UNIVERSITY OF SOUTH CAROLINA UPSTATE
USC UPSTATE ADMINISTRATION BUILDING
REPAIRS AND RENOVATIONS

STATE PROJECT #H34-9541-JM

JULY 12, 2013
CONSTRUCTION DOCUMENTS

A/E PROJECT # 11049.02

GMK
ASSOCIATES, INC.

D I V I S I O N 0

B I D D I N G R E Q U I R E M E N T S

SECTION 00001 - PROJECT TITLE PAGE

OWNER:

USC Campus Planning and Construction

743 Greene Street

Columbia, South Carolina 29208

ARCHITECTS, MECHANICAL AND ELECTRICAL ENGINEERS:

GMK Associates, Inc.

1201 Main Street, Suite 2100

Columbia, South Carolina 29201

tel: 803.256.0000

fax: 803.255.7243

www.gmka.com

Architect: Jerome K. Simons [jsimons@gmka.com]

Mechanical: Jonathan Burkett [jburkett@gmka.com]

Plumbing: Jeff Bernagozzi [jbernagozzi@gmka.com]

Electrical: Brell Foster [bfoster@gmka.com]

STRUCTURAL ENGINEER:

CMC Cary Engineering

P.O. Box 2525

Greenville, South Carolina 29602

tel.864.609.5340

fax: 864.609.5344

Dime Hollingsworth [Dime.Hollingsworth@cmc.com]

END OF PROJECT TITLE PAGE

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PROJECT NUMBER: H34-9541-JM

PROJECT NAME: USC Upstate Administration Building Repairs and Renovation

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2011 Edition
Rev. 7/20/2011

SE-310
REQUEST FOR ADVERTISEMENT

PROJECT NAME: USC Upstate Administration Building Repairs and Renovation

PROJECT NUMBER: H34-9541-JM

PROJECT LOCATION: USC Upstate, Spartanburg, South Carolina

Contractor may be subject to performance appraisal at close of project

BID SECURITY REQUIRED? Yes ☒ **No** ☐

PERFORMANCE & PAYMENT BONDS REQUIRED? Yes ☒ **No** ☐

CONSTRUCTION COST RANGE: $3,000,000 - $4,000,000

DESCRIPTION OF PROJECT: The project consist of a total HVAC replacement, ceiling replacement, minor reconfiguration of interior spaces, bathroom upgrades, new fire alarm and electrical upgrades.

A/E NAME: GMK Associates

A/E CONTACT: Jerome K. Simons

A/E ADDRESS: Street/PO Box:1201 Main Street, Suite 2100
City: Columbia
State: South Carolina ZIP: 29201

EMAIL: jsimons@gmka.com

TELEPHONE: 803.256.0000 **FAX:** 803.255.7243

All questions & correspondence concerning this Invitation shall be addressed to the A/E.

BIDDING DOCUMENTS/PLANS MAY BE OBTAINED FROM: purchasing.sc.ed

PLAN DEPOSIT AMOUNT: N/A **IS DEPOSIT REFUNDABLE: Yes** ☐ **No** ☐

Only those Bidding Documents/Plans obtained from the above listed source(s) are official. Bidders rely on copies of Bidding Documents/Plans obtained from any other source at their own risk.

BIDDING DOCUMENTS/PLANS ARE ALSO ON FILE FOR VIEWING PURPOSES ONLY AT *(list name and location for each plan room or other entity)***:**

purchasing.sc.edu. It is the contractor's responsibility to download any documents from the purchasing website

PRE-BID CONFERENCE? Yes ☒ **No** ☐ **MANDATORY ATTENDANCE? Yes** ☐ **No** ☒

DATE: 8/15/2013 **TIME: 10:00 am** **PLACE:** USC Upstate Rampey Center – Room 125, 490 Hodge Drive, Spartanburg, South Carolina 29303

AGENCY: University of South Carolina

NAME OF AGENCY PROCUREMENT OFFICER: Michelle Adams

ADDRESS: Street/PO Box:743 Greene Street
City: Columbia
State: South Carolina ZIP: 29208

EMAIL: MDADAMS@fmc.sc.edu

TELEPHONE: 803-777-0981 **FAX:** 803-777-7334

BID CLOSING DATE: 9/5/2013 **TIME: 2:00 pm** **LOCATION:** USC Upstate Rampey Center – Room 125, 490 Hodge Drive, Spartanburg, South Carolina 29303

BID DELIVERY ADDRESSES:

HAND-DELIVERY:

Attn: Fred Scott

USC Upstate Facilities Management Center

155 American Way

Spartanburg, South Carolina 29303

MAIL SERVICE:

Attn: Fred Scott

USC Upstate Facilities Management Department

800 University Way

Spartanburg, South Carolina 29303

IS PROJECT WITHIN AGENCY CONSTRUCTION CERTIFICATION? ***(Agency MUST check one)*** **Yes** ☐ **No** ☒

APPROVED BY *(Office of State Engineer)***:** _____ **DATE:** _____

SECTION 00200 - INSTRUCTIONS TO BIDDERS

FORM OF INSTRUCTIONS TO BIDDERS

1.01 See AIA Document A701 (1997 Edition), Instructions to Bidders following this document.

A. Copiesof this document may be obtained from The American Institute of Architects, 1522 Richland Street, Columbia, SC 29201. Phone: 803-252-6050.

1.02 Refer to document 00201-OSE for modifications to this document.

END OF INSTRUCTIONS TO BIDDERS

OSE FORM 00201

Revised October 22, 2012

STANDARD SUPPLEMENTAL INSTRUCTIONS TO BIDDERS

OWNER: University of South Carolina
PROJECT NUMBER: H34-9541-JM
PROJECT NAME: USC Upstate Administration Building – Repairs and Renovation
PROJECT LOCATION: University of South Carolina Upstate, Spartanburg, South Carolina

PROCUREMENT OFFICER: Michelle Adams

1. STANDARD SUPPLEMENTAL INSTRUCTIONS TO BIDDERS

1.1. These Standard Supplemental Instructions To Bidders amend or supplement Instructions To Bidders (AIA Document A701-1997) and other provisions of Bidding and Contract Documents as indicated below.

1.2. Compliance with these Standard Supplemental Instructions is required by the Office of State Engineer (OSE) for all State projects when competitive sealed bidding is used as the method of procurement.

1.3. All provisions of A701-1997, which are not so amended or supplemented, remain in full force and effect.

1.4. Bidders are cautioned to carefully examine the Bidding and Contract Documents for additional instructions or requirements.

2. MODIFICATIONS TO A701-1997

2.1. *Delete Section 1.1 and insert the following:*

> **1.1** Bidding Documents, collectively referred to as the **Invitation for Bids**, include the Bidding Requirements and the proposed Contract Documents. The Bidding Requirements consist of the Advertisement, Instructions to Bidders (A-701), Supplementary Instructions to Bidders, the bid form (SE-330), the Intent to Award Notice (SE-370), and other sample bidding and contract forms. The proposed Contract Documents consist of the form of Agreement between the Owner and Contractor, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, all Addenda issued prior to execution of the Contract, and other documents set forth in the Bidding Documents. Any reference in this document to the Agreement between the Owner and Contractor, AIA Document A101, or some abbreviated reference thereof, shall mean the AIA A101, 2007 Edition as modified by OSE Form 00501 – Standard Modification to Agreement Between Owner and Contractor. Any reference in this document to the General Conditions of the Contract for Construction, AIA Document A201, or some abbreviated reference thereof, shall mean the AIA A201, 2007 Edition as modified by OSE Form 00811 – Standard Supplementary Conditions.

2.2. *In Section 1.8, delete the words "and who meets the requirements set forth in the Bidding Documents".*

2.3. *In Section 2.1, delete the word "making" and substitute the word "submitting."*

2.4. *In Section 2.1.1:*

After the words "Bidding Documents," delete the word "or" and substitute the word "and."

Insert the following at the end of this section:

Bidders are expected to examine the Bidding Documents and Contract Documents thoroughly and should request an explanation of any ambiguities, discrepancies, errors, omissions, or conflicting statements. Failure to do so will be at the Bidder's risk. Bidder assumes responsibility for any patent ambiguity that Bidder does not bring to the Owner's attention prior to bid opening.

2.5. *In Section 2.1.3, insert the following after the term "Contract Documents" and before the period:*

and accepts full responsibility for any pre-bid existing conditions that would affect the Bid that could have been ascertained by a site visit. As provided in Regulation 19-445.2042(B), A bidder's failure to attend an advertised pre-bid conference will not excuse its responsibility for estimating properly the difficulty and cost of successfully performing the work, or for proceeding to successfully perform the work without additional expense to the State.

2.6. *Insert the following Sections 2.2 through 2.6:*

2.2 CERTIFICATION OF INDEPENDENT PRICE DETERMINATION

GIVING FALSE, MISLEADING, OR INCOMPLETE INFORMATION ON THIS CERTIFICATION MAY RENDER YOU SUBJECT TO PROSECUTION UNDER SECTION 16-9-10 OF THE SOUTH CAROLINA CODE OF LAWS AND OTHER APPLICABLE LAWS.

(a) By submitting an bid, the bidder certifies that—

(1) The prices in this bid have been arrived at independently, without, for the purpose of restricting competition, any consultation, communication, or agreement with any other bidder or competitor relating to—

(i) Those prices;
(ii) The intention to submit an bid; or
(iii) The methods or factors used to calculate the prices offered.

(2) The prices in this bid have not been and will not be knowingly disclosed by the bidder, directly or indirectly, to any other bidder or competitor before bid opening (in the case of a sealed bid solicitation) or contract award (in the case of a negotiated solicitation) unless otherwise required by law; and

(3) No attempt has been made or will be made by the bidder to induce any other concern to submit or not to submit an bid for the purpose of restricting competition.

(b) Each signature on the bid is considered to be a certification by the signatory that the signatory—

(1) Is the person in the bidder's organization responsible for determining the prices being offered in this bid, and that the signatory has not participated and will not participate in any action contrary to paragraphs (a)(1) through (a)(3) of this certification; or

(2)(i) Has been authorized, in writing, to act as agent for the bidder's principals in certifying that those principals have not participated, and will not participate in any action contrary to paragraphs (a)(1) through (a)(3) of this certification [As used in this subdivision (b)(2)(i), the term "principals" means the person(s) in the bidder's organization responsible for determining the prices offered in this bid];

(ii) As an authorized agent, does certify that the principals referenced in subdivision (b)(2)(i) of this certification have not participated, and will not participate, in any action contrary to paragraphs (a)(1) through (a)(3) of this certification; and

(iii) As an agent, has not personally participated, and will not participate, in any action contrary to paragraphs (a)(1) through (a)(3) of this certification.

(c) If the bidder deletes or modifies paragraph (a)(2) of this certification, the bidder must furnish with its offer a signed statement setting forth in detail the circumstances of the disclosure.

2.3 DRUG FREE WORKPLACE

By submitting a bid, the Bidder certifies that Bidder will maintain a drug free workplace in accordance with the requirements of Title 44, Chapter 107 of South Carolina Code of Laws, as amended.

2.4 CERTIFICATION REGARDING DEBARMENT AND OTHER RESPONSIBILITY MATTERS

(a) (1) By submitting an Bid, Bidder certifies, to the best of its knowledge and belief, that-

(i) Bidder and/or any of its Principals-

(A) Are not presently debarred, suspended, proposed for debarment, or declared ineligible for the award of contracts by any state or federal agency;

(B) Have not, within a three-year period preceding this bid, been convicted of or had a civil judgment rendered against them for: commission of fraud or a criminal offense in

connection with obtaining, attempting to obtain, or performing a public (Federal, state, or local) contract or subcontract; violation of Federal or state antitrust statutes relating to the submission of bids; or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, tax evasion, or receiving stolen property; and

(C) Are not presently indicted for, or otherwise criminally or civilly charged by a governmental entity with, commission of any of the offenses enumerated in paragraph (a)(1)(i)(B) of this provision.

(ii) Bidder has not, within a three-year period preceding this bid, had one or more contracts terminated for default by any public (Federal, state, or local) entity.

(2) "Principals," for the purposes of this certification, means officers; directors; owners; partners; and, persons having primary management or supervisory responsibilities within a business entity (e.g., general manager; plant manager; head of a subsidiary, division, or business segment, and similar positions).

(b) Bidder shall provide immediate written notice to the Procurement Officer if, at any time prior to contract award, Bidder learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

(c) If Bidder is unable to certify the representations stated in paragraphs (a)(1), Bid must submit a written explanation regarding its inability to make the certification. The certification will be considered in connection with a review of the Bidder's responsibility. Failure of the Bidder to furnish additional information as requested by the Procurement Officer may render the Bidder nonresponsible.

(d) Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render, in good faith, the certification required by paragraph (a) of this provision. The knowledge and information of an Bidder is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

(e) The certification in paragraph (a) of this provision is a material representation of fact upon which reliance was placed when making award. If it is later determined that the Bidder knowingly or in bad faith rendered an erroneous certification, in addition to other remedies available to the State, the Procurement Officer may terminate the contract resulting from this solicitation for default.

2.5 ETHICS CERTIFICATE

By submitting a bid, the bidder certifies that the bidder has and will comply with, and has not, and will not, induce a person to violate Title 8, Chapter 13 of the South Carolina Code of Laws, as amended (ethics act). The following statutes require special attention: Section 8-13-700, regarding use of official position for financial gain; Section 8-13-705, regarding gifts to influence action of public official; Section 8-13-720, regarding offering money for advice or assistance of public official; Sections 8-13-755 and 8-13-760, regarding restrictions on employment by former public official; Section 8-13-775, prohibiting public official with economic interests from acting on contracts; Section 8-13-790, regarding recovery of kickbacks; Section 8-13-1150, regarding statements to be filed by consultants; and Section 8-13-1342, regarding restrictions on contributions by contractor to candidate who participated in awarding of contract. The state may rescind any contract and recover all amounts expended as a result of any action taken in violation of this provision. If contractor participates, directly or indirectly, in the evaluation or award of public contracts, including without limitation, change orders or task orders regarding a public contract, contractor shall, if required by law to file such a statement, provide the statement required by Section 8-13-1150 to the procurement officer at the same time the law requires the statement to be filed.

2.6 RESTRICTIONS APPLICABLE TO BIDDERS & GIFTS

Violation of these restrictions may result in disqualification of your bid, suspension or debarment, and may constitute a violation of the state Ethics Act. (a) After issuance of the solicitation, ***bidder agrees not to discuss this procurement activity in any way with the Owner or its employees, agents or officials.*** All communications must be solely with the Procurement Officer. This restriction may be lifted by express written permission from the Procurement Officer. This restriction expires once a contract has been formed. (b) Unless otherwise approved in writing by the Procurement

Officer, ***bidder agrees not to give anything to the Owner, any affiliated organizations, or the employees, agents or officials of either, prior to award.*** (c) Bidder acknowledges that the policy of the State is that a governmental body should not accept or solicit a gift, directly or indirectly, from a donor if the governmental body has reason to believe the donor has or is seeking to obtain contractual or other business or financial relationships with the governmental body. Regulation 19-445.2165(C) broadly defines the term donor.

2.7. *Delete Section 3.1.1 and substitute the following:*

3.1.1 Bidders may obtain complete sets of the Bidding Documents from the issuing office designated in the Advertisement in the number and for the deposit sum, if any, stated therein. If so provided in the Advertisement, the deposit will be refunded to all plan holders who return the Bidding Documents in good condition within ten days after receipt of Bids. The cost of replacement of missing or damaged documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the Bidding Documents and the Bidder's deposit will be refunded.

2.8. *Delete the language of Section 3.1.2 and insert the word "Reserved."*

2.9. *In Section 3.1.4, delete the words "and Architect may make" and substitute the words "has made."*

2.10. *Insert the following Section 3.1.5*

3.1.5 All persons obtaining Bidding Documents from the issuing office designated in the Advertisement shall provide that office with Bidder's contact information to include the Bidder's name, telephone number, mailing address, and email address.

2.11. *In Section 3.2.2:*

Delete the words "and Sub-bidders"

Delete the word "seven" and substitute the word "ten"

2.12. *In Section 3.2.3:*

In the first Sentence, insert the word "written" before the word "Addendum."

Insert the following at the end of the section:

As provided in Regulation 19-445.2042(B), nothing stated at the pre-bid conference shall change the Bidding Documents unless a change is made by written Addendum.

2.13. *Insert the following at the end of Section 3.3.1:*

Reference in the Bidding Documents to a designated material, product, thing, or service by specific brand or trade name followed by the words "or equal" and "or approved equal" shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition.

2.14. *Delete Section 3.3.2 and substitute the following:*

3.3.2 No request to substitute materials, products, or equipment for materials, products, or equipment described in the Bidding Documents and no request for addition of a manufacturer or supplier to a list of approved manufacturers or suppliers in the Bidding Documents will be considered prior to receipt of Bids unless written request for approval has been received by the Architect at least ten days prior to the date for receipt of Bids established in the Invitation for Bids. Any subsequent extension of the date for receipt of Bids by addendum shall not extend the date for receipt of such requests unless the addendum so specifies. Such requests shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution including drawings, performance and test data, and other information necessary for an evaluation. A statement setting forth changes in other materials, equipment or other portions of the Work, including changes in the work of other contracts that incorporation of the proposed substitution would require, shall be included. The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

2.15. *Delete Section 3.4.3 and substitute the following:*

3.4.3 Addenda will be issued no later than 120 hours prior to the time for receipt of Bids except an Addendum withdrawing the request for Bids or one which includes postponement of the date for receipt of Bids.

2.16. *Insert the following Sections 3.4.5 and 3.4.6:*

3.4.5 When the date for receipt of Bids is to be postponed and there is insufficient time to issue a written Addendum prior to the original Bid Date, Owner will notify prospective Bidders by telephone or other appropriate means with immediate follow up with a written Addendum. This Addendum will verify the postponement of the original Bid Date and establish a new Bid Date. The new Bid Date will be no earlier than the fifth (5th) calendar day after the date of issuance of the Addendum postponing the original Bid Date.

3.4.6. If an emergency or unanticipated event interrupts normal government processes so that bids cannot be received at the government office designated for receipt of bids by the exact time specified in the solicitation, the time specified for receipt of bids will be deemed to be extended to the same time of day specified in the solicitation on the first work day on which normal government processes resume. In lieu of an automatic extension, an Addendum may be issued to reschedule bid opening. If state offices are closed at the time a pre-bid or pre-proposal conference is scheduled, an Addendum will be issued to reschedule the conference. Useful information may be available at: http://www.scemd.org/scgovweb/weather_alert.html

2.17. *In Section 4.1.1, delete the word "forms" and substitute the words "SE-330 Bid Form."*

2.18. *Delete Section 4.1.2 and substitute the following:*

4.1.2 Any blanks on the bid form to be filled in by the Bidder shall be legibly executed in a non-erasable medium. Bids shall be signed in ink or other indelible media.

2.19. *Delete Section 4.1.3 and substitute the following:*

4.1.3 Sums shall be expressed in figures.

2.20. *Insert the following at the end of Section 4.1.4:*

Bidder shall not make stipulations or qualify his bid in any manner not permitted on the bid form. An incomplete Bid or information not requested that is written on or attached to the Bid Form that could be considered a qualification of the Bid, may be cause for rejection of the Bid.

2.21. *Delete Section 4.1.5 and substitute the following:*

4.1.5 All requested Alternates shall be bid. The failure of the bidder to indicate a price for an Alternate shall render the Bid non-responsive. Indicate the change to the Base Bid by entering the dollar amount and marking, as appropriate, the box for "ADD TO" or "DEDUCT FROM". If no change in the Base Bid is required, enter "ZERO" or "No Change." For add alternates to the base bid, Subcontractor(s) listed on page BF-2 of the Bid Form to perform Alternate Work shall be used for both Alternates and Base Bid Work if Alternates are accepted.

2.22. *Delete Section 4.1.6 and substitute the following:*

4.1.6 Pursuant to Title 11, Chapter 35, Section 3020(b)(i) of the South Carolina Code of Laws, as amended, Section 7 of the Bid Form sets forth a list of subcontractor specialties for which Bidder is required to list only the subcontractors Bidder will use to perform the work of each listed specialty. Bidder must follow the Instructions in the Bid Form for filling out this section of the Bid Form. Failure to properly fill out Section 7 may result in rejection of Bidder's bid as non-responsive.

2.23. *Delete Section 4.1.7 and substitute the following:*

4.1.7 Each copy of the Bid shall state the legal name of the Bidder and the nature of legal form of the Bidder. Each copy shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid submitted by an agent shall have a current power of attorney attached certifying the agent's authority to bind the Bidder.

2.24. *Delete Section 4.2.1 and substitute the following:*

4.2.1 If required by the Invitation for Bids, each Bid shall be accompanied by a bid security in an amount of not less than five percent of the Base Bid. The bid security shall be a bid bond or a certified cashier's check. The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and will, if required, furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds if required, the amount of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty.

2.25. *Delete Section 4.2.2 and substitute the following:*

4.2.2 If a surety bond is required, it shall be written on AIA Document A310, Bid Bond, and the attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of the power of attorney. The bid bond shall:

.1 Be issued by a surety company licensed to do business in South Carolina;

.2 Be issued by a surety company having, at a minimum, a "Best Rating" of "A" as stated in the most current publication of "Best's Key Rating Guide, Property-Casualty", which company shows a financial strength rating of at least five (5) times the contract price.

.3 Be enclosed in the bid envelope at the time of Bid Opening, either in paper copy or as an electronic bid bond authorization number provided on the Bid Form and issued by a firm or organization authorized by the surety to receive, authenticate and issue binding electronic bid bonds on behalf the surety.

2.26. *Delete Section 4.2.3 and substitute the following:*

4.2.3 By submitting a bid bond via an electronic bid bond authorization number on the Bid Form and signing the Bid Form, the Bidder certifies that an electronic bid bond has been executed by a Surety meeting the standards required by the Bidding Documents and the Bidder and Surety are firmly bound unto the State of South Carolina under the conditions provided in this Section 4.2.

2.27. *Insert the following Section 4.2.4:*

4.2.4 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until either (a) the Contract has been executed and performance and payment bonds, if required, have been furnished, or (b) the specified time has elapsed so that Bids may be withdrawn or (c) all Bids have been rejected.

2.28. *Delete Section 4.3.1 and substitute the following:*

4.3.1 All copies of the Bid, the bid security, if any, and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope. The envelope shall, unless hand delivered by the Bidder, be addressed to the Owner's designated purchasing office as shown in the Invitation for Bids. The envelope shall be identified with the Project name, the Bidder's name and address and, if applicable, the designated portion of the Work for which the Bid is submitted. If the Bid is sent by mail or special delivery service (UPS, Federal Express, etc.), the envelope should be labeled "BID ENCLOSED" on the face thereof. Bidders hand delivering their Bids shall deliver Bids to the place of the Bid Opening as shown in the Invitation for Bids. Whether or not Bidders attend the Bid Opening, they shall give their Bids to the Owner's procurement officer or his/her designee as shown in the Invitation for Bids prior to the time of the Bid Opening.

2.29. *Insert the following Section 4.3.6 and substitute the following:*

4.3.5 The official time for receipt of Bids will be determined by reference to the clock designated by the Owner's procurement officer or his/her designee. The procurement officer conducting the Bid Opening will determine and announce that the deadline has arrived and no further Bids or bid modifications will be accepted. All Bids and bid modifications in the possession of the procurement officer at the time the announcement is completed will be timely, whether or not the bid envelope has been date/time stamped or otherwise marked by the procurement officer.

2.30. *Delete Section 4.4.2 and substitute the following:*

4.4.2 Prior to the time and date designated for receipt of Bids, a Bid submitted may be withdrawn in person or by written notice to the party receiving Bids at the place designated for receipt of Bids. Withdrawal by written notice shall be in writing over the signature of the Bidder.

2.31. *In Section 5.1, delete everything following the caption "OPENING OF BIDS" and substitute the following:*

5.1.1 Bids received on time will be publicly opened and will be read aloud. Owner will not read aloud Bids that Owner determines, at the time of opening, to be non-responsive. .

5.1.2 At bid opening, Owner will announce the date and location of the posting of the Notice of Intended Award.

5.1.3 Owner will send a copy of the final Bid Tabulation to all Bidders within ten (10) working days of the Bid Opening.

5.1.4 If Owner determines to award the Project, Owner will, after posting a Notice of Intended Award, send a copy of the Notice to all Bidders.

5.1.5 If only one Bid is received, Owner will open and consider the Bid.

2.32. *In Section 5.2, insert the section number "5.2.1" before the words of the "The Owner" at the beginning of the sentence.*

2.33. *Insert the following Sections 5.2.2 and 5.2.3:*

5.2.2 The reasons for which the Owner will reject Bids include, but are not limited to:

.1 Failure by a Bidder to be represented at a Mandatory Pre-Bid Conference or site visit;
.2 Failure to deliver the Bid on time;
.3 Failure to comply with Bid Security requirements, except as expressly allowed by law;
.4 Listing an invalid electronic Bid Bond authorization number on the bid form;
.5 Failure to Bid an Alternate, except as expressly allowed by law;
.6 Failure to list qualified Subcontractors as required by law;
.7 Showing any material modification(s) or exception(s) qualifying the Bid;
.8 Faxing a Bid directly to the Owner or their representative; or
.9 Failure to include a properly executed Power-of-Attorney with the bid bond.

5.2.3 The Owner may reject a Bid as nonresponsive if the prices bid are materially unbalanced between line items or sub-line items. A bid is materially unbalanced when it is based on prices significantly less than cost for some work and prices which are significantly overstated in relation to cost for other work, and if there is a reasonable doubt that the bid will result in the lowest overall cost to the Owner even though it may be the low evaluated bid, or if it is so unbalanced as to be tantamount to allowing an advance payment.

2.34. *Delete Section 6.1 and substitute the following:*

6.1 CONTRACTOR'S RESPONSIBILITY

Owner will make a determination of Bidder's responsibility before awarding a contract. Bidder shall provide all information and documentation requested by the Owner to support the Owner's evaluation of responsibility. Failure of Bidder to provide requested information is cause for the Owner, at its option, to determine the Bidder to be non-responsible

2.35. *Delete the language of Section 6.2 and insert the word "Reserved."*

2.36. *Delete the language of Sections 6.3.2, 6.3.3, and 6.3.4 and insert the word "Reserved" after each Section Number.*

2.37. *Insert the following Section 6.4*

6.4 CLARIFICATION

Pursuant to Section 11-35-1520(8), the Procurement Officer may elect to communicate with a Bidder after opening for the purpose of clarifying either the Bid or the requirements of the Invitation for Bids. Such communications may be conducted only with Bidders who have submitted a Bid which obviously conforms in all material aspects to the Invitation for Bids and only in accordance with Appendix D (Paragraph A(6)) to the Manual for Planning and Execution of State Permanent Improvement, Part II. Clarification of a Bid must be documented in writing and included with the Bid. Clarifications may not be used to revise a Bid or the Invitation for Bids. [Section 11-35-1520(8); R.19-445.2080]

2.38. *Delete Section 7.1.2 and substitute the following:*

7.1.2 The performance and payment bonds shall conform to the requirements of Section 11.4 of the General Conditions of the Contract. If the furnishing of such bonds is stipulated in the Bidding Documents, the cost shall be included in the Bid.

2.39. *Delete the language of Section 7.1.3 and insert the word "Reserved."*

2.40. *In Section 7.2, insert the words "CONTRACT, CERTIFICATES OF INSURANCE" into the caption after the word "Delivery."*

2.41. *Delete Section 7.2.1 and substitute the following:*

7.2.1 After expiration of the protest period, the Owner will tender a signed Contract for Construction to the Bidder and the Bidder shall return the fully executed Contract for Construction to the Owner within seven days thereafter. The Bidder shall deliver the required bonds and certificate of insurance to the Owner not later than three days following the date of execution of the Contract. Failure to deliver these documents as required shall entitle the Owner to consider the Bidder's failure as a refusal to enter into a contract in accordance with the terms and conditions of the Bidder's Bid and to make claim on the Bid Security for re-procurement cost.

2.42. *Delete the language of Section 7.2.2 and insert the word "Reserved."*

2.43. *Delete the language of Article 8 and insert the following:*

Unless otherwise required in the Bidding Documents, the Agreement for the Work will be written on South Carolina Modified AIA Document A101, 2007, Standard Form of Agreement Between Owner and Contractor as modified by OSE Form 00501 – Standard Modification to Agreement Between Owner and Contractor.

2.44. *Insert the following Article 9:*

ARTICLE 9 MISCELLANEOUS

9.1 NONRESIDENT TAXPAYER REGISTRATION AFFIDAVIT INCOME TAX WITHHOLDING

IMPORTANT TAX NOTICE - NONRESIDENTS ONLY

Withholding Requirements for Payments to Nonresidents: Section 12-8-550 of the South Carolina Code of Laws requires persons hiring or contracting with a nonresident conducting a business or performing personal services of a temporary nature within South Carolina to withhold 2% of each payment made to the nonresident. The withholding requirement does not apply to (1) payments on purchase orders for tangible personal property when the payments are not accompanied by services to be performed in South Carolina, (2) nonresidents who are not conducting business in South Carolina, (3) nonresidents for contracts that do not exceed $10,000 in a calendar year, or (4) payments to a nonresident who (a) registers with either the S.C. Department of Revenue or the S.C. Secretary of State and (b) submits a Nonresident Taxpayer Registration Affidavit - Income Tax Withholding, Form I-312 to the person letting the contract.

For information about other withholding requirements (e.g., employee withholding), contact the Withholding Section at the South Carolina Department of Revenue at 803-898-5383 or visit the Department's website at: www.sctax.org

This notice is for informational purposes only. This Owner does not administer and has no authority over tax issues. All registration questions should be directed to the License and Registration Section at 803-898-5872 or to the South Carolina Department of Revenue, Registration Unit, Columbia, S.C. 29214-0140. All withholding questions should be directed to the Withholding Section at 803-898- 5383.

PLEASE SEE THE "NONRESIDENT TAXPAYER REGISTRATION AFFIDAVIT INCOME TAX WITHHOLDING" FORM (FORM NUMBER I-312) LOCATED AT: **http://www.sctax.org/Forms+and+Instructions/withholding/default.htm .**

9.2 CONTRACTOR LICENSING

Contractors and Subcontractors listed in Section 7 of the Bid Form who are required by the South Carolina Code of Laws to be licensed, must be licensed at the time of bidding.

