricate of aluminum with baked enamel off-white finish.

D. Provide opposed blade damper with damper adjustable from diffuser face.

2.3 CEILING GRID CORE EXHAUST AND RETURN REGISTERS/GRILLES

A. Fixed grilles of 1/2 x 1/2 x 1 inch egg crate.

B. Provide inverted T-bar type frame. In plaster ceilings, provide plaster frame and ceiling frame.

C. Fabricate of aluminum with baked enamel off-white finish.

D. Where not individually connected to exhaust fans, provide integral, gang-operated opposed blade dampers with removable key operator, operable from face.

2.4 WALL SUPPLY REGISTERS/GRILLES

A. Streamlined and individually adjustable blades, depth of which exceeds ¾ inch maximum spacing with spring or other device to set blades, horizontal face, double deflection.

B. Fabricate 1¼ inch margin frame with countersunk screw mounting and gasket.

C. Fabricate of aluminum extrusions with 20 gauge minimum frames and 22 gauge minimum blades, with baked enamel off-white finish.

D. Provide integral, gang-operated opposed blade dampers with removable key operator, operable from face.

2.6 LOUVERS

A. Provide 4-inch deep louvers with blades on 45 degree slope with center baffle and return bend, heavy channel frame, bird screen with ½ inch square mesh.

B. Fabricate of 12-gauge extruded aluminum, welded assembly, with factory baked enamel finish. Color selection from manufacturer standard.

C. Furnish with interior screw holes in jambs for installation.

2.7 ROOF HOODS

A. Fabricate air inlet or exhaust hoods in accordance with SMACNA Low Pressure Duct Construction Standards.

B. Fabricate of aluminum, minimum 16 gauge base and 18 gauge hood; suitably reinforced; with removable hood; bird screen with ½ inch square mesh and factory prime coat baked

enamel finish.

C. Mount unit on minimum 12-inch high curb base with insulation between duct and curb.

D. Make hood outlet area minimum of twice throat area.

PART III - EXECUTION

3.1 INSTALLATION

A. Install items in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry and lighting arrangement.

C. Install diffusers to ductwork with air-tight connection.

D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, regardless of whether dampers are specified as part of the diffuser, or grille and register assembly.

E. Paint ductwork visible behind air outlets and inlets matte black.

END OF SECTION 15932

SECTION 15990 - TESTING, ADJUSTING AND BALANCING

PART I - 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 SUMMARY

A. This Section specifies the Requirements and Procedures of Total Mechanical Systems Testing, Adjusting and Balancing. Requirements include measurement and establishment of the fluid quantities of the Mechanical Systems as required to meet Design Specifications and Recording and reporting the results.

B. Testing and Balancing must be conducted by an independent, Certified Testing and Balancing firm, registered with either the AABC or the NEBB.

C. The Test and Balance Contractor shall be a subcontractor to the Mechanical Contractor.

1.3 SECTION INCLUDES

A. Testing, adjustment and balancing of air systems.

B. Measurement of final operating condition of HVAC Systems.

C. Sound measurement of equipment operating conditions.

D. Vibration measurement of equipment operating conditions.

1.4 SUBMITTALS

A. Submit under provisions of Section 15500.

B. Submit name of adjusting and balancing agency for approval within 30 days after Award of Contract.

C. Field Reports: Submit under provisions of Section 15500.

D. Field Reports: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

E. Prior to commencing work, submit report forms or outlines indicating adjusting, balancing, and equipment data required.

F. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Owner and for inclusion in operating and maintenance manuals.

G. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Report shall reference the Contract Drawings for location of equipment and devices. Where reference to the contract drawings is not satisfactory, include a set of reduced drawings or sketches with equipment and devices identified to correspond with data sheets.

H. Include detailed procedures, agenda, sample report forms and copy of AABC National Project Performance Guaranty prior to commencing system balance.

I. Test Reports: Indicate data on AABC National Standards for Total System Balance forms or NEBB forms.

1.5 QUALITY ASSURANCE

A. Perform total system balance in accordance with AABC National Standards for Field Measurement and Instrumentation, Total System Balance, ASHRAE 111, and NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.

B. Maintain one copy of each document on site.

1.6 SEQUENCING AND SCHEDULING

A. Sequence work under the provisions of Section 15500.

B. Sequence work to commence after completion of systems and schedule completion of work before Substantial Completion of Project.

C. Schedule work under the provisions of Section 15500.

D. Schedule and provide assistance in final adjustment and test of Smoke Control System with Fire Authority.

PART II - PRODUCTS (Not Used)

PART III - EXECUTION

3.1 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:

1. Systems are started and operating in a safe and normal condition.

2. Control systems are installed complete and operable.

3. Proper thermal overload protection is in place for electrical equipment.

4. Ductwork Systems:

a. Final filters are clean and in place. If required, install temporary media in addition to final filters.
b. Duct systems are clean of debris.
c. Fans are rotating correctly.
d. Dampers are in place and open.
e. Air coil fins are cleaned and combed.
f. Access doors are closed and duct end caps are in place.
g. Air inlets and outlets are installed and connected.
h. Duct system leakage is minimized.

B. Submit Field Reports: Report defects and deficiencies noted during performance of services which prevent system balance.

C. Beginning of work means acceptance of existing conditions.

3.2 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Owner to facilitate spot checks during testing.

B. Provide additional balancing devices as required.

3.3 INSTALLATION TOLERANCES

A. HVAC Systems: Adjust to within plus or minus 5 percent of design for supply and return systems and plus or minus 10 percent of design for exhaust systems.

B. Air Outlets and Inlets: Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.4 ADJUSTING

A. Ensure recorded data represents actual measured or observed conditions.

B. Permanently mark settings of balancing devices allowing settings to be restored. Set and lock memory stops.

C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.5 AIR SYSTEM PROCEDURE

A. Adjust equipment and distribution systems to provide required or design air quantities.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure and record air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Adjust air volume by adjusting duct internal devices such as dampers and splitters. Do not utilize opposed blade dampers at air inlets and outlets.

F. Vary total system air quantities by adjusting sheave position at each fan. Vary branch air quantities by damper regulation.

G. Measure and record static air pressure conditions at air supply and exhaust units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

H. Adjust settings and minimum set points for motorized and back draft dampers to design conditions.

I. Measure and record inlet and outlet temperatures at each air supply unit at full cooling and heating capacity.

3.6 REPORT FORMS

A. Forms shall include the following:

1. Title Page:
   a. Name of Testing, Adjusting and Balancing Agency
   b. Address of Testing, Adjusting and Balancing Agency
   c. Telephone number of Testing, Adjusting and Balancing Agency
   d. Project Name
   e. Project Location
   f. Project Architect
   g. Project Engineer
   h. Project Contractor
   i. Project Altitude
   j. Report Date

2. Summary Comments:
   a. Design versus final performance
   b. Notable characteristics of system
   c. Description of systems operation sequence
   d. Summary of outdoor and exhaust flows to indicate amount of building pressurization
   e. Nomenclature used throughout report
   f. Test Conditions

3. Instrument List:
   a. Instrument
   b. Manufacturer
   c. Model Number
   d. Serial Number
   e. Range
   f. Calibration Date

4. Electric Motors:
   a. Manufacturer
   b. Model/Frame
   c. HP/BHP/Efficiency
   d. Phase, Voltage, Amperage; Nameplate, Actual, No Load
   e. RPM
   f. Service Factor
   g. Starter Size, Rating, Heater Elements
   h. Sheave Make/Size/Bore

5. V-Belt Drive:
   a. Identification/Location
   b. Required Driven RPM
   c. Driven Sheave, Diameter and RPM
   d. Belt, Size and Quantity
   e. Motor Sheave Diameter and RPM
   f. Center to center distance, maximum, minimum, and actual

6. Equipment Data:
   a. Identification/number
   b. Manufacturer
   c. Model number and Serial number
   d. Capacity
   e. Service

f. Design flow rate, pressure drop, BHP
g. Actual flow rate, pressure drop, BHP
h. Temperature readings

7. Duct Traverse:
   a. System zone/branch
   b. Duct size
   c. Area
   d. Design velocity
   e. Design air flow
   f. Test velocity
   g. Test air flow
   h Duct static pressure
   i Air temperature
   j Correction factor

8. Air Distribution Test Sheet:
   a. Air terminal number
   b. Room number/location
   c. Terminal type
   d. Terminal size
   e. Area factor
   f. Design velocity
   g. Design air flow
   h. Test (final) velocity
   i Test (final) air flow
   j. Percent of design air flow

3.7 SOUND AND VIBRATION TESTING

A. Test and adjust Mechanical Systems for sound and vibration in accordance with the detailed instructions of the referenced Standards.

B. Sound Level Test and Report:
   1. Location
   2. Octave Bands - equipment off
   3. Octave Bands - equipment on

C. Vibration Test and Report:

   1. Location of Points:
      a. Fan bearing: drive end
      b. Fan bearing: opposite end
      c. Motor bearing: center (if applicable)
      d. Motor bearing: drive end
      e. Motor bearing: opposite end
      f. Casing: (bottom or top)
      g. Casing: (side)
      h. Duct after flexible connection: (discharge)
      i. Duct after flexible connection: (suction)

   2. Test Readings:
      a. Horizontal, velocity and displacement
      b. Vertical, velocity and displacement
      c. Axial, velocity and displacement

   3. Normally acceptable readings, velocity and acceleration

4. Unusual conditions at time of test

5. Vibration source (if non-complying)

END OF SECTION 15990

DIVISION 16: ELECTRICAL

16010	Basic Electrical Requirements
16050	Basic Electrical Materials and Methods
16100	Raceways, Boxes and Cabinets
16120	Wires and Cables
16140	Wiring Devices
16190	Supporting Devices
16195	Electrical Identification
16430	Low-Voltage Lighting Control System
16452	Grounding
16470	Panel Boards
16476	Disconnects
16515	Interior Lighting
16721	Fire Alarm Systems, Addressable

SECTION 16010 - BASIC ELECTRICAL REQUIREMENTS

PART I - GENERAL

1.1 GENERAL CONDITIONS

A. The Stipulations and Conditions stated in this Section, together with all provisions of the "Instructions to Bidders", "General Conditions", "Supplemental General Conditions" and "Special Conditions", hereinbefore set forth, shall apply to this and the other Sections of Division 16.

1.2 GENERAL REQUIREMENTS

A. The General Requirements hereinafter listed apply to the Electrical Work Division. If there is any conflict between the General Requirements and the General Conditions, the General Conditions shall take precedence.

1.3 ALTERNATES

A. Carefully examine all alternates at the back of this Specification and on the Drawings to determine if any work described under the Electrical Section will be affected thereby.

1.4 INTENT

A. The intent of these Drawings and Specifications are to describe the installation of a complete, fully adjusted, and operational system. Therefore, any items shown on Drawings and not specifically called for in the Specifications, or any items specified and not specifically indicated or detailed on the Drawings, or any items neither specified or shown, but which are reasonably incidental to and commonly required to make a complete job, will be furnished and installed by the Electrical Contractor at his own expense.

1.5 DEFINITIONS

A. The Electrical Contractor shall provide all supervision, labor, material equipment, machinery, plant, and any and all other items necessary to complete the Electrical systems. All items of equipment are specified in the singular; however, the Electrical Contractor shall provide the number of items of equipment as indicated on the drawings, and as required for complete systems.

Where the word "provide" is used, it shall mean "furnish and install complete and ready to use”.

1.6 VISIT TO THE SITE

A. The Electrical Contractor shall visit the site before submitting his bid so as to be thoroughly familiar with the job conditions and/or peculiarities. No extra payment will be allowed for anything which could have been anticipated from a visit to the site.

1.7 REGULATORY REQUIREMENTS

A. All work under this section shall be accomplished in strict accordance with State codes. Where these plans and specifications conflict with such codes, the codes shall govern.

B. The Electrical Contractor shall notify the Architect or Engineer of such conflicts in writing prior to receipt of bids.

C. References to the National Electrical Code (NEC), Underwriters Laboratories, Inc. (UL), and National Fire Protection Association (NFPA) are a minimum installation requirement.

D. The following regulatory shall be used as minimum standards:

AEIC	American Association of Edison Illuminating Companies
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical and Electronic Engineers
NCCM	N.C. Construction Manual w/G.S. as listed
NCSBC	N.C. State Building Code
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association
U/L	Underwriters' Laboratories, Inc.
OSHA	Occupational Safety and Health Standards
ASHRAE/IES	90.1 energy code

1.8 TEST STANDARDS

A. All material and equipment shall be listed, labeled or certified by a nationally recognized testing laboratory to meet Underwriters Laboratories, Inc., or third party agencies accredited by the North Carolina Building Code Councils latest edition or amendment.

1.9 PERMITS AND FEES

A. NA

1.10 DRAWINGS AND SPECIFICATIONS

A. The Electrical Drawings and Specifications are intended to cover all the work enumerated under the respective headings. The Drawings are diagrammatic only. No Contractor shall take advantage of conflict or error between Drawings and Specifications, or between General Drawings and Mechanical, Plumbing and/or Electrical Drawings, but shall request a clarification of such from the Architect/Engineer, should this condition exist. If there is insufficient time to issue an Addendum for this clarification, the Electrical Contractor shall include in his bid the most expensive of the items in conflict.

B. The Electrical Contractor shall refer to the Architectural and Structural Drawings and Specifications for the general construction of the building, for floors and ceiling heights, for locations of walls, partitions, beams, etc., and shall be guided accordingly for setting of all sleeves, inserts and equipment. No Contractor shall under any circumstances scale drawings for the location of equipment. The Electrical Contractor shall verify the locations of all utility services and electrical equipment.

C. The Electrical Contractor shall keep at least one set of corrected Shop and Design Drawings at the site. Drawings are to be current, denoting approved modifications and actual installed departure. Submit Drawings to Architect/Engineer before final payment is made.

1.11 SUPERVISION

A. The Electrical Contractor performing the work specified shall be required to employ a

qualified superintendent or foreman to continuously supervise the installation of their work, with authorization to act as agent. He shall be capable of checking layouts, coordinating and supervising the work, establishing grades and levels and locating chases, openings, hangers, inserts, sleeves, etc.

PART II - PRODUCTS

2.1 STANDARD PRODUCTS

A. Unless otherwise indicated in writing by the Architect/Engineer, the materials to be provided under this Specification shall be standard products of manufacturers regularly engaged in the production of such equipment and shall be the manufacturer's latest design. All items of the same type or rating shall be identical.

2.2 SUBMITTAL

A. The Electrical Contractor shall submit, for approval, detailed Shop Drawings on all major equipment and where requested. No materials or equipment may be delivered to the job site or installed until the Electrical Contractor has in his possession the approved Shop Drawing for the particular material or equipment. The Electrical Contractor shall furnish the number of copies required by the General or Special Conditions of the contract, but no case less than six (6) copies.

B. Submitted material shall be properly labeled indicating specific service for which material or equipment is to be used, Section and Article Number of Specifications governing, Contractor's name and name of job.

C. Approval of equipment will not relieve the Electrical Contractor of compliance with the Specifications even if such approval is made in writing, unless the attention of the Engineer is called to the non-complying features by letter accompanying the submittal data. Approval of submittal data by the Engineer shall not be construed as a complete check of approval of detailed dimensions, weights, gauges, and similar details with the proposed articles. The conformance with the necessary coordination between the various other Contractors and suppliers shall be solely the responsibility of the Electrical Contractor and with no additional expense to the Owner.

2.3 SUBSTITUTIONS

A. Manufacturer's lists are to establish a standard of quality and not intended to limit the selection to these manufacturers. All materials and equipment which are essential and have not been specified or shown shall be new and of the highest grade and quality free from defect or other imperfections. It should be understood that where the words "furnished and installed" are used, it is intended that the Electrical Contractor shall purchase and install all materials required, unless otherwise noted.

B. All materials and equipment proposed as substitutes for these specified shall require a ten (10) day prior approval from the Engineer prior to the bid date. No substitutions will be allowed after the ten (10) day period before the bid date.

C. All products shall be furnished in compliance with NC General Statute 133-3.

2.4 PRODUCT HANDLING

A. Equipment and materials shall be properly stored, adequately protected, and carefully handled to prevent damage before and during installation. Equipment and materials shall be handled, stored and protected in accordance with the manufacturer's

recommendations and as approved by the Architect/Engineer. Equipment installed with a factory finish shall be fully protected during construction and shall be maintained free of dust, dirt and foreign matter. Dents and other surface damage shall be repaired or replaced to the satisfaction of the Architect/Engineer at no additional cost to the Owner.

B. The Electrical Contractor shall clean up and remove from the job site all waste materials, packaging, crating, and refuse resulting from his work on a daily basis.

2.5 MATERIALS AND WORKMANSHIP

A. The Electrical Contractor shall perform a first class job, both in material and workmanship. None other will be accepted. Deviations from either will be corrected by the Electrical Contractor at the Electrical Contractor's expense.

B. The material used throughout the work, except when otherwise noted, shall be new and of Specification grade and the best of its kind. No substitutes shall be used unless approved by the Architect/Engineer. All work shall be executed with a maximum speed consistent with safety and good workmanship.

C. Any equipment furnished by the Mechanical Contractor or any other Contractor that is larger than those indicated on the Drawings and described in these Specifications or have different Electrical characteristics, the increase in cost to the Electrical Contractor for larger wires, conduit, circuit breakers, switches, etc. or for changes in work already installed shall be borne by the instigating Contractor.

PART III - EXECUTION

3.1 EXCAVATION AND BACKFILL

A. The Electrical Contractor shall preform any and all trench and pit excavation and backfilling required for the installation of his work. Trenches shall be made with the sides vertical and shall be shored where necessary for the protection of men and equipment. All excavation work shall be done in a careful manner to avoid damage to footers and foundations. The backfilling shall be placed in layers not exceeding 4 inches in depth, wetting each layer as it is placed and thoroughly compacting each layer with Mechanical tamper or other approved means. Any damage done during excavation and backfilling operations to roads, sidewalks, curbs, shrubs, sod, footers, foundations, etc. shall be replaced to its original condition prior to construction at no expense to the owner. All work will be approved by the Engineer.