9.3 SUBMITTING CONFIDENTIAL INFORMATION

For every document Bidder submits in response to or with regard to this solicitation or request, Bidder must separately mark with the word "CONFIDENTIAL" every page, or portion thereof, that Bidder contends contains information that is exempt from public disclosure because it is either (a) a trade secret as defined in Section 30-4-40(a)(1), or (b) privileged & confidential, as that phrase is used in Section 11-35-410. For every document Bidder submits in response to or with regard to this solicitation or request, Bidder must separately mark with the words "TRADE SECRET" every page, or portion thereof, that Bidder contends contains a trade secret as that term is defined by Section 39-8-20 of the Trade Secrets Act. For every document Bidder submits in response to or with regard to this solicitation or request, Bidder must separately mark with the word "PROTECTED" every page, or portion thereof, that Bidder contends is protected by Section 11-35-1810. All markings must be conspicuous; use color, bold, underlining, or some other method in order to conspicuously distinguish the mark from the other text. Do not mark your entire bid as confidential, trade secret, or protected! If your bid, or any part thereof, is improperly marked as confidential or trade

secret or protected, the State may, in its sole discretion, determine it nonresponsive. If only portions of a page are subject to some protection, do not mark the entire page. By submitting a response to this solicitation, Bidder (1) agrees to the public disclosure of every page of every document regarding this solicitation or request that was submitted at any time prior to entering into a contract (including, but not limited to, documents contained in a response, documents submitted to clarify a response, & documents submitted during negotiations), unless the page is conspicuously marked "TRADE SECRET" or "CONFIDENTIAL" or "PROTECTED", (2) agrees that any information not marked, as required by these bidding instructions, as a "Trade Secret" is not a trade secret as defined by the Trade Secrets Act, & (3) agrees that, notwithstanding any claims or markings otherwise, any prices, commissions, discounts, or other financial figures used to determine the award, as well as the final contract amount, are subject to public disclosure. In determining whether to release documents, the State will detrimentally rely on Bidders's marking of documents, as required by these bidding instructions, as being either "Confidential" or "Trade Secret" or "PROTECTED". By submitting a response, Bidder agrees to defend, indemnify & hold harmless the State of South Carolina, its officers & employees, from every claim, demand, loss, expense, cost, damage or injury, including attorney's fees, arising out of or resulting from the State withholding information that Bidder marked as "confidential" or "trade secret" or "PROTECTED".

9.4 POSTING OF INTENT TO AWARD

Notice of Intent to Award, SE-370, will be posted at the following location:
Room or Area of Posting: Reception Area
Building Where Posted: Facilities Management Center
Address of Building: 743 Greene Street, Columbia, South Carolina 29208
WEB site address (if applicable): purchasing.sc.edu
Posting date will be announced at bid opening. In addition to posting the notice, the Owner will promptly send all responsive bidders a copy of the notice of intent to award and the final bid tabulation

9.5 PROTEST OF SOLICITATION OR AWARD

Any prospective bidder, offeror, contractor, or subcontractor who is aggrieved in connection with the solicitation of a contract shall protest within fifteen days of the date of issuance of the applicable solicitation document at issue. Any actual bidder, offeror, contractor, or subcontractor who is aggrieved in connection with the intended award or award of a contract shall protest within ten days of the date notification of intent to award is posted in accordance with Title 11, Chapter 35, Section 4210 of the South Carolina Code of Laws, as amended. A protest shall be in writing, shall set forth the grounds of the protest and the relief requested with enough particularity to give notice of the issues to be decided, and must be received by the State Engineer within the time provided.
Any protest must be addressed to the CPO, Office of State Engineer, and submitted in writing:

(a) by email to protest-ose@mmo.sc.gov,
(b) by facsimile at 803-737-0639, or
(c) by post or delivery to 1201 Main Street, Suite 600, Columbia, SC 29201.

By submitting a protest to the foregoing email address, you (and any person acting on your behalf) consent to receive communications regarding your protest (and any related protests) at the e-mail address from which you sent your protest.

9.6 SOLICITATION INFORMATION FROM SOURCES OTHER THAN OFFICIAL SOURCE

South Carolina Business Opportunities (SCBO) is the official state government publication for State of South Carolina solicitations. Any information on State agency solicitations obtained from any other source is unofficial and any reliance placed on such information is at the bidder's sole risk and is without recourse under the South Carolina Consolidated Procurement Code.

9.7 BUILDER'S RISK INSURANCE

Bidder's are directed to Article 11.3 of the South Carolina Modified AIA Document A201, 2007 Edition, which, unless provided otherwise in the bid documents, requires the contractor to provide builder's risk insurance on the project.

9.8 TAX CREDIT FOR SUBCONTRACTING WITH MINORITY FIRMS

Pursuant to Section 12-6-3350, taxpayers, who utilize certified minority subcontractors, may take a tax credit equal to 4% of the payments they make to said subcontractors. The payments claimed must be based on work performed directly for a South Carolina state contract. The credit is limited to a maximum of fifty thousand dollars annually. The taxpayer is eligible to claim the credit for 10 consecutive taxable years beginning with the taxable year in which the first payment is made to the subcontractor that qualifies for the credit. After the above ten consecutive taxable years, the taxpayer is no longer eligible for the credit. The credit may be claimed on Form TC-2, "Minority Business Credit." A copy of the subcontractor's certificate from the Governor's Office of Small and Minority Business (OSMBA) is to be attached to the contractor's income tax return. Taxpayers must maintain evidence of work performed for a State contract by the minority subcontractor. Questions regarding the tax credit and how to file are to be referred to: SC Department of Revenue, Research and Review, Phone: (803) 898-5786, Fax: (803) 898-5888. The subcontractor must be certified as to the criteria of a "Minority Firm" by the Governor's Office of Small and Minority Business Assistance (OSMBA). Certificates are issued to subcontractors upon successful completion of the certification process. Questions regarding subcontractor certification are to be referred to: Governor's Office of Small and Minority Business Assistance, Phone: (803) 734-0657, Fax: (803) 734-2498. Reference: SC §11-35-5010 – Definition for Minority Subcontractor & SC §11-35-5230 (B) – Regulations for Negotiating with State Minority Firms.

§ 9.9 OTHER SPECIAL CONDITIONS OF THE WORK

Section 00210 – Supplement A – Request for Information

_____

_____

_____

_____

END OF DOCUMENT

SECTION 00201 - SUPPLEMENT A - REQUEST FOR INFORMATION

TO: GMK ASSOCIATES, INC. FROM:_____

ATTENTION: JEROME K. SIMONS

DATE/TIME:_____ TELEPHONE #:_____

FAX NUMBER: 803.255.7243 FAX #:_____

NUMBER OF PAGES_____ CONTACT:_____

PROJECT NAME: USC UPSTATE ADMINISTRATION BUILDING - REPAIRS AND RENOVATION

INSTRUCTIONS: IN SPACES PROVIDED BELOW, LIST SPECIFICATION SECTION AND/OR PLAN SHEET FOR WHICH INFORMATION OR CLARIFICATION IS NEEDED FOLLOWED BY DESCRIPTION OR REQUIRED INFORMATION. USE ADDITIONAL COPIES OF REQUEST FOR INFORMATION FORMS AS NEEDED FOR ADDITIONAL REQUESTS. LIMIT TO ONE QUESTION OR SUBJECT INQUIRY PER R.F.I.

SPECIFICATION SECTION(S):

_____

_____

_____

_____

_____

_____

_____

_____

_____

DRAWING SHEET(S):

_____

_____

_____

_____

_____

_____

_____

_____

END OF SECTION

SECTION 00300 - BID BOND

FORM OF BID BOND

1.01 See AIA Document A310 (2010 Edition) , Bid Bond available at the office of GMK Associates, Inc., 1201 Main Street Suite 2100, Columbia, SC 29201. 803-256-0000 OR,

A. Copies of this document may be obtained from The American Institute of Architects, 1522 Richland Street., Columbia, SC 29201. 803-252-6050.

END OF SECTION

SE-330 – LUMP SUM BID
BID FORM

Rev. 9/21/2011

Bidders shall submit bids on only Bid Form SE-330.

BID SUBMITTED BY:_____
(Bidder's Name)

BID SUBMITTED TO: University of South Carolina
(Owner's Name)

FOR PROJECT: PROJECT NAME USC Upstate Administration Building Repairs and Renovation

PROJECT NUMBER H34-9541-JM

OFFER

§ 1. In response to the Invitation for Construction Bids and in compliance with the Instructions to Bidders for the above-named Project, the undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into a Contract with the Owner on the terms included in the Bidding Documents, and to perform all Work as specified or indicated in the Bidding Documents, for the prices and within the time frames indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

§ 2. Pursuant to Section 11-32-3030(1) of the SC Code of Laws, as amended, Bidder has submitted Bid Security as follows in the amount and form required by the Bidding Documents:

☐ Bid Bond with Power of Attorney ☐ Electronic Bid Bond ☐ Cashier's Check
(Bidder check one)

§ 3. Bidder acknowledges the receipt of the following Addenda to the Bidding Documents and has incorporated the effects of said Addenda into this Bid:

ADDENDUM No:_____

§ 4. Bidder accepts all terms and conditions of the Invitation for Bids, including, without limitation, those dealing with the disposition of Bid Security. Bidder agrees that this Bid, including all Bid Alternates, if any, may not be revoked or withdrawn after the opening of bids, and shall remain open for acceptance for a period of 60 Days following the Bid Date, or for such longer period of time that Bidder may agree to in writing upon request of the Owner.

§ 5. Bidder herewith offers to provide all labor, materials, equipment, tools of trades and labor, accessories, appliances, warranties and guarantees, and to pay all royalties, fees, permits, licenses and applicable taxes necessary to complete the following items of construction work:

§ 6.1 BASE BID WORK ***(as indicated in the Bidding Documents and generally described as follows)*****:** The project consist of a total HVAC replacement, ceiling replacement, minor reconfiguration of interior spaces, bathroom upgrades, new fire alarm and electrical upgrades.,

_____, which sum is hereafter called the Base Bid.
(Bidder - insert Base Bid Amount on line above)

SE-330 – LUMP SUM BID
BID FORM

Rev. 9/21/2011

§ 6.2 BID ALTERNATES - as indicated in the Bidding Documents and generally described as follows:

ALTERNATE # 1 *(Brief Description)*: Reduce the number of phases and construction duration. Refer to SECTION 1230 - ALTERNATES for more detailed information.

☐ **ADD TO** or ☐ **DEDUCT FROM BASE BID:**_____

(Bidder to Mark appropriate box to clearly indicate the price adjustment offered for each alternate)

ALTERNATE # 2 *(Brief Description)*: N/A

☐ **ADD TO** or ☐ **DEDUCT FROM BASE BID:**_____

(Bidder to Mark appropriate box to clearly indicate the price adjustment offered for each alternate)

ALTERNATE # 3 *(Brief Description)*: N/A

☐ **ADD TO** or ☐ **DEDUCT FROM BASE BID:**_____

(Bidder to Mark appropriate box to clearly indicate the price adjustment offered for each alternate)

SE-330 – LUMP SUM BID
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BID FORM

§ 7. LISTING OF PROPOSED SUBCONTRACTORS PURSUANT TO SECTION 3020(b)(i), CHAPTER 35, TITLE 11 OF THE SOUTH CAROLINA CODE OF LAWS, AS AMENDED – ***(See Instructions on the following page BF-2A)***

Bidder shall use the below-listed Subcontractors in the performance of the Subcontractor Specialty work listed:

SUBCONTRACTOR SPECIALTY **By License Classification and/or Subclassification** (Completed by Owner)	**SUBCONTRACTOR'S PRIME CONTRACTOR'S NAME** (Must be completed by Bidder) **BASE BID**	**SUBCONTRACTOR'S PRIME CONTRACTOR'S SC LICENSE NUMBER**
PB		
AC		
EL		
HT		
ALTERNATE 1		
ALTERNATE 2		
ALTERNATE 3		

If a Bid Alternate is accepted, Subcontractors listed for the Bid Alternate shall be used for the work of both the Alternate and the Base Bid work.

INSTRUCTIONS FOR SUBCONTRACTOR LISTING

1. Section 7 of the Bid Form sets forth a list of subcontractor specialties for which bidder is required to identify by name the subcontractor(s)Bidder will use to perform the work of each listed specialty. Bidder must identify only the subcontractor(s) who will perform the work and no others.

2. For purposes of subcontractor listing, a Subcontractor is an entity who will perform work or render service to the prime contractor to or about the construction site. Material suppliers, manufacturers, and fabricators that will not perform physical work at the site of the project but will only supply materials or equipment to the bidder or proposed subcontractor(s) are not subcontractors and Bidder should not insert their names in the spaces provided on the bid form. Likewise, Bidder should not insert the names of sub-subcontractors in the spaces provided on the bid form but only the names of those entities with which bidder will contract directly.

3. Bidder must only insert the names of subcontractors who are qualified to perform the work of the listed specialties as specified in the Bidding Documents and South Carolina Licensing Laws**.**

4. If under the terms of the Bidding Documents, Bidder is qualified to perform the work of a specialty listed and Bidder does not intend to subcontract such work but to use Bidder's own employees to perform such work, the Bidder must insert its own name in the space provided for that specialty.

5. If Bidder intends to use multiple subcontractors to perform the work of a single specialty listing, Bidder must insert the name of each subcontractor Bidder will use, preferably separating the name of each by the word **"and"**. If Bidder intends to use both his own employees to perform a part of the work of a single specialty listing and to use one or more subcontractors to perform the remaining work for that specialty listing, bidder must insert his own name and the name of each subcontractor, preferably separating the name of each with the word **"and"**.

6. Bidder may not list subcontractors in the alternative nor in a form that may be reasonably construed at the time of bid opening as a listing in the alternative. A listing that requires subsequent explanation to determine whether or not it is a listing in the alternative is non-responsive. If bidder intends to use multiple entities to perform the work for a single specialty listing, bidder must clearly set forth on the bid form such intent. Bidder may accomplish this by simply inserting the word "**and**" between the name of each entity listed for that specialty. Owner will reject as non-responsive a listing that contains the names of multiple subcontractors separated by a blank space, the word "or", a virgule (that is a /), or any separator that the Owner may reasonably interpret as a listing in the alternative.

7. If Bidder is awarded the contract, bidder must, except with the approval of the owner for good cause shown, use the listed entities to perform the work for which they are listed.

8. If bidder is awarded the contract, bidder will not be allowed to substitute another entity as subcontractor in place of a subcontractor listed in Section 7 of the Bid except for one or more of the reasons allowed by the SC Code of Laws.

9. Bidder's failure to insert a name for each listed specialty subcontractor will render the Bid non-responsive.

SE-330 – LUMP SUM BID
BID FORM

§ 8. LIST OF MANUFACTURERS, MATERIAL SUPPLIERS, AND SUBCONTRACTORS OTHER THAN SUBCONTRACTORS LISTED IN SECTION 7 ABOVE *(FOR INFORMATION ONLY):* Pursuant to instructions in the Invitation for Bids, if any, Bidder will provide to Owner upon the Owner's request and within 24 hours of such request, a listing of manufacturers, material suppliers, and subcontractors, other than those listed in Section 7 above, that Bidder intends to use on the project. Bidder acknowledges and agrees that this list is provided for purposes of determining responsibility and not pursuant to the subcontractor listing requirements of SC Code Ann § 11-35-3020(b)(i).

§ 9. TIME OF CONTRACT PERFORMANCE AND LIQUIDATED DAMAGES

a. CONTRACT TIME: Bidder agrees that the Date of Commencement of the Work shall be established in a Notice to Proceed to be issued by the Owner. Bidder agrees to substantially complete the Work within **357** calendar days from the Date of Commencement, subject to adjustments as provided in the Contract Documents.

b. LIQUIDATED DAMAGES: Bidder further agrees that from the compensation to be paid, the Owner shall retain as Liquidated Damages the sum of $150.00for each calendar day the actual construction time required to achieve Substantial Completion exceeds the specified or adjusted time for Substantial Completion as provided in the Contract Documents. This sum is intended by the parties as the predetermined measure of compensation for actual damages, not as a penalty for nonperformance.

§ 10. AGREEMENTS

a. Bidder agrees that this bid is subject to the requirements of the law of the State of South Carolina.

b. Bidder agrees that at any time prior to the issuance of the Notice to Proceed for this Project, this Project may be canceled for the convenience of, and without cost to, the State.

c. Bidder agrees that neither the State of South Carolina nor any of its agencies, employees or agents shall be responsible for any bid preparation costs, or any costs or charges of any type, should all bids be rejected or the Project canceled for any reason prior to the issuance of the Notice to Proceed.

§ 11. ELECTRONIC BID BOND

By signing below, the Principal is affirming that the identified electronic bid bond has been executed and that the Principal and Surety are firmly bound unto the State of South Carolina under the terms and conditions of the AIA Document A310, Bid Bond, included in the Bidding Documents.

Electronic Bid Bond Number: _____

Signature and Title: _____

SE-330 – LUMP SUM BID
BID FORM

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BIDDER'S TAXPAYER IDENTIFICATION

FEDERAL EMPLOYER'S IDENTIFICATION NUMBER:_____

OR

SOCIAL SECURITY NUMBER:_____

CONTRACTOR'S CLASSIFICATIONS AND SUBCLASSIFICATIONS WITH LIMITATIONS

Classification(s)& Limits: _____

Subclassification(s) & Limits:_____

SC Contractor's License Number(s):_____

BY SIGNING THIS BID, THE PERSON SIGNING REAFFIRMS ALL REPRESENTATIONS AND CERTIFICATIONS MADE BY BOTH THE PERSON SIGNING AND THE BIDDER, INCLUDING WITHOUT LIMITATION, THOSE APPEARING IN ARTICLE 2 OF THE INSTRUCTIONS TO BIDDER. THE INVITATION FOR BIDS, AS DEFINED IN THE INSTRUCTIONS TO BIDDERS, IS EXPRESSLY INCORPORATE BY REFERENCE.

SIGNATURE

BIDDER'S LEGAL NAME: _____

ADRESS: _____

_____

BY:_____ **DATE:**_____
(Signature)

TITLE:_____

TELEPHONE:_____

EMAIL: _____

SECTION 00500 - AGREEMENT

PART 1 GENERAL

FORM OF AGREEMENT

2.01 RELATED REQUIREMENTS

A. Section 00700 - General Conditions.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

AIA DOCUMENT A101-2007, STANDARD FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR, FORMS THE BASIS OF CONTRACT BETWEEN THE OWNER AND CONTRACTOR.

5.01 This document is not bound within the project manual.

A. Copies of this document may be obtained from The American Institute of Architects, 1522 Richland Street., Columbia, SC 29201. 803-252-6050.

B. OR it can be viewed at the offices of GMK Associates, Inc., 1201 Main Street Suite 2100 Columbia, SC 29201 (803)256-0000

5.02 Refer to document 00501-OSE 2011 for modifications to this document.

END OF AGREEMENT

OSE FORM 00501

Rev. 7/11/2011

STANDARD MODIFICATIONS TO AGREEMENT BETWEEN OWNER AND CONTRACTOR

OWNER: University of South Carolina
PROJECT NUMBER: H34-9541-JM
PROJECT NAME: USC Upstate Administration Building – Repairs and Renovation

1. STANDARD MODIFICATIONS TO AIA A101-2007

1.1. These Standard Modifications amend or supplement the *Standard Form of Agreement Between Owner and Contractor* (AIA Document A101-2007) and other provisions of Bidding and Contract Documents as indicated below.

1.2. All provisions of A101-2007, which are not so amended or supplemented, remain in full force and effect.

2. MODIFICATIONS TO A101

2.1. *Insert the following at the end of Article 1:*

Any reference in this document to the Agreement between the Owner and Contractor, AIA Document A101, or some abbreviated reference thereof, shall mean the AIA A101, 2007 Edition as modified by OSE Form 00501 – Standard Modification to Agreement Between Owner and Contractor. Any reference in this document to the General Conditions of the Contract for Construction, AIA Document A201, or some abbreviated reference thereof, shall mean the AIA A201, 2007 Edition as modified by OSE Form 00811 – Standard Supplementary Conditions.

2.2. *Delete Section 3.1 and substitute the following:*

3.1 The Date of Commencement of the Work shall be the date fixed in a Notice to Proceed issued by the Owner. The Owner shall issue the Notice to Proceed to the Contractor in writing, no less than seven days prior to the Date of Commencement. Unless otherwise provided elsewhere in the contract documents, and provided the contractor has secured all required insurance and surety bonds, the contractor may commence work immediately after receipt of the Notice to Proceed.

2.3. *Delete Section 3.2 and substitute the following:*
3.2 The Contract Time shall be measured from the Date of Commencement as provided in Section 9(a) of the Bid Form (SE-330) for this Project. Contractor agrees that if the Contractor fails to achieve Substantial Completion of the Work within the Contract Time, the Owner shall be entitled to withhold or recover from the Contractor liquidated damages in the amounts set forth in Section 9(b) of the Bid Form (SE-330, subject to adjustments of this Contract Time as provided in the Contract Documents.

2.4. *In Section 5.1.1, insert the words "and Owner" after the phrase "Payment submitted to the Architect."*

2.5. *Delete Section 5.1.3 and substitute the following:*

5.1.3 The Owner shall make payment of the certified amount to the Contractor not later than 21 days after receipt of the Application for Payment.

2.6. *In Section 5.1.6, Insert the following after the phrase "Subject to other provisions of the Contract Documents":*

and subject to Title 12, Chapter 8, Section 550 of the South Carolina Code of Laws, as amended (Withholding Requirements for Payments to Non-Residents)

In the spaces provided in Sub-Sections 1 and 2 for inserting the retainage amount, insert "three and one-half percent (3.5%)."

2.7. *In Section 5.1.8, delete the word "follows" and the colon and substitute the following:*

set forth in S.C. Code Ann. § 11-35-3030(4).

2.8. *In Section 5.1.9, delete the words "Except with the Owner's prior approval, the" before the word " Contractor."*

2.9. *In Section 5.2.2, delete the number 30 and substitute the number 21, delete everything following the words "Certificate for Payment" and place a period at the end of the resulting sentence.*

2.10. *Delete the language of Sections 6.1 and 6.2 and substitute the word "Reserved" for the deleted language of each Section .*

2.11. *Delete the language of Section 8.2 and substitute the word "Reserved."*

2.12. *In Section 8.3, make the word "Representative" in the title plural, delete everything following the title, and substitute the following:*

8.3.1 Owner designates the individual listed below as its Senior Representative ("Owner's Senior Representative"), which individual has the responsibility for and, subject to Section 7.2.1 of the General Conditions, the authority to resolve disputes under Section 15.6 of the General Conditions:

Name: Tom Opal
Title: USC Senior Project Manager
Address: 743 Greene Street, Columbia, South Carolina 29208
Telephone: 803-777-5996 **FAX:** 803-777-8739
Email: topal@fmk.sc.edu

8.3.2 Owner designates the individual listed below as its Owner's Representative, which individual has the authority and responsibility set forth in Section 2.1.1 of the General Conditions:

Name: Ann Derrick
Title: USC Project Manager
Address: 743 Greene Street, Columbia, South Carolina 29208
Telephone: (803) 777-5811 **FAX:** 803-777-8739
Email: aderrick@fmc.sc.edu

2.13. *In Section 8.4, make the word "Representative" in the title plural, delete everything following the title, and substitute the following:*

8.4.1 Contractor designates the individual listed below as its Senior Representative ("Contractor's Senior Representative"), which individual has the responsibility for and authority to resolve disputes under Section 15.6 of the General Conditions:

Name: _____
Title: _____
Address: _____
Telephone: _____ **FAX:** _____
Email: _____

8.4.2 Contractor designates the individual listed below as its Contractor's Representative, which individual has the authority and responsibility set forth in Section 3.1.1 of the General Conditions:

Name: _____
Title: _____
Address: _____
Telephone: _____ **FAX:** _____
Email: _____

2.14. *Add the following Section 8.6.1:*

8.6.1 The Architect's representative:

Name: Jerome K. Simons
Title: Project Architect
Address: 1201 Main Street, Suite 2100
Telephone: 803-256-0000 **FAX:** 803-255-7243
Email: jsimons@gmka.com

2.15. *In Section 9.1.7, Sub-Section 2, list the following documents in the space provided for listing documents:*

Invitation for Construction Bids (SE-310)
Instructions to Bidders (AIA Document A701-1997)
Standard Supplemental Instructions to Bidders (OSE Form 00201)
Contractor's Bid (Completed SE-330)
Notice of Intent to Award (Completed SE-370)
Certificate of procurement authority issued by the SC Budget & Control Board

2.16. *In Article 10, delete everything after the first sentence.*

END OF DOCUMENT

SECTION 00700 - GENERAL CONDITIONS

FORM OF GENERAL CONDITIONS

RELATED REQUIREMENTS

2.01 Section 00800 - Supplementary Conditions.

AIA DOCUMENT A201, 2007 EDITION, GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, IS THE GENERAL CONDITIONS BETWEEN THE OWNER AND CONTRACTOR.

3.01 This document is not bound within the project manual.

A. Copies of this document may be obtained from The American Institute of Architects, 1522 Richland Street., Columbia, SC 29201. 803-252-6050.

B. OR it can be viewed at the offices of GMK Associates, Inc., 1201 Main Street Suite 2100 Columbia, SC 29201 (803)256-0000

SUPPLEMENTARY CONDITIONS

4.01 Refer to Document 00811-OSE 2011 for amendments to these General Conditions.

END OF DOCUMENT 00700

SECTION 00800 - SUPPLEMENTARY CONDITIONS

PART 1 GENERAL

1.01 SUMMARY

1.02 These Supplementary Conditions amend and supplement the General Conditions defined in Document 00700 and other provisions of the Contract Documents as indicated below. All provisions that are not so amended or supplemented remain in full force and effect.

1.03 MODIFICATIONS TO GENERAL CONDITIONS

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF DOCUMENT

OSE FORM 00811
Rev. 9/7/2011

STANDARD SUPPLEMENTARY CONDITIONS

OWNER: University of South Carolina
PROJECT NUMBER: H34-9541-JM
PROJECT NAME: USC Upstate Administration Building – Repairs and Renovation

1 GENERAL CONDITIONS

The *General Conditions of the Contract for Construction,* AIA Document A201, 2007 Edition, Articles 1 through 15 inclusive, is a part of this Contract and is incorporated as fully as if herein set forth. For brevity, AIA Document A201 is also referred to in the Contract Documents collectively as the "General Conditions."

2 STANDARD SUPPLEMENTARY CONDITIONS

2.1 The following supplements modify, delete and/or add to the General Conditions. Where any portion of the General Conditions is modified or any paragraph, Section or clause thereof is modified or deleted by these Supplementary Conditions, the unaltered provisions of the General Conditions shall remain in effect.

2.2 Unless otherwise stated, the terms used in these Standard Supplementary Conditions which are defined in the General Conditions have the meanings assigned to them in the General Conditions.

3 MODIFICATIONS TO A201-2007

3.1 *Insert the following at the end of Section 1.1.1:*

Any reference in this document to the Agreement between the Owner and Contractor, AIA Document A101, or some abbreviated reference thereof, shall mean the AIA A101, 2007 Edition as modified by OSE Form 00501 – Standard Modification to Agreement Between Owner and Contractor. Any reference in this document to the General Conditions of the Contract for Construction, AIA Document A201, or some abbreviated reference thereof, shall mean the AIA A201, 2007 Edition as modified by OSE Form 00811 – Standard Supplementary Conditions.

3.2 *Delete the language of Section 1.1.8 and substitute the word "Reserved."*

3.3 *Add the following Section 1.1.9:*

1.1.9 NOTICE TO PROCEED
Notice to Proceed is a document issued by the Owner to the Contractor, with a copy to the Architect, directing the Contractor to begin prosecution of the Work in accordance with the requirements of the Contract Documents. The Notice to Proceed shall fix the date on which the Contract Time will commence.

3.4 *Insert the following at the end of Section 1.2.1:*

In the event of patent ambiguities within or between parts of the Contract Documents, the contractor shall 1) provide the better quality or greater quantity of Work, or 2) comply with the more stringent requirement, either or both in accordance with the Architect's interpretation.

3.5 *Delete Section 1.5.1 and substitute the following:*

1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service and will retain all common law, statutory and other reserved rights, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as a violation of the Architect's or Architect's consultants' reserved rights.

3.6 *Delete Section 2.1.1 and substitute the following:*

2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization, except as provided in Section 7.1.2. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's Representative. [Reference § 8.2 of the Agreement.]

3.7 *Delete Section 2.1.2 and substitute the following:*

2.1.2 The Owner shall furnish to the Contractor within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to post Notice of Project Commencement pursuant to Title 29, Chapter 5, Section 23 of the South Carolina Code of Laws, as amended..

3.8 *Delete Section 2.2.3 and substitute the following:*

2.2.3 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. Subject to the Contractor's obligations, including those in Section 3.2, the Contractor shall be entitled to rely on the accuracy of information furnished by the Owner pursuant to this Section but shall exercise proper precautions relating to the safe performance of the Work.

3.9 *Replace the period at the end of the last sentence of Section 2.2.4 with a semicolon and insert the following after the inserted semicolon:*

"however, the Owner does not warrant the accuracy of any such information requested by the Contractor that is not otherwise required of the Owner by the Contract Documents. Neither the Owner nor the Architect shall be required to conduct investigations or to furnish the Contractor with any information concerning subsurface characteristics or other conditions of the area where the Work is to be performed beyond that which is provide in the Contract Documents."

3.10 *Delete Section 2.2.5 and substitute the following:*

2.2.5 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor with ten copies of the Contract Documents. The Contractor may make reproductions of the Contract Documents pursuant to Section 1.5.2. All copies of the drawings and specifications, except the Contractor's record set, shall be returned or suitably accounted for to the Owner, on request, upon completion of the Work.

3.11 *Add the following Sections 2.2.6 and 2.2.7:*

2.2.6 The Owner assumes no responsibility for any conclusions or interpretation made by the Contractor based on information made available by the Owner.

2.2.7 The Owner shall obtain, at its own cost, general building and specialty inspection services as required by the Contract Documents. The Contractor shall be responsible for payment of any charges imposed for reinspections.

3.12 *Delete Section 2.4 and substitute the following:*

2.4 If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect, including but not limited to providing necessary resources, with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Directive shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect or failure. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

3.13 *Insert the following at the end of Section 3.2.1:*

The Contractor acknowledges that it has investigated and satisfied itself as to the general and local conditions which can affect the work or its cost, including but not limited to (1) conditions bearing upon transportation, disposal, handling, and storage of materials; (2) the availability of labor, water, electric power, and roads; (3) uncertainties of weather, river stages, tides, or similar physical conditions at the site; (4) the conformation and conditions of the ground; and (5) the character of equipment and facilities needed preliminary to and during work performance. The Contractor also acknowledges that it has satisfied itself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, including all exploratory work done by the Owner, as well as from the drawings and specifications made a part of this contract. Any failure of the Contractor to take the actions described and acknowledged in this paragraph will not relieve the Contractor from responsibility for estimating properly the difficulty and cost of successfully performing the work, or for proceeding to successfully perform the work without additional expense to the Owner.

3.14 *In the third sentence of Section 3.2.4, insert the word "latent" before the word "errors."*

3.15 *In the last sentence of Section 3.3.1, insert the words "by the Owner in writing" after the word "instructed."*

3.16 *Delete the third sentence of Section 3.5 and substitute the following sentences:*

Work, materials, or equipment not conforming to these requirements shall be considered defective. Unless caused by the Contractor or a subcontractor at any tier, the Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage.

3.17 *Insert the following at the end of Section 3.6:*

The Contractor shall comply with the requirements of Title 12, Chapter 9 of the South Carolina Code of Laws, as amended, regarding withholding tax for nonresidents, employees, contractors and subcontractors.

3.18 *In Section 3.7.1, delete the words "the building permit as well as for other" and insert the following sentence at the end of this section:*

Pursuant to Title 10, Chapter 1, Section 180 of the South Carolina Code of Laws, as amended, no local general or specialty building permits are required for state buildings.

3.19 *Delete the last sentence of Section 3.7.5 and substitute the following:*

Adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 7.3.3.

3.20 *Delete the last sentence of Section 3.8.2.3 and substitute the following:*

The amount of the Change Order shall reflect the difference between actual costs, as documented by invoices, and the allowances under Section 3.8.2.1.

3.21 *In Section 3.9.1, insert a comma after the word "superintendent" in the first sentence and insert the following after the inserted comma:*

acceptable to the Owner,

3.22 *Delete Section 3.9.2 and substitute the following:*

3.9.2 The Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner the name and qualifications of a proposed superintendent. The Owner may reply within 14 days to the Contractor in writing stating (1) whether the Owner has reasonable objection to the proposed superintendent or (2) that the

Owner requires additional time to review. Failure of the Owner to reply within the 14-day period shall constitute notice of no reasonable objection.

3.23 *After the first sentence in Section 3.9.3, insert the following sentence:*

The Contractor shall notify the Owner, in writing, of any proposed change in the superintendent, including the reason therefore, prior to making such change.

3.24 *Delete Section 3.10.3 and substitute the following:*

3.10.3 Additional requirements, if any, for the constructions schedule are as follows:
(Check box if applicable to this Contract))

☒ The construction schedule shall be in a detailed precedence-style critical path management (CPM) or primavera-type format satisfactory to the Owner and the Architect that shall also (1) provide a graphic representation of all activities and events that will occur during performance of the work; (2) identify each phase of construction and occupancy; and (3) set forth dates that are critical in ensuring the timely and orderly completion of the Work in accordance with the requirements of the Contract Documents (hereinafter referred to as "Milestone Dates"). Upon review and acceptance by the Owner and the Architect of the Milestone Dates, the construction schedule shall be deemed part of the Contract Documents and attached to the Agreement as Exhibit "A." If not accepted, the construction schedule shall be promptly revised by the Contractor in accordance with the recommendations of the Owner and the Architect and resubmitted for acceptance. The Contactor shall monitor the progress of the Work for conformance with the requirements of the construction schedule and shall promptly advise the Owner of any delays or potential delays. Whenever the approved construction schedule no longer reflects actual conditions and progress of the work or the Contract Time is modified in accordance with the terms of the Contract Documents, the Contractor shall update the accepted construction schedule to reflect such conditions. In the event any progress report indicates any delays, the Contractor shall propose an affirmative plan to correct the delay, including overtime and/or additional labor, if necessary. In no event shall any progress report constitute an adjustment in the Contract Time, any Milestone Date, or the Contract Sum unless any such adjustment is agreed to by the Owner and authorized pursuant to Change Order.

3.25 *Add the following Section 3.10.4:*

3.10.4 Owner's review and acceptance of Contractor's schedule is not conducted for the purpose of either determining its accuracy and completeness or approving the construction means, methods, techniques, sequences or procedures. The Owner's approval shall not relieve the Contractor of any obligations. Unless expressly addressed in a Modification, the Owner's approval of a schedule shall not change the Contract Time.

3.26 *Add the following Section 3.12.5.1:*

3.12.5.1 The fire sprinkler shop drawings shall be prepared by a licensed fire sprinkler contractor and shall accurately reflect actual conditions affecting the required layout of the fire sprinkler system. The fire sprinkler contractor shall certify the accuracy of his shop drawings prior to submitting them for review and approval. The fire sprinkler shop drawings shall be reviewed and approved by the Architect's engineer of record who, upon approving the sprinkler shop drawings will submit them to the State Fire Marshal or other authorities having jurisdiction for review and approval. The Architect's engineer of record will submit a copy of the State Fire Marshal's approval letter to the Contractor, Architect, and OSE. Unless authorized in writing by OSE, neither the Contractor nor subcontractor at any tier shall submit the fire sprinkler shop drawings directly to the State Fire Marshal or other authorities having jurisdiction for approval.

3.27 *In the fourth sentence of Section 3.12.10, after the comma following the words "licensed design professional," insert the following:*

who shall comply with reasonable requirements of the Owner regarding qualifications and insurance and

3.28 *In Section 3.13, insert the section number "3.13.1" before the before the opening words "The Contractors shall."*

3.29 Add the following Sections 3.13.2 and 3.13.3:

3.13.2 Protection of construction materials and equipment stored at the Project site from weather, theft, vandalism, damage, and all other adversity is solely the responsibility of the Contractor. The Contractor shall perform the work in a manner that affords reasonable access, both vehicular and pedestrian, to the site of the Work and all adjacent areas. The Work shall be performed, to the fullest extent reasonably possible, in such a manner that public areas adjacent to the site of the Work shall be free from all debris, building materials, and equipment likely to cause hazardous conditions.

3.13.3 The Contractor and any entity for whom the Contractor is responsible shall not erect any sign on the Project site without the prior written consent of the Owner.

3.30 *In the first sentence of Section 3.18.1, after the parenthetical "…(other than the Work itself),…" and before the word "…but...", insert the following:*

including loss of use resulting therefrom,

3.31 *Delete Section 4.1.1 and substitute the following:*

4.1.1 The Architect is that person or entity identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

3.32 *Insert the following at the end of Section 4.2.1:*

Any reference in the Contract Documents to the Architect taking action or rendering a decision with a "reasonable time" is understood to mean no more than fourteen days, unless otherwise specified in the Contract Documents or otherwise agreed to by the parties.

3.33 *Delete the first sentence of Section 4.2.2 and substitute the following:*

The Architect will visit the site as necessary to fulfill its obligation to the Owner for inspection services, if any, and, at a minimum, to assure conformance with the Architect's design as shown in the Contract Documents and to observe the progress and quality of the various components of the Contractor's Work, and to determine if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents.

3.34 *Delete the first sentence of Section 4.2.3 and substitute the following*:

On the basis of the site visits, the Architect will keep the Owner informed about the progress and quality of the portion of the Work completed, and report to the Owner (1) deviations from the Contract Documents and from the most recent construction schedule submitted by the Contractor, and (2) defects and deficiencies observed in the Work.

3.35 *In Section 4.2.5, after the words "evaluations of the" and before the word "Contractor's," insert the following:*

Work completed and correlated with the

3.36 *Delete the first sentence of Section 4.2.11 and substitute the following:*

4.2.11 The Architect will, in the first instance, interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. Upon receipt of such request, the Architect will promptly provide the non-requesting party with a copy of the request.

3.37 *Insert the following at the end of Section 4.2.12:*

If either party disputes the Architects interpretation or decision, that party may proceed as provided in Article 15. The Architect's interpretations and decisions may be, but need not be, accorded any deference in any review conducted pursuant to law or the Contract Documents.

3.38 *Delete Section 4.2.14 and substitute the following:*

The Architect will review and respond to requests for information about the Contract Documents so as to avoid delay to the construction of the Project. The Architect's response to such requests will be made in writing with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information. Any response to a request for information must be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. Unless issued pursuant to a Modification, supplemental Drawings or Specifications will not involve an adjustment to the Contract Sum or Contract Time.

3.39 *Delete Section 5.2.1 and substitute the following:*

5.2.1 Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, within fourteen days after posting of the Notice of Intent to Award the Contract, shall furnish in writing to the Owner through the Architect the names of persons or entities (excluding Listed Subcontractors but including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Owner may reply within 14 days to the Contractor in writing stating (1) whether the Owner has reasonable objection to any such proposed person or entity. Failure of the Owner to reply within the 14 day period shall constitute notice of no reasonable objection.

3.40 *Delete Section 5.2.2 and substitute the following:*

5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner has made reasonable and timely objection. The Owner shall not direct the Contractor to contract with any specific individual or entity for supplies or services unless such supplies and services are necessary for completion of the Work and the specified individual or entity is the only source of such supply or services.

3.41 *In the first sentence of Section 5.2.3, delete the words "…or Architect…" in the two places they appear.*

3.42 *Delete the words "…or Architect…" in the in the first sentence of Section 5.2.4 and insert the following sentence at the end of Section 5.2.4:*

The Contractor's request for substitution must be made to the Owner in writing accompanied by supporting information.

3.43 *Add the following Section 5.2.5:*

5.2.5 A Subcontractor identified in the Contractor's Bid in response the specialty subcontractor listing requirements of Section 7 of the Bid Form (SE-330) may only be substituted in accordance with and as permitted by the provisions of Title 11, Chapter 35, Section 3021 of the South Carolina Code of Laws, as amended. A proposed substitute for a Listed Subcontractor shall be subject to the Owner's approval as set forth is Section 5.2.3.

3.44 *In Section 5.3, delete everything following the heading "SUBCONTRACTUAL RELATIONS" and insert the following Sections 5.3.1, 5.3.2, 5.3.3, and 5.3.4:*

5.3.1 By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, which the Contractor, by these Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not

prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise herein or in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.3.2 Without limitation on the generality of Section 5.3.1, each Subcontract agreement and each Sub-subcontract agreement shall include, and shall be deemed to include, the following Sections of these General Conditions: 3.2, 3.5, 3.18, 5.3, 5.4, 6.2.2, 7.3.3, 7.5, 7.6, 13.1, 13.12, 14.3, 14.4, and 15.1.6.

§ 5.3.3 Each Subcontract Agreement and each Sub-subcontract agreement shall exclude, and shall be deemed to exclude, Sections 13.2.1 and 13.6 and all of Article 15, except Section 15.1.6, of these General Conditions. In the place of these excluded sections of the General Conditions, each Subcontract Agreement and each Sub-subcontract may include Sections 13.2.1 and 13.6 and all of Article 15, except Section 15.1.6, of AIA Document A201-2007, Conditions of the Contract, as originally issued by the American Institute of Architects.

§ 5.3.4 The Contractor shall assure the Owner that all agreements between the Contractor and its Subcontractor incorporate the provisions of Subparagraph 5.3.1 as necessary to preserve and protect the rights of the Owner and the Architect under the Contract Documents with respect to the work to be performed by Subcontractors so that the subcontracting thereof will not prejudice such rights. The Contractor's assurance shall be in the form of an affidavit or in such other form as the Owner may approve. Upon request, the Contractor shall provide the Owner or Architect with copies of any or all subcontracts or purchase orders.

3.45 *Delete the last sentence of Section 5.4.1.*

3.46 *Add the following Sections 5.4.4, 5.4.5 and 5.4.6:*

§ 5.4.4 Each subcontract shall specifically provide that the Owner shall only be responsible to the subcontractor for those obligations of the Contractor that accrue subsequent to the Owner's exercise of any rights under this conditional assignment.

§ 5.4.5 Each subcontract shall specifically provide that the Subcontractor agrees to perform portions of the Work assigned to the Owner in accordance with the Contract Documents.

§ 5.4.6 Nothing in this Section 5.4 shall act to reduce or discharge the Contractor's payment bond surety's obligations to claimants for claims arising prior to the Owner's exercise of any rights under this conditional assignment.

3.47 *Delete the language of Section 6.1.4 and substitute the word "Reserved."*

3.48 *Insert the following at the end of Section 7.1.2:*

If the amount of a Modification exceeds the limits of the Owner's Construction Change Order Certification (reference Section 9.1.7.2 of the Agreement), then the Owner's agreement is not effective, and Work may not proceed, until approved in writing by the Office of State Engineer.

3.49 *Delete Section 7.2.1 and substitute the following:*

7.2.1 A Change Order is a written instrument prepared by the Architect (using State Form SE-480 "Construction Change Order") and signed by the Owner, Contractor and Architect stating their agreement upon all of the following:

.1 The change in the Work;

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

3.50 *Add the following Sections 7.2.2, 7.2.3, 7.2.4, and 7.2.5:*

7.2.2 If a Change Order provides for an adjustment to the Contract Sum, the adjustment must be calculated in accordance with Section 7.3.3.

7.2.3 At the Owner's request, the Contractor shall prepare a proposal to perform the work of a proposed Change Order setting forth the amount of the proposed adjustment, if any, in the Contract Sum; and the extent of the proposed adjustment, if any, in the Contract Time. Any proposed adjustment in the Contract sum shall be prepared in accordance with Section 7.2.2. The Owner's request shall include any revisions to the Drawings or Specifications necessary to define any changes in the Work. Within fifteen days of receiving the request, the Contractor shall submit the proposal to the Owner and Architect along with all documentation required by Section 7.6.

7.2.4 If the Contractor requests a Change Order, the request shall set forth the proposed change in the Work and shall be prepared in accordance with Section 7.2.3. If the Contractor requests a change to the Work that involves a revision to either the Drawings or Specifications, the Contractor shall reimburse the Owner for any expenditures associated with the Architects' review of the proposed revisions, except to the extent the revisions are accepted by execution of a Change Order.

7.2.5 Agreement on any Change Order shall constitute a final settlement of all matters relating to the change in the Work that is the subject of the Change Order, including, but not limited to, any adjustments to the Contract Sum or the Contract Time.

3.51 *Delete 7.3.3 and substitute the following:*

7.3.3 PRICE ADJUSTMENTS
§ 7.3.3.1 If any Modification, including a Construction Change Directive, provides for an adjustment to the Contract Sum, the adjustment shall be based on whichever of the following methods is the most valid approximation of the actual cost to the contractor, with overhead and profit as allowed by Section 7.5:

.1 Mutual acceptance of a lump sum;
.2 Unit prices stated in the Contract Documents, except as provided in Section 7.3.4, or subsequently agreed upon;
.3 Cost attributable to the events or situations under applicable clauses with adjustment of profits or fee, all as specified in the contract, or subsequently agreed upon by the parties, or by some other method as the parties may agree; or
.4 As provided in Section 7.3.7.

§ 7.3.3.2 Consistent with Section 7.6, costs must be properly itemized and supported by substantiating data sufficient to permit evaluation before commencement of the pertinent performance or as soon after that as practicable. All costs incurred by the Contractor must be justifiably compared with prevailing industry standards. Except as provided in Section 7.5, all adjustments to the Contract Price shall be limited to job specific costs and shall not include indirect costs, overhead, home office overhead, or profit.

3.52 *Delete Section 7.3.7 and substitute the following:*

7.3.7 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall make an initial determination, consistent with Section 7.3.3, of the method and the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in Section 7.5. In such case, and also under Section 7.3.3.1.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.7 shall be limited to the following:

.1 Costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;

.2 Costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;

.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others; and

.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work.

3.53 *Delete Section 7.3.8 and substitute the following:*

7.3.8 Using the percentages stated in Section 7.5, any adjustment to the Contract Sum for deleted work shall include any overhead and profit attributable to the cost for the deleted Work.

3.54 *Add the following Sections 7.5 and 7.6:*

7.5 AGREED OVERHEAD AND PROFIT RATES

7.5.1 For any adjustment to the Contract Sum for which overhead and profit may be recovered, other than those made pursuant to Unit Prices stated in the Contract Documents, the Contractor agrees to charge and accept, as full payment for overhead and profit, the following percentages of costs attributable to the change in the Work. The percentages cited below shall be considered to include all indirect costs including, but not limited to: field and office managers, supervisors and assistants, incidental job burdens, small tools, and general overhead allocations. The allowable percentages for overhead and profit are as follows:

.1 To the Contractor for work performed by the Contractor's own forces, 17% of the Contractor's actual costs.

.2 To each Subcontractor for work performed by the Subcontractor's own forces, 17% of the subcontractor's actual costs.

.3 To the Contractor for work performed by a subcontractor, 10% of the subcontractor's actual costs (not including the subcontractor's overhead and profit).

7.6 PRICING DATA AND AUDIT

§ 7.6.1 Cost or Pricing Data.

Upon request of the Owner or Architect, Contractor shall submit cost or pricing data prior to execution of a Modification which exceeds $500,000. Contractor shall certify that, to the best of its knowledge and belief, the cost or pricing data submitted is accurate, complete, and current as of a mutually determined specified date prior to the date of pricing the Modification. Contractor's price, including profit, shall be adjusted to exclude any significant sums by which such price was increased because Contractor furnished cost or pricing data that was inaccurate, incomplete, or not current as of the date specified by the parties. Notwithstanding Subparagraph 9.10.4, such adjustments may be made after final payment to the Contractor.

§ 7.6.2 Cost or pricing data means all facts that, as of the date specified by the parties, prudent buyers and sellers would reasonably expect to affect price negotiations significantly. Cost or pricing data are factual, not judgmental; and are verifiable. While they do not indicate the accuracy of the prospective contractor's judgment about estimated future costs or projections, they do include the data forming the basis for that judgment. Cost or pricing data are more than historical accounting data; they are all the facts that can be reasonably expected to contribute to the soundness of estimates of future costs and to the validity of determinations of costs already incurred.

§ 7.6.3 Records Retention.

As used in Section 7.6, the term "records" means any books or records that relate to cost or pricing data that Contractor is required to submit pursuant to Section 7.6.1. Contractor shall maintain records for three years from the date of final payment, or longer if requested by the chief procurement officer. The Owner may audit Contractor's records at reasonable times and places.

3.55 Delete Section 8.2.2 and substitute the following:

8.2.2 The Contractor shall not knowingly commence operations on the site or elsewhere prior to the effective date of surety bonds and insurance required by Article 11 to be furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such surety bonds or insurance.

3.56 *Delete Section 8.3.1 and substitute the following:*

8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or Architect, or of an employee of either, or of a separate contractor employed by the Owner; or by changes ordered in the Work; or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other causes beyond the control of the Contractor and any subcontractor at any tier; or by delay authorized by the Owner pending dispute resolution; or by other causes that the Architect determines may justify delay, then to the extent such delay will prevent the Contractor from achieving Substantial Completion within the Contract Time and provided the delay (1) is not caused by the fault or negligence of the Contractor or a subcontractor at any tier and (2) is not due to unusual delay in the delivery of supplies, machinery, equipment, or services when such supplies, machinery, equipment, or services were obtainable from other sources in sufficient time for the Contractor to meet the required delivery, the Contract Time shall be extended by Change Order for such reasonable time as the Architect may determine.

3.57 *Insert the following at the end of Section 9.1:*

All changes to the Contract Sum shall be adjusted in accordance with Section 7.3.3.

3.58 *Delete Section 9.2 and substitute the following:*

9.2 SCHEDULE OF VALUES

9.2.1 The Contractor shall submit to the Architect, within ten days of full execution of the Agreement, a schedule of values allocating the entire Contract Sum to the various portions of the Work and prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. As requested by the Architect, the Contractor and each Subcontractor shall prepare a trade payment breakdown for the Work for which each is responsible, such breakdown being submitted on a uniform standardized format approved by the Architect and Owner. The breakdown shall be divided in detail, using convenient units, sufficient to accurately determine the value of completed Work during the course of the Project. The Contractor shall update the schedule of values as required by either the Architect or Owner as necessary to reflect:

- **.1** the description of Work (listing labor and material separately);
- **.2** the total value;
- **.3** the percent and value of the Work completed to date;
- **.4** the percent and value of previous amounts billed; and
- **.5** the current percent completed and amount billed.

9.2.2 Any schedule of values or trade breakdown that fails to include sufficient detail, is unbalanced, or exhibits "front-loading" of the value of the Work shall be rejected. If a schedule of values or trade breakdown is used as the basis for payment and later determined to be inaccurate, sufficient funds shall be withheld from future Applications for Payment to ensure an adequate reserve (exclusive of normal retainage) to complete the Work.

3.59 *Delete Section 9.3.1 and substitute the following:*

Monthly, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2., for completed portions of the Work. Such application shall be notarized, if required, and supported by such data substantiating the Contractor's right to payment as the Owner or Architect may require (such as copies of requisitions from Subcontractors and material suppliers) and shall reflect retainage and any other adjustments provided in Section 5 of the Agreement. If required by the Owner or Architect, the Application for Payment shall be accompanied by a current construction schedule.

3.60 In Section 9.3.2, add the following words to the end of the second sentence:

provided such materials or equipment will be subsequently incorporated in the Work

Insert the following at the end of Section 9.3.2:

The Contractor shall 1) protect such materials from diversion, vandalism, theft, destruction, and damage, 2) mark such materials specifically for use on the Project, and 3) segregate such materials from other materials at the storage facility. The Architect and the Owner shall have the right to make inspections of the storage areas at any time.

3.61 *In Section 9.4.2, in the first sentence, after the words "Work has progressed to the point indicated," insert the following:*

in both the Application for Payment and, if required to be submitted by the Contractor, the accompanying current construction schedule

In the last sentence, delete the third item starting with "(3) reviewed copies" and ending with "Contractor's right to payment,"

3.62 *In Section 9.5.1, in the first sentence, delete the word "may" after the opening words "The Architect" and substitute the word "shall."*

In Section 9.5.1, insert the following sentence after the first sentence:

The Architect shall withhold a Certificate of Payment if the Application for Payment is not accompanied by the current construction schedule required by Section 3.10.1.

3.63 *In Section 9.6.2,* d*elete the word "The…" at the beginning of the first sentence and substitute the following:*

Pursuant to Chapter 6 of Title 29 of the South Carolina Code of Laws, as amended, the

3.64 *Delete Section 9.7 and substitute following:*

9.7 FAILURE OF PAYMENT
If the Architect does not issue a Certificate for Payment to the Owner, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the time established in the Contract Documents the amount certified by the Architect or awarded by a final dispute resolution order, then the Contractor may, upon seven additional days' written notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased, in accordance with the provisions of Section 7.3.3, by the amount of the Contractor's reasonable costs of shut-down, delay and start-up, plus interest as provided for in the Contract Documents.

3.65 *Insert the following words at the end of the sentence in Section 9.8.1:*

and when all required occupancy permits, if any, have been issued and copies of same have been delivered to the Owner.

3.66 *In Section 9.8.2, insert the word "written" after the word "comprehensive" and before the word "list."*

3.67 *Delete Section 9.8.3 and substitute the following:*

9.8.3.1 Upon receipt of the Contractor's list, the Architect, with the Owner and any other person the Architect or the Owner choose, will make an inspection on a date and at a time mutually agreeable to the Architect, Owner, and Contractor, to determine whether the Work or designated portion thereof is substantially complete. The Contractor shall furnish access for the inspection and testing as provided in this Contract. The inspection shall include a

demonstration by the Contractor that all equipment, systems and operable components of the Work function properly and in accordance with the Contract Documents. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion. If more than one Substantial Completion inspection is required, the Contractor shall reimburse the Owner for all costs of reinspections or, at the Owner's option, the costs may be deducted from payments due to the Contractor.

9.8.3.2 If the Architect and Owner concur in the Contractor's assessment that the Work or a portion of the Work is safe to occupy, the Owner and Contractor may arrange for a Certificate of Occupancy Inspection by OSE. The Owner, Architect, and Contractor shall be present at OSE's inspection. Upon verifying that the Work or a portion of the Work is substantially complete and safe to occupy, OSE will issue, as appropriate, a Full or Partial Certificate of Occupancy.

3.68 *In the second sentence of Section 9.8.5, delete the words "and consent of surety, if any."*

3.69 *In the first sentence of Section 9.9.1, delete the words "Section 11.3.1.5"and substitute the words "Section 11.3.1.3."*

3.70 *Delete Section 9.10.1 and substitute the following:*

9.10.1 Unless the parties agree otherwise in the Certificate of Substantial Completion, the Contractor shall achieve Final Completion no later than thirty days after Substantial Completion. Upon receipt of the Contractor's written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect, with the Owner and any other person the Architect or the Owner choose, will make an inspection on a date and at a time mutually agreeable to the Architect, Owner, and Contractor, and, when the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled. If more than one Final Completion inspection is required, the Contractor shall reimburse the Owner for all costs of reinspections or, at the Owner's option, the costs may be deducted from payments due to the Contractor. If the Contractor does not achieve final completion within thirty days after Substantial Completion or the timeframe agreed to by the parties in the Certificate of Substantial Completion, whichever is greater, the Contractor shall be responsible for any additional Architectural fees resulting from the delay.

3.71 *Delete the first sentence of Section 9.10.2 and substitute the following:*

Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner, (6) required Training Manuals, (7) equipment Operations and Maintenance Manuals, (8) any certificates of testing, inspection or approval required by the Contract Documents and not previously provided (9) all warranties and guarantees required under or pursuant to the Contract Documents, and (10) one copy of the Documents required by Section 3.11.

3.72 Delete the first sentence of Section 9.10.3 and substitute the following:

If, after Substantial Completion of the Work, final completion thereof is delayed 60 days through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted.

3.73 *Delete Section 9.10.5 and substitute the following:*

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

3.74 Add the following Section 9.10.6:

9.10.6 If OSE has not previously issued a Certificate of Occupancy for the entire Project, the Parties shall arrange for a representative of OSE to participate in the Final Completion Inspection. Representatives of the State Fire Marshal's Office and other authorities having jurisdiction may be present at the Final Completion Inspection or otherwise inspect the completed Work and advise the Owner whether the Work meets their respective requirements for the Project.

3.75 *Delete Section 10.3.1 and substitute the following:*

10.3.1 If the Contractor encounters a hazardous material or substance which was not discoverable as provided in Section 3.2.1 and not required by the Contract Documents, and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons or serious loss to real or personal property resulting from such material or substance encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner and Architect in writing. Hazardous materials or substances are those hazardous, toxic, or radioactive materials or substances subject to regulations by applicable governmental authorities having jurisdiction, such as, but not limited to, the S.C. Department of Health and Environmental Control, the U.S. Environmental Protection Agency, and the U.S. Nuclear Regulatory Commission.

3.76 *Insert the following at the end of Section 10.3.2:*

In the absence of agreement, the Architect will make an interim determination regarding any delay or impact on the Contractor's additional costs. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15. Any adjustment in the Contract Sum shall be determined in accordance with Section 7.3.3.

3.77 *Delete Section 10.3.3 and substitute the following:*

10.3.3 The Work in the affected area shall be resumed immediately following the occurrence of any one of the following events: (a) the Owner causes remedial work to be performed that results in the absence of hazardous materials or substances; (b) the Owner and the Contractor, by written agreement, decide to resume performance of the Work; or (c) the Work may safely and lawfully proceed, as determined by an appropriate governmental authority or as evidenced by a written report to both the Owner and the Contractor, which is prepared by an environmental engineer reasonably satisfactory to both the Owner and the Contractor.

3.78 *In Section 10.3.5, delete the word "The" at the beginning of the sentence and substitute the following:*

In addition to its obligations under Section 3.18, the

3.79 *Delete the language of Section 10.3.6 and substitute the word "Reserved."*

3.80 *Insert the following at the end of Section 10.4:*

The Contractor shall immediately give the Architect notice of the emergency. This initial notice may be oral followed within five days by a written notice setting forth the nature and scope of the emergency. Within fourteen days of the start of the emergency, the Contractor shall give the Architect a written estimate of the cost and probable effect of delay on the progress of the Work.

3.81 *Delete 11.1.2 and substitute the following:*

11.1.2 The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified below or required by law, whichever coverage is greater. Coverages shall be written on an occurrence basis and shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment, and, with respect to the Contractor's completed operations coverage, until the expiration of the period for correction of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents.

(1) COMMERCIAL GENERAL LIABILITY:
- **(a)** General Aggregate (per project) $1,000,000
- **(b)** Products/Completed Operations $1,000,000
- **(c)** Personal and Advertising Injury $1,000,000
- **(d)** Each Occurrence $1,000,000
- **(e)** Fire Damage (Any one fire) $50,000
- **(f)** Medical Expense (Any one person) $5,000

(2) BUSINESS AUTO LIABILITY (including All Owned, Non-owned, and Hired Vehicles):
- **(a)** Combined Single Limit $1,000,000

(3) WORKER'S COMPENSATION:
- **(a)** State Statutory
- **(b)** Employers Liability ..... $100,000 Per Acc.
  ..... $500,000 Disease, Policy Limit
  ..... $100,000 Disease, Each Employee

In lieu of separate insurance policies for Commercial General Liability, Business Auto Liability, and Employers Liability, the Contractor may provide an umbrella policy meeting or exceeding all coverage requirements set forth in this Section 11.1.2. The umbrella policy limits shall not be less than $3,000,000.

3.82 *Delete Section 11.1.3 and substitute the following:*

11.1.3 Prior to commencement of the Work, and thereafter upon replacement of each required policy of insurance, Contractor shall provide to the Owner a written endorsement to the Contractor's general liability insurance policy that:

(i) names the Owner as an additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations;
(ii) provides that no material alteration, cancellation, non-renewal, or expiration of the coverage contained in such policy shall have effect unless all additional insureds have been given at least ten (10) days prior written notice of cancellation for non-payment of premiums and thirty (30) days prior written notice of cancellation for any other reason; and
(iii) provides that the Contractor's liability insurance policy shall be primary, with any liability insurance of the Owner as secondary and noncontributory.

Prior to commencement of the Work, and thereafter upon renewal or replacement of each required policy of insurance, Contractor shall provide to the Owner a signed, original certificate of liability insurance (ACORD 25). Consistent with this Section 11.1, the certificate shall identify the types of insurance, state the limits of liability for each type of coverage, name the Owner a Consultants as Certificate Holder, provide that the general aggregate limit applies per project, and provide that coverage is written on an occurrence basis. Both the certificates and the

endorsements must be received directly from either the Contractor's insurance agent or the insurance company. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, naming the Owner as an additional insured for claims made under the Contractor's completed operations, and otherwise meeting the above requirements, shall be submitted with the final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage until the expiration of the time required by Section 11.1.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness.

3.83 *Delete Section 11.1.4 and substitute the following:*
11.1.4 A failure by the Owner either (i) to demand a certificate of insurance or written endorsement required by Section 11.1, or (ii) to reject a certificate or endorsement on the grounds that it fails to comply with Section 11.1 shall not be considered a waiver of Contractor's obligations to obtain the required insurance.

3.84 *In Section 11.3.1, delete the first sentence and substitute the following:*

Unless otherwise provided in the Contract Documents, the Contractor shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder's risk "all-risk" or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract Modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis.

3.85 *Delete the language of Section 11.3.1.2 and substitute the word "Reserved."*

3.86 *Delete the language of Section 11.3.1.3 and substitute the word "Reserved."*

3.87 *Delete Section 11.3.2 and substitute the following:*

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

3.88 *Delete Section 11.3.3 and substitute the following:*

11.3.3 LOSS OF USE INSURANCE
The Owner, at the Owner's option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner's property due to fire or other hazards, however caused. To the extent any losses are covered and paid for by such insurance, the Owner waives all rights of action against the Contractor for loss of use of the Owner's property, including consequential losses due to fire or other hazards however caused.

3.89 *Delete Section 11.3.4 and substitute the following:*

11.3.4 If the Owner requests in writing that insurance for risks other than those described herein or other special causes of loss be included in the property insurance policy, the Contractor shall, if possible, include such insurance, and the cost thereof shall be charged to the Owner by appropriate Change Order.

3.90 *Delete the language of Section 11.3.5 and substitute the word "Reserved."*

3.91 *Delete Section 11.3.6 and substitute the following:*

11.3.6 Before an exposure to loss may occur, the Contractor shall file with the Owner a copy of each policy that includes insurance coverages required by this Section 11.3. Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project. Each policy shall contain a provision that the policy will not be canceled or allowed to expire, and that its limits will not be reduced, until at least 30 days' prior written notice has been given to the Owner.

3.92 Delete the first sentence of Section 11.3.7 and substitute the following:

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

3.93 *Delete the first sentence of Section 11.3.8 and substitute the following:*

A loss insured under the Contractor's property insurance shall be adjusted by the Contractor as fiduciary and made payable to the Contractor as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.3.10.