3.2 SCAFFOLDING, RIGGING AND HOISTING

A. The Electrical Contractor shall furnish all necessary scaffolding, staging, rigging and hoisting required for the completion of his work. All such scaffolding, etc., shall be removed from the premises when its use is no longer required on the job.

3.3 CUTTING AND PATCHING

A. The Electrical Contractor shall provide all cutting and patching necessary to install the work specified in the 16000 Sections. The patching shall match adjacent surface material and finishes.

B. No Structural member shall be cut without the approval of the Engineer and all such cutting shall be done in a manner directed by him.

C. Cutting or Holes:

1. Locate holes in advance where they are proposed in the Structural Sections such as ribs or beams. Obtain the approval of the Engineer prior to drilling through Structural Sections.
2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed.

3.4 WATERPROOFING

A. At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight. All work subject to approval of the Engineer.

3.5 EQUIPMENT SPACE AND ARRANGEMENT

A. The equipment shall fit into the space allotted and shall allow adequate clearance for entry, installation, replacement, servicing, and maintenance. The Electrical Contractor shall coordinate the work to ensure that equipment may be moved into place without altering building components or other installations. Access space shall not be less than the equipment manufacturer's requirements. Working clearances shall be not less than N.E.C or other regulatory requirements.

B. These drawings indicate the extent and general arrangement of equipment. If any departures are deemed necessary by the Electrical Contractor, details of such departures and the reasons therefore shall be submitted to the Architect/Engineer for approval as soon as practicable and within 30 days after Award of the Contract. No departure shall be made without written approval of the Architect/Engineer. Any delay on the Contractor's part to provide such submittal will not constitute an extension of the Contract time.

3.6 DAMAGE TO WORK ALREADY IN PLACE

A. The Electrical Contractor shall assume full responsibility for any damage done by him, his agents or employees, to any work already in place. Any such damage done shall be repaired at the Contractor's expense by Mechanics skilled at their respective trades, to the approval of the Architect/Engineer.

3.7 JURISDICTION OF WORK

A. It may become necessary for the Electrical Contractor to furnish labor or materials which are not generally accepted as part of this trade. In cases of this type, he shall contract the work or shall furnish materials and employ workmen of the trade involved in order not to cause any delay or stoppage of work caused by infringement of Trade Agreements as to jurisdiction, alleged or actual.

3.8 COORDINATION WITH OTHER TRADES

A. All work shall be coordinated with other trades involved in the construction project. All work shall be carefully laid out in advance to coordinate Architectural, Structural, Mechanical, Plumbing and Electrical features of construction. The Contractor shall verify at the site all locations, grades, elevations and utility service connections indicated. Any conflicts due to lack of proper coordination shall be brought to the attention of the Architect/Engineer for resolution. The Electrical Contractor shall make required changes or relocations at no additional cost to the Owner.

B. Installation, inspection, and testing of work above ceilings shall be completed and approved by the Architect/Engineer prior to installation of the specified finished ceilings.

However, a Ceiling Suspension System may be installed as required for coordination.

C. The Electrical Contractor shall consult with the other trades at the start of the work and periodically thereafter, as required to properly coordinate the various items of work, and to avoid interferences. Should any interferences of any nature develop as the work progresses, such interferences shall be resolved and eliminated as directed. The cost of any work directed shall be borne by the Subcontractor or Contractors directed to do this work.

3.9 DIVISION OF WORK

A. These paragraphs are intended to show exactly the point of division of work between the Electrical Division and the Mechanical Division or any other division.

C. All equipment covered in the Mechanical Division or any other Division of the Specifications shall be furnished, mounted, and aligned under the respective Division. All starters, controls and wiring for this equipment, including final connection to the same, shall be furnished and installed under that Division.

D. Divisions of the Specifications shall be completed under the respective Division.

E. Under Division 16, the Contractor shall be responsible for providing all line side power wiring, conduit, disconnect switches, and junction boxes as shown on the electrical drawings.

3.10 EQUIPMENT INSTALLATION

A. Manufacturer's Instructions: Equipment shall be installed as recommended by the manufacturer to conform to the requirements of the particular application, in accordance with these Drawings and Specifications.

3.11 OPERATION AND MAINTENANCE MANUALS

A. Prepare maintenance manuals in accordance with Division 1 Section "PROJECT CLOSEOUT". In addition to the requirements specified in Division 1, include the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.

2. Manufacturer's printed Operating Procedures to include start-up, break-in, and routine and normal Operating Instructions; regulation, control, stopping, shutdown, and emergency instructions and summer and winter operating instructions.

3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and re-assembly; aligning and adjusting instructions.

4. Servicing Instructions and Lubrication Charts and Schedules.

3.12 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements in Division 1 Section "PROJECT CLOSEOUT". In addition to the requirements specified in Division 1,

indicate installed conditions for:

1. Major raceway systems, size and location, for both exterior and interior; locations of control devices; distribution and branch electrical circuitry; and fuse and circuit breaker size and arrangements.

2. Equipment locations (exposed and concealed) dimensioned from prominent building lines.

3. Approved substitutions, Contract modifications and actual equipment and materials installed.

3.13 GUARANTEE

A. The Electrical Contractor shall present to the Owner a written guarantee covering his work, including all equipment, material and workmanship. This guarantee shall be against all defects in any of the above work, and shall run for a period of one (1) year from the date of written acceptance of the Contractor's work.

B. Any defective work, equipment, material and/or workmanship that develops within the Guarantee period, which is not caused by ordinary wear or abuse by other persons, shall be replaced by the Electrical Contractor without cost to the Owner.

3.14 FINAL INSPECTION

A. When the entire Contract has been completed and the work is ready for final inspection, the Architect/Engineer or his duly authorized representative will make the inspection. At the time of inspection, the Electrical Contractor shall demonstrate to the Architect/Engineer that the various systems and pieces of equipment have been adjusted to operate in accordance with the requirements of the Contract.

B. An authorized Inspector from the North Carolina Department of Insurance shall inspect the project during construction and upon completion of the construction phase. It shall be the responsibility of the Electrical Contractor to notify the Inspector as the work progresses. The NCDOI Inspector can be reached at (919) 661-5880.

3.15 FINAL PAYMENTS

A. All Final Payments are contingent upon all necessary Certificates and/or Approvals cited above, together with the written Guarantee being presented to the Owner.

3.16 DOCUMENTATION

A. All tests shall be completely documented indicated time of day, temperature, and all pertinent test information.

B. All required documentation of readings shall be submitted to the engineer prior to, and as one of the prerequisites for, final acceptance of the project.

END OF SECTION 16010

SECTION 16050 - BASIC ELECTRICAL MATERIALS AND METHODS

PART I - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes limited Scope, General Construction Materials and Methods for Application with Electrical Installations as follows:

1. Miscellaneous metals for support of electrical materials and equipment.

2. Joint sealers for sealing around electrical materials and equipment; and for sealing penetrations in fire and smoke barriers, floors, and foundation walls.

1.3 DEFINITIONS

A. The following definitions apply to excavation operations:

1. Additional Excavation: Where excavation has reached required subgrade elevations, if unsuitable bearing materials are encountered, continue excavation until suitable bearing materials are reached. The Contract Sum may be adjusted by an appropriate Contract Modification.

2. Sub-Base: As used in this Section refers to the compacted soil layer used in pavement systems between the subgrade and the pavement base course material.

3. Sub-Grade: As used in this Section refers to the compacted soil immediately below the slab or pavement system.

4. Unauthorized excavation consists of removal of materials beyond indicated sub-grade elevations or dimensions without specific direction from the Architect.

1.4 SEQUENCE AND SCHEDULING

A. Coordinate the shut-off and disconnection of electrical service with the Owner and the utility company.

PART II - PRODUCTS

2.1 SOIL MATERIALS

A. Sub-Base Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, or natural or crushed sand.

B. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100 percent passing a 1½ inch sieve, and not more than 5 percent passing a No. 4 sieve.

C. Backfill and Fill Materials: Materials complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, and SP; free of clay, rock, or gravel larger than 2 inches

in any dimension; debris; waste; frozen materials; and vegetable and other deleterious matter.

2.2 MISCELLANEOUS METALS

A. Steel plates, shapes, bars, and bar grating: ASTM A 36.

B. Cold-Formed Steel Tubing: ASTM A 500.

C. Hot-Rolled Steel Tubing: ASTM A 501.

D. Steel Pipe: ASTM A 53, Schedule 40, welded.

E. Fasteners: Zinc-coated, type, grade and class as required.

PART III - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting installation and application of joint sealers. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 EXCAVATION

A. Slope sides of excavations to comply with local codes and ordinances. Shore and brace as required for stability of excavation.

B. Install sediment and erosion control measures in accordance with local codes and ordinances.

C. Dewatering: Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding project site and surrounding area.

1. Do not allow water to accumulate in excavations. Remove water to prevent softening of bearing materials.

2. Provide and establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey surface water to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.

D. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.

1. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.

2. Remove and legally dispose of excess excavated materials and materials not acceptable for use as backfill or fill.

E. Trenching: Excavate trenches for electrical installations as follows:

1. Excavate trenches to the uniform width, sufficiently wide to provide ample working room and a minimum of 6 to 9 inches clearance on both sides of raceways and equipment.

2. Excavate trenches to depth indicated or required.

3. Limit the length of open trench to that in which installations can be made and the trench backfilled within the same day.

4. Where rock is encountered, carry excavation below required elevation and backfill with a layer of crushed stone or gravel prior to installation of raceways and equipment. Provide a minimum of 6 inches of stone or gravel cushion between rock bearing surface and electrical installations.

F. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F (1 degree 2 C).

G. Backfilling and Filling: Place soil materials in layers to required subgrade elevations for each area classification listed below, using materials specified in Part 2 of this Section.

1. Under walks and pavements, use a combination of sub-base materials and excavated or borrowed materials.

2. Under building slabs, use drainage fill materials.

3. Under piping and equipment, use subbase materials where required over rock bearing surface and for correction of unauthorized excavation.

4. For raceways less than 30 inches below surface of roadways, provide 4-inch thick concrete base slab support. After installation of raceways, provide a 4-inch thick concrete encasement (sides and top) prior to backfilling and placement of roadway sub-base.

5. Other areas, use excavated or borrowed materials.

H. Backfill excavations as promptly as work permits, but not until completion of the following:

1. Inspection, testing, approval, and locations of underground utilities have been recorded.

2. Removal of concrete formwork.

3. Removal of shoring and bracing and backfilling of voids.

4. Removal of trash and debris.

I. Placement and Compaction: Place backfill and fill materials in layers of not more than eight (8) inches in loose depth for material compacted by heavy equipment, and not more than four (4) inches in loose depth for material compacted by hand operated tampers.

J. 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 specified below. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

K. Place backfill and fill materials evenly adjacent to structures, piping, and equipment to required elevations. Prevent displacement of raceways and equipment by carrying material uniformly around them to approximately same elevation in each lift.

L. Compaction: Control soil compaction during construction, providing minimum percentage of density specified for each area classification indicated below.

1. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture density relationship (cohesive soils), determined in accordance with ASTM D 1557 and not less than the following percentages of relative density, determined in accordance with ASTM D 2049, for soils which will not exhibit a well-defined moisture density relationship (cohesion-less soils).

2. Areas Under Structures, Building Slabs and Steps, Pavements: Compact top 12 inches of material, or 95 percent relative density for cohesionless material.

    a. Areas Under Walkways: Compact top 6 inches of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material or 95 percent relative density for cohesionless material.

    b. Other Areas: Compact top 6 inches of subgrade and each layer of backfill or fill material to 85 percent maximum density for cohesive soils, and 90 percent relative density for cohesionless soils.

3. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water. Apply water in minimum quantity necessary to achieve required moisture content and to prevent water appearing on surface during, or subsequent to, compaction operations.

4. Subsidence: Where subsidence occurs at electrical installation excavations during the period 12 months after Substantial Completion, remove surface treatment (i.e., pavement, lawn, or other finish), add backfill material, compact to specified conditions, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent areas.

3.3 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal fabrications accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS "Structural Welding Code".

END OF SECTION 16050

SECTION 16100 - RACEWAYS, BOXES AND CABINETS

PART I - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes Raceways, Fittings, Boxes, Enclosures and Cabinets for Electrical Wiring.

PART II - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Rigid Steel Conduit: ANSI C80.1

B. Intermediate Metal Conduit: ANSI C80.6

C. Electrical Metallic Tubing and Fittings: ANSI C80.3 with compression-type fittings.

D. Flexible Metal Conduit: Zinc coated steel

E. Liquid tight Flexible Metal Conduit: Flexible steel conduit with PVC jacket.

F. Fittings: NEMA FB 1, compatible with conduit/tubing materials.

G. Non-Metallic Rigid Conduit: Schedule 40 pvc as where shown on the drawings.

H. "MC" type cable.

2.2 OUTLET AND DEVICE BOXES

A. Sheet Metal Boxes: NEMA OS 1

B. Cast Metal Boxes: NEMA FB 1, type FD, cast alloy box with gasketed cover

2.3 PULL AND JUNCTION BOXES

A. Small Sheet Metal Boxes: NEMA OS 1.

B. Cast Metal Boxes: NEMA FB 1, cast aluminum with gasketed cover.

C. Pull Boxes: Code gauge steel with screw type removable cover. NEMA rated for the condition.

PART III - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of the raceway system. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 MINIMUM CONDUIT SIZE: (unless indicated otherwise) on the drawings conduit shall be sized as follows:

A. Indoors: The minimum conduit size shall be 1/2".

1. Flexible metal conduit may be used for tap connection to recessed lighting fixtures.

B. Outdoors: Branch circuit conduit installed below grade to exterior equipment shall be one (1) inch minimum unless noted otherwise.

3.3 WIRING METHODS: Unless noted otherwise on the drawings the following materials shall be used:

A. Outdoors: Use the following wiring methods:

1. Exposed: Rigid or intermediate metal conduit.

2. Underground: Galvanized Rigid Conduit.

3. Connection to Vibrating Equipment (including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment): Liquid tight flexible metal conduit.

4. Boxes and Enclosures: NEMA Type 3R or Type 4.

B. Indoors: Use the following wiring methods:

1. Connection to Vibrating Equipment (including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment): Flexible metal conduit, except in wet or damp locations use liquid tight flexible metal conduit.

2. Damp or Wet Locations: Rigid steel conduit.

3. Exposed: Electrical metallic tubing above 8 feet and rigid metallic conduit below eight (8) feet.

4. Concealed: Electrical metallic tubing or MC cable.

5. Boxes and Enclosures: NEMA Type 1, except in damp or wet locations use NEMA Type 3R, unless otherwise noted.

3.4 INSTALLATION

A. Telephone/Data/Cable TV outlet boxes shall be 2 gang with appropriate trim and cover. Coordinate cover plates with Owner.

B. Provide insulated bushings for all conduit ends.

C. Conceal rigid conduit and EMT, unless otherwise indicated, within finished walls, ceilings, above attic space and below floors.

D. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot water pipes. Install horizontal raceway runs above water and steam piping.

E. Install raceways level and square and at proper elevations. Provide adequate headroom.

F. Complete raceway installation before starting conductor installation.

G. Use temporary closures to prevent foreign matter from entering raceway.

H. Protect stubs from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

I. **Where non-metallic conduit is shown to be used below the slab provide rigid conduit to turn up into the building space or at all exterior walls, poles or equipment.**

J. Use raceway fittings compatible with raceway and suitable for use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings, except as otherwise indicated.

K. Run concealed raceways with a minimum of bends in the shortest practical distance considering the type of building construction and obstructions, except as otherwise indicated. Where the number of bends exceed the total number required by the N.E.C., provide pull boxes as required by code.

L. Install raceways parallel to or at right angles to surfaces or structural members, and follow the surface contours as much as practical.

1. Run parallel or banked raceways together, on common supports where practical.

2. Make bends in parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where they can be installed parallel; otherwise, provide field bends for parallel raceways.

M. Join raceways with fittings designed and approved for the purpose and make joints tight.

1. Use bonding jumpers where joints cannot be made tight.

2. Use insulating bushings to protect conductors.

3. Provide expansion joint fittings where required for the raceway used.

N. IMC and GRC shall terminate with either a double locknut/bushing set or in a threaded hub.

O. Where conduit type "LB" fittings are used all conduits on conduits over 2" in size shall be "MOGAL" type.

P. "EMT" connectors shall be steel plated hexagonal compression type only. Do not use pot metal, set-screw, or indenter type connectors.

Q. Where concentric, eccentric, or oversized knockouts are encountered, a grounding-type insulated bushing shall be provided.

R. Where conduits of any type pass over a building expansion joint, a standard “expansion joint” fitting, compatible with the type raceway, shall be provided.

S. Terminations: Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely and install the locknuts with dished part against the box. Where terminations cannot be made secure with one locknut, use two locknuts, one inside and one outside the box.

T. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box and tighten the chase nipple so no threads are exposed.

U. Install pull cords in all empty raceways. Use monofilament plastic line having not less than 200-lb (90 kg) tensile strength. Leave not less than 12 inches (300 mm) of slack at each end of the pull cord.

V. Telephone and Signal System Raceways 2 Inch Trade Size and Smaller: In addition to the above requirements, install in maximum lengths of 150 feet (45 m) and with a maximum of two 90-degree bends or equivalent. Install pull or junction boxes where necessary to comply with these requirements. Pull boxes shall be a minimum of 10" square x 6" deep with removable cover.

W. Install raceway sealing fittings at suitable, approved, accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points and elsewhere as indicated:

1. Where conduits enter or leave hazardous classified locations.

2. Where conduits pass from warm locations to cold locations, such as exterior spaces and air-conditioned spaces.

3. Where otherwise required by the NEC.

X. Stub-Up Connections: Extend conduits through concrete floor a minimum of 6" for connection to freestanding equipment. Extend conductors to equipment with flexible metal conduit. Where equipment connections are not made under this Contract verify the length of the flexible connectors.