3.94 *Delete Section 11.3.9 and substitute the following:*

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

3.95 *Delete Section 11.3.10 and substitute the following:*

11.3.10 The Contractor as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within five days after occurrence of loss to the Contractor's exercise of this power; if such objection is made, the dispute shall be resolved in the manner provided in the contract between the parties in dispute as the method of binding dispute resolution. The Contractor as fiduciary shall make settlement with insurers or, in the case of a dispute over distribution of insurance proceeds, in accordance with a final order or determination issued by the appropriate authority having jurisdiction over the dispute..

3.96 *Delete Section 11.4.1 and substitute the following:*

11.4.1 Before commencing any services hereunder, the Contractor shall provide the Owner with Performance and Payment Bonds, each in an amount not less than the Contract Price set forth in Article 4 of the Agreement. The Surety shall have, at a minimum, a "Best Rating" of "A" as stated in the most current publication of "Best's Key Rating Guide, Property-Casualty". In addition, the Surety shall have a minimum "Best Financial Strength Category" of "Class V", and in no case less than five (5) times the contract amount. The Performance Bond shall be written on Form SE-355, "Performance Bond" and the Payment Bond shall written on Form SE-357, "Labor and Material Payment Bond", and both shall be made payable to the Owner.

3.97 *Delete Section 11.4.2 and substitute the following:*

11.4.2 The Performance and Labor and Material Payment Bonds shall:

.1 be issued by a surety company licensed to do business in South Carolina;
.2 be accompanied by a current power of attorney and certified by the attorney-in-fact who executes the bond on the behalf of the surety company; and
.3 remain in effect for a period not less than one (1) year following the date of Substantial Completion or the time required to resolve any items of incomplete Work and the payment of any disputed amounts, whichever time period is longer.

3.98 *Add the following Sections 11.4.3 and 11.4.4:*

11.4.3 Any bonds required by this Contract shall meet the requirements of the South Carolina Code of Laws and Regulations, as amended.

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

3.99 *Delete Section 12.1.1 and substitute the following:*

12.1.1 If a portion of the Work is covered contrary to the to requirements specifically expressed in the Contract Documents, including inspections of work-in-progress required by all authorities having jurisdiction over the Project, it must, upon demand of the Architect or authority having jurisdiction, be uncovered for observation and be replaced at the Contractor's expense without change in the Contract Time.

3.100 *In Section 12.2.2.1, delete the words "and to make a claim for breach of warranty" at the end of the third sentence.*

3.101 *In Section 12.2.2.3, add the following to the end of the sentence:*

unless otherwise provided in the Contract Documents.

3.102 *Insert the following at the end of Section 12.2.4:*

If, prior to the date of Substantial Completion, the Contractor, a Subcontractor, or anyone for whom either is responsible, uses or damages any portion of the Work, including, without limitation, mechanical, electrical, plumbing, and other building systems, machinery, equipment, or other mechanical device, the Contractor shall cause such item to be restored to "like new" condition at no expense to the Owner.

3.103 *Delete Section 13.1 and substitute the following:*

13.1 GOVERNING LAW
The Contract, any dispute, claim, or controversy relating to the Contract, and all the rights and obligations of the parties shall, in all respects, be interpreted, construed, enforced and governed by and under the laws of the State of South Carolina, except its choice of law rules.

3.104 *Delete Section 13.2, including its Sub-Sections 13.2.1 and 13.2.2, and substitute the following:*

13.2 SUCCESSORS AND ASSIGNS
The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to covenants, agreements and obligations contained in the Contract Documents. Neither party to the Contract shall assign the Contract as a whole, or in part, without written consent of the other and then only in accordance with and as permitted by Regulation 19-445.2180 of the South Carolina Code of Regulations, as amended. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

3.105 *Delete Section 13.3 and substitute the following:*

13.3 WRITTEN NOTICE
Unless otherwise permitted herein, all notices contemplated by the Contract Documents shall be in writing and shall be deemed given:

.1 upon actual delivery, if delivery is by hand;
.2 upon receipt by the transmitting party of confirmation or reply, if delivery is by electronic mail, facsimile, telex or telegram;
.3 upon receipt, if delivery is by the United States mail.

Notice to Contractor shall be to the address provided in Section 8.3.2 of the Agreement. Notice to Owner shall be to the address provided in Section 8.2.2 of the Agreement. Either party may designate a different address for notice by giving notice in accordance with this paragraph.

3.106 *In Section 13.4.1, insert the following at the beginning of the sentence:*

Unless expressly provided otherwise,

3.107 *Add the following Section 13.4.3:*

13.4.3 Notwithstanding Section 9.10.4, the rights and obligations which, by their nature, would continue beyond the termination, cancellation, rejection, or expiration of this contract shall survive such termination, cancellation, rejection, or expiration, including, but not limited to, the rights and obligations created by the following clauses:

1.5 Ownership and Use of Drawings, Specifications and Other Instruments of Service;
3.5 Warranty
3.17 Royalties, Patents and Copyrights
3.18 Indemnification
7.6 Cost or Pricing Data
11.1 Contractor's Liability Insurance
11.4 Performance and Payment Bond
15.1.6 Claims for Listed Damages
15.1.7 Waiver of Claims Against the Architect
15.6 Dispute Resolution
15.4 Service of Process

3.108 *Delete Section 13.6 and substitute the following:*

13.6 INTEREST
Payments due to the Contractor and unpaid under the Contract Documents shall bear interest only if and to the extent allowed by Title 29, Chapter 6, Article 1 of the South Carolina Code of Laws. Amounts due to the Owner shall bear interest at the rate of one percent a month or a pro rata fraction thereof on the unpaid balance as may be due.

3.109 *Delete the language of Section 13.7 and substitute the word "Reserved."*

3.110 *Add the following Sections 13.8 through 13.16:*

13.8 PROCUREMENT OF MATERIALS BY OWNER
The Contractor accepts assignment of all purchase orders and other agreements for procurement of materials and equipment by the Owner that are identified as part of the Contract Documents. The Contractor shall, upon delivery, be responsible for the storage, protection, proper installation, and preservation of such Owner purchased items, if any, as if the Contractor were the original purchaser. The Contract Sum includes, without limitation, all costs and expenses in connection with delivery, storage, insurance, installation, and testing of items covered in any assigned purchase orders or agreements. Unless the Contract Documents specifically provide otherwise, all Contractor warranty of workmanship and correction of the Work obligations under the Contract Documents shall apply to the Contractor's installation of and modifications to any Owner purchased items,.

13.9 INTERPRETATION OF BUILDING CODES
As required by Title 10, Chapter 1, Section 180 of the South Caroline Code of Laws, as amended, OSE shall determine the enforcement and interpretation of all building codes and referenced standards on state buildings. The Contractor shall refer any questions, comments, or directives from local officials to the Owner and OSE for resolution.

13.10 MINORITY BUSINESS ENTERPRISES

Contractor shall notify Owner of each Minority Business Enterprise (MBE) providing labor, materials, equipment, or supplies to the Project under a contract with the Contractor. Contractor's notification shall be via the first monthly status report submitted to the Owner after execution of the contract with the MBE. For each such MBE, the Contractor shall provide the MBE's name, address, and telephone number, the nature of the work to be performed or materials or equipment to be supplied by the MBE, whether the MBE is certified by the South Carolina Office of Small and Minority Business Assistance, and the value of the contract.

13.11 SEVERABILITY

If any provision or any part of a provision of the Contract Documents shall be finally determined to be superseded, invalid, illegal, or otherwise unenforceable pursuant to any applicable Legal Requirements, such determination shall not impair or otherwise affect the validity, legality, or enforceability of the remaining provision or parts of the provision of the Contract Documents, which shall remain in full force and effect as if the unenforceable provision or part were deleted.

13.12 ILLEGAL IMMIGRATION

Contractor certifies and agrees that it will comply with the applicable requirements of Title 8, Chapter 14 of the South Carolina Code of Laws and agrees to provide to the State upon request any documentation required to establish either: (a) that Title 8, Chapter 14 is inapplicable both to Contractor and its subcontractors or sub-subcontractors; or (b) that Contractor and its subcontractors or sub-subcontractors are in compliance with Title 8, Chapter 14. Pursuant to Section 8-14-60, "A person who knowingly makes or files any false, fictitious, or fraudulent document, statement, or report pursuant to this chapter is guilty of a felony, and, upon conviction, must be fined within the discretion of the court or imprisoned for not more than five years, or both." Contractor agrees to include in any contracts with its subcontractors language requiring its subcontractors to (a) comply with the applicable requirements of Title 8, Chapter 14, and (b) include in their contracts with the sub-subcontractors language requiring the sub-subcontractors to comply with the applicable requirements of Title 8, Chapter 14. (An overview is available at www.procurement.sc.gov)

13.13 SETOFF

The Owner shall have all of its common law, equitable, and statutory rights of set-off.

13.14 DRUG-FREE WORKPLACE

The Contractor certifies to the Owner that Contractor will provide a Drug-Free Workplace, as required by Title 44, Chapter 107 of the South Carolina Code of Laws, as amended.

13.15 FALSE CLAIMS

According to the S.C. Code of Laws § 16-13-240, "a person who by false pretense or representation obtains the signature of a person to a written instrument or obtains from another person any chattel, money, valuable security, or other property, real or personal, with intent to cheat and defraud a person of that property is guilty" of a crime.

13.16 NON-INDEMNIFICATION:

Any term or condition is void to the extent it requires the State to indemnify anyone. It is unlawful for a person charged with disbursements of state funds appropriated by the General Assembly to exceed the amounts and purposes stated in the appropriations. (§ 11-9-20) It is unlawful for an authorized public officer to enter into a contract for a purpose in which the sum is in excess of the amount appropriated for that purpose. It is unlawful for an authorized public officer to divert or appropriate the funds arising from any tax levied and collected for any one fiscal year to the payment of an indebtedness contracted or incurred for a previous year. (§ 11-1-40)

3.111 *Delete Section 14.1.1 and substitute the following:*

14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 45 consecutive days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons:

.1 Issuance of an order of a court or other public authority having jurisdiction that requires substantially all Work to be stopped; or

.2 An act of government, such as a declaration of national emergency that requires substantially all Work to be stopped.

.3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents and the Contractor has stopped work in accordance with Section 9.7

3.112 *Insert the following at the end of Section 14.1.3:*

Any adjustment to the Contract Sum pursuant to this Section shall be made in accordance with the requirements of Article 7.

3.113 *In Section 14.1.4, replace the word "repeatedly" with the word "persistently."*

3.114 *Delete Section 14.2.1 and substitute the following:*

14.2.1 The Owner may terminate the Contract if the Contractor

.1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials, or otherwise fails to prosecute the Work, or any separable part of the Work, with the diligence, resources and skill that will ensure its completion within the time specified in the Contract Documents, including any authorized adjustments;

.2 fails to make payment to Subcontractors for materials or labor in accordance with the Contract Documents and the respective agreements between the Contractor and the Subcontractors;

.3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or

.4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

3.115 *In Section 14.2.2, delete the parenthetical statement ", upon certification by the Initial Decision Maker that sufficient cause exists to justify such action," immediately following the word "Owner" in the first line.*

3.116 *In Section 14.2.4, replace the words "Initial Decision Maker" with the word "Architect"*

3.117 *Add the following Section 14.2.5:*

14.2.5 If, after termination for cause, it is determined that the Owner lacked justification to terminate under Section 14.2.1, or that the Contractor's default was excusable, the rights and obligations of the parties shall be the same as if the termination had been issued for the convenience of the Owner under Section 14.4.

3.118 *Delete the second sentence of Section 14.3.2 and substitute the following:*

Any adjustment to the Contract Sum made pursuant to this section shall be made in accordance with the requirements of Article 7.3.3.

3.119 *Delete Section 14.4.1 and substitute the following:*

14.4.1 The Owner may, at any time, terminate the Contract, in whole or in part for the Owner's convenience and without cause. The Owner shall give written notice of the termination to the Contractor specifying the part of the Contract terminated and when termination becomes effective.

3.120 *Delete Section 14.4.2 and substitute the following:*

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

.1 cease operations as directed by the Owner in the notice;

.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work;

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders; and

.4 complete the performance of the Work not terminated, if any.

3.121 *Delete Section 14.4.3 and substitute the following:*

14.4.3 In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed, costs incurred by reason of such termination, and any other adjustments otherwise allowed by the Contract. Any adjustment to the Contract Sum made pursuant to this Section 14.4 shall be made in accordance with the requirements of Article 7.3.3.

3.122 *Add the following Sections 14.4.4, 14.4.5, and 14.5:*

14.4.4 Contractor's failure to include an appropriate termination for convenience clause in any subcontract shall not (i) affect the Owner's right to require the termination of a subcontract, or (ii) increase the obligation of the Owner beyond what it would have been if the subcontract had contained an appropriate clause.

14.4.5 Upon written consent of the Contractor, the Owner may reinstate the terminated portion of this Contract in whole or in part by amending the notice of termination if it has been determined that:

.1 the termination was due to withdrawal of funding by the General Assembly, Governor, or Budget and Control Board or the need to divert project funds to respond to an emergency as defined by Regulation 19-445.2110(B) of the South Carolina Code of Regulations, as amended;

.2 funding for the reinstated portion of the work has been restored;

.3 circumstances clearly indicate a requirement for the terminated work; and

.4 reinstatement of the terminated work is advantageous to the Owner.

14.5 CANCELLATION AFTER AWARD BUT PRIOR TO PERFORMANCE
Pursuant to Title 11, Chapter 35 and Regulation 19-445.2085 of the South Carolina Code of Laws and Regulations, as amended, this contract may be canceled after award but prior to performance.

3.123 *Insert the following sentence after the second sentence of Section 15.1.1:*

A voucher, invoice, payment application or other routine request for payment that is not in dispute when submitted is not a Claim under this definition.

3.124 *Delete Section 15.1.2 and substitute the following:*

15.1.2 NOTICE OF CLAIMS
Claims by either the Owner or Contractor must be initiated by written notice to the other party and to the Architect. Such notice shall include sufficient information to advise the Architect and other party of the circumstances giving rise to the claim, the specific contractual adjustment or relief requested and the basis of such request. Claims by either party arising prior to the date final payment is due must be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later except as stated for adverse weather days in Section 15.1.5.2. By failing to give written notice of a Claim within the time required by this Section, a party expressly waives its claim.

3.125 *Delete Section 15.1.3 and substitute the following:*

15.1.3 CONTINUING CONTRACT PERFORMANCE
Pending final resolution of a Claim, including any administrative review allowed under Section 15.6, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents. The Architect will issue Certificates for Payment in accordance with the initial decisions and determinations of the Architect.

3.126 *Insert the following at the end of Section 15.1.5.1:*

Claims for an increase in the Contract Time shall be based on one additional calendar day for each full calendar day that the Contractor is prevented from working.

3.127 *Insert the following Sub-Sections at the end of Section 15.1.5.2:*

.1 Claims for adverse weather shall be based on actual weather conditions at the job site or other place of performance of the Work, as documented in the Contractor's job site log.

.2 For the purpose of this Contract, a total of five (5) calendar days per calendar month (non-cumulative) shall be anticipated as "adverse weather" at the job site, and such time will not be considered justification for an extension of time. If, in any month, adverse weather develops beyond the five (5) days, the Contractor shall be allowed to claim additional days to compensate for the excess weather delays only to the extent of the impact on the approved construction schedule. The remedy for this condition is for an extension of time only and is exclusive of all other rights and remedies available under the Contract Documents or imposed or available by law.

.3 The Contractor shall submit monthly with their pay application all claims for adverse weather conditions that occurred during the previous month. The Architect shall review each monthly submittal in accordance with Section 15.5 and inform the Contractor and the Owner promptly of its evaluation. Approved days shall be included in the next Change Order issued by the Architect. Adverse weather conditions not claimed within the time limits of this Subparagraph shall be considered to be waived by the Contractor. Claims will not be allowed for adverse weather days that occur after the scheduled (original or adjusted) date of Substantial Completion.

3.128 *Delete Section 15.1.6 and substitute the following:*

15.1.6 CLAIMS FOR LISTED DAMAGES
Notwithstanding any other provision of the Contract Documents, including Section 1.2.1, but subject to a duty of good faith and fair dealing, the Contractor and Owner waive Claims against each other for listed damages arising out of or relating to this Contract.

15.1.6.1 For the Owner, listed damages are (i) lost revenue and profit, (ii) losses resulting from injury to business or reputation, (iii) additional or escalated overhead and administration expenses, (iv) additional financing costs, (v) costs suffered by a third party unable to commence work, (vi) attorney's fees, (vii) any interest, except to the extent allowed by Section 13.6 (Interest), (viii) lost revenue and profit for lost use of the property, (ix) costs resulting from lost productivity or efficiency.

15.1.6.2 For the Contractor, listed damages are (i) lost revenue and profit, (ii) losses resulting from injury to business or reputation, (iii) additional or escalated overhead and administration expenses, (iv) additional financing costs, (v) attorney's fees, (vi) any interest, except to the extent allowed by Section 13.6 (Interest); (vii) unamortized equipment costs; and, (viii) losses incurred by subcontractors for the types of damages the Contractor has waive as against the Owner. Without limitation, this mutual waiver is applicable to all damages due to either party’s termination in accordance with Article 14. Nothing contained in this Section shall be deemed to preclude an award of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents. This mutual waiver is not applicable to amounts due or obligations under Section 3.18 (Indemnification).

3.129 *Add the following Section 15.1.7:*

15.1.7 WAIVER OF CLAIMS AGAINST THE ARCHITECT
Notwithstanding any other provision of the Contract Documents, including Section 1.2.1, but subject to a duty of good faith and fair dealing, the Contractor waives all claims against the Architect and any other design professionals who provide design and/or project management services to the Owner, either directly or as independent contractors or subcontractors to the Architect, for listed damages arising out of or relating to this Contract. The listed damages are (i) lost revenue and profit, (ii) losses resulting from injury to business or reputation, (iii) additional or escalated overhead and administration expenses, (iv) additional financing costs, (v)

attorney's fees, (vi) any interest; (vii) unamortized equipment costs; and, (viii) losses incurred by subcontractors for the types of damages the Contractor has waive as against the Owner. This mutual waiver is not applicable to amounts due or obligations under Section 3.18 (Indemnification).

3.130 ***Delete the language of Sections 15.2, 15.3, and 15.4, including all Sub-Sections, and substitute the word "Reserved" for the deleted language of each Section and Sub-Section.***

3.131 *Add the following Sections 15.5 and 15.6 with their sub-sections:*

15.5 CLAIM AND DISPUTES - DUTY OF COOPERATION, NOTICE, AND ARCHITECTS INITIAL DECISION

15.5.1 Contractor and Owner are fully committed to working with each other throughout the Project to avoid or minimize claims. To further this goal, Contractor and Owner agree to communicate regularly with each other and the Architect at all times notifying one another as soon as reasonably possible of any issue that if not addressed may cause loss, delay, and/or disruption of the Work. If claims do arise, Contractor and Owner each commit to resolving such claims in an amicable, professional, and expeditious manner to avoid unnecessary losses, delays, and disruptions to the Work.

15.5.2 Claims shall first be referred to the Architect for initial decision. An initial decision shall be required as a condition precedent to resolution pursuant to Section 15.6 of any Claim arising prior to the date of final payment, unless 30 days have passed after the Claim has been referred to the Architect with no decision having been rendered, or after all the Architect's requests for additional supporting data have been answered, whichever is later. The Architect will not address claims between the Contractor and persons or entities other than the Owner.

15.5.3 The Architect will review Claims and within ten days of the receipt of a Claim (1) request additional supporting data from the claimant or a response with supporting data from the other party or (2) render an initial decision in accordance with Section 15.5.5.

15.5.4 If the Architect requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of such request, and shall either (1) provide a response on the requested supporting data, (2) advise the Architect when the response or supporting data will be furnished or (3) advise the Architect that all supporting data has already been provided. Upon receipt of the response or supporting data, the Architect will render an initial decision in accordance with Section 15.5.5.

15.5.5 The Architect will render an initial decision in writing; (1) stating the reasons therefor; and (2) notifying the parties of any change in the Contract Sum or Contract Time or both. The Architect will deliver the initial decision to the parties within two weeks of receipt of any response or supporting data requested pursuant to Section 16.4, or within such longer period as may be mutually agreeable to the parties. If the parties accept the initial decision, the Architect shall prepare a Change Order with appropriate supporting documentation for the review and approval of the parties and the Office of State Engineer. If either the Contractor, Owner, or both, disagree with the initial decision, the Contractor and Owner shall proceed with dispute resolution in accordance with the provisions of Section 15.6.

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

15.6 DISPUTE RESOLUTION

15.6.1 If a claim is not resolved pursuant to Section 15.5 to the satisfaction of either party, both parties shall attempt to resolve the dispute at the field level through discussions between Contractor's Representative and Owner's Representative. If a dispute cannot be resolved through Contractor's Representative and Owner's Representative, then the Contractor's Senior Representative and the Owner's Senior Representative, upon the request of either party, shall meet as soon as conveniently possible, but in no case later than twenty-one days after such a request is made, to attempt to resolve such dispute. Prior to any meetings between the Senior Representatives, the parties will exchange relevant information that will assist the parties in resolving their dispute. The meetings required by this Section are a condition precedent to resolution pursuant to Section 15.6.2.

15.6.2 If after meeting in accordance with the provisions of Section 15.6.1, the Senior Representatives determine that the dispute cannot be resolved on terms satisfactory to both the Contractor and the Owner, then either party may submit the dispute by written request to South Carolina's Chief Procurement Officer for Construction (CPOC). Except as otherwise provided in Article 15, all claims, claims, or controversies relating to the Contract shall be resolved exclusively by the appropriate Chief Procurement Officer in accordance with Title 11, Chapter 35, Article 17 of the South Carolina Code of Laws, or in the absence of jurisdiction, only in the Court of Common Pleas for, or in the absence of jurisdiction a federal court located in, Richland County, State of South Carolina. Contractor agrees that any act by the State regarding the Contract is not a waiver of either the State's sovereign immunity or the State's immunity under the Eleventh Amendment of the United State's Constitution.

15.6.3 If any party seeks resolution to a dispute pursuant to Section 15.6.2, the parties shall participate in non-binding mediation to resolve the claim. If the claim is governed by Title 11, Chapter 35, Article 17 of the South Carolina Code of Laws as amended and the amount in controversy is $100,000.00 or less, the CPOC shall appoint a mediator, otherwise, the mediation shall be conducted by an impartial mediator selected by mutual agreement of the parties, or if the parties cannot so agree, a mediator designated by the American Arbitration Association ("AAA") pursuant to its Construction Industry Mediation Rules. The mediation will be governed by and conducted pursuant to a mediation agreement negotiated by the parties or, if the parties cannot so agree, by procedures established by the mediator.

15.6.4 Without relieving any party from the other requirements of Sections 15.5 and 15.6, either party may initiate proceedings in the appropriate forum prior to initiating or completing the procedures required by Sections 15.5 and 15.6 if such action is necessary to preserve a claim by avoiding the application of any applicable statutory period of limitation or repose.

15.6.5 SERVICE OF PROCESS

Contractor consents that any papers, notices, or process necessary or proper for the initiation or continuation of any claims, claims, or controversies relating to the Contract; for any court action in connection therewith; or for the entry of judgment on any award made, may be served on Contractor by certified mail (return receipt requested) addressed to Contractor at the address provided for the Contractor's Senior Representative or by personal service or by any other manner that is permitted by law, in or outside South Carolina. Notice by certified mail is deemed duly given upon deposit in the United States mail.

3.132 *Add the following Article 16:*

ARTICLE 16 PROJECT-SPECIFIC REQUIREMENTS AND INFORMATION

16.1. Inspection Requirements: *(Indicate the inspection services required by the Contract)*

☒ Special Inspections are required and are not part of the Contract Sum. *(see section 01400)*
☒ Building Inspections are required and are not part of the Contract Sum. *(see section 01400)*
☐ Building Inspections are required and are part of the Contract Sum. The inspections required for this Work are : *(Indicate which services are required and the provider)*

- ☐ Civil: _____
- ☒ Structural: _____
- ☒ Mechanical: _____
- ☒ Plumbing: _____
- ☒ Electrical: _____
- ☐ Gas: _____
- ☐ Other *(list):* _____

Remarks: _____

16.1.1 Contractor shall schedule and request inspections in an orderly and efficient manner and shall notify the Owner whenever the Contractor schedules an inspection in accordance with the requirements of Section 16.1. Contractor shall be responsible for the cost of inspections scheduled and conducted without the Owner's knowledge and for any increase in the cost of inspections resulting from the inefficient scheduling of inspections.

16.2 List Cash Allowances, if any. *(Refer to attachments as needed* If *none, enter NONE)*
None

16.3. Requirements for Record Drawings, if any. *(Refer to attachments as needed.* If *none, enter NONE)*
Refer to SECTION 01780 - CLOSEOUT SUBMITTALS

16.4. Requirements for Shop Drawings and other submittals, if any, including number, procedure for submission, list of materials to be submitted, etc. *(Refer to attachments as needed. If none, enter NONE)*
Refer to SECTION 01300 - ADMINISTRATIVE REQUIRMENTS

16.5. Requirements for signage, on-site office or trailer, utilities, restrooms, etc., in addition to the Contract, if any. *(Refer to attachments as needed. If none, enter NONE)*
See Section 01500 Temporary Facilities and Controls

16.6. Requirements for Project Cleanup in addition to the Contract, if any. *(Refer to attachments as needed. If none, enter NONE)*
See Final Cleaning in Section 01700 - Execution Requirements

16.7. List all attachments that modify these General Conditions. *(If none, enter NONE)*
USC Supplemental Conditions

SE-355 2011 Edition

Performance Bond

KNOW ALL MEN BY THESE PRESENTS, that *(Insert full name or legal title and address of Contractor)*

Name: _____
Address: _____
_____

hereinafter referred to as "Contractor", and *(Insert full name and address of principal place of business of Surety)*

Name: _____
Address: _____
_____

hereinafter called the "surety", are jointly and severally held and firmly bound unto *(Insert full name and address of Agency)*

Name: _____
Address: _____
_____

hereinafter referred to as "Agency", or its successors or assigns, the sum of _____($_____), being the sum of the Bond to which payment to be well and truly made, the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, Contractor has by written agreement dated _____ entered into a contract with Agency to construct

State Project Name: USC Upstate Administration Building Repairs and Renovation
State Project Number: H34-9541-JM
Brief Description of Awarded Work, as found on the SE-330, Bid Form: The project consist of a total HVAC replacement, ceiling replacement, minor reconfiguration of interior spaces, bathroom upgrades, new fire alarm and electrical upgrades.

in accordance with Drawings and Specifications prepared by *(Insert full name and address of A/E)*

Name: GMK Associates, Inc.
Address: 1201 Main Street, Suite 2100
Columbia, South Carolina 29201

which agreement is by reference made a part hereof, and is hereinafter referred to as the Contract.

IN WITNESS WHEREOF, Surety and Contractor, intending to be legally bound hereby, subject to the terms stated herein, do each cause this Performance Bond to be duly executed on its behalf by its authorized officer, agent or representative.

DATED this _____day of _____, 2_____ BOND NUMBER _____
(shall be no earlier than Date of Contract)

CONTRACTOR	SURETY
By: _____ (Seal)	By: _____ (Seal)
Print Name: _____	Print Name: _____
Print Title: _____	Print Title: _____ (Attach Power of Attorney)
Witness: _____	Witness: _____

(Additional Signatures, if any, appear on attached page)

Performance Bond

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH THAT:

1. The Contractor and the Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Agency for the full and faithful performance of the contract, which is incorporated herein by reference

2. If the Contractor performs the contract, the Surety and the Contractor have no obligation under this Bond, except to participate in conferences as provided in paragraph 3.1.

3. The Surety's obligation under this Bond shall arise after:

3.1 The Agency has notified the Contractor and the Surety at the address described in paragraph 10 below, that the Agency is considering declaring a Contractor Default and has requested and attempted to arrange a conference with the Contractor and the Surety to be held not later than 15 days after receipt of such notice to discuss methods of performing the Contract. If the Agency, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Contract, but such an agreement shall not waive the Agency's right, if any, subsequently to declare a Contractor Default; or

3.2 The Agency has declared a Contractor Default and formally terminated the Contractor's right to complete the Contract.

4. The Surety shall, within 15 days after receipt of notice of the Agency's declaration of a Contractor Default, and at the Surety's sole expense, take one of the following actions:

4.1 Arrange for the Contractor, with consent of the Agency, to perform and complete the Contract; or

4.2 Undertake to perform and complete the Contract itself, through its agents or through independent contractors; or

4.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Agency for a contract for performance and completion of the Contract, arrange for a contract to be prepared for execution by the Agency and the contractor selected with the Agency's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the Bonds issued on the Contract, and pay to the Agency the amount of damages as described in paragraph 7 in excess of the Balance of the Contract Sum incurred by the Agency resulting from the Contractor Default; or

4.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and:

4.4.1 After investigation, determine the amount for which it may be liable to the Agency and, within 60 days of waiving its rights under this paragraph, tender payment thereof to the Agency; or

4.4.2 Deny liability in whole or in part and notify the Agency, citing the reasons therefore.

5. Provided Surety has proceeded under paragraphs 4.1, 4.2, or 4.3, the Agency shall pay the Balance of the Contract Sum to either:

5.1 Surety in accordance with the terms of the Contract; or

5.2 Another contractor selected pursuant to paragraph 4.3 to perform the Contract.

5.3 The balance of the Contract Sum due either the Surety or another contractor shall be reduced by the amount of damages as described in paragraph 7.

6. If the Surety does not proceed as provided in paragraph 4 with reasonable promptness, the Surety shall be deemed to be in default on this Bond 15 days after receipt of written notice from the Agency to the Surety demanding that the Surety perform its obligations under this Bond, and the Agency shall be entitled to enforce any remedy available to the Agency.

6.1 If the Surety proceeds as provided in paragraph 4.4, and the Agency refuses the payment tendered or the Surety has denied liability, in whole or in part, then without further notice the Agency shall be entitled to enforce any remedy available to the Agency.

6.2 Any dispute, suit, action or proceeding arising out of or relating to this Bond shall be governed by the Dispute Resolution process defined in the Contract Documents and the laws of the State of South Carolina.

7. After the Agency has terminated the Contractor's right to complete the Contract, and if the Surety elects to act under paragraph 4.1, 4.2, or 4.3 above, then the responsibilities of the Surety to the Agency shall be those of the Contractor under the Contract, and the responsibilities of the Agency to the Surety shall those of the Agency under the Contract. To a limit of the amount of this Bond, but subject to commitment by the Agency of the Balance of the Contract Sum to mitigation of costs and damages on the Contract, the Surety is obligated to the Agency without duplication for:

7.1 The responsibilities of the Contractor for correction of defective Work and completion of the Contract; and

7.2 Additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under paragraph 4; and

7.3 Damages awarded pursuant to the Dispute Resolution Provisions of the Contract. Surety may join in any Dispute Resolution proceeding brought under the Contract and shall be bound by the results thereof; and

7.4 Liquidated Damages, or if no Liquidated Damages are specified in the Contract, actual damages caused by delayed performance or non-performance of the Contractor.

8. The Surety shall not be liable to the Agency or others for obligations of the Contractor that are unrelated to the Contract, and the Balance of the Contract Sum shall not be reduced or set-off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Agency or its heirs, executors, administrators, or successors.

9. The Surety hereby waives notice of any change, including changes of time, to the contract or to related subcontracts, purchase orders and other obligations.

10. Notice to the Surety, the Agency or the Contractor shall be mailed or delivered to the address shown on the signature page.