Y. Flexible Connections: Use maximum of 6 feet (1830 mm) of flexible conduit for recessed and semi-recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquid tight flexible conduit in wet or damp locations. Install separate ground conductor.

AA. Provide grounding connections for raceway, boxes and components. Tighten connectors and terminals according to tightening torques specified in UL Standard 486A.

BB. All underground raceways shall be identified by "UNDERGROUND LINE MARKING TAPE" located directly above the raceway at 6" below finished grade. Tape shall be permanent, bright-colored, continuous, magnetic strip, printed, plastic tape compounded for direct burial not less than 6" wide and 4 mils thick. Printed legend shall be indicative of the service it is marking. Provide sufficient tape not less than 2/3 of the width of the item marked for the full length of the Raceway.

CC. Where underground raceways are required to turn up into cabinets, equipment, etc., and on to poles, the elbow required and the sub-up out of the slab or earth shall be rigid steel.

DD. Where shown to be used on the drawings PVC non-metallic conduit used exterior to the building for grouped circuits it shall be encased in a minimum of 3" of 3000 psi rated concrete. Concrete encased non-metallic ducts shall be supported on plastic separators coordinated with duct size and spacing. Separators shall be spaced close enough to prevent sagging and deforming of ducts. Secure separators to the earth and to ducts to prevent floating during placement of concrete. Do not use steel or tie wires in such a way

to form conductive or magnetic loops around ducts or duct groups.

EE. The Raceway System shall not be relied on for grounding continuity. A green grounding conductor, properly sized per NEC Table 250-122, shall be run in all power raceways.

FF. Where non-metallic conduit is allowed on the drawings all bends and off-sets shall be made by approved mechanical benders per the manufacturers instruction. Any conduit not in compliance will be removed.

3.5 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, to ensure that coatings, finishes, and cabinets are without damage or deterioration at Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to paint finishes with matching touch-up coating recommended by the manufacturer.

3.6 CLEANING

A. Upon completion of installation of system, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt and construction debris and repair damaged finish, including chips.

END OF SECTION 16100

SECTION 16120 - WIRES AND CABLES

PART I - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes Building Wires and Cables and Associated Splices, Connectors and Terminations for Wiring Systems rated 600 Volts and Less.

PART II - PRODUCTS

2.1 BUILDING WIRES AND CABLES

A. UL-listed building wires and cables with conductor material, insulation type, cable construction, and rating as specified in Part 3 "Applications" Article.

B. Rubber Insulation: Conform to NEMA WC 3.

C. Thermoplastic Insulation: Conform to NEMA WC 5.

D. Cross-Linked Polyethylene Insulation: Conform to NEMA WC 7.

E. Ethylene Propylene Rubber Insulation: Conform to NEMA WC 8.

F. Solid conductor for 10 AWG and smaller: Stranded conductor for larger than 10 AWG.

2.2 CONNECTORS AND SPLICES

A. UL-listed factory fabricated wiring connectors of size, ampacity rating, material, and type and class for application and for service indicated.

PART III - EXECUTION

3.1 EXAMINATION

A. Examine raceways and building finishes to receive wires and cables for compliance with installation tolerances and other conditions. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Feeders and Branch Circuits: Type THHN\THWN or XHHW, copper conductor, in raceway.

3.3 INSTALLATION

A. All conductors shall be copper.

B. Minimum conductor size for power and lighting circuits shall be #12 AWG. Maximum conductor size shall be 500 KCMIL AWG.

C. All power and lighting circuits #10 awg and smaller shall be solid copper conductors. Conductor sizes #8 awg and larger shall be Class "B" stranded copper conductors.

D. Pull conductors into raceway simultaneously where more than one is being installed in same raceway.

1. Use pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation.

2. Use pulling means, including fish tape, cable, rope, and basket weave wire/cable grips that will not damage cables or raceway.

E. Conductor Splices: Keep to minimum.

F. Wiring at Outlets: Install with at least 8 inches of slack conductor at each outlet.

G. Connect outlets and components to wiring and to ground as indicated. Tighten to UL Standard 486A.

H. Power and Lighting circuits shall have individual neutral conductors.

I. All power circuits noted for computer equipment with isolated grounding shall be individually installed in a separate conduit with separate phase, neutral conductor, grounding conductor, and isolated grounding conductor, unless noted otherwise.

J. In no case shall any wire installed to a device exceed the U.L. rating of the device.

3.4 SPLICING

A. Joints in solid conductors shall be using Idea "wire nuts", 3M Company "scotch lock", or "T&B" "PIGGY" connectors in junction boxes, outlet boxes and lighting fixtures.

B. "Sta-kon" or other permanent type crimp connectors shall not be used for branch circuit connections.

C. Joints in stranded conductors shall be spliced by approved mechanical connectors. Solderless mechanical connectors similar to "NSI" multi-cable connector blocks for splices and taps, provided with UL approved insulating covers, may be used instead of mechanical connectors plus tape.

D. Conductors in all cases, shall be continuous from outlet to outlet unless "taps" are required and shall be made only within outlet, junction boxes, troughs and gutters.

3.5 VOLTAGE DROP

A. Where conductor length from the panel to the first outlet on a 120 volt circuit exceeds 100 feet, the branch circuit conductors from the panel to the first outlet shall be not smaller than #10 awg.

3.6 FIELD QUALITY CONTROL

A. Testing: Upon installation of wires and cables and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each Visual and Mechanical Inspection and Electrical Test stated in NETA Standard ATS, Section 7.3.1. Certify compliance with test parameters.

B. Correct malfunctioning products at site, where possible, and re-test to demonstrate compliance; otherwise, remove and replace with new units and re-test.

3.7 ELECTRICAL TESTING

A. Feeder Insulation Resistance Testing:

1. All current carrying phase conductors and neutrals shall be tested as installed, and before connections are made, for insulation resistance and accidental grounds. This shall be done with a 500-volt megger. The procedures listed below shall be followed:

2. Minimum readings shall be one million (1,000,000) or more ohms for # 6 AWG wire and smaller, 250,000 ohms or more for #4 wire or larger, between conductor and the grounding conductor.

3. After all devices and equipment are installed and all connections completed to each panel, the Contractor shall disconnect the neutral feeder conductor from the neutral bar and take a megger reading between the neutral bar and the grounded enclosure. If this reading is less than 250,000 ohms, the Contractor shall disconnect the branch circuit neutral wires from the neutral bar. Test each neutral conductor separately until the low readings are found. The Contractor shall correct troubles, reconnect and re-test until at least 250,000 ohms from the neutral bar to the grounded panel can be achieved with only the neutral feeder disconnected.

4. The Contractor shall send a letter to the Engineer certifying that the above has been done and tabulating the megger readings for each panel. This shall be done at least four (4) days prior to final inspection.

5. At the final inspection, the Contractor shall furnish a megger and show the Engineers that the panels comply with the above requirements. He shall also furnish a hook-on type ammeter and a voltmeter and take current and voltage readings as directed by the representatives.

END OF SECTION 16120

SECTION 16140 - WIRING DEVICES

PART I - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes various types of receptacles, connectors, switches and finish plates.

1.3 SUBMITTALS

A. Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each product specified.

PART II - PRODUCTS

2.1 WIRING DEVICES

A. Comply with NEMA Standard WD 1-101968, "General Purpose Wiring Devices".

B. Enclosures: NEMA 1 equivalent, except as otherwise indicated.

C. Color: Selected by Architect.

D. Duplex receptacles shall be of the grounding type arranged for back and side wiring, with separate single or double grounding terminals. Receptacles shall be straight blade, rated 20 amp, 125 volt and the face configuration shall conform to the NEMA Standard No. WDI.101968, and shall be approved third party listed. Self-grounding or automatic type grounding receptacles are not acceptable in lieu of receptacles with separate grounding screw lugs and a direct green insulated conductor connection to the equipment grounding system. Receptacles shall be specification grade mounted vertically.

E. Receptacles, Straight-Blade, Special Features: Comply with the basic requirements specified above for straight-blade receptacles of the class and type indicted, and with the following additional requirements:

1. Ground Fault Circuit Interrupter (GFCI) Receptacles: UL Standard 943, "Ground Fault Circuit Interrupters" with integral NEMA 5-20R duplex receptacle. Design units for installation in a 2¾ inch (70-mm) deep outlet box without an adapter.

2. Isolated Ground Receptacles: Equipment grounding contacts are connected only to the green grounding screw terminal of the device and have inherent electrical isolation from the mounting strap.

a. Devices: Listed and labeled as isolated ground receptacles.

b. Isolation Method: Integral to the receptacle construction and not dependent on removable parts.

c. Color: Orange with "green" triangle.

F. Receptacles, Industrial Heavy-Duty: Conform to NEMA Standard PK 4 "Plugs, Receptacles and Cable Connectors of the Pin and Sleeve type for Industrial Use".

G. Plug Sets: Match voltage and current ratings and number of conductors to requirements of the equipment being connected.

H. Single pole and three/four-way toggle type Snap Switches: Shall be 20 amp 120/277v. a.c. rated, quiet-type a.c. switches, NRTL listed and labeled as complying with UL Standard 20 "General Use Snap Switches" and with Federal Specification W-S-896. Color selected by Architect.

I. Dimmer Switches: Modular full-wave solid-state units with integral, quiet On/Off switches, and audible and electromagnetic noise filters. See plans for model numbers.

1. Wattage rating shall be 2000 watts minimum, except as otherwise indicted.

2. Control: Continuously adjustable slide or toggle. Single pole or 3-way switch to suit conditions.

J. Motion Sensor Switches

1. Single Pole-single switching- Hubbell Model LHMTS1

2. Single Pole-double switching-Hubbell Model LMHTD2

3. Switches shall be combination ultrasonic and passive infrared.

4. 100 square foot coverage, 180 degree.

5. 120 volt: 800 watt incandescent, 1000 watt fluorescent.

6. 277 volt, 1800 watt fluorescent.

7. 5 year warranty.

8. Equals by Wattstopper and Lutron.

K. Wall Plates: Single and combination types that mate and match with corresponding wiring devices. Features include the following:

1. Color: Matches wiring device except as otherwise indicate.

2. Plate-Securing Screws: Metal with heads colored to match plate finish

2.2 FLOOR SERVICE OUTLET ASSEMBLIES

A. Types: Modular, above-floor, or recessed in floor, dual service units suitable for the wiring method indicated.

B. Compartmentation: Barrier separates power and signal compartments.

C. Housing Material: Die-cast aluminum, satin finished.

D. Power Receptacle: NEMA configuration 5-20R, ivory finish, except as otherwise indicated.

E. Signal Outlet: Blank cover with bushed cable opening, except as otherwise indicated.

2.3 MULTI-OUTLET ASSEMBLIES

A. Comply with Standard UL 5, "Surface Metal Raceways and Fittings".

B. Components of Assemblies: Products of a single manufacturer designed to be used together to provide a complete matching assembly of raceways and receptacles.

C. Raceway Material: Metal with manufacturer's standard corrosion-resistant finish.

PART III - EXECUTION

3.1 INSTALLATION

A. Install devices and assemblies plumb and secure.

B. Install wall plates when painting is complete.

1. Arrangement of Devices: Except as otherwise indicated, mount flush, with long dimension vertical and grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.

C. Protect devices and assemblies during painting.

D. Adjust locations at which floor service outlets are installed to suit the indicated arrangement of partitions and furnishings.

E. Field verify the actual location of all outlet devices above equipment or counter tops before rough-in and installation. Any outlet installed in conflict with equipment or conditions that could have been avoided, will be corrected at the Contractor's expense.

F. Provide weatherproof cast aluminum cover plates for all device’s exterior to the building or in "wet" locations, Hubbell WP26M or equal. Ensure covers for outdoor receptacles are Extra Duty rated per 2017 NEC 406.9(B)(1).

G. GFCI protection shall be provided for all receptacles exterior to the building, in restrooms or where required by Code.

H. Locate all receptacles in rated walls with 24" minimum horizontal separation. This includes devices located opposite each other in the walls.

3.2 IDENTIFICATION

A. Comply with Division 16 Section "Electrical Identification".

1. Switches: Where 3 or more switches are ganged and elsewhere where indicated, identify each switch with approved legend engraved on wall plate.

2. Receptacles: Identify the panelboard and circuit number from which served. Use machine-printed, pressure-sensitive, abrasion-resistant label tape on face of plate and durable wire markers or tags within outlet boxes.

3.3 GROUNDING

A. Isolated Ground Receptacles: Connect to isolated grounding conductor routed to

designated isolated equipment ground terminal of Electrical System.

3.3 FIELD QUALITY CONTROL

A. Testing: Test wiring devices for proper polarity and ground continuity. Operate each operable device at least six (6) times.

B. Test ground-fault circuit interrupter operation with both local and remote fault simulations according to manufacturer recommendations.

C. Replace damaged or defective components.

3.4 CLEANING

A. General: Internally clean devices, device outlet boxes and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION 16140

SECTION 16140 - WIRING DEVICES

PART I - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes various types of receptacles, connectors, switches and finish plates.

1.3 SUBMITTALS

A. Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each product specified.

PART II - PRODUCTS

2.1 WIRING DEVICES

A. Comply with NEMA Standard WD 1-101968, "General Purpose Wiring Devices".

B. Enclosures: NEMA 1 equivalent, except as otherwise indicated.

C. Color: Selected by Architect.

D. Duplex receptacles shall be of the grounding type arranged for back and side wiring, with separate single or double grounding terminals. Receptacles shall be straight blade, rated 20 amp, 125 volt and the face configuration shall conform to the NEMA Standard No. WD-1, NEMA WD-6, DSCC W-C-596G & UL 498, and shall be approved third party listed. Self-grounding or automatic type grounding receptacles are not acceptable in lieu of receptacles with separate grounding screw lugs and a direct green insulated conductor connection to the equipment grounding system. Receptacles shall be specification grade mounted vertically.

E. Receptacles, Straight-Blade, Special Features: Comply with the basic requirements specified above for straight-blade receptacles of the class and type indicted, and with the following additional requirements:

1. Ground Fault Circuit Interrupter (GFCI) Receptacles: UL Standard 943, "Ground Fault Circuit Interrupters" with integral NEMA 5-20R duplex receptacle. Design units for installation in a 2¾ inch (70-mm) deep outlet box without an adapter.

F. Receptacles, Industrial Heavy-Duty: Conform to NEMA Standard PK 4 "Plugs, Receptacles and Cable Connectors of the Pin and Sleeve type for Industrial Use".

G. Plug Sets: Match voltage and current ratings and number of conductors to requirements of the equipment being connected.

H. Single pole and three or four-way toggle type as indicated on the drawings. Switches shall be of the grounding type with hex-head grounding screw rated 20 amp 120/277V

AC only. Lighted handle switches shall have neon lights of the correct voltage rating where indicated on the drawings. All switches shall have quiet operating mechanisms without the use of mercury switches. All switches shall be listed by an approved third-party agency, approved for the voltage and amperage indicated. Color selected by Architect.

I. Motion Sensor Switches

1. Single Pole-single switching

2. Single Pole-double switching

3. Switches shall be combination ultrasonic and passive infrared.

4. 100 square foot coverage, 180 degree.

5. 120 volt: 800 watt incandescent, 1000 watt fluorescent.

6. 277 volt, 1800 watt fluorescent.

7. 5 year warranty.

J. Wall Plates: Single and combination types that mate and match with corresponding wiring devices. Features include the following:

1. Material for Finished Spaces: 0.04 inch thick, type 302, satin finished stainless steel, intermediate jumbo size except as otherwise indicated.

2. Material for Unfinished Spaces: Galvanized cast ferrous steel, standard size.

3. Provide a quantity of 2% spare cover plates for each type of device cover used to the Owner.

PART III - EXECUTION

3.1 INSTALLATION

A. Install devices and assemblies plumb and secure.

B. Install wall plates when painting is complete.

1. Arrangement of Devices: Except as otherwise indicated, mount flush, with long dimension vertical and grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.

C. Protect devices and assemblies during painting.

D. Adjust locations at which floor service outlets are installed to suit the indicated arrangement of partitions and furnishings.

E. Field verify the actual location of all outlet devices above equipment or counter tops before rough-in and installation. Any outlet installed in conflict with equipment or conditions that could have been avoided, will be corrected at the Contractor's expense.

F. Provide weatherproof cast aluminum cover plates for all devices exterior to the building or in "wet" locations, Hubbell WP26M or equal.

G. GFCI protection shall be provided for all receptacles exterior to the building, in restrooms or where required by Code.

H. Locate all receptacles in rated walls with 24" minimum horizontal separation. This includes devices located opposite each other in the walls.

3.2 IDENTIFICATION

A. Comply with Division 16 Section "Electrical Identification".

1. Switches: Where 3 or more switches are ganged and elsewhere where indicated, identify each switch with approved legend engraved on wall plate.

2. Receptacles: Identify the panelboard and circuit number from which served. Use machine-printed, pressure-sensitive, abrasion-resistant label tape on face of plate and durable wire markers or tags within outlet boxes.

3.3 FIELD QUALITY CONTROL

A. Testing: Test wiring devices for proper polarity and ground continuity. Operate each operable device at least six (6) times.

B. Test ground-fault circuit interrupter operation with both local and remote fault simulations according to manufacturer recommendations.

C. Replace damaged or defective components.

3.4 CLEANING

A. General: Internally clean devices, device outlet boxes and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION 16140

SECTION 16190 - SUPPORTING DEVICES

PART I - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes secure support from the building structure for Electrical items by means of Hangers, Supports, Anchors, Sleeves, Inserts, Seals and Associated Fastenings.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data for each type of product specified.

PART II - PRODUCTS

2.1 COATINGS

A. Coating: Supports, support hardware and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish and inherent material characteristic. Products for use outdoors shall be hot-dip galvanized.

2.2 MANUFACTURED SUPPORTING DEVICES

A. Raceway Supports: Clevis hangers, riser clamps, conduit straps, threaded C clamps with retainers, ceiling trapeze hangers, wall brackets and spring steel clamps.

1. Expansion Anchors: Carbon steel wedge or sleeve type.

2. Toggle Bolts: All steel spring-head type.

B. Conduit Sealing Bushings: Factory-fabricated watertight conduit sealing bushing assemblies suitable for sealing around conduit or tubing passing through concrete floors and walls. Construct seals with steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps and cap screws.

C. U-Channel Systems: 16-gage steel channels, with 9/16-inch diameter holes, at a minimum of 8 inches on center, in top surface. Provide fittings and accessories that mate and match with U-channel and are of the same manufacturer.

2.3 FABRICATED SUPPORTING DEVICES

A. General: Shop or field fabricated supports or manufactured supports assembled from U-Channel components.

B. Steel Brackets: Fabricated of angles, channels and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.

C. Pipe Sleeves: Provide pipe sleeves of one of the following:

1. Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snap-lock joint, welded spiral seams, or welded longitudinal joint. Fabricate sleeves from the following gage metal for sleeve diameter noted:

   a. 3-inch and smaller: 20-gage
   b. 4-inch to 6-inch: 16-gage

2. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe.

3. Plastic Pipe: Fabricate from Schedule 80 PVC plastic pipe.

PART III - EXECUTION

3.1 INSTALLATION

A. Install supporting devices to fasten electrical components securely and permanently in accordance with NEC requirements.

B. Coordinate with the building structural system and with other electrical installation.

C. Raceway Supports: Comply with the NEC and the following requirements:

1. Strength of each support shall be adequate to carry present and future load multiplied by a safety factor of at least four. Where this determination results in a safety allowance of less than 200 lbs, provide additional strength until there is a minimum of 200 lbs safety allowance in the strength of each support.

2. Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments and other hardware necessary for hanger assembly and for securing hanger rods and conduits.

3. Support parallel runs of horizontal raceways together on trapeze-type hangers.

4. Support individual horizontal raceways by separate pipe hangers. Spring steel fasteners may be used in lieu of hangers only for 1 inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings only. For hanger rods with spring steel fasteners, use ¼ inch diameter or larger threaded steel. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing.

5. Space supports for raceway's types not covered by the above in accordance with NEC.

6. Support exposed and concealed raceway within 1 foot of an unsupported box and access fittings. In horizontal runs, support at the box and access fittings may be omitted where box or access fittings are independently supported and raceway terminals are not made with chase nipples or threadless box connectors.

7. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports with no weight load on raceway terminals.

8. In interior spaces provide a minimum of ¼ inch space for all conduits installed on

the exterior building walls. Approved "clamp-back" or strut devices shall be used.

D. Miscellaneous Supports: Support miscellaneous electrical components as required to produce the same structural safety factors as specified for raceway supports. Install metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers and other devices.

E. In open overhead spaces, cast boxes threaded to raceways need not be supported separately except where used for fixture support; support sheet metal boxes directly from the building structure or by bar hangers. Where bar hangers are used, attach the bar to raceways on opposite sides of the box and support the raceway with an approved type of fastener not more than 24 inches from the box.

F. Conduit Seals: Install bushing seals for conduit penetrations of slabs on grade and exterior walls below grade. Tighten sleeve seal screws until sealing grommets have expanded to form watertight seal.

G. Fastening: Unless otherwise indicated, fasten electrical items and their supporting hardware securely to the building structure, including but not limited to conduits, raceways, cables, cable trays, bus ways, cabinets, panelboards, transformers, boxes, disconnect switches and control components in accordance with the following:

1. Fasten by means of wood screws or screw-type nails on wood, toggle bolts on hollow masonry units, concrete inserts or expansion bolts on concrete or solid masonry and machine screws, welded threaded studs, or spring-tension clamps on steel. Do not weld conduit, pipe straps or items other than threaded studs to steel structures. In partitions of light steel construction, use sheet metal screws.

END OF SECTION 16190

SECTION 16195 - ELECTRICAL IDENTIFICATION

PART I - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes Identification of Electrical Materials, Equipment and Installations.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product Data for each type of product specified.

PART II - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Ideal Industries, Inc.
2. National Band and Tag Co.
3. Panduit Corp.
4. Seton Name Plate Co.
5. Standard Signs, Inc.
6. W.H. Brady, Co.

2.2 ELECTRICAL IDENTIFICATION PRODUCTS

A. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape not less than 3 mils thick by 1 inch to 2 inches in width. Colors to match color schemes noted herein.

B. Underground Line Marking Tape: Permanent, bright colored, continuous printed, metallic strip, plastic tape compounded for direct burial service not less than 6 inches wide by 4 mils thick. Printed legend indicative of general type of underground line below.

C. Wire/Cable Designation Tape Markers: Vinyl or vinyl cloth, self adhesive, wrap-around, cable/conductor markers with pre-printed numbers and letter.

D. Furnish and install engraved laminated phenolic nameplates for all safety switches, panelboards, transformers, switchboards, switchboard branch breakers, motor control centers and other electrical equipment. Nameplates shall be securely attached with self-tapping stainless steel screws, if the screw end is protected; otherwise rivets shall be used. Letters shall be approximately ½" high minimum. Embossed self-adhesive tape is not acceptable for marking equipment.

E. Cable Ties: Fungus inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18-inch minimum width, 50-lb minimum tensile strength, and suitable for a temperature

range from minus 50 degrees F to 350 degrees F. Provide ties in specified colors when used for color coding.

PART III - EXECUTION

3.1 INSTALLATION

A. Lettering and Graphics: Coordinate names, abbreviations, colors and other designations used in Electrical Identification work with corresponding designations specified or indicated. Install numbers, lettering, and colors as approved in submittals and as required by code.

B. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work.

C. Identify Junction, Pull, and Connection Boxes: Install on outside of box cover. Label box covers with identity of contained circuits. Use pressure-sensitive plastic labels at exposed locations and similar labels concealed boxes. Color code boxes as indicated below. Method shall be by colored adhesive not less than 4 square inches for 4" boxes and larger boxes. Permanent type "magic" markers are not accepted as a means of identification.

120/208 volt blue

D. Underground Electrical Line Identification: During trench backfilling, for exterior underground power, signal and communications lines, install continuous underground plastic line marker, located directly above line at 6 inches below finished grade where multiple lines are installed in a common trench or concrete envelope. Provide marker tape to cover 2/3 of the overall width.

E. Conductor Color Coding: Provide color coding for secondary service, feeder, and branch circuit conductors throughout the project secondary electrical system as follows:

230/120 Volts	**Phase**
Black	A
Red	B
White	Neutral
Green	Ground

G. Use conductors with color factory-applied the entire length of the conductors except as follows:

1. The following field-applied color-coding methods may be used in lieu of factory-coded wire for sizes larger than No. 10 AWG.

a. Apply colored, pressure-sensitive plastic tape in half- lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply the last two laps of tape with no tension to prevent possible unwinding. Use 1-inch wide tape in colors as specified. Do not obliterate cable identification markings by taping. Tape locations may be adjusted slightly to prevent such obliteration minimum width 2".

H. Tag or label conductors as follows:

1. Multiple Circuits: Where multiple branch circuits or control wiring or

communications/signal conductors are present in the same box or enclosure (except for three-circuit, four-wire home runs), label each conductor or cable. Provide legend indicating source, voltage, circuit number, and phase for branch circuit wiring. Phase and voltage of branch circuit wiring may be indicated by mean of coded color of conductor insulation. For control and communications/signal wiring, use color coding or wire/cable marking tape at terminations and at intermediate locations where conductors appear in wiring boxes, troughs, and control cabinets. Use consistent letter/number conductor designations throughout on wire/cable marking tapes.

2. Match identification markings with designations used in panelboards shop drawings, Contract Documents, and similar previously established identification schemes for the facility's electrical installations.

I. Install equipment/system circuit/device identification as follows:

1. Apply equipment identification labels of engraved plastic-laminate on each major unit of electrical equipment in building, including central or master unit of each electrical system. This includes communication/signal/alarm systems, unless unit is specified with its own self-explanatory identification. Except as otherwise indicated, provide single line of text, with 1/2 inch high lettering on 1½ inch high label (2 inch high where two lines are required), white lettering in blue field for normal power equipment other face colors shall match the equipment served. Text shall match terminology and numbering of the Contract Documents and shop drawings.

2. All Phenolic labels shall be securely attached to the equipment by self-tapping stainless steel screws.

3. Name plate colors shall be as follows:

....Blue surface with white core for 120/230 Volt Equipment.

J. Apply circuit/control/item designation labels of engraved plastic laminate for disconnect switches, breakers, pushbuttons, pilot lights, motor control centers, and similar items for power distribution and control components above, except panelboards and alarm/signal components, where labeling is specified elsewhere. For panelboards, provide framed, typed circuit schedules with explicit description and identification of items controlled by each individual breaker. Pencil in all spare and leave spaces blank.

K. All outlet boxes, junction boxes and pull boxes shall have their covers and exterior visible surfaces painted with colors to match the surface color scheme specified. This includes covers on boxes above lay-in and other type accessible ceilings.

L. All empty conduit runs and conduit with conductors for future use shall be identified for use and shall indicate where they terminate. Identification shall be by pressure sensitive label applied to the conduit or outlet; designate "use" and "location served".

END OF SECTION 16195

SECTION 16430 - LOW-VOLTAGE LIGHTING CONTROL SYSTEM

PART I - GENERAL

1.1 SUMMARY

A. The intent of this set of Specifications is to provide a Complete, Functional, Low-Voltage Lighting Control System for the Control of Incandescent and LED Lighting Sources.

B. Where shown on the Drawings, the Contractor shall furnish and install a complete low-voltage lighting control system consisting of, but not limited to, Relays, Contactors, Controllers, Enclosures, Switch Station and Miscellaneous Components as required for a complete, operable Lighting Control System.

C. Where applicable standards have been established, all items of equipment, individual components and installation methods shall meet the requirements of these standards, including, but not limited to, Underwriter Laboratories (UL), the National Electrical Code (NEC), Federal Communications Commission (FCC) and any local or State codes that may be applicable.

D. The system equipment specified herein should be similar and equal to Intelligent Lighting Controls, Inc. Low-Voltage Lighting Control Systems by other manufacturers will be considered provided they meet the requirements of these Specifications and provide the Quality and Performance specified herein.

E. Listing of a manufacturer as acceptable does not in any way relieve the Contractor from the responsibility for providing a Lighting Control System that meets all the requirements of these Specifications.

F. All manufacturers shall submit to the Specifying Engineer a line-by-line compliance comparison between each Specifications requirement and the system being proposed.

G. Any ambiguities in the Drawings or Specifications shall be brought to the attention of the Specifying Engineer for clarification.

1.2 QUALITY ASSURANCE

A. Factory Assembly: All relays, contactors, controllers, enclosures, switch station and miscellaneous components shall be factory assembled and tested. All System components shall arrive at the job site completely pre-wired and ready for installation, requiring only the connection of lighting circuits and low-voltage control stations. All connections shall be made to clearly and permanently labeled termination points. Systems that require field assembly shall not be acceptable.

B. Component Testing: All system components and assemblies shall be individually tested prior to assembly. Once assembled, all finished products shall be tested for proper operation of all control functions per specifications prior to shipment.

C. NEC Compliance: All system components shall comply with all applicable Sections of the National Electrical Code (NEC) as required.

D. NEMA Compliance: All system components shall comply with all applicable portions of NEMA standards pertaining to types of electrical equipment and enclosures.

E. UL Approval: All applicable equipment shall be UL listed under Section 916 / 508 and shall bear labels indicating compliance.

F. FCC Emissions: All applicable equipment shall comply with FCC Emissions Standards specified in Part 15, sub-part j for Commercial and Residential Applications and shall bear labels indicating Compliance Testing. Equipment that does not meet these Standards shall not be acceptable.

1.3 SUBMITTALS

A. Submittal package shall include, but not be limited to, the following. Submittals that do not contain all the information listed below will not be considered for approval.

1. Specifications Compliance: Submit a line-by-line comparison that describes the differences between each Specification requirement and the equipment / systems being proposed. Comparison shall include a complete listing of how the proposed equipment / systems differ from that specified with regard to size, quantity, quality, method of control, features and functions, control software functions and installation requirements.

2. System Description: Supply as part of the submittal package a brief description of the Lighting Control System's major features and functions.

3. Bill of Materials: Provide as part of the Submittal Package a detailed itemized listing of all proposed equipment, including quantities and capacities for all major system components.

4. Product Data Sheets: Provide as part of the Submittal Package detailed product data sheets for all major system components.

5. Riser Drawing: Provide as part of the Submittal Package a system riser drawing of sufficient detail to indicate relative placement of major system components and the required connections between each.

6. Shop Drawings: Submittal shall include Shop Drawings that accurately represent the system or systems specified herein. Shop Drawings shall include the name of the project, quantity and physical dimensions of all major system components, wire sizes and counts for all required connections between system components.

1.4 WARRANTY

A. Manufacturer's Warranty: Manufacturer shall provide a written warranty that shall cover all lighting control equipment. Manufacturer shall agree to repair or replace any equipment that fails due to material or workmanship for a period of 1 year.

B. Relay Warranty: Manufacturer shall provide a separate written warranty that shall cover all lighting control relays within the Lighting Control System. Manufacturer shall agree to repair or replace any relay that fails due to material or workmanship for a period of three (3) years.

C. Warranty Period: The warranty period shall begin after the completion of the installation and the systems start-up and training, the point at which the System Owner receives beneficial use of the Control System.

PART II - PRODUCTS

2.1 PROGRAMMABLE LIGHTING CONTROLLER

A. Where shown on the Drawings, the Contractor shall furnish and install programmable lighting controller of the quantity, size and type shown on the drawing and specified herein.

B. Programmable Lighting Controller shall contain relays, Contractors and other devices of the sizes and quantities indicated on the drawings and specified herein.

C. Hardware Features:

1. Controller Back box: Each programmable Lighting Controller shall be provided with a factory furnished, UL listed NEMA 1 enclosure designed for wall mounting. Back Box must be capable of being shipped ahead of Controller chassis insert to allow for rough-in of all electrical connections prior to receipt of the Controller chassis insert.

2. Controller Chassis Insert: Each programmable lighting controller shall be provided with a factory or field installable controller chassis insert. Controller chassis insert shall contain all controller electronics, power supplies, relays, contractors and other required components. Controller chassis inserts shall arrive at the project site completely pre-wired and requiring only the connection of lighting circuits and control devices. Systems that require field assembly of controllers or chassis inserts are not acceptable.

3. High-Voltage / Low-Voltage Separation: Each programmable lighting controller shall be provided with a mechanical barrier that separates all high-voltage components and wiring from all low-voltage components and wiring. An additional barrier shall be installed within the high-voltage section that shall provide isolation between normal and emergency circuits where required.

4. Controller Covers: Each programmable lighting controller shall be provided with a dead front screw-held or hinged locking cover that is designed for either surface or flush mounting.

D. Electrical

1. Controller Power Supply: Each programmable lighting controller shall be provided with a single dual-rated, UL listed Class 2 transformer capable of either 120 or 277 VAC primary (+ or - 20% VAC, 50 to 60 Hz).

2. Connections: All connections shall be made to clearly and permanently labeled termination points.

E. Controller Electronics

1. Controller CPU: Each programmable controller shall be provided with a CPU (Central Processing Unit) that shall provide all the programming and control functions for the entire controller.

2. I/O Controller: I/O (input/output) cards shall be provided to expand the controller capability from 8 to 64 switch inputs and relay outputs in groups of 8.

3. Capacity: Each controller shall be capable of controlling 32 individual lighting control relays with 32 switch inputs and relay outputs.

F. Integration and Interfacing With Other Systems

1. Dry Contact Interface Input: Each programmable lighting control shall be designed to interface with other building control and alarm systems via dry contact inputs. Dry contact interface shall be in the form of either a 2 or 3-wire maintained or momentary input. Dry contact inputs from other systems shall be programmable as any of the available controller switch input types.

2. Dry Contact Interface Output: Each programmable lighting control shall be designed to interface with other building control and alarm systems via dry contact outputs. Dry contact outputs shall be in the form of either a 2 or 3-wire maintained or momentary output. Dry contact outputs shall be capable of being programmed in the same manner as any of the controller relay outputs.

3. Serial / Networked Communications Interface: Programmable lighting controllers shall be designed to be integrated / interfaced with other building automation and control systems via built-in serial communications protocols. As a minimum, programmable controllers shall be provided with the following built-in protocol capabilities.

ILC NET	ILC NET Open Protocol ASCI
Modibus RTU	Modibus RTU Protocol
Metasys N2	Johnson Controls Protocol

4. Programmable lighting controllers integrated / interfaced to other building control and alarm systems must remain completely functional and continue to process all programmed commands, including local switching. Commands shall be available to allow controlling systems to disable or enable local function via network commands. Systems that become simple slaves to the Controlling System are not acceptable.

G. Programming: Programmable controllers shall be capable of being programmed, monitored or controlled through any or all of the below methods, either individually or simultaneously. Regardless of the method being used to program, monitor or control, the programmable controller must remain completely functional during this process. Controllers that must be taken “OFF LINE” for programming are not acceptable. All programming changes shall take effect immediately as they are programmed.

1. Local Key Pad: Programming is performed through the use of a simple Local Key Pad consisting of 3 programming buttons and 6 LED indicators.

H. Diagnostic Aids: Each programmable lighting controller shall be provided with an LED that shall indicate that the main power supply is present and operational. Each relay output shall have an LED pilot to indicate the current status of all controlled relay outputs. In addition, the system user shall be able to monitor and control any programmable lighting controller directly and in real time through any of the programming methods listed above. System users shall be able to view the current status of any or all relay outputs, force any relay output ON or OFF view the current status of any or all switch inputs.

I. Data Protection and Storage: All programmed data shall be stored in non-volatile lithium-backed RAM that shall protect all stored programming data from loss during a power outage for a minimum period of 10 years without power of any type.