11. Definitions

11.1 Balance of the Contract Sum: The total amount payable by the Agency to the Contractor under the Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts to be received by the Agency in settlement of insurance or other Claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Contract.

11.2 Contractor Default: Failure of the Contractor, which has neither been remedied nor waived, to perform the Contract or otherwise to comply with the terms of the Contract.

SE-357
Rev. 8/9/2011

Labor and Material Payment Bond

KNOW ALL MEN BY THESE PRESENTS, that *(Insert full name or legal title and address of Contractor)*

Name: _____
Address: _____
_____

hereinafter referred to as "Contractor", and *(Insert full name and address of principal place of business of Surety)*

Name: _____
Address: _____
_____

hereinafter called the "surety", are jointly and severally held and firmly bound unto *(Insert full name and address of Agency)*

Name: _____
Address: _____
_____

hereinafter referred to as "Agency", or its successors or assigns, the sum of _____($_____), being the sum of the Bond to which payment to be well and truly made, the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, Contractor has by written agreement dated _____ entered into a contract with Agency to construct

Project Name: USC Upstate Administration Building Repairs and Renovation

Project Number: H34-9541-JM

Brief Description of Awarded Work, as found on the SE-330, Bid Form: The project consist of a total HVAC replacement, ceiling replacement, minor reconfiguration of interior spaces, bathroom upgrades, new fire alarm and electrical upgrades.

in accordance with Drawings and Specifications prepared by *(Insert full name and address of A/E)*

Name: GMK Associates
Address: 1201 Main Street, Suite 2100
Columbia, South Carolina 29201

which agreement is by reference made a part hereof, and is hereinafter referred to as the Contract.

IN WITNESS WHEREOF, Surety and Contractor, intending to be legally bound hereby, subject to the terms stated herein, do each cause this Labor and Material Payment Bond to be duly executed on its behalf by its authorized officer, agent or representative.

DATED this _____day of _____, 2_____ BOND NUMBER _____
(shall be no earlier than Date of Contract)

CONTRACTOR	SURETY
By: _____ (Seal)	By: _____ (Seal)
Print Name: _____	Print Name: _____
Print Title: _____	Print Title: _____ (Attach Power of Attorney)
Witness: _____	Witness: _____

(Additional Signatures, if any, appear on attached page)

SE-357

Rev. 8/9/2011

Labor and Material Payment Bond

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH THAT:

1. The Contractor and the Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Agency to pay for all labor, materials and equipment required for use in the performance of the Contract, which is incorporated herein by reference.

2. With respect to the Agency, this obligation shall be null and void if the Contractor:

2.1 Promptly makes payment, directly or indirectly, for all sums due Claimants; and

2.2 Defends, indemnifies and holds harmless the Agency from all claims, demands, liens or suits by any person or entity who furnished labor, materials or equipment for use in the performance of the Contract.

3. With respect to Claimants, this obligation shall be null and void if the Contractor promptly makes payment, directly or indirectly, for all sums due.

4. With respect to Claimants, and subject to the provisions of Title 29, Chapter 5 and the provisions of §11-35-3030(2)(c) of the SC Code of Laws, as amended, the Surety's obligation under this Bond shall arise as follows:

4.1 Every person who has furnished labor, material or rental equipment to the Contractor or its subcontractors for the work specified in the Contract, and who has not been paid in full therefore before the expiration of a period of ninety (90) days after the date on which the last of the labor was done or performed by him or material or rental equipment was furnished or supplied by him for which such claim is made, shall have the right to sue on the payment bond for the amount, or the balance thereof, unpaid at the time of institution of such suit and to prosecute such action for the sum or sums justly due him.

4.2 A remote claimant shall have a right of action on the payment bond upon giving written notice by certified or registered mail to the Contractor within ninety (90) days from the date on which such person did or performed the last of the labor or furnished or supplied the last of the material or rental equipment upon which such claim is made.

4.3 Every suit instituted upon a payment bond shall be brought in a court of competent jurisdiction for the county or circuit in which the construction contract was to be performed, but no such suit shall be commenced after the expiration of o ne year after the day on which the last of the labor was performed or material or rental equipment was supplied by the person bringing suit.

5. When the Claimant has satisfied the conditions of paragraph 4, the Surety shall promptly and at the Surety's expense take the following actions:

5.1 Send an answer to the Claimant, with a copy to the Agency, within sixty (60) days after receipt of the claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed.

5.2 Pay or arrange for payment of any undisputed amounts.

5.3 The Surety's failure to discharge its obligations under this paragraph 5 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a claim. However, if the Surety fails to discharge its obligations under this paragraph 5, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs to recover any sums found to be due and owing to the Claimant.

6. Amounts owed by the Agency to the Contractor under the Contract shall be used for the performance of the Contract and to satisfy claims, if any, under any Performance Bond. By the Contractor furnishing and the Agency accepting this Bond, they agree that all funds earned by the contractor in the performance of the Contract are dedicated to satisfy obligations of the Contractor and the Surety under this Bond, subject to the Agency's prior right to use the funds for the completion of the Work.

7. The Surety shall not be liable to the Agency, Claimants or others for obligations of the Contractor that are unrelated to the Contract. The Agency shall not be liable for payment of any costs or expenses of any claimant under this bond, and shall have under this Bond no obligations to make payments to, give notices on behalf of, or otherwise have obligations to Claimants under this Bond.

8. The Surety hereby waives notice of any change, including changes of time, to the Contract or to related Subcontracts, purchase orders and other obligations.

9. Notice to the Surety, the Agency or the Contractor shall be mailed or delivered to the addresses shown on the signature page. Actual receipt of notice by Surety, the Agency or the contractor, however accomplished, shall be sufficient compliance as of the date received at the address shown on the signature page.

10. By the Contractor furnishing and the Agency accepting this Bond, they agree that this Bond has been furnished to comply with the statutory requirements of the South Carolina Code of Laws, as amended, and further, that any provision in this Bond conflicting with said statutory requirements shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory Bond and not as a common law bond.

11. Upon request of any person or entity appearing to be a potential beneficiary of this bond, the Contractor shall promptly furnish a copy of this Bond or shall permit a copy to be made.

12. Any dispute, suit, action or proceeding arising out of or relating to this Bond shall be governed by the laws of the State of South Carolina.

13. **DEFINITIONS**

13.1 Claimant: An individual or entity having a direct contract with the Contractor or with a Subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Contract. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Contract, architectural and engineering services required for performance of the Work of the Contractor and the Contractor's Subcontractors, and all other items for which a mechanic's lien might otherwise be asserted.

13.2 Remote Claimant: A person having a direct contractual relationship with a subcontractor of the Contractor or subcontractor, but no contractual relationship expressed or implied with the Contractor.

13.3 Contract: The agreement between the Agency and the Contractor identified on the signature page, including all Contract Documents and changes thereto.

USC SUPPLEMENTAL GENERAL CONDITIONS
FOR CONSTRUCTION PROJECTS

1. Contractor's employees shall take all reasonable means not to interrupt the flow of student traffic in building corridors, lobbies and stairs. All necessary and reasonable safety precautions shall be taken to prevent injury to building occupants while transporting materials and equipment through the building to the work area. Providing safe, accessible, plywood pedestrian ways around construction may be required if a suitable alternative route is not available.

2. Fraternization between Contractor's employees and USC students, faculty or staff is strictly prohibited-zero tolerance!

3. USC will not tolerate rude, abusive or degrading behavior on the job site. Heckling and cat-calling directed toward students, faculty or staff or any other person on USC property is strictly prohibited. Any contractor whose employees violate this requirement will be assessed a fine of up to $500 per violation.

4. Contractor's employees must adhere to the University's policy of maintaining a drug-free and smoke-free/tobacco free workplace.

5. Contractor must sign a Contractor Key Receipt/Return form before any keys are issued. Keys must be returned immediately upon the completion of the work. The Contractor will bear the cost of any re-keying necessary due to the loss of or failure to return keys.

6. A welding permit must be issued by the University Fire Marshall before any welding can begin inside a building. Project Manager will coordinate.

7. Contractor must notify the University immediately upon the discovery of suspect material such as those potentially containing asbestos or other such hazardous materials. These materials **must not** be disturbed until approved by the USC Project Manager.

8. At the beginning of the project, the USC Project Manager will establish the Contractor's lay-down area. This area will also be used for the Contractor's work vehicles. No personal vehicles will be allowed in this area, or in any areas surrounding the construction site that are not regular or authorized parking lots. Personal vehicles must be parked in the perimeter parking lots. Parking permits can be obtained at the USC Parking Office located in the Pendleton Street parking garage. The lay down area will be clearly identified to the contractor by the PM, with a sketch or drawing provided to Parking. In turn, the contractor will mark off this area with a sign containing the project name, PM name, Contractor name and contact number, and end date. Where this area is subject to foot traffic, protective barriers will be provided as specified by the PM. The area will be maintained in a neat and orderly fashion. Vehicles parked in the lay down area (or designated parking areas) will be clearly marked or display a CPC furnished placard for identification.

9. Contractor will be responsible for providing its own temporary toilet facilities, unless prior arrangements are made with the USC Project Manager.

10. Use of USC communications facilities (telephones, computers, etc.) by the Contractor is prohibited, unless prior arrangements are made with the USC Project Manager.

Updated: July 15, 2011

11. For all projects over $100,000, including IDC's, an SE-395, Contractor Performance Evaluation, will be completed by the USC Project Manager and reviewed with the GC at the beginning of the project and a copy given to the GC. At the end of the project the form will be completed and a Construction Performance rating will be established.

12. Contractor is responsible for removal of all debris from the site, and is required to provide the necessary dumpsters which will be emptied at least 2 times per week. Construction waste must not be placed in University dumpsters. THE CONSTRUCTION SITE MUST BE THOROUGHLY CLEANED WITH ALL TRASH PICKED UP AND PROPERLY DISPOSED OF ON A DAILY BASIS AND THE SITE MUST BE LEFT IN A SAFE AND SANITARY CONDITION EACH DAY. THE UNIVERSITY WILL INSPECT JOB SITES REGULARLY AND WILL FINE ANY CONTRACTOR FOUND TO BE IN VIOLATION OF THIS REQUIREMENT AN AMOUNT OF UP TO $1,000 PER VIOLATION.

13. **Contractor must provide all O&M manuals, as-built drawings, and training of USC personnel on new equipment, controls, etc. prior to Substantial Completion. Final payment will not be made until this is completed.**

14. The contractor will comply with all regulations set forth by OSHA and SCDHEC. Contractor must also adhere to USC's internal policies and procedures (available by request). As requested, the contractor will submit all Safety Programs and Certificates of Insurance to the University for review.

15. Tree protection fencing is required to protect existing trees and other landscape features to be preserved within a construction area. The limits of this fence will be evaluated for each situation with the consultant, USC Arborist and USC Project Manager. The tree protection fence shall be 5' high chain link fence unless otherwise approved by USC Project Manager. No entry or materials storage will be allowed inside the tree protection zone. A 4" layer of mulch shall be placed over the tree protection area to maintain moisture in the root zone.

16. Where it is necessary to cross walks, tree root zones (i.e., under canopy) or lawns the following measures shall be taken: For single loads up to 9,000 lbs., a 3/4" minimum plywood base shall be placed over areas impacted. For single loads over 9,000 lbs., two layers of 3/4" plywood is required.

17. For projects requiring heavy loads to cross walks tree root zones or lawns. A construction entry road consisting of 10' X 16' oak logging mates on 12" coarse, chipped, hardwood base. Mulch and logging mats shall be supplemented throughout the project to keep matting structurally functional.

18. Any damage to existing landscaping (including lawn areas) will be remediated before final payment is made.

19. Orange safety fence to be provided by the contractor. (USC Arborist, Kevin Curtis may be contacted at 777-0033 or 315-0319)

CAMPUS VEHICLE EXPECTATIONS

1. All motorized vehicles on the University campus are expected to travel and park on roadways and/or in parking stalls.

2. All motorized vehicle traffic on USC walkways must first receive the Landscape Manager=s authorization. Violators may be subject to fines and penalties.

3. All motorized vehicles that leak or drip liquids are prohibited from traveling or parking on walks or landscaped areas.

4. Contractors, vendors, and delivery personnel are required to obtain prior parking authorization before parking in a designated space. Violators may be subject to fines and/or penalties. See Item 10 below.

5. Drivers of equipment or motor vehicles that damage university hardscape or landscape will be held personally responsible for damages and restoration expense.

6. Vehicle drivers who park on landscape or drives must be able to produce written evidence of need or emergency requiring parking on same.

7. All vehicles parked on landscape, hardscape, or in the process of service delivery, must display adequate safety devices, i.e. flashing lights, cones, signage, etc.

8. All drivers of equipment and vehicles will be respectful of University landscape, equipment, structures, fixtures and signage.

9. All incidents of property damage will be reported to Parking Services or the Work Management Center.

10. Parking on campus is restricted to spaces designated by Parking Services at the beginning of the project. Once the project manager and contractor agree on how many spaces are needed, the project manager will obtain a placard for each vehicle. This placard must be hung from the mirror of the vehicle, otherwise a ticket will be issued and these tickets cannot be “fixed”. Parking spaces are restricted to work vehicles only; no personal vehicles.

Updated: July 15, 2011

Project Name: USC Upstate Administration Building Repairs and Renovation

Project Number: H34-9541-JM

University of South Carolina

CONTRACTOR'S ONE YEAR GUARANTEE

STATE OF _____

COUNTY OF _____

WE_____

as General Contractor on the above-named project, do hereby guarantee that all work executed under the requirements of the Contract Documents shall be free from defects due to faulty materials and /or workmanship for a period of one (1) year from date of acceptance of the work by the Owner and/or Architect/Engineer; and hereby agree to remedy defects due to faulty materials and/or workmanship, and pay for any damage resulting wherefrom, at no cost to the Owner, provided; however, that the following are excluded from this guarantee;

Defects or failures resulting from abuse by Owner.

Damage caused by fire, tornado, hail, hurricane, acts of God, wars, riots, or civil commotion.

_____
[Name of Contracting Firm]

*By_____

Title_____

*Must be executed by an office of the Contracting Firm.

SWORN TO before me this _____ day of _____, 2____ (seal) _____State

My commission expires _____

D I V I S I O N 1

G E N E R A L R E Q U I R E M E N T S

SECTION 01040 - COORDINATION DRAWINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Coordination drawings for all areas containing more than one of the following:
   1. Ductwork
   2. Plumbing
   3. Piping
   4. Bus Duct
   5. Recessed light fixtures
   6. Electrical conduit 2" diameter and larger
   7. Pneumatic mechanical equipment controls piping
   8. Other areas indicated by the Contractor that involve congestion

1.02 QUALITY ASSURANCE

A. Prepare coordination drawings by personnel familiar with requirements of this project and skilled as a draftsperson competent to prepare required drawings.

1.03 SEQUENCE

A. Complete the coordination drawing process prior to submitting submittals for items included in the coordination drawings.

B. The mechanical, piping and ceiling layout drawings may be used for shop drawings when combined with proper levels indicated, providing they are in compliance with their particular section.

C. The coordination drawings ae not shop drawings.

1.04 ORDER OF PRECEDENCE OF EQUIPMENT AND ITEMS

A. The list below is the precedence of assigned work items for space priority in descending order. Items not listed shall have the same precedence as similar items.
   1. Reflected ceiling with all light fixtures, access above light fixtures required for maintenance, sprinkler head locations and all ceiling fixtures and devices.
   2. Space designed for future utility placement.
   3. Gravity flow plumbing waste, roof drainage, steam condensate return, gravity flow central wet vacuum, and other systems that rely upon gravity for flow.
   4. Ductwork and appurtenances, except that external bracing shall be relocated to accommodate local interference.
   5. Bus duct.
   6. Electrical conduit over two inches in diameter.
   7. HVAC piping except for gravity flow steam condensate and pressurized domestic water piping.
   8. Plumbing vents.
   9. Pneumatic mechanical equipment controls piping.

1.05 PARTICIPATION

A. The Contractor and Subcontractors responsible for items of work located in or above ceiling shall participate in the coordination drawing process. Participation is mandatory. If the

Contractor or Subcontractor fails to participate in the coordination drawing process, the Owner reserves the right to do the following:

1. Stop construction progress payments for work performed by the Contractor. Payments will be reinstated only after the Contractor or Subcontractor resumes participation in the coordination drawing process.
2. Require the relocation and resizing of components as necessary to ensure components will be installed as intended. In the event the Contractor did not participate in the coordination process, the Contractor will not be entitled to contract cost increases or time extensions due to Owner initiated changes in the work.
3. The Contractor shall be held responsible for unnecessary rework that is attributable to failure to participate in the coordination process.

1.06 DRAWING REQUIREMENTS

A. Preparation
   1. Prepare coordination drawings using a CADD system acceptable to all parties involved in the coordination drawing process.
   2. Electronic media of the Construction Documents are not available for the Contractor's use.

B. Scale of drawings:
   1. General plans: 1/4" = 1'-0" (minimum)
   2. Mechanical, electrical, communication rooms (including the surrounding 10'-0" area): 1/2" = 1'-0" (minimum)
   3. Shafts and risers: 1/2" = 1'-0" (minimum)
   4. Sections of shafts and mechanical and electrical equipment rooms: 3/8" = 1'-0" (minimum)
   5. Sections of congested areas: 3/4" = 1'-0" (minimum)

C. Each major trade/system on a separate drawing layer:
   1. Layer 1 - column grids, structural beams and sizes, exterior walls, and interior partitions.
   2. Layer 2 - reflected ceiling.
   3. Layer 3 - HVAC equipment and other equipment located above ceiling, future utility space allocations.
   4. Layer 4 - ductwork.
   5. Layer 5 - plumbing waste and roof drainage, domestic water, medical gases.
   6. Layer 7 - heating hot water, steam and steam condensate, and chilled water.
   7. Layer 8 - significant conduit runs (over 2" diameter).
   8. Layer 9 - bus duct.
   9. Layer 10 - recessed light fixtures.
   10. Layer 11 - pneumatic mechanical equipment controls piping

D. There may be more drawings required for risers, top and bottom levels of mechanical rooms and shafts. The minimum quantity of drawings will be established at the first coordination meeting and sent for review by the Architect. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. Provide coordination in determining adequate and code required clearances and space requirements for mechanical equipment and electrical equipment and other items/equipment in the project. The Architect reserves the right to determine space priority of equipment in the event of interference between pieces of equipment, piping, conduit, ducts and equipment of the trades. The Architect will only review conflicts and give an opinion, but will not perform as a coordinator.

B. Provide coordination drawings indicating structural components, reflected ceiling layout, mechanical items, and electrical items.

C. Indicate on the coordination drawings:
   1. Where components will be installed and how the service access area to such items shall be maintained. Illustrate items requiring access for maintenance or adjustment.
   2. Deviations from the Contract Documents that are necessary for overall systems installations and coordination.
   3. The Contract Drawings are schematic in nature and do not show every fitting and appurtenance for each utility because of the scale of the drawings. Each Subcontractor is expected to have included in his bid sufficient fittings, material and labor to allow for adjustments in routing of utilities made necessary by the coordination process. The Contractor will not be allowed any contract cost extra or time extension for changes dictated by the coordination process.

D. Access panels shall occur only in gypsum wallboard or plaster ceilings where indicated on the drawings. Access to mechanical and electrical items shall be through accessible acoustical ceiling areas. Additional access panels will not be allowed without written approval from the Architect at the coordination drawing stage and only after alternatives are reviewed. Layout changes shall be made to avoid additional access panels. If additional access panels are required, they shall be provided at no additional cost to the Owner

E. Soffit penetrations light alcoves shall be fully coordinated with hanging devices, studs, fire/smoke ratings and structural support requirements.

3.02 PROCEDURE

A. Initial Coordination:
   1. Prior to start of construction, a meeting shall be scheduled with participants responsible for the coordination of the work. Coordination drawing requirements shall be implemented in relation to the project progress schedule which shall be drafted with qualified personnel to produce high quality drawings.
   2. The Contractor shall provide to coordination participants composite base sheet drawings indicating the following:
      a. Column center lines with structural beams and sizes.
      b. Exterior walls.
      c. Interior partition locations with dimensions and wall types (thicknesses) verified. Fire and smoke ratings of partitions.
      d. Reflected ceilings with ceiling components located.
      e. The base drawings shall reference the applicable structural, mechanical, electrical, fire protection, plumbing and reflected ceiling drawings.
   3. The ductwork drawings shall be roughed out as a point of beginning for use as a base

for other components. The ductwork drawings shall be modified to accommodate other components as the coordination drawings progress. The ductwork drawings shall indicate the following:

a. Duct sizes including insulation, fire/smoke dampers outside dimension.
b. Equipment layouts.
c. Dimensions from column lines.
d. Dimensions from finished floors to bottom of ducts.
e. Dimensions from structural openings (wall/floor) showing that finished items will fit.
    1) Sectional views shall be provided in congested areas.
    2) Ductwork shall be maintained tight to the underside of floor slabs and/or beams (no damage to the fireproofing will be allowed).
    3) Ductwork layouts shall be produced in sequence in conjunction with the project schedule. The earliest area indicated in the schedule will receive the first effort.
f. The location of HVAC equipment and other equipment above ceiling shall be indicated along with future utility routings indicated on the Contract Drawings on a separate layer.
g. When the base sheet/ductwork drawings for the earliest scheduled area have been completed (time limitation as determined at the initial coordination meeting) one set of transparency drawings shall be distributed to the coordination participants for use in indicating the major components of proposed installation using the Contract Documents as a guide.

B. Coordination Meetings:
1. Within a period of not to exceed two weeks after distribution of the base drawings, a meeting shall be scheduled with the coordination participants to resolve areas of conflict.
    a. Meeting participants shall overlay the transparency drawings to identify areas of conflict, cooperate in resolving the conflicts.
    b. The coordination drawing participants shall recommend changes, rerouting, resizing or relocation of components, if necessary, so all trades can install their systems in the space allotted.
    c. Any proposed changes from the systems layout on the construction documents, shall be done in accordance with the design criteria specified in applicable codes and standards outlined in each technical section.
    d. Changes shall be subject to the review and acceptance of the Architect.
    e. Distribute two composite copies indicating resolutions to coordination participants.
    f. The coordination process shall be repeated until all areas of the Work have been coordinated.
2. Coordination participants shall provide equipment installation and clearance requirements. This information shall be indicated on the coordination drawings.
3. Coordination drawings shall indicate the following major system components (including insulation, hub or connection widths with verification of turning radius).
    a. Large waste piping
    b. Equipment located above the ceiling
    c. Heating hot water piping
    d. Chilled water piping

e. Conduit runs, 2" and larger
f. Bus duct
g. Recessed light fixtures
h. Building wiring or cable trays
i. Ceiling heights as shown in Contract Documents and thickness of system
j. Soffits (including framing of supports)
k. Access points and clearances required
l. Access panels
m. Valves
n. Dampers
o. Coils
p. Ductwork
q. Fire rated wall, partition, and floor penetrations
r. Steam and condensate piping
s. Space allotted for future utilities
t. Equipment in mechanical and electrical spaces
u. Pneumatic mechanical equipment controls piping

4. Information shall be delineated to indicated distances from column center lines, pipe/equipment size and distance from finished floor to bottom of pipe/equipment and hangers.

C. Provide composite drawing review sets, with one set at each review period to each trade involved.

D. The coordination drawings shall be submitted to the Architect and Owner's Representative for review. The submitted coordination drawings shall indicate which Subcontractors participated in the process and where conflicts appear to occur even after the priority ranking of utility routing has been utilized. In the event that conflicts require input from the Architect, recommended solutions will be provided with the coordination drawings for review by the Architect, the Architect will review and return with their opinion to the Contractor for implementation. All Subcontractors shall agree to the final coordinated layout by signing off on the coordination drawings before any construction can begin.

E. Maintain an updated set of coordination drawings at the job site reflecting changes, modifications and adjustments. Changes shall be reflected and sets or new sheets reissued to the Architect and the Owner for review on a monthly basis with changes "clouded" and brought to the attention of the Architect and the Owner.

F. When a change order request is issued, the affected Subcontractors shall review the coordination drawings and bring to the attention of the Contractor and the Architect revisions necessary to the work of others not directly affected by the change order.

G. Coordination participants that fail to cooperate in the coordination drawing effort shall be responsible for all costs incurred for adjustments to the work made necessary to accommodate installations. Provide adequate clearance and access through accessible ceilings. Conflicts that result after the coordination drawings are signed-off will be the responsibility of the Contractor or Subcontractor who did not properly identify their work or installed the work improperly.

H. At the completion of the project one composite reproducible copy of the coordination

drawings shall be submitted to the Architect.

END OF SECTION

SECTION 01066 - INTERIM LIFE SAFETY MEASURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interim Life Safety Measures

1.02 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Submit a written plan indicating that Interim Life Safety Measures (ILSM) have been addressed and shall be enforced, within two weeks of Notice to Proceed .

1.03 PROCEDURES

A. The Interim Life Safety Measures shall:
1. Ensure that exits provide free and unobstructed egress. Personnel shall receive training if alternative exits are designated. Buildings and areas under construction shall have maintained escape facilities for the Contractor's work forces at all times. Means of egress in construction areas shall be inspected daily.
2. Ensure the fire alarm, detection, and suppression systems are properly functioning and are not impaired.
3. Provide additional fire-fighting equipment and use training for personnel.
4. Smoking is prohibited on campus.
5. Develop and enforce storage, housekeeping, and debris removal practices that reduce the flammable and combustible fire load of the building to the lowest level necessary for daily operations.
6. Conducting a minimum of two fire drills per shift per quarter.
7. Increase "hazard surveillance" of buildings, grounds and equipment with special attention to excavations, construction areas, construction storage, and field offices.
8. Train personnel when structural or compartmentalize features of fire safety are compromised.
9. Conduct organization-wide safety education programs to ensure awareness of Life Safety Code deficiencies, construction hazards, and these requirements.

END OF SECTION

SECTION 01068 - DUST CONTROL PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Dust Control Procedures to be implemented by the Contractor for construction and renovation projects. The work shall include, but not be limited to, dust control measures pertaining to the following:
   1. Location of and erection methods of interim dust barriers, preceding erection and/or demolition of impervious dust barriers around demolition/construction areas.
   2. Location of and erection methods for impervious dust barriers around demolition/construction areas.
   3. Debris removal.
   4. Dust/debris control.
   5. Small-scale demolition/construction activities.
   6. Cleaning frequently at:
      a. Dust barrier entrances.
      b. Corridors used for both debris removal circulation.
   7. Circulation control patterns for construction personnel.
   8. Limitations/restrictions for outdoor demolition/construction activities pertaining to:
      a. Activities adjacent to air intakes.
      b. Dirt/debris removals and movement.
      c. Location and use of air compressors or other construction equipment machinery capable of creating odors, fumes, or exhausts.

1.02 RELATED SECTIONS

A. Section 01066 - Interim Life Safety Measures

1.03 WORK SEQUENCE

A. Interior construction/demolition work will be conducted in phases as described in the Contract Documents. The Contractor is responsible for submitting phasing drawings, indicating work areas and locations of impervious barriers once final phasing has been coordinated with the Owner’s Representative.

1.04 QUALITY ASSURANCE

A. Provide daily monitoring/inspection of construction barriers to verify that they are properly sealed.

B. Define techniques prior to initiation of the construction/demolition project.

C. Review existing ventilation systems and identify potential for contamination to be dispersed through air intakes or ductwork that might be disrupted during demolition/construction activities. Identify the effect of air pressure changes in the ventilation system caused by temporary sealing of active ventilation systems sealed during the demolition/construction activities.

1.05 SUBMITTALS

A. Prior to starting work, the Contractor shall submit for review by the Architect and approval by the Owner's Representative an outline of proposed procedure showing compliance with

specifications for each of the following:

1. Systems, arrangements, construction, and locations of interim and impervious barriers.
2. Clean up, debris removal, and dust/debris control systems.
3. Foot traffic patterns to and from work areas for construction/demolition personnel and materials.

PART 2 PRODUCTS

2.01 Materials/Equipment:

A. Reinforced polyethylene sheets used for dust control shall be fire retardant, and have a minimum thickness of 6-mil.

B. Refer to applicable specification sections for building materials utilized in the execution of this work.

PART 3 EXECUTION

3.01 General Requirements:

A. Interim Dust Barriers
   1. Prior to erection and/or demolition of impervious dust barriers around construction/demolition areas whether or not indicated on the plans, install an interim, air-tight, reinforced plastic dust abatement curtain approximately four (4) feet outside construction/demolition limits at exiting corridors, to isolate public areas from the area of work.
   2. Dust abatement curtain shall be constructed of polyethylene sheets, and is to be completely taped to walls, floors, and ceilings with duct tape and/or spackling compound.
   3. Prior to removal of the interim dust barrier, obtain approval from the Owner's Representative.
   4. Cover existing carpet in all interior spaces with polyethelene sheets. Overlap and tape all joints. Inspect and repair damage to polyethelene sheets daily. Protect carpet throughout construction duration.

B. Impervious Dust Control Barriers
   1. Prior to performing work within an interior construction area, the Contractor shall install an impervious dust barrier at locations around the work area, as indicated on drawings, and/or as directed by the Owner's Representative. Coordinate placement of impervious barriers with the owner's representative and architect. It is the Contractor’s responsibility to coordinate amendments to Interim Life Safety requirements caused by the location of impervious barriers throughout the course of the construction/demolition work.
   2. At completion of impervious dust barrier erection or demolition, completely clean floor, ceiling, and walls, including a minimum of four feet beyond the limits of the barrier using HEPA-filtered vacuum equipment.
   3. The impervious barrier shall completely seal off the construction/demolition area from occupied areas. Barriers will be full height, temporary partitions extending from the floor to the underside of the floor/roof structure above. Partitions shall be constructed of 3-5/8” metal studs (20 gauge), spaced a maximum of 16” on center, with 5/8" gypsum board on one side on one side and taped, mudded and painted.

C. At high traffic cart areas, corridors, areas exposed to visitors and building occupants, or as indicated on submittal, use type x gypsum board in lieu of polyethylene sheets. Provide fire/smoke rated partitions where required.

D. When gypsum board is used, provide temporary doors set in hollow metal frames when required for access into the work area. Coordinate door locations with the Owner's Representative.

E. Where existing mechanical and/or electrical systems obstruct extending impervious partitions to underside of floor/roof structures above, terminate partition at obstruction and seal off the balance of the underside of the deck of the floor above with reinforced, fire-retardant polyethylene sheets and duct tape.

F. Inspect interior and exterior perimeters of the construction/demolition area for miscellaneous openings, such as penetrations of duct and/or piping, conduit, and hangers on a daily basis. All openings must be sealed airtight to confine dust and dirt to within the construction/demolition work area.

G. Dust and Debris Control Measures
   1. Prior to utility shutdowns which will necessitate removal of ceiling for access to valves and/or equipment, and which may necessitate access on floors above or below the work area, review dust containment procedures at each specific location with the Owner's Representative.
   2. The construction/demolition work area shall be cleaned and maintained daily to eliminate dust and debris.
   3. Seal or tape doors, areas, or rooms during projects that are dust producing. Block off and seal all grilles and diffusers in the areas of small-scale activities.
   4. Cleaning of Work Area
      a. Frequency of cleaning
         1) On a daily basis, clean elevators used for debris removal and/or material delivery.
         2) On a daily basis clean exit pathways inside of the building that lead from the demolition/construction work area to the dumpster and/or the designated materials storage area.
      b. Cleaning Personnel
         1) The Contractor shall designate certain staff for housekeeping and cleaning responsibilities, and use appropriate equipment and supplies. Covered carts used for debris removal should be clean and dust-free while transporting debris through occupied areas of the building.