J. Power Failure and Power-Up Options: Each programmable lighting controller shall be provided with circuitry that shall automatically shut down the controller whenever the incoming power fails to be delivered to (user selectable) for each controlled relay output in the system.

1. No Action: Upon restoration of incoming control power, the controller electronics shall be restarted and resume normal operations, and all circuits will be maintained in the condition they were last in. Exception: Time-scheduled events that were to take place during the power outage will be automatically activated to bring the controller into the correct operating status.

2. Forced ON: Controller will force relay output to the "ON" state after power-up.

3. Time-scheduled events that were to take place during the power outage will be ignored; however, all future scheduled events will be activated.

4. Forced OFF: Controller will force relay output to the 'OFF' state after power-up. Time-scheduled events that were to take place during the power outage will be ignored; however, all future scheduled events will be activated.

K. Manual Override: Each relay output shall be supplied with an ON and OFF manual override push-button with LED pilot that shall allow the system user to view the current status and/or manually override any relay output to the ON or OFF state.

L. True Relay Status Feedback: Each controller shall be provided with circuitry that shall monitor the actual current status of each relay via a set of pilot contacts that are mechanically linked to the relay's main contacts.

M. Staggered or Instant Relay ON/OFF Activation: Programmable lighting controller shall be provided with a jumper that shall allow the system user to select instant or staggered relay operation. With the jumper in the instant mode, all relays in the controller will be turned ON or OFF at the same time. With the jumper in the staggered mode, relays will be turned ON or OFF with a 20-msec pause between each relay being switched.

N. Input Flexibility: Each switch input shall accept the logical equivalent of a dry contact 2 or 3-wire maintained or momentary switch.

O. Input to Output Programmability: Any switch input may be programmed to control any or all of the controller relay output(s) without limitations. Any switch input anywhere in a control network can control any or all relay output(s) anywhere on the network, without limitations.

P. Switch Input Types: Each of the programmable lighting controller switch inputs shall be programmable for one of the below listed switch types.

1. Momentary ON/OFF: When momentary contact is made between the ON and COM, relay outputs controlled by this input are turned ON. When momentary contact is made between OFF and COM, relay outputs controlled by this input are turned OFF.

2. Maintained ON/OFF: When contact is made between the ON and COM, relay outputs controlled by this input are turned ON. When contact is broken between ON and COM, relay outputs controlled by this input are turned OFF.

2.2 CLASS 2 LIGHTING CONTROL RELAYS

A. Electrical Contractor shall provide quantities of Class 2 lighting control relays as indicated on the drawings and schedules and specified herein.

B. Class 2 lighting control relays shall be individually UL and CUL listed and shall bear labels indicating compliance.

C. Class 2 lighting control relays shall be designed and tested to have a minimum cycle life of 200,000 ON/OFF cycles @ FULL LOAD and 1,000,000 ON/OFF cycles at no load.

D. Class 2 lighting control relays shall be designed for control of 120, 277 or 347 VAC lighting control circuits at a full 20 AMPS and motor loads of 1 Hp @ 120 VAC or 1.5 Hp @ 277 VAC.

E. Class 2 lighting control relays shall be designed with a magnetic latching mechanism that shall hold the relay in its last activated state indefinitely, with no change of state during an interruption of power. Solid state or electrically held relays are not acceptable.

F. Each Class 2 lighting control relay shall contain an auxiliary set of contacts (rated at 1 AMP 30 VAC) electrically isolated but mechanically linked to the main contacts for the purpose of status monitoring and pilot light activation.

G. Relays shall be capable of panel or remote mounting up to 2,500 feet from the controlling device.

2.3 SWITCH PLATES & CONTROL STATIONS

A. Standard Switch Plates (NFP): Electrical Contractor shall provide and Install switch plates and switches of the quantities and types shown on the drawings and specified herein.

1. Switch plates shall consist of a control panel faceplate, switches, LED pilot lights and all mounting hardware.

2. Switch plates shall be manufactured from a single piece of stainless steel or aluminum, finished and labeled as per the Plans and Specifications or as indicated on approved Drawings.

3. Switch plates shall be designed to mount to standard electrical gang boxes supplied by the Electrical Contractor for either flush or surface mounting.

4. Switch plate labeling and switch identification shall be accomplished through the use of engraved Phenolic labels, permanently attached to the switch plate or engraved into the control panel faceplate material. Silk-screened or painted labeling shall not be acceptable.

B. Custom Switch Plates and Graphic Switching Stations: Electrical Contractor shall provide and install custom switch plates and graphical switching stations of the quantities and types shown on the Drawings and specified herein.

1. Switch plates shall consist of a control panel faceplate, switches and other control devices as required, LED pilot lights and all mounting hardware.

2. Switch plates shall be manufactured from a single piece of bronze, finished and labeled as per the Plans and Specifications or as indicated on approved Drawings.

3. Switch plates shall be designed to mount either to a standard electrical gang box supplied by the Electrical Contractor for either flush or surface mounting or to a custom back-box supplied by the manufacturer.

4. Switch plate labeling shall be accomplished through the use of one or a combination of multi-color anodization, engraving or Phenolic labels, permanently attached to the faceplate material. Painted labeling shall not be acceptable.

5. Switch plates shall be supplied with the appropriate number of switches, LED pilots and other control devices as indicated on the Drawings.

PART III - EXECUTION

3.1 INSTALLATION

A. Where shown on the Drawings, the Contractor shall furnish and install programmable lighting controllers of the quantities, sizes and types shown on the Drawings or specified herein.

B. All equipment shall be installed in accordance with manufacturer's requirements and in compliance with all applicable local and national codes and requirements.

3.2 MANUFACTURER'S SERVICES

A. Factory Programming: All controllers shall be factory programmed in accordance with the project specifications prior to shipment. All required firmware and software shall be installed prior to final testing and shipment.

B. Installation Assistance: During the installation process, the manufacturer shall provide, at no cost, technical support via a toll-free telephone line to the installing Contractor or Owner's representative to answer questions and supply additional information when required.

C. System Start-Up: The System manufacturer shall provide a factory authorized Field Engineer to the project site after installation has been completed and prior to system energizing for the purpose of testing and adjustment of the system. Factory Field Engineer shall test and verify all system functions and ensure proper operation of the System components in accordance with the specifications and on-site conditions. The installing Contractor shall notify the system manufacturer in writing that the system is completely wired and ready to be energized and tested 2 weeks prior to scheduling a Field Engineer for start-up of the system. Should the Field Engineer arrive on the job site

and find the installation incomplete, the installing Contractor shall pay the cost of any future visits by the Field Engineer required to complete the system start-up.

D. On-Site Programming: During the start-up procedure, the factory Field Engineer shall provide programming assistance and guidance to the building operating personnel in order to program the systems for initial operation.

E. Instruction: During the start-up procedure, the factory Field Engineer shall provide training to the Building Operating Personnel in the Operation, Programming and Maintenance of the Lighting Control System.

F. As-Built Drawings: After completion of the System installation and testing, the manufacturer shall provide three (3) sets of “As-Built” drawings.

G. Operation and Maintenance Manuals: After completion of the system installation and testing, the manufacturer shall provide three (3) sets of Operations and Maintenance Manuals.

H. Lifetime Toll-Free Telephone Support: The system manufacturer shall provide a toll-free telephone number to the system user and shall allow access to free telephone support for the life of the system.

PART IV – OWNER TRAINING

4.1 Provide initial Owner training prior to turn over of building. Provide a minimum of four (4) hours training for up to six (6) persons. Coordinate training session with Owner’s schedule.

4.2 Provide an additional four (4) hours of training after ninety (90) days of operation.

4.3 All training shall be conducted by the manufacturer’s representative. The electrical contractor shall attend all training sessions.

END OF SECTION 16430

SECTION 16452 - GROUNDING

PART I - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes Solid Grounding of Electrical Systems and Equipment. It includes basic requirements for grounding for protection of life, equipment, circuits, and systems. Grounding requirements specified in this Section may be supplemented in other Sections of these Specifications.

1.3 QUALITY ASSURANCE

A. Listing and Labeling: Provide products specified in this Section that are listed and labeled. The terms "listed" and "labeled" shall be defined as they are in the National Electrical Code, Article 100.

PART II - PRODUCTS

2.1 GROUNDING AND BONDING PRODUCTS

A. Products: Of types indicated and of sizes and ratings to comply with NEC. Where types, sizes, ratings, and quantities indicated are in excess of NEC requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.

B. Conductor Materials: Copper

2.2 WIRE AND CABLE CONDUCTORS

A. General: Comply with Division 16 Section "Wires and Cables". Conform to NEC Table 8, except as otherwise indicated, for conductor properties, including stranding.

B. Equipment Grounding Conductor: Green insulated

C. Grounding Electrode Conductor: Stranded cable

D. Bare Copper Conductors: Conform to the following:

1. Solid Conductors: ASTM B-3

2. Assembly of Stranded Conductors: ASTM B-8

3. Tinned Conductors: ASTM B-33

2.3 MISCELLANEOUS CONDUCTORS

A. Ground Bus: Bare annealed copper bars of rectangular cross section, full-size rated.

B. Braided Bonding Jumpers: Copper tape, braided No. 30 gauge bare copper wire, terminated with copper ferrules.

C. Bonding Strap Conductor/Connectors: Soft copper, 0.05 inch thick and 2 inches wide, except as indicated.

2.4 CONNECTOR PRODUCTS

A. General: Listed and labeled as Grounding Connectors for the materials used.

B. Pressure Connectors: High conductivity-plated units

C. Bolted Clamps: Heavy-duty units listed for the application

2.5 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel with high strength steel core and electrolytic grade copper outer sheath, molten welded to core.

1. Size: 3/4 inch by 10 feet

PART III - EXECUTION

3.1 APPLICATION

A. Equipment Grounding Conductor Application: Comply with NEC Article 250 for sizes and quantities of equipment grounding conductors, except where larger sizes or more conductors are indicated.

1. The raceway system shall not be relied on for ground continuity .Install an equipment ground conductor in all power related conduits. Size conductor as required by NEC Table 250-122. Data and Signal conduits do not require a separate grounding conductor unless required by the manufacturer of the equipment to be installed.

C. Signal and Communications: For telephone, alarm, and communication systems, provide a #6 AWG minimum green insulated copper conductor in raceway from the grounding electrode system to each terminal equipment location. Leave 3' pigtail wiring at termination point where equipment boards are shown. Make direct connection where equipment is provided.

3.2 INSTALLATION

A. General: Ground electrical systems and equipment in accordance with NEC requirements except where the Drawings or Specifications exceed NEC requirements.

B. The electrical service shall be grounded by three (3) means:

1. To the cold water main, if metallic and in direct contact with the earth for at least 10 feet as per the NEC Article 250-81.

2. To the steel frame of the building, provided the building frame is effectively grounded.

3. To ground rod(s)

C. Ground Rods: Locate a minimum of one-rod length from each other and at least the same distance from any other grounding electrode. Interconnect ground rods with bare conductors buried at least 24 inches below grade. Connect bare-cable ground

conductors to ground rods by means of exothermic welds except as otherwise indicated. Make these connections without damaging the copper coating or exposing the steel. Use ¾ inch by 10 ft. ground rods except as otherwise indicated. Drive rods until tops are 6 inches below finished floor or final grade except as otherwise indicated. All ground connections shall be accessible.

D. Metallic Water Service Pipe: Provide insulated copper ground conductors, sized as indicated, in conduit from the building main service equipment, or the ground bus, to main metallic water service entrances to the building. Connect ground conductors to the main metallic water service pipes by means of ground clamps. Where a dielectric main water fitting is installed, connect the ground conductor to the street side of the fitting. Do not install a grounding jumper around dielectric fittings. Bond the ground conductor conduit to the conductor at each end.

E. Route grounding conductors along the shortest and straightest paths possible without obstructing access or placing conductors where they may be subjected to strain, impact, or damage, except as indicated.

3.3 CONNECTIONS

A. General: Make connections in such a manner as to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot tin-coated materials to assure high conductivity and make contact points closer in order of galvanic series.

2. Make connections with clean bare metal at points of contact.

3. Aluminum to steel connections shall be with stainless steel separators and mechanical clamps.

4. Aluminum to galvanized steel connections shall be with tin-plated copper jumpers and mechanical clamps.

5. Coat and seal connections involving dissimilar metals with inert material such as red lead paint to prevent future penetration of moisture to contact surfaces.

B. Terminate insulated equipment grounding conductors for feeders and branch circuits with pressure-type grounding lugs. Where metallic raceways terminate at metallic housings without mechanical and electrical connection to the housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to the ground bus in the housing. Bond electrically non-continuous conduits at both entrances and exits with grounding bushings and bare grounding conductors.

C. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with torque tightening values specified in UL 486A and UL 486B.

D. Compression-Type Connections: Use hydraulic compression tools to provide the correct circumferential pressure for compression connectors. Use tools and dies recommended by the manufacturer of the connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on the ground conductor.

3.4 FIELD QUALITY CONTROL

A. Tests: Subject the completed grounding system to a megger test at each location where a maximum ground resistance level is specified, at service disconnect enclosure ground terminal, and at ground test wells. Measure ground resistance without the soil being moistened by any means other than natural precipitation or natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests by the 2 point method in accordance with Section 9.03 of IEEE 81, "Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Grounding System".

B. Service Grounding Test

1. After completion of the electrical grounding and bonding systems, test the ground resistance with a ground resistance tester. Where test shown resistance-to-ground is over 25 ohms, provide additional ground rods until the minimum of 25 ohms is achieved.

C. Deficiencies: Where ground resistances exceed specified values, and if directed, modify the grounding system to reduce resistance values. Where measures are detected that exceed those indicated the provisions of the Contract, covering changes will apply.

D. Report: Prepare test reports of the ground resistance at each test location. Include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

3.5 CLEANING AND ADJUSTING

A. Restore surface features at areas disturbed by excavation and re-establish original grades. Where sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other Work to their original condition. Include necessary topsoil, fertilizing, liming, seeding, sodding, sprigging, or mulching.

END OF SECTION 16452

SECTION 16470 – PANEL BOARDS

PART I - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes Lighting and Power Panel Boards and Associated Auxiliary Equipment Rated 600 V or Less

1.3 DEFINITIONS

A. Panel Boards: A panel board with thermal magnetic circuit-breaker branches, designed for residential and light commercial projects, operating at 600 V and below, available in both single and 3-phase versions, and equipped with combination flush/surface mounting trim.

B. Over-current Protective Device (OCPD): A device operative on excessive current that causes and maintains the interruption of power in the circuit it protects.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data for each type panel board, accessory item, and component specified.

C. Shop Drawings from manufacturers of panel boards including dimensioned plans, sections, and elevations. Show tabulations of installed devices, major features and voltage rating.

D. Include the following:

1. Enclosure type with details for types other than NEMA Type 1.

2. Bus configuration and current ratings.

3. Short-circuit current rating of panelboard.

4. Features, characteristics, ratings, and factory settings of individual protective devices and auxiliary components.

1.5 QUALITY ASSURANCE

A. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

1. The terms "listed" and "labeled" shall be defined as they are in the National Electrical Code, Article 100.

B. Electrical Component Standard: Components and installation shall comply with NFPA 70, "National Electrical Code”.

C. NEMA Standard: Comply with NEMA PB1, "Panel Boards".

D. UL Standards: Comply with UL 61, "Panel Boards", and UL 50, "Cabinets and Boxes".

PART II - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Cutler Hammer

2. Square D

3. Siemens

2.2 PANELBOARDS - GENERAL REQUIREMENTS

A. Over-current Protective Devices (OCPDs): Provide type, rating, and features as indicated on the schedules. Tandem circuit breakers shall not be used. Multiple breakers shall have common trip.

B. Circuit Breakers shall be bolt-on type.

C. 100% rated copper Ground and Neutral Bus (unless noted otherwise).

D. Enclosures: Cabinets, flush or surface mounted as indicted. NEMA Type 1 enclosure.

E. Front: Secured to box with concealed trim clamps except as indicated. Front for surface-mounted panels shall be same dimensions as box. Fronts for flush panels shall overlap box except as otherwise specified.

F. Directory Frame: Metal, mounted inside each panel door.

G. Bus: Hard drawn copper of 98 percent conductivity

H. Main and Neutral Lugs: Bolt-on type

I. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors.

J. Provision for Future Devices: Equip with mounting brackets, bus connections, and necessary appurtenances, for the OCPD ampere ratings indicated for future installation of devices.

K. Feed-through panels are not permitted.

L. The use of series breakers is not permitted.

M. Flash protection boundary and the incident energy for the electrical equipment shall be determined in accordance with IEEE 1584 and NFPA 70E requirements.

2.3 IDENTIFICATION

A. Panel Board Nameplates: Engraved laminated plastic or metal nameplate for each panel board mounted with self-tapping stainless steel screws.

PART III - EXECUTION

3.1 INSTALLATION

A. General: Install panel boards and accessory items in accordance with NEMA PB 1.1, "General Instructions for Proper Installation, Operation and Maintenance of Panel Boards Rated 600 Volts or Less" and manufacturers' written installation instructions.

B. Mounting Heights: Top of trim 6'-2" above finished floor, except as indicated.

C. Mounting: Plumb and rigid without distortion of box. Mount flush panels uniformly flush with wall finish.

D. Circuit Directory: Typed and reflective of final circuit changes required to balance panel loads. Obtain approval before installing. Pencil all spares. Spaces shall be left blank.

E. Install filler plates in unused spaces.

F. Provision for Future Circuits at Flush Panel Boards: Stub four 1-inch empty conduits from panel into accessible ceiling space or space designated to be ceiling space in future.

G. Wiring in Panel Gutters: Train conductors neatly in groups, bundle and wrap with wire ties after completion of load balancing.

3.2 GROUNDING

A. Connections: Make equipment grounding connections for panelboards as indicated.

B. Provide ground continuity to main electrical ground bus indicated.

3.3 CONNECTIONS

A. All connections shall be provided per UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Quality Control Program: Conform to the following:

1. Procedures: Field tests and Inspections will be made by the Engineer at time of completion of the work and in accordance these Specifications.

2. Schedule tests with at least one (1) week in advance notification.

B. Visual and Mechanical Inspection: Include the following inspections and related work:

1. Inspect for defects and physical damage, labeling, and nameplate compliance with requirements of up-to-date Drawings and Panel Board Schedules.

2. Exercise and perform of operational tests of all Mechanical components and other operable devices in accordance with manufacturer's Instruction Manual.

3. Check panel board mounting, area clearances and alignment and fit of components.

4. Check tightness of bolted electrical connections with calibrated torque wrench.

3.5 CLEANING

A. Upon completion of installation, inspect interior and exterior of panel boards. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

END OF SECTION 16470

SECTION 16476 – DISCONNECTS

PART I - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes Equipment and Service disconnects.

1.3 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for Switches and Accessories specified in this Section.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 70 "National Electrical Code" for components and installation.

B. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in the "National Electrical Code", Article 100.

PART II - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Cutler-Hammer Products; Eaton Corp.

2. Siemens

3. Square D Company

2.2 ENCLOSED SWITCHES

A. Enclosed Non-Fusible Switch: NEMA KS 1, Type HD, handle lockable with 2 padlocks.

B. Enclosed Fusible Switch, 800 Amperes and Smaller: NEMA KS 1, Type HD, clips to accommodate specified fuses, enclosure consistent with environment where located, handle lockable with 2 padlocks, and interlocked with cover in CLOSED position.

C. Enclosure: NEMA KS 1, Type 1, unless specified or required otherwise to meet environmental conditions of installed location.

D. Outdoor Locations: Type 3R

E. Other Wet or Damp Indoor Locations: Type 4

F. All switches shall be "Heavy Duty" rated for the voltage required.

G. Coordinate all fuse rated switches with the equipment to be furnished. Furnish fuses.

H. Safety switches shall be third-party listed.

I. Switches shall have defeatable door interlocks that prevent the door from opening when the operating handle is in the open position.

J. Switches shall have handles whose positions are easily recognizable in the “on” or “off” position. For safety reasons, padlocks shall be provided for switches located in the public areas.

K. Switches shall have nonteasible, positive, quick make-quick-quick-break mechanisms.

L. Switches shall be properly labeled. See section 16195, Electrical Identification.

PART III - EXECUTION

3.1 INSTALLATION

A. Install enclosed switches level and plumb.

B. Where fuses are required, the fuses shall be matched with the equipment supplier's requirements.

C. Provide one additional set of fuses for each disconnect switch.

3.2 FIELD QUALITY CONTROL

A. Testing: After installing enclosed switches and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

B. Correct malfunctioning units at site, where possible, and retest to demonstrate compliance. Otherwise, remove and replace with new units and re-test.

3.3 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, construction debris and repair damaged finish including chips, scratches and abrasions.

END OF SECTION 16476

SECTION 16515 - INTERIOR LIGHTING

PART I - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes interior lighting fixtures, lamps, ballasts, emergency lighting units, and accessories.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data describing fixtures, lamps, ballasts, and emergency lighting units. Arrange product data for fixtures in order of fixture designation. Include data on features and accessories and the following information:

1. Outline drawings of fixtures indicating dimensions and principal features.

2. Electrical ratings and photometric data with specified lamps and certified results of independent laboratory tests.

3. Data on batteries and chargers of emergency lighting units.

4. Shop Drawings from manufacturers detailing non-standard fixtures and indicating dimensions, weights, methods of field assembly, components, features and accessories.

5. Non-returnable samples, when requested by Engineer, for verification purposes of specific individual fixtures.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 70 "National Electrical Code" for components and installation.

B. Listing and Labeling: Provide fixtures that are listed and labeled for their indicated use on the Project.

C. Coordination of Fixtures With Ceiling: Coordinate fixtures mounting hardware and trim with the ceiling system. Provide plaster or sheet-rock trims when required on the project whether indicated or not at no additional cost to the Owner. Coordinate with Architectural Plans before ordering fixtures.

1.5 WARRANTY

A. Minimum warranty period on emergency lights shall be three (3) years from date acceptance. Warranty shall include all parts (less lamps).

B. All other lighting products shall be warranted for a period of not less than 1 year from date of acceptance. This warranty does not include miscellaneous parts which are external to the product (i.e. lamps) which are considered maintenance item.

PART II - PRODUCTS

2.1 FIXTURES - GENERAL

A. Comply with the requirements specified in the Articles below and the Lighting Fixture Schedule on the Drawings.

2.2 FIXTURE COMPONENTS - GENERAL

A. Metal Parts: Free from burrs and sharp corners and edges.

B. Sheet Metal Components: Steel, except as indicated. Components are formed and supported to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating and free from light leakage under operating conditions. Arrange to permit re-lamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during re-lamping and when secured in the operating position. Light seal strips inside the fixture will not be allowed.

D. Reflecting Surfaces: Minimum reflectances as follows, except as otherwise indicated:

1. White Surfaces: 85 percent

2. Specular Surfaces: 83 percent

3. Diffusing Specular Surfaces: 75 percent

4. Laminated Silver Metalized Film: 90 percent

E. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic

1. Plastic: Highly resistance to yellowing and other changes due to aging, exposure to heat and UV radiation.

2. Lens Thickness: 0.125 inches minimum

2.3 SUSPENDED FIXTURE SUPPORT COMPONENTS

A. Single-Stem Hangers: ½ inch steel tubing with swivel ball fitting and ceiling canopy. Finish same as fixture.

B. Twin-Stem Hangers: Two, ½ inch steel tubes with single canopy arranged to mount a single fixture. Finish same as fixture.

C. Rod Hangers: 3/16 inch diameter cadmium plated, threaded steel rod.

2.4 FLUORESCENT FIXTURES

A. Electronic Ballast:

1. Ballast to be "UL listed, Class P”.

2. Ballast to be "Sound Rated A”.

3. Ballast enclosure size shall be same as or smaller than, magnetic ballast.

4. Light regulation shall be +/- 10% input voltage variation.

5. Ballast shall have high power factor (minimum of 90%).

6. Lamp current crest factor shall be equal to, or less than, 1.7.

7. Input current third harmonics shall not exceed ANSI recommendations (32% total harmonic distortion, 27.5% of the third triplets).

8. Flicker shall be 15% or less with any lamp suitable for the ballast.

9. Ballast design shall withstand line transients per IEEE 587, Category A.

10. Ballast case temperature shall not exceed 25 degrees C rise over 40 degrees C ambient.

11. Ballast shall meet FCC Rules and Regulations, Part 18.

12. Parallel wiring between the ballast and fixture is recommended.

13. Minimum of five (5) years warranty is required with each electronic ballast.

14. The manufacturer shall have not less than 5 years of experience in manufacturing electronic ballast.

B. Provide disconnecting means per NEC 410.130 G.

C. Low Temperature Ballast Minimum Starting Temperature: Minus 20 degrees C

D. Where compact fluorescent light fixtures are specified, "High Power Factor" electronic ballast shall be standard.

2.5 FLUORESCENT LAMPS

A. All fluorescent lamps to be {41} K-rated unless noted otherwise.

2.6 EXIT SIGNS

A. Conform to UL 924, "Emergency Lighting and Power Equipment”.

1. Arrows: Include as indicated.

B. Emergency Exit Signs shall be of the "LED" style.

C. Units shall be completely self-contained, provided with maintenance-free battery, automatic charger, and other features. Luminaire must be third-party listed as emergency lighting equipment, and meet or exceed the following standards: NEC, NC Building Code, Volume X Energy code, NFPA-101, and NEMA Standards.

D. BATTERY-It shall be sealed, maintenance-free type, with minimum of 90 minutes operating endurance. Must have a normal life expectancy of 10 years. Batteries shall be a high temperature type with an operating range of 0 degree C to 60 degrees C and contain a resealable pressure vent, a sintered + positive and – negative terminal.

E. CHARGER- It shall be fully automatic solid state type, full wave rectifying, with current limiting. Charger shall restore the battery to its full charge within 24 hours after a discharge of 90 minutes under full rated load. The unit shall be activated when the

voltage drops below 80%. A low voltage disconnect switch shall be included if LEAD battery is used to disconnect the battery from the load and prevent damage from a deep discharge during extended power outage.

F. ADDITIONAL FEATURES- Pilot light to indicate the unit is connected to AC power. The battery shall have rate discharge pilot light, unless self-diagnostic type. Test switch to simulate the operation of the unit upon loss of AC power by energizing the lamps from the battery. This simulation must also exercise the transfer relay.

G. WARRANTY-The entire unit shall be warranted for 3 years. The battery must have an additional 2 more years pro-rated warranty. Warranty shall start from the date of project final acceptance. Warranty shall be included in the contract document.

H. LED-The use of LED is required due to their reliable performance, low power consumption, and limited maintenance requirements. Maximum LED failure rate shall be 25% within a seven (7) year period; otherwise, if exceeded, manufacturer shall replace the complete unit at no charge to the owner.

2.7 EMERGENCY LIGHTING UNITS

A. Conform to UL 924, "Emergency Lighting and Power Equipment" requirements for "Unit Equipment". Provide self-contained units with the following features and additional characteristics as indicated.

B. Units shall be completely self-contained, provided with maintenance-free battery, automatic charger, and other features. Luminaire must be third-party listed as emergency lighting equipment, and meet or exceed the following standards: NEC, NC Building Code, Volume X Energy code, NFPA-101, and NEMA Standards.

C. BATTERY-It shall be sealed, maintenance-free type, with minimum of 90 minutes operating endurance. Must have a normal life expectancy of 10 years. Batteries shall be a high temperature type with an operating range of 0 degree C to 60 degrees C and contain a resealable pressure vent, a sintered + positive and – negative terminal.

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E. ADDITIONAL FEATURES- Pilot light to indicate the unit is connected to AC power. The battery shall have rate discharge pilot light, unless self-diagnostic type. Test switch to simulate the operation of the unit upon loss of AC power by energizing the lamps from the battery. This simulation must also exercise the transfer relay.

F WARRANTY-The entire unit shall be warranted for 3 years. The battery must have an additional 2 more years pro-rated warranty. Warranty shall start from the date of project final acceptance. Warranty shall be included in the contract document.

2.8 FINISH

A. Steel Parts: Manufacturer's standard finish applied over corrosion-resistant primer, free of streaks, runs, holidays, stains, blisters, and defects. Remove fixtures showing evidence of corrosion during project warranty period and replace with new fixtures.

B. Paint parts after fabrication.

PART III – EXECUTION

3.1 INSTALLATION

A. Setting and Securing: Set units plumb, square, and level with ceiling and walls, and secure according to manufacturer's printed instructions and approved Shop Drawings.

B. Support For Recessed and Semi-Recessed Fixtures: Units shall be supported independent from suspended ceiling. Install fixture with support wires at 2 diagonal corners to the structure or building steel.

1. Fixtures of Sizes Less Than Ceiling Grid: Center in the acoustical panel. Support fixtures independently with at least two ¾ inch metal channels spanning and secured to the ceiling tees.

2. Install support clips or screws for recessed fixtures, securely fastened to ceiling grid members, at or near each fixture corners.

3. Support wires shall be not less than the support wires for the ceiling system.

C. Support for Suspended Fixtures: Brace pendants and rods that are 4 feet long or longer to limit swinging. Support stem mounted single unit suspended fluorescent fixtures with twin stem hangers. For continuous rows, use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of chassis, including one at each end.

D. Lamping: See Schedule on Drawings, or provide standard lamp for the rating of the fixture.

E. Where mounting height for fixtures are not scheduled, coordinate with the Engineer before any installation.

3.2 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Emergency Battery Units Test: Verify normal operation of each fixture after fixtures have been installed and circuits have been energized with normal power source. Interrupt electrical energy for a period of not less than 90 minutes to demonstrate proper operation of Emergency Lighting installation. Include the following in tests of emergency lighting equipment.

1. Duration of supply

2. Low battery voltage shut-down

3. Normal transfer to battery source and retransfer to normal

4. Low supply voltage transfer

C. Replace or repair malfunctioning fixtures and components, then retest. Repeat procedure until all units operate properly.

D. Contractor shall perform a test on each unit after it is permanently installed and charged for a minimum of 24 hours. Battery shall be tested for 90 minutes. The battery test shall be done 10 days prior to final inspection by the State Construction Office. Any unit which fails the test must be repaired or replaced and tested again. Copy of the test report shall be sent to the State Construction Office.

3.3 ADJUSTING AND CLEANING

A. Clean fixtures upon completion of installation. Use methods and materials recommended by manufacturer.

B. Adjust aimable fixtures to provide required light intensities.

END OF SECTION 16515

SECTION 16721 - FIRE ALARM SYSTEMS, ADDRESSABLE

PART I - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes Fire Alarm Systems, including Manual Stations, Detectors, Signal Equipment, Controls and Devices.

1.3 SYSTEM DESCRIPTION

A. General: Complete Addressable Fire Detection and Alarm System with Manual and Automatic Alarm Initiation.

B. Signal Transmission: Hard-wired, using separate individual circuits for each zone of alarm initiation and alarm device operation.

C. Audible Alarm Indication: By sounding of horns and bells.

D. Functional Description: The following are required System Functions and Operating Features:

1. Signal Initiation: The manual or automatic operation of an alarm-initiating or supervisory-operating device causes the FACP to transmit an appropriate signal including:

    a. General Alarm
    b. Fire-Suppression System Operation Alarm
    c. Smoke Detector Alarm
    d. Door Release
    e. Elevator Recall
    f. Elevator Shutdown
    g. System Trouble
    h. Air-Handling Fan Shut Down
    i. Automatic Dial-Out

2. Silencing at FACP: Switches provide capability for acknowledgment of alarm; supervisory, trouble, and other specified signals at the FACP; and capability to silence the local audible signal and light a light-emitting diode (LED). Subsequent zone alarms cause the audible signal to sound again until silenced in turn by switch operation. Restoration to normal of alarm, supervisory and trouble conditions extinguish the associated LED and cause the audible signal to sound again until the restoration is acknowledged by switch operation.

3. Loss of primary power at the FACP sounds trouble signal at the FACP and indicates at the FACP when the system is operating on an alternate power supply.

4. Loss of primary power at the FACP sounds trouble signal at the FACP and the annunciator. An emergency power light is illuminated at both locations when the system is operating on an alternate power supply.

5. Annunciation: Manual and automatic operation of alarm and supervisory initiating devices is annunciated both on the FACP and on the annunciator, indicating the location and type device.

6. General Alarm: A System General Alarm includes:

   a. Indicating the general alarm condition at the FACP and the annunciator.
   b. Identifying the device that is the source of the alarm (or its zone) at the FACP and the annunciator.
   c. Initiating audible and visible alarm signals throughout the building.
   d. Initiating elevators' automatic recall operation.
   e. Closing fire and smoke doors normally held open by magnetic door holders.
   f. Closing smoke dampers on system serving zone where alarm is initiated.
   g. Initiating smoke control sequence through a signal to the building automatic temperature control system.

7. Manual station alarm operation initiates a general alarm.

8. Water-flow alarm switch operation:

   a. Initiates a general alarm.
   b. Causes flashing of the device location-indicating lamp of the device that has operated.

9. Sprinkler valve tamper switch operation causes or initiates the following:

   a. A supervisory audible and visible “valve tamper" signal indication at FACP and annunciator.
   b. The location-indicating light to flash for the device that has operated.

1.4 SUBMITTALS

A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.

B. Product Data for System Components. Include dimensioned plans and elevations showing minimum clearances and installed features and devices. Include list of materials and NRTL listing data.

C. Wiring diagrams from manufacturer differentiating between factory and field installed wiring. Include diagrams for equipment and for system with all terminals and interconnections identified. Indicate components for both field and factory wiring.

D. Shop Drawings showing details of [visual or graphic] annunciator.

E. System operation description covering this specific project including method of operation and supervision of each type of circuit and sequence of operations for all manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.

F. Operating instructions for mounting at the FACP.

G. Operation and Maintenance Data for inclusion in Operating and Maintenance Manual specified in Division 1. Include data for each type product, including all features and operating sequences, both automatic and manual. Include recommendations for spare

parts to be stocked at the site. Provide the names, addresses, and telephone numbers of service organizations that carry stock of repair parts for the system to be furnished.

H. Product Certification signed by the manufacturer of the fire alarm system components certifying that their products comply with indicated requirements.

I. Submission to Authority Having Jurisdiction: In addition to routine submission of the above material, make an identical submission to the authority having jurisdiction. Include copies of annotated Contract Drawings as required to depict component locations to facilitate review. Upon receipt of comments from the Authority, submit them for review. Make resubmissions if required to make clarifications or revisions to obtain approval.

J. Record of field tests of system.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A factory-authorized Installer is to perform the work of this Section.

B. Compliance With Local Requirements: Comply with the applicable building code, local ordinances and regulations and the requirements of the authority having jurisdiction.

C. Comply with NFPA 70, "National Electrical Code".

D. NFPA Compliance: Provide Fire Alarm and Detection Systems conforming to the requirements of the following publications:

1. NFPA 72, "Installation, Maintenance, and Use of Protective Signaling Systems".

2. NFPA 72E, "Automatic Fire Detectors".

3. NFPA 72G, "Guide for the Installation, Maintenance and Use of Notification Appliances for Protective Signaling Systems".

E. NRTL Listing: Provide systems and equipment that are listed and labeled.

1. Terms "Listed" and "Labeled", as defined in the "National Electrical Code", Article 100.

2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

F. Single-Source Responsibility: Obtain fire alarm components from a single source who assumes responsibility for compatibility for system components.

1.6 EXTRA MATERIALS

A. General: Furnish extra materials, matching products installed (as described below), packaging with protective covering for storage and identifying with labels clearly describing contents.

B. Lamps for Remote Indicating Lamp Units: Furnish quantity equal to 10 percent of the number of units installed, but not less than one.