END OF SECTION

SECTION 01100 - SUMMARY

PART 1 GENERAL

1.01 PROJECT

A. Project Name: USC Upstate Administration Building Repairs and Renovation.

B. Owner's Name: University of South Carolina Upstate.

C. Architect's Name: GMK Associates.

D. The Project consists of the alteration of 44,423 sq. ft. which includes a new mechancial system, minor modifications to spacial arrangements,electrical alterations and bathroom upgrades.

1.02 CONTRACT DESCRIPTION

A. Contract Type: A single prime contract based on a Stipulated Price as described in A101-2007, Standard Form of Agreement Between Owner and Contractor, forms the basis of Contract between the Owner and Contractor.

1.03 DESCRIPTION OF ALTERATIONS WORK

A. Scope of demolition and removal work is shown on drawings.

B. Scope of alterations work is shown on drawings.

C. Plumbing: Alter existing system and add new construction, keeping existing in operation.

D. HVAC: Replace existing system with new construction, keeping existing in operation until ready for changeover.

E. Electrical Power and Lighting: Replace existing system with new construction, keeping existing in operation until ready for changeover.

F. Fire Alarm: Install new fire alarm system as inidcated in the contract documents.

G. Contractor shall remove and store the following prior to start of work, for later reinstallation by Contractor:
   1. Fire Extinguishers and mounting brackets.

1.04 OWNER OCCUPANCY

A. Owner intends to occupy the Project upon Substantial Completion.

B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

C. Schedule the Work to accommodate Owner occupancy.

1.05 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings.

B. Provide access to and from site as required by law and by Owner:

C. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.

D. Utility Outages and Shutdown:

E. Limit disruption of utility services to hours the building is unoccupied.
   1. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.

1.06 PHASING

A. The Owner shall continue to occupy portions of the building throughout construction.

B. The project will be phased to accommodate the continuous operation of the building throughout the project.

C. The IT server room on the first floor will remain operational at all times. The contractor is to coordinate power shut downs that effect this area with the Owner prior to the commencement of any work. The phased relocation of the IT Server room should be coordinated with the owner.

D. Drawings show general intent of design. Contractor shall coordinate construction with phasing. Phasing shall take in to account all aspect of the job including HVAC, electrical, network, phones, plumbing, etc. Building shall be occupied at all times throughout construction. Coordinate phasing and shutdowns with owner. Owner shall be provided with two weeks notice prior to shutdowns. No occupied floor shall be without HVAC during construction or demolition work.

E. Contractor shall provide a fire watch during entire construction. Fire watch shall be dedicated full time trained personnel monitoring the occupied building monday through friday from 7:00am until 6:00pm. Will also have to be on site when building is occupied after hours.

F. At least one men's and one women's toilet shall be operational at all times throughout construction.

G. The building elevator needs to be maintained at all times for occupants. A safe route shall be provided on the first floor to the elevator from the parking lot for ADA access to upper floors.

H. Contractor shall provide a detailed coordination plan and submit it to the architect/owner for approval. Coordination plan shall include all trades and schedules for completion.

I. The Owner will be using suite 207 on the second floor as swing space. The Owner will need 1 week between phases to move occupants from the swing space to the completed area and from the next phase work area into the swing space. The contractor shall plan for this time as part of the schedule.

J. Phase One shall generally include the first floor, the stacked women's bathrooms, the exhaust fan and associated ductwork serving the bathrooms. Provide temporary exhaust fans to serve the other two floors in windows as indicated. The contractor shall provide temporary pumps in the first floor mechanical room to keep all mechanical equipment operational until the new pumps come on line. Transfer from existing pumps to the temporary pumps and finally to the new pumps shall take place during times when the building is unoccupied.

K. Phase Two shall generally include work on the third floor and the installation of AHU-3A and AHU-3B. It will also include the renovation of the stacked men's toilet on the second and third floors.

L. Phase Three shall generally include work on the second floor and be subdivided into 3A and 3B to allow for continued use of the swing space in suite 207. Phase 3A shall include demolition and renovation of the plan west end of the floor and Phase 3B shall include existing AHU-6 and new AHU-2A. Contractor shall coordinate phasing electrical work to keep suite 207 active during this phase of construction.

M. Demolition of system components shall be coordinated with phases and over all coordination plan. Demolition of components may occur outside of phases as necessary.

N. All power, controls, and necessary components required for the proper operation of equipment shall be provided and coordinated with the phasing.

O. Each individual phase will include a substantial completion, punchlist and certificate of occupancy.

1.07 SCHEDULE

A. Construct Work in phases during the construction period:
   1. Phase 1: 126 calendar days.
      a. 84 calendar days demolish, site preparation, shop drawings, etc.
      b. 28 calendar days delivery and installation
      c. 14 calendar days certificate of occupancy, inspections, punchlist, etc.
   2. Owner occupancy and move: 14 calendar days
      a. IT move January 2, 2014 - January 10, 2014
   3. Phase 2: 91 calendar days.
      a. 70 calendar days construction
      b. 21 calendar days certificate of occupancy, inspections, punchlist, etc.
   4. Owner occupancy and move: 14 calendar days
      a. 7 calendar days allowance for Graduation
   5. Phase 3A: 70 calendar days.
      a. 49 calendar days construction
      b. 21 calendar days certificate of occupancy, inspections, punchlist, etc.
   6. Owner occupancy and move: 7 calendar days
   7. Phase 3B: 70 calendar days
      a. 49 calendar days construction
      b. 21 calendar days certificate of occupancy, inspections, punchlist, etc.

B. Coordinate construction schedule and operations with Owner.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01200 - PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.

B. Documentation of changes in Contract Sum and Contract Time.

C. Coordinate the Schedule of Values and Applications for Payment with the Contractor's Construction Schedule, List of Subcontracts, and Submittal Schedule.

D. The Contractor's Construction Schedule and Submittal Schedule are included in other sections of Division 1.

E. See also the payment requirements in Supplementary Conditions.

F. Change procedures.

G. Correlation of Contractor submittals based on changes.

H. Procedures for preparation and submittal of application for final payment.

1.02 RELATED REQUIREMENTS

A. Document 00500 - Agreement: Contract Sum.

B. Document 00700 - General Conditions: Additional requirements for progress payments, final payment, changes in the Work.

1.03 SCHEDULE OF VALUES

A. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to GMK Associates for approval.

B. Forms filled out by hand will not be accepted.

C. Submit Schedule of Values in duplicate within 30 days after date of Owner-Contractor Agreement.

D. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification Section. Identify site mobilization and bonds and insurance.
   1. Provide minimum of 1% of the Construction Cost for Project Record Drawings.
   2. Provide minimum of 1% of the Construction Cost for Operating and Maintenance Data.
   3. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Break principal subcontract amounts down into several line items.

E. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:
   1. Contractor's construction schedule.
   2. Application for Payment form.
   3. List of Subcontractors.
   4. Schedule of allowances.

5. List of principal suppliers and fabricators.
6. Schedule of submittals.

F. Sub-Schedules: Where the Work is separated into phases that require separately phased payments, provide sub-schedules showing values correlated with each phase of payment.

G. Identification: Include the following Project identification on the Schedule of Values:
1. Project name and location.
2. Name of the Architect.
3. Contractor's name and address.
4. Date of submittal.

H. Round amounts off to the nearest whole dollar; the total shall equal the Contract Sum.

I. Include within each line item, a direct proportional amount of Contractor's overhead and profit.

J. For each part of the Work where an Application for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed, provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

K. 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.

L. Revise schedule to list approved Change Orders, with each Application For Payment.

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

A. Payment Period: Submit at intervals stipulated in the Agreement.

B. Forms filled out by hand will not be accepted.

C. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of the first Application for Payment include the following:
1. List of Subcontractors.
2. List of principal suppliers and fabricators.
3. Schedule of Values.
4. Contractor's Construction Schedule (preliminary if not final).
5. Schedule of principal products.
6. Submittal Schedule (preliminary if not final).
7. List of Contractor's staff assignments.
8. List of Contractor's principal consultants.
9. Copies of building permits.
10. Copies of authorizations and licenses from governing authorities for performance of the Work.
11. Initial progress report.
12. Report of pre-construction meeting.
13. Certificates of insurance and insurance policies.
14. Performance and payment bonds (if required).
15. Data needed to acquire Owner's insurance.
16. Initial settlement survey and damage report, if required.

D. For each item, provide a column for listing each of the following:
   1. Item Number.
   2. Description of work.
   3. Scheduled Values.
   4. Previous Applications.
   5. Work in Place and Stored Materials under this Application.
   6. Authorized Change Orders.
   7. Total Completed and Stored to Date of Application.
   8. Percentage of Completion.
   9. Balance to Finish.
   10. Retainage.

E. Execute certification by signature of authorized officer.
   1. Incomplete applications will be returned without action.

F. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored Products.

G. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of Work.

H. Submit three copies of each Application for Payment.

I. Waiver Forms: Submit waivers of lien on forms, and executed in a manner, acceptable to Owner.

J. Include the following with the application:
   1. Transmittal letter as specified for Submittals in Section 01300.
   2. Construction progress schedule, revised and current as specified in Section 01325.
   3. Partial release of liens from major Subcontractors and vendors.
   4. Project record documents as specified in Section 01780, for review by Owner which will be returned to the Contractor.

K. Waiver Delays: Submit each Application for Payment with the Contractor's waiver of mechanics lien for the period of construction covered by the application.

L. When an application shows completion of an item, submit final or full waivers.

M. When GMK Associates requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

N. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment; this application shall reflect any Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

O. Administrative actions and submittals that shall proceed or coincide with this application include:
   1. Occupancy permits and similar approvals.
   2. Warranties (guarantees) and maintenance agreements.
   3. Test/adjust/balance records.
   4. Meter readings.

5. Start-up performance reports.
6. Change-over information related to Owner's occupancy, use, operation and maintenance.
7. Final cleaning.
8. Application for reduction of retainage, and consent of surety.
9. Advice on shifting insurance coverages.

P. List of incomplete Work, recognized as exceptions to Architect's Certificate of Substantial Completion.

Q. Contractor is required to assemble and complete information required by SC Department of Health and Environmental Control for project close-out. Copies of these regulations and guidelines are available from SCDHEC or will be given to successful bidder upon start of work. Three copies of all information is required.

1.05 MODIFICATION PROCEDURES

A. Submit name of the individual authorized to receive change documents and who will be responsible for informing others in Contractor's employ or subcontractors of changes to the Contract Documents.

B. For minor changes not involving an adjustment to the Contract Price or Contract Time, GMK Associates will issue instructions directly to Contractor.

C. For other required changes, GMK Associates will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
2. Promptly execute the change.

D. For changes for which advance pricing is desired, GMK Associates will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 14 days.

E. Contractor may propose a change by submitting a request for change to GMK Associates, describing the proposed change and its full effect on the Work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation and a statement describing the effect on Work by separate or other contractors. Document any requested substitutions in accordance with Section 01600.

F. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
1. For change requested by GMK Associates for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by GMK Associates.
3. For pre-determined unit prices and quantities, the amount will based on the fixed unit prices.

4. For change ordered by GMK Associates without a quotation from Contractor, the amount will be determined by GMK Associates based on the Contractor's substantiation of costs as specified for Time and Material work.

G. Substantiation of Costs: Provide full information required for evaluation.
   1. Provide following data:
      a. Quantities of products, labor, and equipment.
      b. Taxes, insurance, and bonds.
      c. Overhead and profit.
      d. Justification for any change in Contract Time.
      e. Credit for deletions from Contract, similarly documented.
   2. Support each claim for additional costs with additional information:
      a. Origin and date of claim.
      b. Dates and times work was performed, and by whom.
      c. Time records and wage rates paid.
      d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
   3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.

H. Execution of Change Orders: GMK Associates will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

I. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.

J. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.

K. Promptly enter changes in Project Record Documents.

1.06 APPLICATION FOR FINAL PAYMENT

A. Submit final Application for Payment with or preceded by final waivers from every entity involved with performance of Work covered by the application who could lawfully be entitled to a lien.

B. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.

C. Final Payment Application: Administrative actions and submittals which must precede or coincide with submittal of the final payment Application for Payment include the following:
   1. Completion of Project closeout requirements.
   2. Completion of items specified for completion after Substantial Completion.
   3. Assurance that unsettled claims will be settled.
   4. Assurance that Work not complete and accepted will be completed without undue delay.
   5. Transmittal of required Project construction records to Owner.
   6. Certified property survey.
   7. Proof that taxes, fees and similar obligations have been paid.
   8. Removal of temporary facilities and services.

9. Removal of surplus materials, rubbish and similar elements.
10. Change of door locks to Owner's access.

D. Application for Final Payment will not be considered until the following have been accomplished:
1. All closeout procedures specified in Section 01700.

END OF SECTION

SECTION 01230 - ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Description of alternatess.

B. Procedures for pricing base bids.

C. Documentation of changes to Contract Sum and Contract Time.

1.02 RELATED REQUIREMENTS

A. Document 00200 - Instructions to Bidders: Instructions for preparation of pricing for alternatives.

1.03 ACCEPTANCE OF BASE BIDS

A. Alternates quoted on SE-330 will be reviewed and accepted or rejected at Owner's option. Accepted alternates will be identified in the Owner-Contractor Agreement.

B. Coordinate related work and modify surrounding work to integrate the Work of each alternate.

1.04 SCHEDULE OF ALTERNATES

A. Alternate No. 1 Description: Reduce the number of phases and construction duration.
   1. Phase 1
      a. Phase one shall generally include the demolition and renovation of the first and third floors, the stacked women's bathrooms, the exhaust fan and associated ductwork serving the bathrooms, installation of AHU-3A and AHU-3B. Provide temporary exhaust fans to serve the other second floor in windows as indicated. The contractor shall provide temporary pumps in the first floor mechanical room to keep all mechanical equipment operational until the new pumps come on line. Transfer from existing pumps to the temporary pumps and finally to the new pumps shall take place during times when the building is unoccupied. The server room 110C shall be online throughout construction. Power and HVAC must be maintained in this room at all times. The contractor will schedule all shut downs for the server room with the owner.
      b. Phase two shall generally include the demolition and renovation of the second floor, the stacked men's toilet on the second and third floors, the installation of AHU-2A and AHU-2B.
   2. Scheduling:
      a. The owner will need 4 calendar days for relocation of staff between phases.
      b. IT server room must be ready for owner relocation of server equipment by January 2, 2014. Relocation of the server room equipment to take place from January 2, 2014 - January 10, 2014. The server room and IT area must be available to the owner by those dates.
      c. The contractor is to propose the number of calendars days required to complete the project as described in the phasing above and in lieu of the base bid phasing.
      d. Coordinate construction schedule and operations with Owner.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01300 - ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preconstruction meeting.

B. Progress meetings.

C. Coordination drawings.

D. Submittals for review, information, and project closeout.

E. Number of copies of submittals.

F. Submittal procedures.

1.02 RELATED REQUIREMENTS

A. Document 00700 - General Conditions: Dates for applications for payment.

B. Section 01325 - Construction Progress Schedule: Form, content, and administration of schedules.

C. Section 01700 - Execution Requirements: Additional coordination requirements.

D. Section 01780 - Closeout Submittals: Project record documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

A. Owner will schedule a meeting after Notice of Award.

B. Attendance Required:
1. Owner.
2. GMK Associates.
3. Contractor.

C. Agenda:
1. Execution of Owner-Contractor Agreement.
2. Submission of executed bonds and insurance certificates.
3. Distribution of Contract Documents.
4. Submission of list of Subcontractors, list of Products, schedule of values, and progress schedule.
5. Designation of personnel representing the parties to Contract, Owner, and GMK Associates.
6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
7. Scheduling.
8. Scheduling activities of Special Inspector.

D. Contractor to record minutes and distribute copies within two days after meeting to participants, with two copies to GMK Associates, Owner, participants, and those affected

by decisions made.

3.02 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the Work at maximum weekly intervals on day and time convenient for all parties involved.

B. Make arrangements for meetings, prepare agenda with copies for participants prior to meetings, preside at meetings.

C. Attendance Required: Job superintendent, major Subcontractors and suppliers as appropriate to agenda topics for each meeting. The Architect and Owner may attend.

D. Agenda:
1. Review minutes of previous meetings.
2. Review of Work progress.
3. Field observations, problems, and decisions.
4. Identification of problems that impede, or will impede, planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of status of Request for Information (RFI).
7. Review of status of Architectural Supplemental Instructions (ASI).
8. Review of status of proposal requests (PR).
9. Review of status of Change Orders (CO).
10. Review of off-site fabrication and delivery schedules.
11. Maintenance of progress schedule.
12. Corrective measures to regain projected schedules.
13. Planned progress during succeeding work period.
14. Coordination of projected progress.
15. Maintenance of quality and work standards.
16. Effect of proposed changes on progress schedule and coordination.
17. Other business relating to Work.

E. Record minutes and distribute copies within five days after meeting to participants, with three copies to GMK Associates, one copy to Owner, participants, and those affected by decisions made.

3.03 COORDINATION DRAWINGS

A. Review drawings prior to submission to GMK Associates.

3.04 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
1. Product data.
a. When product data submittals are prepared specifically for this project (in the absence of standard printed information) submit such information as shop drawings and not as product data submittals.
b. Content:
1) Identify the particular product being submitted; submit only pertinent pages.
2) Show compliance with properties specified.
3) Identify which options and accessories are applicable.
4) Show compliance with the specific standards referenced.

5) Show compliance with specified testing agency listings; show the limitations of their labels or seals, if any.
6) Identify dimensions which have been verified by field measurement.
7) Show special coordination requirements for the product.

2. Shop drawings.
   a. Original drawings, prepared by Contractor, Subcontractor, supplier or distributor, which illustrate portion of the work, showing fabrication, layout, setting and erection details.
   b. Do not reproduce the Contract Drawings for the shop drawing submittals. Electronic media of the Construction Documents are not available for the Contractor's Subcontractor's, or material suppliers use.
   c. Identify details by reference to drawing sheet number(s) and pertinent detail number(s).
   d. Shop drawings shall not include the phrase by others, except when relating to materials, products or equipment not included under the total Contract.
3. Samples.
   a. Provide samples that are the same as proposed product.
   b. Where products are to match a sample prepared by other entities, prepare sample to match.
   c. Preparation:
      1) Attach a description to each sample.
      2) Attach name of manufacturer or source to each sample.
      3) Where compliance with specified properties is required, attach documentation showing compliance.
      4) Where selection is required, the first submittal may be a single set of all options; after return of submittal with selection indicated, submit standard number of sets of selected item.
   d. Keep final sample set(s) at the project site, available for use during progress of the work.
   e. Contractor shall be responsible for submitting all interior and exterior materials samples that require a color and/or finish selection or is required to be part of a mock up assembly at the same time. The Contractor shall include the color, finish, material selection schedule in the shop drawing submittal schedule. The Architect will provide final color, finish, and material selections only when they have all been submitted by the Contractor.

B. Submit to GMK Associates for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.

C. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01780 - CLOSEOUT SUBMITTALS.

3.05 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
   1. Design data.
   2. Certificates.
   3. Test reports.

4. Inspection reports.
5. Manufacturer's instructions.
6. Manufacturer's field reports.
7. Other types indicated.

B. Submit for GMK Associates's knowledge as contract administrator or for Owner. No action will be taken.

3.06 SUBMITTALS FOR PROJECT CLOSEOUT

A. When the following are specified in individual sections, submit them at project closeout:
1. Project record documents.
2. Operation and maintenance data.
3. Warranties.
4. Bonds.
5. Other types as indicated.

B. Submit for Owner's benefit during and after project completion.

3.07 NUMBER OF COPIES OF SUBMITTALS

A. Documents for Review:
1. Small Size Sheets, Not Larger Than 8-1/2 x 11 inches: Submit the number of copies that Contractor requires, plus two copies that will be retained by GMK Associates.

B. Documents for Information: Submit two copies.

C. Documents for Project Closeout: Make one reproduction of submittal originally reviewed. Submit one extra of submittals for information.

3.08 SUBMITTAL PROCEDURES

A. Transmit each submittal with AIA Form G810, in duplicate.
1. Submittals received without a transmittal form will be returned without review or action.
2. Fill out a separate transmittal form for each submittal; also include the following:
a. Other relevant information.
b. Requests for additional information.
3. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.

B. Identify Project name and numbers, Contractor's, Subcontractor's or supplier's name and address, Architect's name and address, Manufacturer's name ; pertinent drawing and detail number, and specification section number, as appropriate on each copy.

C. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, quantities, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.
1. Contractor’s responsibility regarding errors and omissions in submittals is not relieved by Architect’s review of submittals.
2. Contractor’s responsibility regarding deviations in submittals from requirements of Contract Documents is not relieved by Architect’s review submittals, unless Architect

gives written acceptance of specific deviations as approved by Owner.

3. When work is directly related and involves more than one trade, shop drawings shall be coordinated by the submitting Contractor/Subcontractor with other trades prior submission and related work submitted under one cover.
    a. After shop drawing has been submitted for review, no changes may be made to that Drawing other than changes resulting from review notes made by the Architect unless such changes are clearly identified and circled before being resubmitted. Any failure to comply with this requirement shall nullify and invalidate the Architect's review.
4. Submittals without Contractor's stamp of review will not be reviewed and will be returned for resubmission.

D. Submittals will be accepted from the Contractor only. Submittals received from other entities will be returned without review or action.

E. Do not submit substitute items that have not been approved by means of the procedure specified elsewhere.

F. Do not include requests for substitution (either direct or indirect) on submittals; comply with procedures for substitutions specified elsewhere.

G. Schedule submittals to expedite the Project, and coordinate submission of related items.
1. Prepare and submit, in accordance with the approved Project Construction Schedule, a separate document listing dates by which shop drawings, product data and samples must be submitted for each material, product or equipment item requiring submittal.
2. The schedule shall reflect an orderly sequence so as to cause no delay in the Work.
3. Coordinate submittals and activities that must be performed in sequence, so that the Architect has enough information to properly review the submittals.
4. Coordinate submittals of different types for the same product or system so that the Architect has enough information to properly review each submittal.
5. The dates indicated shall allow reasonable time for the review process of checking, correcting and resubmitting and reasonable time for procurement.
6. No extension of time will be granted to the Contractor/Subcontractor because of failure to expeditiously submit shop drawings and samples in reasonable time to allow for review process.
7. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor. Architect shall review with reasonable promptness.

H. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.

I. Provide space for Contractor and GMK Associates review stamps. Submittals to receive Architect's action marking: Provide blank space on the label or on the submittal itself for action marking; 4 inches wide by 6 inches high.

J. Do not commence work which requires review of any submittals until receipt of returned submittals with an acceptable action.
1. Stamped Reviewed, no corrections or resubmissions required, fabrication may proceed.
2. Stamped Revise and Resubmit.
    a. If Contractor/Subcontractor complies with noted corrections, fabrication may proceed.

3. If for any reason the Contractor/Subcontractor cannot comply with the noted corrections, fabrication shall not proceed and Contractor/Subcontractor shall resubmit, following procedures outlined herein before.
4. Stamped Revise and Resubmit or Resubmit.
   a. Contractor/Subcontractor shall revise and resubmit for review. Fabrication shall not proceed.

K. When revised for resubmission, identify all changes made since previous submission.

L. Distribute reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.

M. Submittals not requested will not be recognized or processed.

END OF SECTION

SECTION 01325 - CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preliminary schedule.

B. Construction progress schedule, bar chart type.

C. Reports.

1.02 SUBMITTALS

A. Within 7 days after date established in Notice to Proceed, submit preliminary schedule defining planned operations for the first 45 days of Work, with a general outline for remainder of Work.

B. If preliminary schedule requires revision after review, submit revised schedule within 3 working days.

C. Within 10 days after date established in Notice to Proceed, submit draft of proposed complete schedule for review.
   1. Include written certification that major contractors have reviewed and accepted proposed schedule.

D. Within 3 days after Architect's review, submit complete schedule.

E. Submit Daily Construction Reports every week.

F. Submit updated schedule and Progress Reports with each Application for Payment.

G. Submit the number of opaque reproductions that Contractor requires, plus three copies that will be retained by GMK Associates.

H. Submit under transmittal letter form specified in Section 01300.

1.03 QUALITY ASSURANCE

A. Scheduler: Contractor's personnel or specialist Consultant specializing in CPM scheduling with one years minimum experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 48 hours of request.

1.04 SCHEDULE FORMAT

A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.

B. Diagram Sheet Size: Maximum 22 x 17 inches or width required.

C. Sheet Size: Multiples of 8-1/2 x 11 inches.

D. Scale and Spacing: To allow for notations and revisions.

1.05 COORDINATION

A. In preparation of schedules, take into account the time allowed or required for the

Architect's administrative procedures.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.02 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

B. Provide full description of work in each phase and overall impact of phasing on the project.

C. Identify each item by specification section number.

D. Identify work of separate stages and other logically grouped activities.

E. Provide sub-schedules to define critical portions of the entire schedule.

F. Include conferences and meetings in schedule.

G. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

H. Provide separate schedule of submittal dates for shop drawings, product data, and samples, owner-furnished products, Products identified under Allowances, and dates reviewed submittals will be required from GMK Associates. Indicate decision dates for selection of finishes.

I. Indicate delivery dates for owner-furnished products.

J. Coordinate content with schedule of values specified in Section 01200.

K. Provide legend for symbols and abbreviations used.

L. Use the same terminology as that used in the Contract Documents.

3.03 BAR CHARTS

A. Include a separate bar for each major portion of Work or operation.

B. Identify the first work day of each week.

C. Coordinate each element on the schedule with other construction activities.

D. Show activities in proper sequence.

E. Include cost bar at top of chart, showing estimated and actual costs of work performed at the date of each application for payment.

F. Use vertical lines to mark the time scale at not more than one week intervals.

3.04 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Provide construction schedule in the form of bar charts:
   1. Use the same items of work as shown in the schedule of values.

2. Where related activities must be performed in sequence, show relationship graphically.
3. Incorporate the submittal schedule specified elsewhere.
4. Incorporate the quality control activities schedule specified elsewhere.
5. Show dates of:
    a. Each activity that influences the construction time.
    b. Preconstruction meeting.
    c. Ordering dates for products requiring long lead time.
    d. Completion of demolition for each phase.
    e. Completion of mechanical work for each phase.
    f. Completion of electrical work for each phase.
    g. Instruction of the Owner's personnel in operation and maintenance of equipment and systems.
    h. Substantial and final completion of each phase, with time frames for the Architect's completion procedures and owner move in dates.
6. In developing the schedule take into account:
    a. Continued occupancy of areas adjacent to the work area as well as throughout the building.
    b. Interruption of services to occupied facilities
    c. The owner will require a week to move staff between phases of the project.
    d. Each phase will require Certificate of Occupancy from the Office of the State Engineer.
    e. Each phase will have a punch list produced and must be completed prior to the owner's acceptance of the space and occupancy.
    f. Site limitations

3.05 UPDATING SCHEDULE

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity.

C. Annotate diagrams to graphically depict current status of Work.

D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

E. Indicate changes required to maintain Date of Substantial Completion.

F. Submit progress reports required to support recommended changes.

3.06 DISTRIBUTION OF SCHEDULE

A. Distribute copies of updated schedules and reports to Contractor's project site file, to Subcontractors, suppliers, GMK Associates, Owner, and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections shown in schedules.

3.07 REPORTS

A. Daily Construction Logs: Every day, record the following information concerning events at the site:

1. Approximate number of persons at the site.
2. Visitors to the site.
3. Modifications to the contract received; modifications implemented.
4. Changes in occupancy.
5. Delays; reasons for delay.
6. Emergencies and accidents.
7. Equipment and system start-ups and tests.
8. Losses of material and property.
9. Meetings held and significant decisions made there.
10. Names of Subcontractors at site.
11. Orders and requests of representatives of governing authorities.
12. Unusual events.
13. Utility service disconnections and connections.

B. Progress Reports: Prepare a narrative report describing the general state of completion of the work and describing in detail the following:
   1. Actual and anticipated delays, their impact on the schedule, and corrective actions taken or proposed.
   2. Actual and potential problems.
   3. Status of change order work.
   4. Effect of delays, problems, and changes on the schedules of Subcontractors.
   5. Outstanding change proposal requests.
   6. Status of corrective work ordered by the Architect

END OF SECTION

SECTION 01400 - QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. References and standards.

B. Mock-ups.

C. Control of installation.

D. Tolerances.

E. Testing and inspection services.

F. Manufacturers' field services.

1.02 RELATED REQUIREMENTS

A. Document 00700 - General Conditions: Inspections and approvals required by public authorities.

B. Section 01300 - Administrative Requirements: Submittal procedures.

C. Section 01600 - Product Requirements: Requirements for material and product quality.

1.03 SUBMITTALS

A. Design Data: Submit for GMK Associates's knowledge as contract administrator for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents, or for Owner's information.

B. Test Reports: After each test/inspection, promptly submit two copies of report to GMK Associates and to Contractor.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of inspector.
      d. Date and time of sampling or inspection.
      e. Identification of product and specifications section.
      f. Location in the Project.
      g. Type of test/inspection.
      h. Date of test/inspection.
      i. Results of test/inspection.
      j. Conformance with Contract Documents.
      k. When requested by GMK Associates, provide interpretation of results.
   2. Test report submittals are for GMK Associates's knowledge as contract administrator for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents, or for Owner's information.

C. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to GMK Associates, in quantities specified for Product Data.
   1. Indicate material or product conforms to or exceeds specified requirements. Submit

supporting reference data, affidavits, and certifications as appropriate.

D. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

E. Manufacturer's Field Reports: Submit reports for GMK Associates's benefit as contract administrator or for Owner.
   1. Submit report within 10 days of observation to GMK Associates for information.
   2. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

F. Erection Drawings: Submit drawings for GMK Associates's benefit as contract administrator or for Owner.
   1. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.
   2. Data indicating inappropriate or unacceptable Work may be subject to action by GMK Associates or Owner.

1.04 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from GMK Associates before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of GMK Associates shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.05 TESTING AND INSPECTION AGENCIES

A. Owner will employ and pay for services of an independent testing agency to perform other specified testing.

B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from GMK Associates before proceeding.

D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have Work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

A. Tests will be performed under provisions identified in this section and identified in the respective product specification sections.

B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

C. Accepted mock-ups shall be a comparison standard for the remaining Work.

D. Where mock-up has been accepted by GMK Associates and is specified in product specification sections to be removed, remove mock-up and clear area when directed to do so.

3.03 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from GMK Associates before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 TESTING AND INSPECTION

A. See individual specification sections for testing required.

B. Testing Agency Duties:
   1. Test samples of mixes submitted by Contractor.
   2. Provide qualified personnel at site. Cooperate with GMK Associates and Contractor in performance of services.
   3. Perform specified sampling and testing of products in accordance with specified standards.

4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
5. Promptly notify GMK Associates and Contractor of observed irregularities or non-conformance of Work or products.
6. Perform additional tests and inspections required by GMK Associates.
7. Submit reports of all tests/inspections specified.