C. Lamps for Strobe Units: Furnish quantity equal to 10 percent of the number of units installed, but not less than one.

D. Smoke Detectors and Heat Detectors: Furnish quantity equal to 10 percent of the number of units of each type installed, but not less than one (1) of each type.

E. Detector Bases: Furnish quantity equal to 2 percent of the number of units of each type installed but not less than one of each type.

PART II - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Notifier

2. Honeywood

3. Simplex Time Recorder Co.

2.2 MANUAL PULL STATIONS [ADDRESSABLE]

A. Description: Double-action type, fabricated of metal or plastic and finished in red with molded, raised letter operating instructions of contrasting color. Stations requiring the breaking of a glass panel are not acceptable.

B. Station Reset: Key operated, double-pole, double-throw, switch-rated for the voltage and current at which it operates. Stations have screw terminals for connections.

2.3 SMOKE DETECTORS [ADDRESSABLE]

A. General: Comply with UL 268, "Smoke Detectors for Fire Protective Signaling Systems". Include the following features:

1. Factory Nameplate: Serial number and type identification

2. Operating Voltage: 24-V d.c. nominal.

3. Self-Restoring: Detectors do not require re-setting or re-adjustment after actuation to restore them to normal operation.

4. Plug-In Arrangement: Detector and associated encapsulated electronic components are mounted in a module that connects to a fixed base with a twist-locking plug connection. The plug connection requires no springs for secure mounting and contact maintenance. Terminals in the fixed base accept building wiring.

5. Visual Indicator: Connected to indicate detector has operated.

B. Photo Electric-Type Smoke Detector: Analog type adjustable sensitivity. Notifier 5DX-551/BX-501.

C. Duct Smoke Detector: Notifier DXH502 Photo-Electric type, with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied. Detector includes relay as required for fan shutdown.

2.4 OTHER DETECTORS [ADDRESSABLE]

A. Thermal Heat Detector: Notifier FDX-551 Combination fixed-temperature and rate-of-rise unit with mounting plate arranged for outlet box mounting; 135 degrees F fixed temperature setting except as indicated.

2.5 ALARM-INDICATING DEVICES

A. General: Equip alarm-indicating devices for mounting as indicated. Provide terminal blocks for system connections.

B. Fire Alarm Bells: Electric vibrating, 24-V d.c., under-dome type, with provision for housing the operating mechanism behind the bell. When operating, bells provide a sound pressure level of 94 dB, measured 10 feet from the bell. 10 inch size except as indicated. Bells are weatherproof where indicated. Notifier MB-G10-24.

C. Visual Alarm Devices: Dual-voltage (120-V a.c. or 24-V d.c.) strobe lights with clear polycarbonate lens and xenon flash tube. Mount lenses on an aluminum face-plate. The word "FIRE" is engraved in minimum 1-inch high letters on the lens. Notifier ST24-1575.

1. Lamps have a minimum peak intensity of 8,000 candlepower. Strobe leads are factory-connected to screw terminals.

2. Combination devices consist of factory-combined, audible and visual alarm units in a single mounting assembly. Notifier H524-1575.

D. Control relay module Notified CMX-2.

2.6 MAGNETIC DOOR HOLDERS

A. Magnetic holder will be furnished by the General Contractor and installed by the Electrical Contractor to the F.A. System equipment as required.

B. Material and Finish: Match door hardware.

2.7 FIRE ALARM CONTROL PANEL (FACP) Notifier AFP-200

A. General: Comply with UL 864, "Control Units for Fire-Protective Signaling Systems".

B. Cabinet: Lockable Steel Enclosure. Arrange panel so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure. If more than a single unit is required to form a complete control panel, provide exactly matching modular unit enclosures. Accommodate all components and allow ample gutter space for interconnection of panels as well as field wiring. Identify each enclosure by an engraved, red-laminated, Phenolic resin nameplate. Lettering on the enclosure nameplate shall not be less than one (1) inch high. Identify individual components and modules within the cabinets with permanent labels.

C. Systems: Alarm and Supervisory Systems shall be separate and independent in the "FACP." Each initiating device shall individually report to the "FACP." The System shall be microprocessor based, custom programmable.

D. Alarm supervisory and trouble conditions are to have dedicated "Leeds" and tone-alert. Point status shall be by alphanumeric "LCD" for all alarms and troubles.

E. Resetting: Provide the necessary controls to prevent the resetting of any alarm,

supervisory, or trouble signal while the alarm or trouble condition still exists.

F. The FACP shall be capability of being connected into the Telephone System equipment to automatically dial if an alarm is generated.

G. Instructions: Printed or typewritten instruction card mounted behind a lexan plastic or glass cover in a stainless steel or aluminum frame. Install the frame in a location observable from the FACP. Include interpretation and appropriate response for displays and signals and briefly describe the functional operation of the system under normal, alarm and trouble conditions.

2.8 REMOTE ANNUNCIATOR PANEL

A. Remote unit shall be alphanumeric liquid crystal display with capability of indicating all alarm and trouble signals. Unit shall completely be compatible with the Master Fire Alarm Control Panel. Notifier LCD-80.

B. Unit shall be "U.L." listed and labeled.

C. Locate at Main Entry to building as shown on the Drawings or as directed by the local Inspector. Coordinate location shown before installing.

2.9 GRAPHIC ANNUNICATOR

A. The annunciator shall be similar and equal to “L.E.D.” model number LD-1 Back-Lit recessed mounted with a brushed aluminum frame attached to the back box with vandal resistant hidden hinge. The cover shall be key lockable to prevent unauthorized access and terminal strips shall be screw connectors with wire captive protection to secure loosening.

B. The electronic components shall be permanently installed on the circuit boards. Ribbon connectors shall be provided from the circuit to the terminal strip.

C. The annunciator shall have two (2) sets of lights - one (1) for the Fire Alarm System annunciation. Lamps shall be “Red” in color. The other shall be for the Security System. The lamp shall be “Amber”.

D. The Normal System Operation shall be indicated by a “Green” LED indicator. A test lamp shall be provided to activate all system indicators to indicate that all internal circuit, wiring and LED’s are 1.1.

1. Standby Voltage - Nominal 24 Vdc: Min. 18 Vdc to 36 Vdc

2. Standby Current - Typical Range 0 - 20 ma.

3. Alarm Current - Standby Current is increased by approximately 20 ma. for each activated alarm indicator.

4. Indicator - Super Bright LED’s - Red, Green, Amber

5. Activating Voltage - Positive or Negative, as specified.

6. Operating Temp - 32 degrees. - 100 degrees. F. (0 degrees - 38 degrees C).

E. All shall be protected by a non-glare plexiglass screen finished in a brushed aluminum trim. The annunciator shall be able to operate from a nominal 24-volt D.C. supplied

system from the Fire Alarm Control Panel under the present contract. Upon activation of any alarm from the Fire Alarm or Security System shall utilize and operate on the Fire Alarm Control Panel standby batteries is upon any normal loss of power.

F. The graphic layout of the annunciator shall be drawn by the annunciator manufacturer and submitted to the Engineer for final approval. The Graphic Drawing shall show the building floor plan to proper scaled proportions. The LED's shall light in the area of the device(s) in the alarm. Provide Red LED's to light in the area in the alarm by Fire Alarm System. Provide green LED's to light in the area in alarm by the Security 80 character LCD display. The top line of 40 characters shall be the point label and the second line shall be the device type identifier. The System Alarm LED shall flash the remote until the alarm has been acknowledged. Once acknowledged, this same LED shall latch on. A subsequent alarm received from another zone shall flash the system alarm LED. The LCD display shall show the new alarm information.

G. All graphic information shall be white photo-emulsion factory applied to ¼-inch smoke Plexi-glass face at the time of manufacture. The annunciator face shall be protected by 1/10th inch clear plexiglass enclosed by the architectural gray extruded aluminum frame.

H. The annunciator shall be point back-lighted and use socket mounted LED's to facilitate any future changes. LED's for fire alarm annunciation shall be "Red". Incandescent lights are not acceptable.

I. The annunciator shall be graphically and electronically expandable. Field updates of graphic information shall be possible though the use of factory supplied photo emulsion change kits. More extensive changes (major modification of graphic elements, adding or deleting LED's, etc.) shall be possible without requiring full replacement of the original panel.

J. Back boxes shall be factory painted with a black two-part textured epoxy and shall be recess mounted. Backbones shall be available for shipment to the job site at the earliest date required by the Contractor. Front panels shall be designed for quick bolt-on attachments to the back box following completion of final on-site electric connections.

K. The annunciator shall operate on 24 volts DC and be capable of annunciating more than one system. The annunciator shall have switches to perform auxiliary functions as follows:

1. System Reset
2. Alarm Silence
3. Trouble Silence
4. Alarm Acknowledge
5. Trouble Acknowledge
6. Supervisory Services Acknowledge

L. All electronics shall be factory mounted to a metal back plane that shall be mounted to the back-box at the time of final annunciator installation. All field connections to the back plate shall be made though System Standard Terminal Strips. All front panel LED's shall be connected to the back plane by a quick disconnecting of ribbon cables. All front panel switches shall utilize quick plug-in circuit board connectors. The annunciator shall have a piezoelectric alarm (Model PC-900). Upon any input to the annunciator, the audio alert shall sound continuously until silenced by a momentary key or push button switch.

Subsequent inputs shall re-sound the audio alert.

M. The annunciator shall be UL listed and labeled.

N. The graphic annunciator shall be provided by a manufacturer with not less than five (5) years of experience. Samples may be required.

2.10 EMERGENCY POWER SUPPLY

A. General: Components include lead-acid type gel-cell battery, charger, and an automatic transfer switch.

B. Battery capacity is adequate to operate the complete alarm system in normal or supervisory (non-alarm) mode for a period of 24 hours. At the end of this period, the battery has sufficient capacity to operate the system, including alarm-indicating devices in either alarm or supervisory mode for a period of 15 minutes.

1. Magnetic door holders are not served by emergency power. Magnetic door holders are released when normal power fails.

C. Battery Charger: Solid state, fully automatic, variable charging rate type. Provide capacity for 150 percent of the connected system load while maintaining the batteries at full charge. In the event batteries are fully discharged, the charger recharges them fully within four hours. Charger output is supervised as part of system power supply supervision.

D. Automatic Transfer Switch transfers the load to the battery without loss of signals or status indications when normal power fails.

2.11 WIRE

A. Line-Voltage and Low-Voltage Circuits: Solid copper conductors with 600 V-rated insulation. All conductors in conduit shall be sized by manufacturer.

2.12 TAGS

A. Tags For Identifying Tested Components: Comply with NFPA 72H.

PART III – EXECUTION

3.1 INSTALLATION - GENERAL

A. Install system according to NFPA Standards referenced in Parts 1 and 2 of this Section.

3.2 EQUIPMENT INSTALLATION

A. Manual Pull Stations: Mount semi-flush in recessed back boxes install 48 inches above finished floor to the top of device.

B. Water-Flow Detectors and Valve Supervisory Switches: Connect for each sprinkler valve station required to be supervised.

C. Smoke Detectors: Install ceiling-mounted detectors not less than 4 inches from a side wall to the near edge. Install detectors located on the wall at least 4 inches but not more than 12 inches below the ceiling. For exposed solid joist construction, mount detectors

on the bottoms of the joists. On smooth ceilings, install detectors not over 30 feet apart in any direction and 15' form the end of corridors. Install detectors no closer than 3 feet from air registers. Field coordinate location before installation.

D. Return air smoke detectors shall be furnished by the Electrical Contractor and installed by the Division 15 Contractor. All wiring and connections to the Fire Alarm System Controller will be by the Electrical Contractor. All control wiring and shut down of the Division 15 equipment will be by the Division 15 Contractor.

E. Remote return air detector annunciators, ceiling typed, shall be provided by the Electrical Contractor and connected to the respective return air smoke detector. Locate in a visible area. Label annunciator as to the unit controlled.

F. All sprinkler flow and tamper switches will be furnished and installed by the Division 15 Contractor. The Electrical Contractor shall provide all wiring and conduit to connect into the Fire Alarm System Controller.

G. Audible Alarm-Indicating Devices: Install not more than eighty (80) inches above the finished floor nor less than six (6) inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device operating mechanism concealed behind a grille or as indicated. Combine audible and visual alarms at the same location into a single unit.

H. Visual Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn not more than eighty (80) inches above the finished floor and at least six (6) inches below the ceiling.

I. Device Location-Indicating Lights: Locate in the public space immediately adjacent to the device they monitor.

J. Fire Alarm Control Panel (FACP): Surface mount with tops of cabinets not more than six (6) feet above the finished floor.

K. Remote Annunciator: Arrange as indicated, with the top of the panel no more than six (6) feet above the finished floor.

3.3 SURGE PROTECTION

A. Surge Protection: Provide surge protectors similar to "Ditek" DTK-120/240 CM for the Control Panel.

B. Provide surge protection for all signal and initiating circuits which exit and enter the building to remote locations. Provide protection at each end.

3.4 WIRING INSTALLATION

A. Wiring Method: Install wiring in metal raceway according to Division 16 Section "Raceways". Conceal raceway except in unfinished spaces and as indicated.

B. Wiring Within Enclosures: Install conductors parallel with or at right angles to the sides and back of the enclosure. Bundle, lace and train the conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the Fire Alarm System to terminal blocks. Mark each terminal according to the wiring diagrams of the system. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

C. Cable Taps: Use numbered terminal strips in junction, pull or outlet boxes, cabinets, or equipment enclosures where any circuit tap is made.

D. System Wiring: All addressable control circuits shall be Class "A". Wire sizes shall be as required by the manufacturer.

E. Color Coding: Color code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm circuits wiring and a different color code for supervisory circuits. Color code audible alarm indicating circuits differently from alarm initiating circuits. Use different colors for visual alarm indicating devices. Paint Fire Alarm System Junction Boxes and Covers 'Red'.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pre-testing, testing and adjustment of the system.

B. Pre-testing: Upon completing installation of the system, align, adjust and balance the system and perform complete pre-testing. Determine, through pre-testing, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.

C. Report of Pre-testing: After pre-testing is complete, provide a letter certifying the installation is complete and fully operable, including the names and titles of the witnesses to the preliminary tests.

D. Final Test Notice: Provide a 10 day minimum notice in writing when the system is ready for final acceptance testing.

E. Minimum System Tests: Test the system according to the procedures outlined in NFPA 72H, Chapters 2 and 4, and NFPA 72E, Chapter 8. Minimum required tests are as follows:

1. Verify the absence of unwanted voltages between circuit conductors and ground.

2. Megger test all conductors other than those intentionally and permanently grounded with electronic components disconnected. Test for resistance to ground. Report readings less than 1 megohm for evaluation.

3. Test all conductors for short circuits utilizing an insulation testing device.

4. With each circuit pair, short circuit at the far end of the circuit and measure the circuit resistance with an ohmmeter. Record the circuit resistance of each circuit on the Record Drawings.

5. Verify the control unit is in the normal condition as detailed in the manufacturer's operating and maintenance manual.

6. Test initiating and indicating circuits for proper signal transmission under open circuit conditions. One connection each should be opened at not less than 10 percent of the initiating and indicating devices. Observe proper signal transmission according to class of wiring used.

7. Test each initiating and indicating device for alarm operation and proper response at the control unit. Test smoke detectors with actual products of combustion.

8. Test both primary power and secondary power. Verify, by test, the secondary power system is capable of operating the system for the period and in the manner specified.

F. Re-Testing: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

G. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Submit log upon the satisfactory completion of tests.

H. Tag all equipment, stations, and other components at which tests have been satisfactorily completed.

I. The owner shall be provided computer software upgrades at no additional cost for the entire life of the system.

3.6 CLEANING AND ADJUSTING

A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer.

B. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels and adjusting controls and sensitivities to suit actual occupied conditions. Provide up to three visits to the site for this purpose.

3.7 DEMONSTRATION

A. Provide the services of a factory-authorized service representative to demonstrate the system and train Owner's maintenance personnel as specified below.

1. Train Owner's Maintenance Personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventive maintaining of the system. Provide a minimum of two (2) hours training.

2. Schedule training with the Owner at least seven (7) days in advance.

3.8 WARRANTY

A. The Contractor shall warrant the workmanship to be free of defects for a period of (5) five years from the date of final acceptance. Should the Owner uncover defective workmanship during the warranty period, the Contractor of Record shall remedy the defect and certify that the correction has been made not less than seven (7) calendar days or reimburse reasonable direct or indirect costs to the Owner should the Contractor fail to correct the defect within the time allowed.

3.9 ALTERNATE

A. An alternate price shall be submitted for Simplex Time Recorder Company for the Fire Alarm System specified.

END OF SECTION 16721

DIVISION 21 - FIRE SUPPRESSION

212200 Clean-Agent Fire-Extinguishing System

SECTION 212200 – CLEAN-AGENT FIRE-EXTINGUISHING SYSTEMS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. This specification outlines the requirements for a "Total Flood" Clean Agent Fire Suppression System with a Potter Releasing Panel. The work described in this specification includes all engineering, labor, materials, equipment, design and service necessary and required to complete and test the suppression system.

B. The contract drawings indicate the general requirements of the areas to receive detection and clean agent system protection. Contractor shall review all drawings so that all items affecting the operation of the fire detection/fire suppression system (such as equipment location, air diffusers, damper closures, and door openings) are considered in the design of the engineered system.