C. Limits on Testing/Inspection Agency Authority:
1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Agency may not approve or accept any portion of the Work.
3. Agency may not assume any duties of Contractor.
4. Agency has no authority to stop the Work.

D. Contractor Responsibilities:
1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
3. Provide incidental labor and facilities:
   a. To provide access to Work to be tested/inspected.
   b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
   c. To facilitate tests/inspections.
   d. To provide storage and curing of test samples.
4. Notify GMK Associates and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

E. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by GMK Associates.

F. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.

3.05 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.06 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not conforming to specified requirements.

B. If, in the opinion of GMK Associates, it is not practical to remove and replace the Work,

GMK Associates will direct an appropriate remedy or adjust payment.

END OF SECTION

Schedule of Special Inspections

Project Name: USC Upstate Administration Building Repairs and Renovation

Project Number: H34-9541-JM

Page: 1 Of: 1

Instructions: The Structural Engineer of Record shall determine the material and/or work on the project requiring Special Inspections. The Special Inspection requirements shall be based on Section 1704 of Chapter 17 of the 2009 International Building Code. If Inspection is by "Other," the inspecting entity shall be identified.

Materials	Type of Inspection	Specification Reference	Inspection by		
			Architect	Engineer	Other
Suspended Ceilings	Review Submittal	09511	X		
	Inspection of installation and anchorage of Suspension System. (Periodic)	09511			X
Mechanical and Electrical Components	Manufacturers certification required on mechanical equipment.	15010		X	
	Inspection of label and anchorage of mechanical equipment.	15010			X
	Inspection of label and anchorage of electrical equipment.	16010			X
	Seismic Isolators, review of submittals.	15073		X	
	Seismic isolators, field inspection of installation.	15073			X

SECTION 01500 - TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary utilities.

B. Temporary sanitary facilities.

C. Security requirements.

D. Vehicular access and parking.

E. Waste removal facilities and services.

F. Field offices.

G. Campus Policy

1.02 SUBMITTALS

A. Implementation and Termination Schedule: Submit a schedule indicating implementation and termination of each temporary utility connection within 10 days of the date established for commencement of the Work.

1.03 QUALITY ASSURANCE

A. Regulations: Comply with industry standards and applicable laws and regulations if authorities having jurisdiction, including but not limited to:
   1. Building Code requirements.
   2. Health and safety regulations.
   3. Utility company regulations.
   4. Police, Fire Department and Rescue Squad rules.
   5. Environmental protection regulations.

B. Standards: Comply with NFPA Code 241, "Building Construction and Demolition Operations", ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition", and NECA Electrical Design Library, "Temporary Electrical Facilities."

C. Electrical Service: Comply with NEMA, NECA and UL standards and regulations for temporary electric service. Install service in compliance with National Electric Code (NFPA 70).

D. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.04 PROJECT CONDITIONS

A. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility connection. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of the permanent service.

1.05 MATERIALS

A. General: Provide new materials; if acceptable to the Architect, undamaged previously used

materials in serviceable condition may be used. Provide materials suitable for the use intended.

B. Gypsum Wallboard: Provide gypsum wallboard complying with requirements of ASTM C 36 on interior walls of temporary offices.

C. Paint: Comply with requirements of Division-9 Section "Paints and Coatings."

D. Water: Provide potable water approved by local health authorities.

1.06 EQUIPMENT

A. General: Provide new equipment; if acceptable to the Architect, undamaged, previously used equipment in serviceable condition may be used. Provide equipment suitable for use intended.

B. Water Hoses: Provide 3/4" heavy-duty, abrasion-resistant, flexible rubber hoses 100 ft. long, with pressure rating greater than the maximum pressure of the water distribution system; provide adjustable shut-off nozzles at hose discharge.

C. Electrical Outlets: Provide properly configured NEMA polarized outlets to prevent insertion of 110-120 volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button and pilot light, for connection of power tools and equipment.

D. Electrical Power Cords: Provide grounded extension cords; use "hard-service" cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords, if single lengths will not reach areas where construction activities are in progress.

E. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered glass enclosures, where exposed to breakage. Provide exterior fixtures where exposed to moisture.

F. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM or another recognized trade association related to the type of fuel being consumed.

G. Temporary Offices: Locate office within the construction site as directed by Owner.

H. Temporary Toilet Units: Provide and maintain temporary portable units. Location as directed by owner.

I. First Aid Supplies: Comply with governing regulations. All accidents or injuries shall be reported to Owner.

J. Fire Extinguishers: Provide hand-carried, portable UL-rated, class "A" fire extinguishers for temporary offices and similar spaces. In other locations provide hand-carried, portable, UL-rated, class "ABC" dry chemical extinguishers, or a combination of extinguishers of NFPA recommended classes for the exposures.

K. Comply with NFPA 10 and 241 for classification, extinguishing agent and size required by location and class of fire exposure.

L. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not

overload facilities, or permit them to interfere with progress. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site

1.07 TEMPORARY UTILITIES

A. Existing facilities may be used.

1.08 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

B. Maintain daily in clean and sanitary condition.

1.09 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.

C. Provide protection for plants designated to remain. Replace damaged plants.

D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.10 FENCING

A. Construction: Commercial grade chain link fence.

B. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.11 EXTERIOR ENCLOSURES

A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.12 INTERIOR ENCLOSURES

A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.

B. Construction: Framing and gypsum board sheet materials with closed joints and sealed edges at intersections with existing surfaces:
   1. STC rating of 35 in accordance with ASTM E90.
   2. Maximum flame spread rating of 75 in accordance with ASTM E84.

C. Paint surfaces exposed to view from Owner-occupied areas.

1.13 SECURITY

A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

B. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer as requested by the Architect.

C. Temporary Fire Protection: Until fire protection needs are supplied by permanent facilities, install and maintain temporary fire protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers," and NFPA 241 "Standard for Safeguarding Construction, Alterations and Demolition Operations."

D. Store combustible materials in containers in fire-safe locations

E. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities for fighting fires. Prohibit smoking in the building.

F. Provide supervision of welding operations, combustion type temporary heating units, and similar sources of fire ignition.

G. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft and similar violations of security.

H. Environmental Protection: Provide protection, operate temporary facilities and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, might be contaminated or polluted, or that other undesirable effects might result.

I. Coordinate with Owner's security program.

1.14 VEHICULAR ACCESS AND PARKING

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.

B. Coordinate access and haul routes with governing authorities and Owner.

C. Provide and maintain access to fire hydrants, free of obstructions.

D. Provide means of removing mud from vehicle wheels before entering streets.

E. Designated existing on-site roads may be used for construction traffic.

F. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

G. Existing parking areas may be used for construction parking as directed by Owner.

1.15 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

B. Provide containers with lids. Remove trash from site periodically.

C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.16 CAMPUS POLICY

A. Smoking is not allowed by construction personnel.

B. Food and canned or bottled drinks are prohibited in the areas of interior consruction work. Contractor shall provde designated areas for water stations and consumption of food.

C. Workers not complying with these requirements shall be subject to dismissal.

1.17 FIELD OFFICES

A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack and drawing display table.

B. Provide space for Project meetings, with table and chairs to accommodate 8 persons.

C. Locate offices a minimum distance of 30 feet from existing and new structures.

1.18 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Substantial Completion inspection.

B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.

C. Clean and repair damage caused by installation or use of temporary work.

D. Restore existing facilities used during construction to original condition.

E. Restore new permanent facilities used during construction to specified condition.

1.19 HANDICAP ACCESSIBILITY

A. The contractor is to provide access to the elevator either through the first floor or by building a temporary ramp as indicated on sheet A1.2.

B. Ramp:
   1. The ramp is to be built from dimensional lumber and plywood.
   2. Max Slope: 1 inch vertical in 12 inches horinzontal
   3. Handrails: Continuous 1-1/2" diameter, 2'-10" a.f.f.
   4. Guardrails: Continuous plywood on dimensional lumber framing
   5. Max horinzontal run: 30'-0"
   6. Width: 5'-0"
   7. The ramp is to be maintained until handicap access is restored through the first floor. Once normal handicap access to the building has been restored the contractor will demolish the ramp.

C. Elevator Access from ground floor
   1. The contractor is to erect temporary partitions on the ground floor during construction

to allow normal handicap access to the elevator.

2. The construction partitions shall be maintained and access shall be maintained until construction is completed on the first floor and a certificate of occupancy for the first floor has been issued.

END OF SECTION

SECTION 01600 - PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Re-use of existing products.

C. Transportation, handling, storage and protection.

D. Product option requirements.

E. Substitution limitations and procedures.

F. Procedures for Owner-supplied products.

G. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

A. Section 01400 - Quality Requirements: Product quality monitoring.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
   1. Submit within 15 days after date of Agreement.
   2. For products specified only by reference standards, list applicable reference standards.

B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by the Contract Documents.

B. Unforeseen historic items encountered remain the property of the Owner; notify Owner

promptly upon discovery; protect, remove, handle, and store as directed by Owner.

C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

D. Reused Products: Reused products include materials and equipment previously used in this or other construction, salvaged and refurbished as specified.

2.02 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by the Contract Documents.

B. Where all other criteria are met, Contractor shall give preference to products that:
   1. Are extracted, harvested, and/or manufactured closer to the location of the project.
   2. Have longer documented life span under normal use.
   3. Result in less construction waste.

C. Provide interchangeable components of the same manufacture for components being replaced.

D. Motors: Refer to Section 15065, NEMA MG 1 Type. Specific motor type is specified in individual specification sections.

E. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Size terminal lugs to NFPA 70, include lugs for terminal box.

F. Cord and Plug: Provide minimum 6 foot cord and plug including grounding connector for connection to electric wiring system. Cord of longer length is specified in individual specification sections.

2.03 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.04 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION PROCEDURES

A. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.

B. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.

C. Document each request with complete data substantiating compliance of proposed

substitution with Contract Documents.

D. A request for substitution constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
   2. Will provide the same warranty for the substitution as for the specified product.
   3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.
   5. Will reimburse Owner and GMK Associates for review or redesign services associated with re-approval by authorities.

E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

F. Substitution Submittal Procedure:
   1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
   2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
   3. The GMK Associates will notify Contractor in writing of decision to accept or reject request.

G. Substitution Request Form:
   1. SUBSTITUTIONS WILL BE CONSIDERED ONLY WHEN THE ATTACHED FORM IS COMPLETED AND INCLUDED WITH THE SUBMITTAL WITH ALL BACK-UP DATA.

3.02 OWNER-SUPPLIED PRODUCTS

A. See Section 01100 - Summary for identification of Owner-supplied products.

B. Owner's Responsibilities:
   1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
   2. Arrange and pay for product delivery to site.
   3. On delivery, inspect products jointly with Contractor.
   4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
   5. Arrange for manufacturers' warranties, inspections, and service.

C. Contractor's Responsibilities:
   1. Review Owner reviewed shop drawings, product data, and samples.
   2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
   3. Handle, store, install and finish products.
   4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING

A. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

B. Transport and handle products in accordance with manufacturer's instructions.

C. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

D. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

E. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

F. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.

B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.

G. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

H. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

I. Prevent contact with material that may cause corrosion, discoloration, or staining.

J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 01601 - SUPPLEMENT A - SUBSTITUTION REQUEST FORM

TO:

Jerome K. Simons

GMK Associates, Inc.

1201 Main Street, Suite 2100

Columbia, South Carolina 29201

fax: 803.255.7243

We hereby submit for your consideration the following product instead of the specified item for the above project:

DRAWING NO._____ DRAWING NAME_____

SPEC. SECT.	SPEC NAME	PARAGRAPH	SPECIFIED ITEM
_____	_____	_____	_____

Proposed Substitution:_____

Attached complete information on changes to Drawings and/or Specifications, which proposed substitution would require for its proper installation.

Submit with request necessary samples and substantiating data to prove equal quality and performance to that which is specified. Clearly mark manufacturer's literature to indicate equality in performance.

The undersigned certifies that the function, appearance and quality are of equal performance and assumes liability for equal performance, equal design and compatibility with adjacent materials.

Submitted By:

_____ _____

Signature Title

_____

Firm

_____

Address

_____ _____

Telephone Date

Signature shall be by person having authority to legally bind his firm to the above terms. Failure to provide legally binding signature will result in retraction of approval.

_____

For use by the Architect:

__ Recommended __ Recommended as noted

__ Not Recommended __ Received too late

__ Insufficient data received

By:

Date:

For use by the Owner:

__ Approved

__ Not Approved

__ Approved as noted

By:

Date:

_____

Fill in Blanks Below:

A. Does the substitution affect dimensions shown on Drawings: Yes___No___ If yes, clearly indicate changes._____

B. Will the undersigned pay for changes to the building design, including engineering and detailing costs caused by the requested substitution? Yes ___ No ___ If no, fully explain:_____

C. What affect does substitution have on other Contracts or other trades?
_____

D. What affect does substitution have on construction schedule?
_____

E. Manufacturer's warranties of the proposed and specified items are: ___ Same ___ Different (If Different, Explain on Attachment)

F. Reason for Request: _____

G. Itemized comparison of specified item(s) with the proposed substitution; list significant variations:_____
_____

H. Accurate cost data comparing proposed substitution with product specified:
_____

I. Designation of maintenance services and sources:
_____

(Attach additional sheets if required.)

END OF SECTION

SECTION 01700 - EXECUTION REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.

C. Pre-installation meetings.

D. Cutting and patching.

E. Surveying for laying out the work.

F. Cleaning and protection.

G. Starting of systems and equipment.

H. Demonstration and instruction of Owner personnel.

I. Closeout procedures, except payment procedures.

J. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

A. Section 01300 - Administrative Requirements: Submittals procedures.

B. Section 01400 - Quality Requirements: Testing and inspection procedures.

C. Section 01500 - Temporary Facilities and Controls: Temporary interior partitions.

D. Section 01780 - Closeout Submittals: Project record documents, operation and maintenance data, warranties and bonds.

1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
   1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences. Include design drawings and calculations for bracing and shoring.
   2. Identify demolition firm and submit qualifications.
   3. Include a summary of safety procedures.

C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   4. Visual qualities of sight exposed elements.
   5. Work of Owner or separate Contractor.
   6. Include in request:
      a. Identification of Project.

b. Location and description of affected work.
c. Necessity for cutting or alteration.
d. Description of proposed work and products to be used.
e. Alternatives to cutting and patching.
f. Effect on work of Owner or separate Contractor.
g. Written permission of affected separate Contractor.
h. Date and time work will be executed.

D. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.04 PROJECT CONDITIONS

A. Use of explosives is not permitted.

B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

D. Provide methods, means and facilities to prevent water intrusion into new construction and renovations. Eliminate standing water immediately. Remove wet materials and replace with new.

E. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

F. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.
2. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Owner.
3. Clean interior spaces prior to the start of the finish painting and continue cleaning on an as-needed basis until painting is finished.
4. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly-coated surfaces.
5. Handle materials in a controlled manner with as little handling as possible; do not drop or throw materials from heights.

G. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
1. Minimize amount of bare soil exposed at one time.
2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

H. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

1. Outdoors: Limit conduct of especially noisy exterior work to the hours of 8 am to 5 pm.

I. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

J. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

K. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.05 COORDINATION

A. See Section 01100 for occupancy-related requirements.

B. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

C. Notify affected utility companies and comply with their requirements.

D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

E. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

G. Coordinate completion and clean-up of work of separate sections.

H. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01600.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify GMK Associates four days in advance of meeting date.

D. Prepare agenda and preside at meeting:
   1. Review conditions of examination, preparation and installation procedures.
   2. Review coordination with related work.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to GMK Associates, Owner, participants, and those affected by decisions made.

3.04 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Building shall be enclosed, ventilated and sealed from the exterior prior to installation of interior finish materials.

C. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

D. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

E. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

F. Make neat transitions between different surfaces, maintaining texture and appearance.

3.05 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as shown.
   2. Report discrepancies to GMK Associates before disturbing existing installation.
   3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01500 in locations indicated on drawings.

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
   1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
   2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.

D. Remove existing work as indicated and as required to accomplish new work.
   1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
   2. Remove items indicated on drawings.
   3. Relocate items indicated on drawings.
   4. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
   5. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
   2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
   3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
      a. Disable existing systems only to make switchovers and connections; minimize

duration of outages.
b. See Section 01100 for other limitations on outages and required notifications.
c. Provide temporary connections as required to maintain existing systems in service.

4. Verify that abandoned services serve only abandoned facilities.
5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

F. Protect existing work to remain.
1. Prevent movement of structure; provide shoring and bracing if necessary.
2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
3. Repair adjacent construction and finishes damaged during removal work.

G. Adapt existing work to fit new work: Make as neat and smooth transition as possible.

H. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to GMK Associates.

I. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.

J. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for GMK Associates review and request instructions.

K. Trim existing wood doors as necessary to clear new floor finish. Refinish trim as required.

L. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

M. Refinish existing surfaces as indicated:

N. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.

O. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.

P. Clean existing systems and equipment.

Q. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

R. Do not begin new construction in alterations areas before demolition is complete.

S. Comply with all other applicable requirements of this section.

3.06 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. See Alterations article above for additional requirements.

C. Perform whatever cutting and patching is necessary to:
   1. Complete the work.
   2. Fit products together to integrate with other work.
   3. Provide openings for penetration of mechanical, electrical, and other services.
   4. Match work that has been cut to adjacent work.
   5. Repair areas adjacent to cuts to required condition.
   6. Repair new work damaged by subsequent work.
   7. Remove samples of installed work for testing when requested.
   8. Remove and replace defective and non-conforming work.

D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

G. Restore work with new products in accordance with requirements of Contract Documents.

H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07840, to full thickness of the penetrated element.

J. Patching:
   1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   2. Match color, texture, and appearance.
   3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

K. Meet with management staff of the area of construction for required infection control practices in that department and comply with the Owner's policies.

3.07 PROGRESS CLEANING

A. Conduct cleaning and disposal operations to comply with codes, ordinances, regulations, and anti-pollution laws.

B. Contractor shall assess the amount of air borne dust and debris for construction and apprise the Owner of the need to change the air filtration filters in the air handling system at an increased frequency.

C. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

D. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

E. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

F. Collect and remove waste materials, debris, and rubbish from site periodically and dispose off-site.

G. Do not dispose of volatile wastes such as mineral spirits, oil or paint thinner in storm or sanitary drains.

3.08 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Prohibit traffic from landscaped areas.

H. Remove protective coverings when no longer needed; reuse or recycle plastic coverings if possible.

3.09 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify GMK Associates and owner seven days prior to start-up of each item.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

E. Verify that wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

G. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.10 DEMONSTRATION AND INSTRUCTION

A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.

B. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing,

maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.

C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of owner personnel.

E. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

G. The amount of time required for instruction on each item of equipment and system is that specified in individual sections.

3.11 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

B. Testing, adjusting, and balancing HVAC systems: See Section 15950.

3.12 FINAL CLEANING

A. Employ skilled workmen for final cleaning.

B. Materials:
1. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.
2. Use only those cleaning materials and methods recommended by manufacturer of the surface material to be cleaned.
3. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.
4. Sweeping compounds used in cleaning operations shall leave no residue on concrete floor surfaces that may effect installation of finish flooring materials.

C. Execute final cleaning prior to final project assessment.
1. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.

D. Use cleaning materials that are nonhazardous.

E. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

F. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

G. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from sight-exposed interior surfaces.

H. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

I. Dust cabinetwork and remove markings.

J. Prior to final completion, or Owner occupancy, the Contractor shall conduct an inspection of sight-exposed interior surfaces, and all work areas, to verify that the entire Work is clean

K. Tunnels and closed off spaces shall be cleaned of packing boxes, wood frame members and other waste materials used in the construction.

L. The entire system of piping and equipment shall be cleaned internally. The Contractor installing those items shall open all dirt pockets and strainers, completely blowing down as required and clean strainer screens of all accumulated debris.

M. Tanks, fixtures and pumps shall be drained and proved free of sludge and accumulated matter.

N. Temporary labels, stickers, etc., shall be removed from fixtures and equipment. (Do not remove permanent name plates, equipment model numbers, ratings, etc.)

O. Heating and air conditioning equipment, tanks, pumps and traps shall be thoroughly cleaned and new filters or filter media installed.

P. Before being placed in service, domestic water distribution systems, including those for cold water, drinking water and the hot water system shall be chlorinated. The method to be used shall be at the option of the Contractor installing the systems, and one of the methods set forth in the AWWA Standard specifications, latest edition, including all amendments thereto. The treatment shall consist of a solution of not less than 50 parts per million of available chlorine. The chlorinating material shall be either liquid chlorine or sodium hypochloride. After sterilization the system shall be flushed with clear water until the chlorine residual is not greater than 0.2 per million.

Q. Clean filters of operating equipment.

R. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.13 CLOSEOUT PROCEDURES

A. Contract requirements shall be met when construction activities have successfully produced, in this order, these three terminal activities:
   1. Substantial Completion.
   2. Final Completion.
   3. Final Payment.

B. Make submittals that are required by governing or other authorities.
   1. Provide copies to GMK Associates and Owner.

C. Substantial Completion:
   1. The date of Substantial Completion of the Work or designated portion thereof is the date certified by the Architect when construction is sufficiently complete, in accordance with the Contract Documents, so the Owner may occupy the Work or designated portion thereof for the use for which it is intended.
   2. When the Contractor considers the Work is substantially complete, he shall submit to the Architect:
      a. A written notice that the Work, or designated portion thereof, is substantially

complete.
   b. A list of items to be completed or corrected, (herein after referred to as Punch List).
   c. Request Substantial Completion Observation at a mutually agreeable date.
3. Within a reasonable time after receipt of such notice, the Architect, the Contractor, and at his option, the Owner, will make an observation to determine the status of completion.
4. Should the Architect determine that the Work is not substantially complete:
   a. The Architect will promptly notify the Contractor in writing, giving the reasons thereof.
   b. The Contractor shall remedy the deficiencies in the Work, and send a second written notice of substantial completion to the Architect.
   c. The Architect will re-observe the Work and the cost of the Architect's time and reimbursable expenses will be charged to the Contractor.
5. When the Architect concurs that the Work is substantially complete, he will:
   a. Prepare a Certificate of Substantial Completion on AIA Form G704, accompanied by the Contractor's Punch List of items to be completed or corrected, as verified and amended by the Architect. (Note: Contract responsibilities are not altered by inclusion or omission of required work from the Punch List.)
   b. Submit the Certificate to the Owner and the Contractor for their written acceptance of the responsibilities assigned to them in the Certificate.
6. The Contractor shall complete or correct all items identified on the Punch List and required by the Contract requirements within time limits established by the Certificate.
7. Notify GMK Associates when work is considered ready for Substantial Completion.
8. Submit written certification that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for GMK Associates's review.
9. Owner will occupy portions of the building as specified in Section 01100.
10. Correct items of work listed in executed Certificates of Substantial Completion and comply with requirements for access to Owner-occupied areas.

D. Final Completion:
1. To attain final completion the Contractor shall complete activities pertaining to Substantial Completion, and complete work on punch list items. Only then shall he issue written request to the Architect for Final Observation.
2. When the Contractor considers the Work is complete, he shall submit written certification that:
   a. Contract Documents have been reviewed.
   b. Work has been inspected for compliance with Contract Documents.
   c. Work has been completed in accordance with Contract Documents.
   d. Equipment and systems have been tested in the presence of the Owner's representative and are operational.
   e. Work is completed and ready for final observation.
3. The Architect, the Contractor and the Owner will make an observation to verify the status of completion with reasonable promptness after receipt of such certification.
4. Should the Architect consider that the Work is incomplete or defective:
   a. The Architect will promptly notify the Contractor in writing, listing the incomplete or defective work.

b. The Contractor shall take immediate steps to remedy the stated deficiencies, and send a second written certification to the Architect that the Work is complete.
c. The Architect will reinspect the Work.

5. When the Architect finds that the Work is acceptable under the Contract Documents, he shall request the Contractor to make closeout submittals.
6. Notify GMK Associates when work is considered finally complete.
7. Complete items of work determined by GMK Associates's final inspection.

E. The Contractor's Closeout Submittals to the Architect:
1. Evidence of compliance with requirements of governing authorities:
a. Certificate of Occupancy
b. Certificates of Inspection
c. Mechanical
d. Electrical
2. Project Record Documents: To requirements of Section 01780.
3. Operating and Maintenance Data, Instructions to the Owner's Personnel: To requirements of Section 01780.
4. Warranties and Bonds: To requirements of individual sections.
5. Spare Parts and Maintenance Materials: To requirements of individual sections.
6. Evidence of Payment and Release of Liens: To requirements of General and Supplementary Conditions.

F. Final Adjustment of Accounts:
1. Submit a final statement of accounting to the Architect.
2. Statement shall reflect all adjustments to the Contract Sum:
a. The original Contract Sum.
b. Additions and deductions resulting from:
1) Previous Change Orders.
2) Deductions for uncorrected Work.
3) Deductions for reinspection payments.
4) Other adjustments.
c. Total contract sum, as adjusted.
d. Previous payments
e. Sum remaining due.
3. Architect will prepare a final Change Order, reflecting adjustments to the Contract Sum which were not previously made by Change Orders.

G. Final Application for Payment:
1. The Contractor shall submit the final Application and Certificate for Payment in accordance with procedures and requirements stated in the Conditions of the Contract.

3.14 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.

B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.

C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION

SECTION 01780 - CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project Record Documents.

B. Operation and Maintenance Data.

C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. Section 01300 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

B. Section 01700 - Execution Requirements: Contract closeout procedures.

C. Individual Product Sections: Specific requirements for operation and maintenance data.

D. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

A. Project Record Documents: Submit documents to GMK Associates prior to claim for final Application for Payment.

B. Operation and Maintenance Data:
1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. GMK Associates will review draft and return one copy with comments.
2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with GMK Associates comments. Revise content of all document sets as required prior to final submission.
4. Submit two sets of revised final documents in final form within 10 days after final inspection.

C. Warranties and Bonds:
1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 15 days after acceptance.
2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Architect.
3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.
4. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties.

Submit a draft to the Owner through the Architect for approval prior to final execution.

5. Refer to individual Sections of Divisions-2 through -16 for specific content requirements, and particular requirements for submittal of special warranties.
6. Form of Submittal: At Final Completion compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor,subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
7. Bind warranties and bonds in two (or more) duplicate heavy-duty, commercial quality, durable 3-hole punch tab binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" paper.
8. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer.
9. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS," the Project title or name, and the name of the Contractor.
10. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.

2. Field changes of dimension and detail.
3. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

A. For Each Product or System: List names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

E. Manuals:
   1. Purpose:
      a. Operation and maintenance manuals will be used for training of, and use by, Owner's personnel in operation and maintenance of mechanical and electrical systems and equipment. A separate manual or chapter within a manual shall be prepared for each class of equipment or system.
      b. For additional requirements refer to various specification sections.

F. Instructions of Owner's Personnel
   1. Fully instruct Owner's designated operating and maintenance personnel in operating, adjustments and maintenance of all mechanical and electrical systems and equipment as required by respective and pertinent sections, after all final inspection, tests and repairs have been completed.
   2. Operating and maintenance manuals shall constitute the basis of instructions. Contents of manual shall be reviewed in full detail, explaining all aspects of operations and maintenance.
   3. Prepare and include additional data when need for such data becomes apparent during instruction and training and sessions.
   4. Training sessions shall be jointly arranged with Owner during Contractor's normal week and daily hours. The Owner shall have the responsibility of scheduling its shift work personnel accordingly.
   5. Owner and Contractor shall coordinate and cooperate to keep training sessions to a reasonable minimum.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
   1. Product data, with catalog number, size, composition, and color and texture designations.
   2. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Additional information as specified in individual product specification sections.

E. Provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
   1. Description of unit or system, and component parts.
   2. Identify function, normal operating characteristics, and limiting conditions.
   3. Include performance curves, with engineering data and tests.
   4. Complete nomenclature and model number of replaceable parts.

B. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

C. Include color coded wiring diagrams as installed.

D. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

E. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

F. Provide servicing and lubrication schedule, and list of lubricants required.

G. Include manufacturer's printed operation and maintenance instructions.

H. Include sequence of operation by controls manufacturer.

I. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

J. Provide control diagrams by controls manufacturer as installed.

K. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.

L. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

M. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

N. Include test and balancing reports.

O. Safety instructions.

P. Additional Requirements: As specified in individual product specification sections.

3.05 OPERATION AND MAINTENANCE MANUALS

A. Prepare instructions and data by personnel experienced in maintenance and operation of described products.

B. Prepare data in the form of an instructional manual.

C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

D. Cover: Identify each binder on the front and the spine with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

E. Provide heavy duty paper tabbed dividers for each separate product and system, with typed description of product and major component parts of equipment.

F. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.

G. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

H. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.

I. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
   1. Part 1: Directory, listing names, addresses, and telephone numbers of GMK Associates, Contractor, Subcontractors, and major equipment suppliers.
   2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
      a. Significant design criteria.
      b. List of equipment.
      c. Parts list for each component.
      d. Operating instructions.
      e. Maintenance instructions for equipment and systems.
      f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
   3. Part 3: Project documents and certificates, including the following:
      a. Shop drawings and product data.
      b. Air and water balance reports.
      c. Certificates.

J. Provide a listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.

K. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of GMK Associates, Consultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.

3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors,

suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.

F. Cover: Identify each binder on the front and the spine with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.

G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

I. See all provisions under "3.5 WARRANTY:" in General Conditions.

J. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

K. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, guarantee the corrected work with a new warranty equal to the original.

L. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

M. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, right and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.

N. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

O. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments

are willing to do so.

END OF SECTION

SECTION 01820 - DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

A. Demonstration of products and systems where indicated in specific specification sections.

B. Training of Owner personnel in operation and maintenance is required for:
   1. All software-operated systems.
   2. HVAC systems and equipment.
   3. Plumbing equipment.
   4. Electrical systems and equipment.
   5. Items specified in individual product Sections.

C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
   1. waterproofing, and other weather-exposed or moisture protection products.
   2. Finishes, including flooring, wall finishes, ceiling finishes.
   3. Fixtures and fittings.
   4. Items specified in individual product Sections.

1.02 RELATED REQUIREMENTS

A. Section 01780 - Closeout Submittals: Operation and maintenance manuals.

1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Training Plan: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit to GMK Associates for transmittal to Owner.
   2. Submit not less than four weeks prior to start of training.
   3. Revise and resubmit until acceptable.
   4. Provide an overall schedule showing all training sessions.
   5. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Name of firm and person conducting training; include qualifications.
      d. Intended audience, such as job description.
      e. Objectives of training and suggested methods of ensuring adequate training.
      f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
      g. Media to be used, such a slides, hand-outs, etc.
      h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
   1. Include applicable portion of O&M manuals.
   2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
   3. Provide one extra copy of each training manual to be included with operation and maintenance data.

1.04 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
   1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
   2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.

B. Demonstration may be combined with Owner personnel training if applicable.

C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.
   2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. Conduct training on-site unless otherwise indicated.

B. Owner will provide classroom and seating at no cost to Contractor.

C. Provide training in minimum two hour segments.

D. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

E. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
   1. The location of the O&M manuals and procedures for use and preservation; backup copies.
   2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
   3. Typical uses of the O&M manuals.

F. Product- and System-Specific Training:
   1. Review the applicable O&M manuals.
   2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.