1.2 APPLICABLE STANDARDS AND PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto (latest edition):

1. National Fire Protection Association (NFPA) Standards:

NFPA 2001: Standard on Clean Agent Fire Extinguishing Systems
NFPA 70: National Electrical Code
NFPA 72: National Fire Alarm and Signaling Code
NFPA 75: Standard for the Fire Protection of Information Technology Equipment
NFPA 76: Standard for the Fire Protection of Telecommunications Facilities

2. Factory Mutual Systems (FM) Publication

Factory Mutual Approval Guide

3. Underwriters Laboratories, Inc. (UL) Publication

UL 217:	Smoke Detectors, Single and Multiple Stations
UL 228:	Door Closers–Holders for Fire Protective Signaling Systems
UL 268:	Standard for Smoke Detectors for Open Areas
UL 268A:	Standard for Smoke Detectors for Duct Application
UL 521:	Heat Detectors for Fire Protective Signaling Systems UL
UL 864:	Control Units and Accessories for Fire Alarm Systems
UL 1638:	Visual Signaling Appliances
UL 1971:	Signaling Devices for Hearing Impaired Fire Protection Equipment Directory with quarterly supplements

4. National Electrical Manufacturers Association (NEMA) Publication Enclosures for Industrial Controls and Systems

5. U.S. Environmental Protection Agency, Protection of Stratospheric Ozone 59 FR 13044, March 18, 1994 (Final SNAP Ruling)

6. Requirements of the Authority Having Jurisdiction (AHJ)

7. Manufacturer’s Design, Installation, Operation and Maintenance Manual

8. The complete system shall have the following applicable listings and approvals

a) Underwriters Laboratories Inc.
b) Factory Mutual Global

9. U.S. Environmental Protection Agency, Protection of Stratospheric Ozone 59 FR 13044, March 18, 1994 (Final SNAP Ruling)

10. Requirements of the Authority Having Jurisdiction (AHJ)

11. Manufacturer's Design, Installation, Operation and Maintenance Manual

1.3 APPROVAL REQUIREMENTS

A. The fire detection and suppression system shall be listed together and shall have the following applicable listings and approvals:

1. UL Listed
2. ULC Listed
3. FM Approved

B. The standards listed, all applicable codes, and sound engineering practices, shall be used as "minimum" design standards.

1.4 GENERAL

A. Furnish all engineering design and materials for a complete fire detection/fire suppression system including charged storage cylinders, nozzles, control unit, detectors, wiring, annunciators, alarm and all other equipment necessary for a complete operational system.

B. Major system components shall be produced by SEVO Systems (no alternatives) and shall be installed by an authorized SEVO Systems Distributor certified for the design, installation, and service of the fire suppression systems

1.5 SUBMITTAL:

A. The following shall be submitted for approval within 21 days of award and prior to delivery of materials:

1. Material and equipment information shall include manufacturer's catalog cut sheet and technical data for each component or device used in the system. This shall include, but not be limited to, the following:

a) Detectors
b) Manual discharge switches
c) Control unit
d) Release devices
e) Alarm devices
f) Agent storage cylinders
g) Mounting brackets
h) Discharge nozzles
i) Abort stations
j) Piping isometrics
k) Flow calculations

B. Provide information outlining the warranty of each component or device used in the system.

C. Provide information outlining the operation and maintenance procedures that will be required

of the owner. This information shall explain any special knowledge or tools the owner will be required to employ and all spare parts that should be readily available.

D. Drawings shall indicate locations, installation details and operation details of all equipment associated with the fire suppression system. Floor plans shall be provided showing equipment locations, piping, point- to-point wiring and other details as required. Floor plans shall be drawn to a scale of not less than 1/8 in. (3.2 mm) = 1 ft 0 in. (0.3 m). Elevations, cross sections and other details shall be drawn to a larger scale as required. Isometric piping layouts shall be provided with the shop drawings. In addition, point- to-point electrical layout drawings shall be provided.

E. Show a complete Riser diagram with specific detail on connections to all monitor and control functions.

F. Testing plan that includes means, methods and schedules for interface testing with systems that will be interfaced to via monitor or control modules.

G. Sequence of operation, electrical schematics and connection diagrams shall be provided to completely describe the operation of the fire suppression system controls.

PART 2 – PRODUCTS

2.1 SYSTEM DESCRIPTION AND OPERATION

A. The system shall be a Total Flood SEVO Systems Engineered Fire Suppression System, Potter Signal Releasing Control Panel and detection system.

B. The system provided shall be FFT-1230 (FK 5-1-12) clean agent with a minimum agent design concentration based on the hazard per NFPA 2001. A design concentration of 4.5% by volume for Class A hazards and a minimum of 5.85% by volume for Class B hazards in all areas and/or protected spaces, at the minimum anticipated temperature within the protected area. System design shall not exceed 10% for normally occupied spaces, adjusted for maximum space temperature anticipated, with provisions for room evacuation before agent release.

C. The system shall be complete including mechanical and electrical installation, all detection and control equipment, agent storage containers, FFT-1230 agent, discharge nozzles, pipe and fittings, manual release and abort stations, audible and visual alarm devices, auxiliary devices and controls, shutdowns, alarm interface, advisory signs, functional checkout and testing, training, and any other operations necessary for a functional UL listed SEVO Systems Clean Agent suppression system.

D. Provide two inspections during the first year of service: Inspections shall be made at 6-month intervals commencing when the system is first placed into normal service.

E. The general contractor shall be responsible for sealing and securing the protected spaces against agent loss and/or leakage for a minimum design concentration hold time of 10 minutes or a time period sufficient for a response by trained personnel.

F. The system(s) shall be actuated by photoelectric detectors installed for maximum area coverage of 250 ft² (23.2 m²) per detector, in the room, under the floor, and above the ceiling protected spaces. If the airflow is one air change per minute, photoelectric detectors only shall be installed for maximum area coverage of 125 ft² (11.6 m²) per detector (Reference NFPA 72).

2.2 SEQUENCE OF OPERATION

A. Detectors shall be Cross-Zoned detection requiring two detectors to be in alarm before release. Automatic operation of each protected area shall be as follows:

1. Actuation of one detector, within the system, shall:

   a) Illuminate the "ALARM" lamp on the control panel face.
   b) Energize an alarm bell.
   c) Transfer auxiliary contacts, which can perform auxiliary system functions such as: Operate door holder/closures on access doors; Transmit a signal to a fire alarm system; Shutdown HVAC equipment.
   d) Light an individual lamp on an optional annunciator.

2. Actuation of a 2nd detector, within the system, shall:

   a) Illuminate the "PRE-DISCHARGE" lamp on the control panel face.
   b) Energize a pre-discharge horn/strobe device.
   c) Shut down the HVAC system and/or close dampers.
   d) Start time-delay sequence (not to exceed 60 seconds).
   e) System abort sequence is enabled at this time.
   f) Light an individual lamp on an optional annunciator.
   g) After completion of the time-delay sequence, the SEVO Systems Engineered Clean Agent system shall discharge and the following shall occur:
   h) Illuminate a "SYSTEM FIRED" lamp on the control panel face.
   i) Shutdown of all power to high-voltage equipment.
   j) Energize a visual indicator(s) outside the hazard in which the discharge occurred.
   k) Energize a "System Fired" audible device. (Optional)

3. The system shall be capable of being actuated by manual discharge devices located at each hazard exit. Operation of a manual device shall duplicate the sequence description above except that the time delay and abort functions shall be bypassed. The manual discharge station shall be of the electrical actuation type and shall be supervised at the main control panel.

2.3 AUXILIARY COMPONENTS

A. Double action manual releasing stations shall be provided at each exit of the protected area and shall, when activated, immediately release the fire suppression system and cause all audible/visual alarms to activate. In addition, activation of the manual releasing stations shall cause immediate shutdown of air and power circuits.

B. Abort stations shall be provided at each exit of the protected area and shall, when operated, interrupt the discharge of fire suppression system and emergency power-off functions. The abort stations shall be momentary devices (dead-man) requiring constant pressure to maintain contact closure.

PART 3 – MATERIALS AND EQUIPMENT

3.1 GENERAL REQUIREMENTS:

A. The SEVO Systems Clean Agent system materials and equipment shall be standard products of the supplier's latest design and suitable to perform all functions intended. When one or more pieces of equipment must perform the same function(s), they shall be duplicates produced by one manufacturer.

B. All devices and equipment shall be UL Listed and/or FM approved.

C. Each system shall have its own supply of clean agent.

D. The system design can be modular, central storage, or a combination of both design criteria.

E. Systems shall be designed in accordance with the manufacturer's guidelines.

F. The clean agent shall be stored in Clean Agent storage tanks. Tanks shall be super- pressurized with dry nitrogen to an operating pressure of 500 psi at 70 °F. Tanks shall be of high-strength low alloy steel construction and conforming to NFPA 2001.

G. Tanks (master) shall be actuated by either a resettable electric actuator or by pneumatic means from a nitrogen cartridge located in the releasing device. Explosive devices shall not be permitted.

H. Each tank shall have a pressure gauge and low pressure switch (optional) to provide visual and electrical supervision of the container pressure. The low-pressure switch shall be wired to the control panel to provide audible and visual "Trouble" alarms in the event the container pressure drops.The pressure gauge shall be color coded to provide an easy, visual indication of container pressure.

I. Engineered discharge nozzles shall be provided within the manufacturer's guidelines to distribute the FFT 1230 agent throughout the protected spaces. The nozzles shall be designed to provide proper agent quantity and distribution. Nozzles shall be available in 1/2 in. through 2 in. pipe sizes. Each size shall be available in 180° and 360° distribution patterns.

J. Distribution piping and fittings shall be installed in accordance with the manufacturer's requirements, NFPA 2001, and approved piping standards and guidelines. All distribution piping shall be installed by qualified individuals using accepted practices and quality procedures. All piping shall be adequately supported and anchored at all directional changes and nozzle locations.

K. All piping shall be reamed, blown clear and swabbed with suitable solvents to remove burrs, mill varnish, and cutting oils before assembly.

L. All pipe threads shall be sealed with Teflon tape pipe sealant applied to the male thread only.

PART 4 – TESTING AND DOCUMENTATION

4.1 SYSTEM INSPECTION AND CHECKOUT

A. After the system installation has been completed, the entire system shall be checked out, inspected, and functionally tested by qualified, trained personnel, in accordance with the manufacturer's recommended procedures and NFPA standards.

B. All containers and distribution piping shall be checked for proper mounting and installation.

C. All electrical wiring shall be tested for proper connection, continuity and resistance to earth.

D. The complete system shall be functionally tested, in the presence of the owner or his representative, and all functions, including system and equipment interlocks, must be operational at least five days prior to the final acceptance tests.

E. Each detector shall be tested in accordance with the manufacturer's recommended procedures and test values recorded.

F. All system and equipment interlocks, such as door release devices, audible and visual devices, equipment shutdowns, local and remote alarms, etc. shall function as required and designed.

G. Each control panel circuit shall be tested for trouble by inducing a trouble condition into the system.

4.2 TRAINING REQUIREMENTS

A. Prior to final acceptance, the installing contractor shall provide operational training to each shift of the owner’s personnel. Each training session shall include control panel operation, manual and (optional) abort functions, trouble procedures, supervisory procedures, auxiliary functions and emergency procedures.

4.3 OPERATION AND MAINTENANCE

A. Prior to final acceptance, the installing contractor shall provide four complete operation and maintenance instruction manuals to the owner. All aspects of system operation and maintenance shall be detailed, including piping isometrics, wiring diagrams of all circuits, a written description of the system design, sequence of operation and drawing(s) illustrating control logic and equipment used in the system. Checklists and procedures for emergency situations, troubleshooting techniques, maintenance operations and procedures shall be included in the manual.

4.4 AS-BUILT DRAWINGS

A. Upon completion of each system, the installing contractor shall provide four copies of system as-built drawings to the owner. The drawings shall show actual installation details including all equipment locations (i.e., control panel(s), agent container(s), detectors, alarms, manual pull station(s), and abort switch(s), etc.), as well as piping and conduit routing details. Show all room or facilities modifications, including door and/or damper installations completed. One copy of reproducible engineering drawings shall be provided reflecting all actual installation details.

4.5 ACCEPTANCE TEST

A. At the time As-built drawings and maintenance/operations manuals are submitted, the installing contractor shall submit a "Test Plan" describing procedures to be used to test the control system(s). The Test Plan shall include a step-by-step description of all tests to be performed and shall indicate the type and location of test apparatus to be employed. The tests shall demonstrate that the operational and installation requirements of this specification have been met. All tests shall be conducted in the presence of the owner or owner’s representative and shall not be conducted until the Test Plan has been approved.

B. The tests shall demonstrate that the entire control system functions as designed and intended. All circuits shall be tested: automatic actuation and manual actuation, HVAC and power shutdowns, audible and visual alarm devices, and manual override of abort functions. Supervision of all control panel circuits, including AC power and battery power supplies, shall be tested and qualified.

C. A room pressurization test shall be conducted in each protected space to determine the presence of openings, which would affect the agent concentration levels. The test(s) shall be conducted using the Retrotec Inc. Door Fan system, or equivalent, with integrated computer program. All testing shall be in accordance with NFPA 2001.

D. If room pressurization testing indicates that openings exist which would result in leaks and/or loss of the extinguishing agent, the installing contractor shall be responsible for coordinating the proper sealing of the protected space(s) by the general contractor or his sub-contractor or agent. The general contractor shall be responsible for adequately sealing all protected space(s) against agent loss or leakage. The installing contractor shall inspect all work to ascertain that the protected space(s) have been adequately and properly sealed. THE SUPPRESSION SYSTEM INSTALLING CONTRACTOR SHALL BE RESPONSIBLE FOR THE SUCCESS OF THE ROOM PRESSURIZATION TESTS. If the first room pressurization test is not successful, in accordance with these specifications, the installing contractor shall direct the general contractor to determine, and correct, the cause of the test failure. The installing contractor shall conduct additional room pressurization tests, at no additional cost to the owner, until a successful test is obtained. Copies of successful test results shall be submitted to the owner for his record. Upon acceptance by the owner, the completed system(s) shall be placed into service.

4.6 SYSTEM INSPECTIONS

A. During the one-year warranty period, the installing contractor shall provide two inspections of each system installed under this contract. The first inspection shall be at the 6-month interval, and the second inspection at the 12-month interval. Inspections shall be conducted in

accordance with the manufacturer's guidelines and the recommendations of NFPA 2001.

B. Documents certifying satisfactory system(s) inspection shall be submitted to the owner upon completion of each inspection.

END OF SECTION 212200

DIVISION 26 - LIGHTING PROTECTION

264113 Lighting Protection for Structures

SECTION 264113 – LIGHTING PROTECTION FOR STRUCTURES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes lighting protection system for ordinary structures.

B. Section includes lighting protection system for the following:

1. Ordinary structures

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include layouts of the lighting protection system, with details of the components to be used in the installation.

2. Include raceway locations needed for the installation of conductors.

3. Details of air terminals. Ground rods, ground rings, conductor supports, splices, and terminations, including concealment requirements.

4. Include roof attachment details, coordinated with roof installation.

5. Calculations required by NFPA 780 for bonding of metal bodies.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Completion Certificate:

1. UL Master Label Certificate.

1.6 QUALITY ASSURANCE

B. Installer Qualifications: UL-listed installer, category OWAY.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advanced Lighting Technology, Ltd.

2. East Coast Lighting Equipment, Inc.

3. Harger Lighting & Grounding

4. Independent Protection Co.

5. National Lighting Protection

6. Robbins Lighting, Inc.

7. Thompson Lighting Protection, Inc.

2.2 PERFORMANCE REQUIREMENTS

A. NFPA Lighting Protection Standards: Comply with NFPA 780 requirements for Class I buildings.

B. UL Lighting Protection Standard: Comply with UL 96A requirements for Class I buildings.

C. Lighting Protection Components, Devices, and Accessories: Listed and labeled by a qualified testing agency as complying with UL 96, and marked for intended location and application.

2.3 MATERIALS

A. Electrical wire and cable shall have lead content less than 300 parts per million.

B. Air Terminals:

1. Copper unless otherwise indicated

2. 5/8-inch diameter by 18 inches long.

3. Rounded tip.

4. Threaded base support.

C. Class I Main Conductors:

1. Stranded Copper: 57,400 circular mils in diameter.

D. Class II Main Conductors:

1. Stranded Copper: 115,000 circular mils in diameter.

E. Secondary Conductors:

1. Stranded Copper: 26,240 circular mils in diameter.

F. Ground Loop Conductors: Stranded Copper.

G. Ground Rods:

1. Material: Copper-clad steel.

2. Diameter: ¾ inch.

3. Rods shall not be less than 120 inches long.

H. Conductor Splices and Connectors: Compression fittings that are installed with hydraulically operated tools, or exothermic welds, approved for use with the class type.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install lighting protection components and systems according to UL 96A NFPA 780.

B. Install conductors with direct paths from air terminals to ground connections. Avoid bends less than 90 degrees and 8 inches in radius and marrow loops.

C. Conceal conductors within normal view from exterior locations at grade within 200 feet of building. Comply with requirements for concealed installations in UL 96A concealed systems in MFPA 780.

1. Roof penetrations required for down conductors and connections to structural-steel framework shall be made using listed through-roof fitting and connectors assemblies with solid rods and appropriate roof flashings. Use materials approved by the roofing manufacturer for the purpose. Conform to the methods and materials required at roofing penetrations of the lighting protection components to ensure compatibility with the roofing specifications and warranty.

2. Install conduit where necessary to comply with conductor concealment requirements.

3. Air Terminals on Single-Ply Membrane Roofing: Comply with adhesive manufacturer's written instructions. Adhesive shall be compatible with the roof material and shall not compromise the warranty of the roof.

D. Ground Ring Electrode: The conductor shall be not less than the main-size lighting conductor.

3.2 CONNECTIONS

A. Aboveground concealed connections, and connections in earth or concrete, shall be done by exothermic welds or by high-compression fittings listed for the purpose.

B. Aboveground exposed connections shall be done using the following types of connectors, listed and labeled for the purpose.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate and adjacent part.

2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.

3. Bonding to the building electrode system.

3.3 CORROSION PROTECTION

A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials.

B. Use conductors with protective coatings where conditions would cause deterioration or corrosion of conductors.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:

1. Perform inspections as required to obtain a UL Master Label for system.

2. Perform inspections to obtain an LPI certification.

B. Prepare test and inspection reports and certificates.

1. Upon completion and review by an NCBCC approved third-party lighting protection agency, Contractor shall obtain, and deliver to Owner, the certifications.

END OF SECTION 264113