3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
4. Provide hands-on training on all operational modes possible and preventive maintenance.
5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
6. Discuss common troubleshooting problems and solutions.
7. Discuss any peculiarities of equipment installation or operation.
8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
9. Review recommended tools and spare parts inventory suggestions of manufacturers.
10. Review spare parts and tools required to be furnished by Contractor.
11. Review spare parts suppliers and sources and procurement procedures.

G. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION

D I V I S I O N 2

S I T E C O N T R U C T I O N

Applicable Portions Of The Conditions Of The Contract And Division 1 General Requirements Apply To The Work Of This Division.

SECTION 02080 – ASBESTOS ABATEMENT

PART 1 - GENERAL

1.1 Requirements of the General and Supplemental Conditions apply to all Work in this Section. Provide all labor, material, equipment, and services indicated on the Drawings or specified herein or reasonably necessary for and incidental to a complete job.

1.2 DESCRIPTION OF WORK

A. The work includes the complete isolation of the work area for the duration of the work so as to prevent asbestos-contaminating dust or debris from passing beyond the isolated areas; the pre-cleaning of fixed objects; the removal and disposal of all spray-applied and/or trowel-applied materials that have previously been determined to contain asbestos where shown on the Drawings or in Schedules.

B. The removal of plaster and metal lath ceiling systems; the removal of asbestos-containing floor tile systems; and the removal of pipe and joint and insulation and security and safety up discovery of any of these materials.

C. This specification is comprehensive for a variety of possible asbestos scenarios that could be encountered during this renovation to take into account possible unforeseen conditions. Contractors should base bids on the scope of work defined in the attached Limited Asbestos Evaluation Report prepared by S&ME dated 6/13/2011.

1.3 POTENTIAL ASBESTOS HAZARD

A. The disturbance or dislocation of asbestos-containing materials may cause asbestos fibers to be released into the building's atmosphere, thereby creating a potential health hazard to workmen and building occupants. Apprise all workers, supervisory personnel, subcontractors and consultants who will be at the jobsite of the seriousness of the hazard and of proper work procedures which must be followed.

B. Where in the performance of the work, workers, supervisory personnel, subcontractors, or consultants may encounter, disturb, or otherwise function in the immediate vicinity of any identified asbestos-containing materials, take appropriate continuous measures as necessary to protect all building occupants from the potential hazard of exposure to airborne asbestos. Such measures shall include the procedures and methods described herein, and compliance with regulations of applicable federal, state and local agencies.

1.4 STOP WORK

A. If the Engineer, Owner, the Owner's Representative, or the Project Administrator presents a written stop work order, immediately stop all work. Do not recommence work until authorized in writing by the Engineer or Owner's Representative.

1.5 DEFINITIONS

A. Words and/or terms used in the process of, and during removal, and/or replacement of asbestos containing building materials.

1. Abatement: Procedures to control fiber release from asbestos-containing materials. Includes encapsulation, enclosure, removal, repair, and any associated preparation, clean-

up and disposal activities having the potential to disturb regulated asbestos-containing materials.

2. Adequately wet: to sufficiently mix or penetrate with liquid to prevent the potential release of particulates. The absence of visible emissions is not sufficient evidence of being adequately wet.
3. Aggressive clearance sampling: A method of sampling which uses electric fans, electric leaf blowers, or other devices to simulate vigorous activity in the abated area while air samples are being collected.
4. Airlock: A chamber which permits entrance and exit with minimum air movement between a contaminated area and an uncontaminated area, consisting of two doorways protected by two overlapping polyethylene sheets and separated by a sufficient distance such that one passes through one doorway into the chamber, allowing the doorway sheeting to overlap and close off the opening before proceeding through the second doorway. The airlock maintains a pressure differential between the contaminated and uncontaminated areas, thereby minimizing flow through contamination further.
5. Air Monitoring: The process of measuring the fiber content of a specific volume of air in a stated period of time.
6. Area Air Monitoring: Any form of air sampling whereby the sampling device is placed at a stationary location either inside or outside the regulated work area.
7. Amended Water: Water containing a wetting agent or surfactant.
8. Asbestos: The term asbestos includes chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite.
9. Asbestos-containing Material ACM: Any material containing more than l% by weight of asbestos of any type or mixture of types as determined by using the method specified in 40 CFR Part 763, Appendix A, subpart F, Section 1, as amended, or an accepted equivalent. (NOTE: “Appendix A to Subpart F” has been redesignated as, and shall hereinafter be referred to as “Appendix E to Subpart E” – 60 FR 31917, June 19, 1995.)
10. Asbestos-containing waste material: Any material which is or is suspected of being or any material contaminated with an asbestos-containing material which is to be removed from a work area for disposal.
11. Asbestos Control Area: An area where asbestos abatement operations are performed, which is isolated by physical boundaries to prevent the spread of asbestos dust, fibers, or debris.
12. Authorized Visitor: The Owner, the Engineer, or a representative of any regulatory or other agency having jurisdiction over the project. This is limited to government project inspectors, police, paramedics, fire-safety personnel, and insurance loss prevention safety auditors, or other personnel as approved on a case-by-case basis.
13. Background air monitoring: Area sampling performed prior to abatement to obtain an index of existing airborne fiber levels under typical activity.
14. Barrier: Any surface that seals off the work area to inhibit the movement of fibers.
15. Breathing Zone: A hemisphere forward of the shoulders with a radius of approximately 6 to 9 inches.
16. Ceiling Concentration: The concentration of an airborne substance that shall not be exceeded.
17. Certified Industrial Hygienist (CIH.): An industrial hygienist certified in Comprehensive Practice by the American Board of Industrial Hygiene.

18. Clean Room: An uncontaminated area or room which is part of the worker decontamination enclosure system, with provisions for storage of workers' street clothes and protective equipment.
19. Clearance air monitoring: Area air sampling performed using aggressive clearance sampling techniques to determine the airborne concentrations of residual fibers upon conclusion of asbestos abatement.
20. Critical barrier: At a minimum, two independent layers of 6-mil plastic sheeting applied to any opening into a work area in a manner that creates a leak-tight seal within the work area to isolate vents, windows, doors, switches, outlets, and any other cavity or opening to the contaminated work area.
21. Curtained Doorway: A device to allow ingress or egress from one room to another while permitting minimal air movement between the rooms, typically constructed by placing two overlapping sheets of plastic over an existing or temporarily framed doorway, securing each along the top of the doorway, securing the vertical edge of one sheet along one vertical side of the doorway, and securing the vertical edge of the other sheet along the opposite vertical side of the doorway.
22. Decontamination Enclosure System: A series of connected rooms, with curtained doorways between any two adjacent rooms, for the decontamination of workers or of materials and equipment. A decontamination enclosure system always contains at least one airlock.
23. Demolition: The wrecking or taking out of any load supporting structural member of a facility together with any related handling operations or the intentional burning of any facility.
24. Encapsulant: A liquid material which can be applied to asbestos-containing material and which controls the possible release of asbestos fibers from the material either by creating a membrane over the surface (bridging encapsulant) or by penetrating into the material and binding its components together (penetrating encapsulant).
25. Encapsulation: All herein specified procedures necessary to coat or embed all asbestos-containing materials with an encapsulant to control the possible release of asbestos fibers into the ambient air.
26. Enclosure: All herein specified procedures necessary to complete enclosure of all asbestos-containing material behind airtight, impermeable, permanent barriers to prevent access to regulated asbestos-containing material and to prevent the release of asbestos fibers.
27. EPA: United States Environmental Protection Agency
28. Equipment Decontamination Enclosure System: A decontamination enclosure system for materials and equipment, typically consisting of a designated area of the work area, a washroom, a holding area, and an uncontaminated area.
29. Equipment Area: A contaminated area or room which is part of the worker decontamination enclosure system, with provisions for storage of contaminated clothing and equipment.
30. Fiber: A structure greater than 0.5 micrometers in length with an aspect ratio (length to width) of 5 to 1or greater and having substantially parallel sides.
31. Fixed Object: A unit of equipment or furniture in the work area which cannot be removed from the work area.
32. Friable Asbestos Material: Material that contains more than one percent asbestos by weight and that can be crumbled, pulverized, or reduced to powder by hand pressure when dry. Also refers to previously non-friable asbestos-containing material after such

material becomes damaged to the extent that when dry, can be or has been crumbled, pulverized, or reduced to powder.

33. Glovebag: A sealed compartment with attached inner gloves used for the handling of asbestos-containing materials.
34. HEPA Filter: A High Efficiency Particulate Absolute (HEPA) filter capable of trapping and retaining 99.97% of asbestos fibers greater than 0.3 microns in length.
35. HEPA Filter Vacuum Collection Equipment (or vacuum cleaner): High efficiency particulate air (absolute) filtered vacuum collection equipment with a filter system capable of collecting and retaining asbestos fibers. Filters should be of 99.97% efficiency for retaining fibers of 0.3 microns or larger.
36. High-efficiency Filter: A filter which removes from air 99.97% or more of monodisperse dioctyl phthalate (DOP) particles having a mean particle diameter of 0.3 micrometer.
37. Holding Area: A chamber between the washroom and an uncontaminated area in the equipment decontamination enclosure system. The holding area comprises an airlock.
38. Leak-tight: Dust, solids, or liquids cannot escape or spill out.
39. Movable Object: A unit of equipment or furniture in the work area which can be removed from the work area.
40. Negative Pressure: Air pressure lower than surrounding areas, generally caused by exhausting air from a sealed space (work area).
41. Negative Pressure Respirator: A respirator in which the air pressure inside the respiratory-inlet covering is positive during exhalation in relation to the air pressure of the outside atmosphere and negative during inhalation in relation to the air pressure of the outside atmosphere.
42. Negative Pressure Ventilation System: A local exhaust system, utilizing HEPA filtration capable of maintaining a constant negative pressure inside the work area and a constant air flow from adjacent areas into the work area and exhausting that air outside the work area.
43. Nonfriable Asbestos Material: Material that contains asbestos in which the fibers have been locked in by a bonding agent, coating, binder, or other material so that the asbestos is well bound and will not release fibers in excess of the asbestos control limit during any appropriate use, handling, demolition, storage, transportation, processing, or disposal.
44. OSHA: Occupational Safety and Health Administration.
45. Owner: University of South Carolina, Upstate.
46. Personal Air Monitoring: Sampling of asbestos fiber concentrations within the breathing zone of an employee.
47. Plasticize: To cover floors and walls with plastic sheeting as herein specified.
48. Protection Factor: The ratio of the ambient concentration of an airborne substance to the concentration of the substance inside the respirator at the breathing zone of the wearer. The protection factor is a measure of the degree of protection provided by a respirator to the wearer.
49. Regulated area: An area established by the owner of an asbestos project to demarcate areas where asbestos abatement activities are conducted; any adjoining area where debris and waste from such asbestos work is stored; and any work area within which airborne concentrations of asbestos exceed, or there is a reasonable possibility they may exceed the permissible exposure limit.
50. Removal: All herein specified procedures necessary to strip all asbestos-containing materials from the designated areas and to dispose of these materials at an acceptable site.

51. Respirator: A device designed to protect the wearer from the inhalation of harmful atmospheres.
52. Shower Room: A room between the clean room and the equipment room in the worker decontamination enclosure system, with hot and cold running water controllable within the shower room and suitably arranged for complete showering during decontamination. The shower room comprises an airlock between contaminated and clean areas.
53. Surfactant: A chemical wetting agent added to water to improve penetration, thus reducing the quantity of water required for a given operation or area.
54. Time Weighted Average (TWA): Three samples are required to establish the 8-hour time weighted average. The TWA is an 8-hour time weighted average airborne concentration of fibers, longer than 5 micrometers, per cubic centimeter of air.
55. Visible Emissions: Any emissions containing particulate asbestos material that are visually detectable without the aid of instruments. This does not include condensed uncombined water vapor.
56. Washroom: A room between the work area and the holding area in the equipment decontamination enclosure system. The washroom comprises an airlock.
57. Wet Cleaning: The process of eliminating asbestos contamination from building surfaces and objects by using cloths, mops, or other cleaning tools which have been dampened with amended water, and by afterwards disposing of these cleaning tools as asbestos-contaminated waste.
58. Work Area: Designated rooms, spaces, or areas of the project in which asbestos abatement actions are to be undertaken or which may become contaminated as a result of such abatement actions. A contained work area is a work area which has been sealed, plasticized, and equipped with a decontamination enclosure system. A non-contained work area is an isolated or controlled-access work area which has not been plasticized or equipped with a decontamination system.
59. Work Card: Certification obtained from an OSHA approved organization stating that the holder of the card has attended and satisfactorily completed an asbestos worker training course. Proof of equivalent training provided by other organizations will be accepted.
60. Worker Decontamination Enclosure System: A decontamination enclosure system for workers and other authorized personnel or visitors, typically consisting of a clean room, a shower room, and an equipment room. Such a system typically consists of three rooms, and three air locks as follows: Clean room, air lock, shower room, air lock, equipment room, and air lock, which leads to the contaminated work area.

1.6 CONTRACTOR USE OF PREMISES

A. The Contractor shall limit his use of the premises to the work indicated, so as to allow for Owner occupancy and use by the public.

B. Use of the Site: Confine operations at the site to the areas permitted under the contract. Portions of the site beyond areas on which work is indicated are not to be disturbed. Conform to site rules and regulations affecting the work while engaged in project construction.
   1. Keep existing driveways and entrances serving the premises clear and available to the Owner and his employees at all times. Do not use these areas for parking or storage of materials, unless authorized in writing by the Owner.
   2. Do not unreasonably encumber the site with materials or equipment. Confine stockpiling of materials and location of storage sheds to the areas indicated. If additional storage is necessary, obtain and pay for such storage off site.

3. Lock automotive type vehicles, such as passenger cars and trucks and other mechanized or motorized construction equipment, when parked and unattended, so as to prevent unauthorized use. Do not leave such vehicles or equipment unattended with the motor running or the ignition key in place or accessible to unauthorized persons.

C. Contractors Use of the Existing Building: Maintain existing building in a safe and weathertight condition throughout the construction period. Repair damage caused by construction operations. Take all precautions necessary to protect the building and its occupants during the construction period.
   1. Keep public areas such as hallways, stairs, elevator lobbies and toilet rooms free from accumulation of waste, rubbish or construction debris.
   2. Smoking or open fires will not be permitted within the building enclosure or on the premises.

1.7 OWNER OCCUPANCY

A. Full Owner Occupancy: The Owner will occupy the site and the adjacent areas of the building during the entire period of construction. Cooperate fully with the Owner and his Representative during construction operations to minimize conflicts and to facilitate Owner usage. Perform the work so as not to interfere with the Owner's operation.

B. Partial Owner Occupancy: The Owner reserves the right to place and install equipment as necessary in areas of the building in which all asbestos abatement and project decontamination procedures have been completed, and to occupy such completed areas prior to substantial completion, provided that such occupancy does not substantially interfere with completion of the work. Such placing of equipment and partial occupancy shall not constitute acceptance of the work or any part of the work.

1.8 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

A. Provide a full-time General Superintendent who is experienced in administration and supervision of asbestos abatement projects including work practices, protective measures for building and personnel, disposal procedures, etc. This person is the Competent Person as required by 29 CFR 1926 for the Contractor and is the Contractor's representative responsible for compliance with all applicable federal, state and local regulations, particularly those relating to asbestos-containing materials. The General Superintendent or Supervisor must be accredited as required by 40 CFR 763.90 (g). Accreditation must be in accordance with 40 CFR 763, Appendix C to Subpart E -EPA Model Contractor Accreditation Plan and must have at least two years on-the-job experience in asbestos abatement projects. The Contractor shall provide proof of such accreditation and licenses to the Engineer not less than l0 days prior to commencing any work.
   1. The certified General Superintendent must be present at the project site at all times that work is in progress. It is mandatory that the Superintendent enter the work area (asbestos enclosure) a minimum of two times each eight hour shift to inspect progress of work and work practices. Proof of such inspections shall be provided in the form of daily inspection forms signed by the General Superintendent.
   2. The Contractor shall be licensed as an “Asbestos Contractor” and each worker as an “Asbestos Worker” pursuant to the requirements in the state of the work. Proof of such license shall be provided to the Engineer and the Owner.

1.9 SPECIAL REPORTS

A. Except as otherwise indicated, submit special reports directly to the Owner and the Engineer within one day of occurrence requiring special report, with copies to all others affected by the occurrence.

B. Reporting Unusual Events: When an event of unusual and significant nature occurs at the site (examples: failure of negative pressure system, rupture of temporary enclosures, unauthorized entry into work areas), prepare and submit a special report listing date and time of event, chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. When such events are known or predictable in advance, advise the Engineer and Owner in advance at earliest possible date.

C. Reporting Accidents: Prepare and submit special reports of significant accidents, at the site and anywhere else work is in progress related to this project. Record and document data and actions; comply with industry standards. For this purpose, a significant accident is defined to include events where personal injury is sustained, or property loss of substance is sustained, or where the event posed a significant threat of loss or personal injury.

1.10 CONTINGENCY PLAN

A. Prepare a contingency plan for emergencies including fire, accident, power failure, negative pressure system failure, supplied air system failure, or any other event that may require modification of decontamination or work area isolation procedures. Include in the plan specific procedures for decontamination or work area isolation. Note that nothing in this Project Manual should impede safe exiting or providing of adequate medical attention in the event of an emergency. A copy of the plan must be submitted to and approved by the Engineer, Owners Representative prior to any work.

B. Posting: Post in the clean room of the decontamination unit and in the Contractor's office trailer telephone numbers and locations of emergency services including but not limited to fire, ambulance, doctor, hospital, power company, police, and telephone company.

1.11 PERMITS AND NOTIFICATIONS

A. Secure necessary permits in conjunction with asbestos removal, hauling, and disposition and provide timely notification of such actions as may be required by federal, state, regional, and local authorities. Notify the Regional Office of the United States Environmental Protection Agency (USEPA) in accordance with 40 CFR 6l.22 (d)(1) and provide copies of the notification to the Engineer and the State Environmental Regulatory Agency 10 days prior to commencement of the work. Notifications must be supplied specifically to the following:

Asbestos Coordinator
EPA Region IV
345 Courtland Street
Atlanta, GA 30308

NESHAPS Manager for SC
Air Compliance & Management Div. Bureau of Air Quality Control
South Carolina Department of Health and Environmental Control
2600 Bull Street
Columbia, SC 29201

B. NOTICE; SCDHEC AIR MANAGER: Not less than 10 days prior to actual removal of asbestos, notify in writing the District Air Quality Manager of the South Carolina Department of Health and Environmental Control, to arrange for an inspection of the abatement activities. Each project in South Carolina must be inspected during actual abatement activities. If an inspection is attempted during the time indicated by the Contractor on the notification and removal is not taking place at that time, the Contractor will be considered by SCDHEC to be in violation of notification requirements. Provide a copy of this notification to the Engineer prior to beginning actual removal of asbestos.

C. The SCDHEC District Air Quality Manager for this project can be contacted at the following address:

South Carolina Department of Health and Environmental Control (Region 2)
Environmental Quality Control Office
District Air Quality Manager
301 University Ridge, Suite
5800 Greenville, S.C. 29601-3677
(864) 241-1090

D. Notice. Police and Fire Departments: Not less than 10 days prior to commencing any work, notify the local fire department, in writing, of proposed asbestos abatement work. In addition to the information required by the paragraph entitled PERMITS AND NOTIFICATIONS, GENERAL, advise the police and fire departments of the nature of the asbestos abatement work, and the necessity that all personnel who may enter the worksite in the case of fire wear self-contained breathing apparatus. Provide one copy of the notices to the Engineer prior to commencing the project.

E. Permits: Not less than 10 days prior to commencing any work, submit proof satisfactory to the Engineer that all required permits, site location, and arrangements for transport and disposal of asbestos-containing or contaminated materials, supplies, and the like have been obtained.

1.12 SAFETY COMPLIANCE

A. In addition to detailed requirements of this specification, comply with laws, ordinances, rules, and regulations of federal, state, regional, and local authorities regarding handling, storing, transporting, and disposing of asbestos waste materials. Comply with the applicable requirements of the current issue of 29 CFR l926.1101 and 40 CFR 61, Subparts A and B. Submit matters of interpretation of standards to the appropriate administrative agency for

resolution before starting the work. Where the requirements of this specification and referenced documents vary, the most stringent requirement shall apply.

1.13 RESPIRATOR PROGRAM

A. Establish a respirator program as required by ANSI Z88.2 and 29 CFR l926.1101(h), l926.103, and l910.134.

1.14 CODES AND REGULATIONS

A. General Applicability of Codes, Regulations, and Standards: Except to the extent that more explicit or more stringent requirements are written directly into the contract documents, all applicable codes, regulations, and standards have the same force and effect (and are made a part of the contract documents by reference) as if copied directly into the contract documents, or as if published copies are bound herewith.

B. Contractor Responsibility: The Contractor shall assume full responsibility and liability for the compliance with all applicable federal, state, and local regulations pertaining to work practices, hauling, disposal, and protection of workers, visitors to the site, and persons occupying areas adjacent to the site. The Contractor is responsible for providing medical examinations and maintaining medical records or personnel as required by the applicable federal, state, and local regulations. The Contractor shall hold the Owner, Engineer, and Owner's Representative harmless for failure to comply with any applicable work, hauling, disposal, safety, health or other regulation on the part of himself, his employees, or his subcontractors.

1.15 Referenced Standards

A. Unless otherwise indicated, all referenced standards shall be the latest edition available at the time of bidding. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards. Comply with the provisions of the following codes and standards, except as otherwise shown or specified. Where conflict among requirements or with these specifications exists, the more stringent requirements shall apply.

B. Federal Requirements; OSHA: U.S. Department of Labor, Occupational Safety and Health Administration, (OSHA) requirements which govern asbestos abatement work or hauling and disposal of asbestos waste materials include but are not limited to the following:

Occupational Exposure to Asbestos, Tremolite,
Anthophyllite, and Actinolite; Final Rules
Title 29, Part l9l0, Section 1001 of the
Code of Federal Regulations

Respiratory Protection
Title 29, Part 1910, Section 134 of the
Code of Federal Regulations

Access to Employee Exposure and Medical Records
Title 29, Part 1910, Section 2 of the
Code of Federal Regulations

Hazard Communication
Title 29, Part 1910, Section 1200 of the
Code of Federal Regulations
Specifications for Accident Prevention Signs and Tags
Title 29, Part l9l0, Section 145 of the
Code of Federal Regulations

Construction Industry
Title 29, Part 1926, of the
Code of Federal Regulations

C. Federal Requirements; EPA

1. U.S. Environmental Protection Agency (EPA) requirements which govern asbestos abatement work or hauling and disposal of asbestos waste materials include but are not limited to the following:

Asbestos Abatement Projects Rule
40 CFR Part 762
CPTS 62044, FRL 2843-9
Federal Register, Vol 50 No. 134, July 12, 1985
P28530-28540

Regulation for Asbestos
Title 40, Part 61, Sub-part A of the
Code of Federal Regulations

National Emission Standard for Hazardous Air Pollutants
Title 40, Part 6l, Sub-part M (Revised Sub-part B) of the
Code of Federal Regulations

D. State Requirements

1. State requirements which govern asbestos abatement work or hauling and disposal of asbestos waste materials include but are not limited to the following:
South Carolina:

South Carolina Department of Health and Environmental Control Regulation

No. 61-86.1, Standards of Performance for Asbestos Projects.

E. Industry Standards: Industry standards which govern asbestos abatement work or hauling and disposal of asbestos waste materials include but are not limited to the following:
   1. ANSI Z9.2 Fundamentals Governing the Design and Operation of Local Exhaust Systems
   2. ANSI Z88.2 American National Standard for Respiratory Protection
   3. UL 586 High Efficiency, Particulate, Air-Filter Units
   4. NIOSH National Institute for Occupational Safety and Health

1.16 SUBMITTALS

A. The following items shall be submitted to and approved by the Engineer prior to commencing work involving asbestos materials.
   1. Respirator Program: Submit a copy of the written respirator program to the Engineer not less than 10 days prior to commencing any work.
   2. Certificates of Compliance; Ventilation Equipment: Submit manufacturer's certification that vacuums, ventilation equipment, and other equipment required to contain airborne asbestos fibers conform to ANSI Z9.2. Manufacturer's brochures without certifications are not acceptable.
   3. Asbestos Plan: Not less than 10 days prior to commencing any work, submit a detailed plan of the work procedures to be used in the removal and demolition of materials containing asbestos. Such plan shall include location of asbestos control areas, decontamination units, layout of decontamination units, location of access routes to asbestos control areas, sequencing of asbestos related work, disposal plan, type of wetting agent and asbestos sealer to be used, air monitoring, and a detailed description of the method to be employed in order to control pollution. This plan must be approved prior to the start of any asbestos work.
   4. If Glovebag Technique is to be used, submit to the Engineer for review and approval, a plan showing method and sequence of tasks including preparation, containment, removal of asbestos containing materials from pipes, removal of material from the work area and personal protection.
   5. Contingency Plan: Not less than l0 days prior to commencing any work, submit a plan for emergency actions as required by paragraph 1.11 of this section.
   6. Notification: Notify the Engineer not less than 3 working days prior to commencing any asbestos work.
   7. Landfill: Not less than 10 days prior to commencing any work, submit written evidence that the landfill to be used for disposal of asbestos has been notified of pending disposal of asbestos from USC Upstate, All asbestos shall be disposed of at:
   8. Negative Pressure System: Not less than 10 days prior to commencing any work, submit to the Engineer the design of the negative pressure system. Do not begin work until the submittal is approved by the Engineer. Include in the submittal at a minimum:
      a. Number of negative air machines required and the calculations necessary to determine the number of machines.
      b. Description of projected airflow within the work area and methods required to provide adequate airflow in all portions of the work area.
      c. Manufacturer’s product data and certifications for the machines to be used.
      d. Location of machines in the work area.
      e. Location of pressure differential measurement equipment.
      f. Manufacturers product data on equipment used to maintain pressure differential.

9. Security and Safety Log: Not less than 10 days prior to commencing any work, submit for approval the form of security and safety log which will be maintained on the project.
10. Training: Not less than 5 days prior to commencing any work, submit proof that each worker is accredited as required by 40 CFR 763.90 (g), in accordance with 40 CFR 763, Appendix C to Subpart E. Also provide proof that training requirements as specified in 29 CFR 1926.1101(k)(3) and SCDHEC Regulation No. 61-86.1 have been complied with.
11. Certificate of Workers Release: Prior to allowing an employee to perform any work on the project, submit to the Owner a copy of the properly executed Certificate of Workers Release for each employee.
12. Manufacturer's Data: Encapsulants: Submit for approval, documentation, including test results and manufacturer's installation recommendations of encapsulating materials proposed for use.
13. Manufacturers Data: Sealants: Submit for approval, documentation, including test results, of sealant materials proposed for use. Sealants must be compatible with proposed new finishes.
14. Room Inspection: Before any work is initiated, make an inspection of all areas in which work is to be performed in the presence of representatives of the Owner and Engineer. The purpose of the inspection is to inventory any existing damage to components, such as walls, doors, windows, carpeting, fixtures, and equipment. It is agreed that the inspection is for the benefit of the Contractor and is intended to enable him to have the protection afforded by a record of such existing damage as is usually ascertainable.
    a. It is the responsibility of the Contractor to make arrangements for the inspection, notify the participants, record the findings, and issue minutes of the inspection to all participants within 10 days of the inspection.
15. Decontamination Enclosure Systems: Not less than 10 days prior to commencing any work, submit to the Engineer a description of the plans for construction of decontamination enclosure systems and for isolation of the work areas in compliance with this specification and applicable regulations.
16. Schedules: Not less than 10 days prior to commencing any work, provide a detailed schedule including work dates, work shift time, number of employees, dates of start and completion of all work activities (including mobilization, work area preparation, asbestos abatement, inspection and clearance monitoring, each phase of refinishing, and final inspections). Schedule shall be updated with each partial payment request.
17. Air Supply System (If brought onto site): Not less than 10 days prior to commencing any work, submit to the Engineer manufacturer's product information for each component used in the Type "C" supplied air respiratory system, including NIOSH and MSHA Certifications for each component in an assembly and/or the entire assembly.
    a. Provide a notarized certification that the system is capable of providing Grade "D" breathable air. Not less than 10 days prior to use of the air supply system, submit to the Engineer, a copy of the manufacturer's operations manual for the air purification system and the carbon monoxide monitor.
    b. Include in the submittal a drawing showing the assembly of components into a complete supplied air respiratory system. Also include a diagram showing the location of the compressor, the air purification system, backup air supply tanks (if used), and hose line connections.

c. Submit complete operating and maintenance instructions for all components and systems as a whole. This submittal shall be in bound manual form suitable for field use.

1.17 REPORTING

A. Daily Log: Maintain within the Clean Room of the decontamination unit or in the Contractor's office trailer a daily log documenting the dates and time of the following items, as well as other significant events:
   1. Minutes of meetings: purpose, attendees, brief discussion
   2. Visitations: authorized and unauthorized
   3. Personnel: by name, entering and leaving the work area
   4. Special or unusual events
   5. Personnel air monitoring tests and results
   6. Documentation with confirmation signature of Owner's on-site representative of the following:
      a. Inspection of work area preparation prior to start of removal and daily thereafter
      b. Removal of any polyethylene barriers
      c. Contractors inspections prior to encapsulation
      d. Removal of waste materials from work area and transport and disposal at approved site.
      e. Decontamination of equipment
      f. Final inspection and clearance air monitoring
      g. General Superintendent's Inspection Forms
      h. Asbestos Waste Shipment Records
      i. Daily differential pressure recorder charts

B. Provide two bound copies of this log to the Engineer with the application for final payment.

1.18 AIR MONITORING

A. Throughout the entire removal and cleaning operations, air monitoring will be conducted to ensure that the Contractor is complying with the EPA and OSHA regulations and any applicable state and local government regulations. The Owner will provide an air-monitoring technician to take area air samples at the job site at no cost to the Contractor.
   1. The Contractor shall be responsible for providing his own personnel monitoring within the work area as required to meet CFR 1926.1101.

B. Work Area Isolation: The purpose of the Owner's air monitoring will be to detect faults in the work area isolation such as:
   1. Contamination of the building outside of the work area with airborne asbestos fibers,
   2. Failure of filtration or rupture in the negative pressure system,
   3. Contamination of the exterior of the building with airborne asbestos fibers.
   4. Should any of the above occur, the Contractor shall immediately cease asbestos abatement activities until the fault is corrected. Work shall not recommence until authorized by the Engineer.

C. Work Area Airborne Fiber Count: The Owner will monitor airborne fiber counts in the work area. The purpose of this air monitoring will be to detect airborne fiber counts which may significantly challenge the ability of the work area isolation procedures to protect the balance of the building or outside of the building from contamination by airborne fibers.

D. Work Area Clearance: To determine if the elevated airborne fiber counts encountered during abatement operations have been reduced to an acceptable level, the Owner will sample and analyze air using procedures specified herein. The Owner will be conducting air monitoring throughout the course of the project.

1.19 AIRBORNE FIBER COUNTS

A. Outside Work Area: If any air sample taken outside of the work area exceeds the base line established below, immediately and automatically stop all work.
   1. If this air sample was taken inside the building and outside of critical barriers around the work area, immediately erect new critical barriers to isolate the affected area from the balance of the building.
   2. Erect Critical Barriers at the next existing structural isolation of the involved space (eg. wall, ceiling, floor).
   3. Decontaminate the affected area in accordance with the procedures outlined in Subsection entitled DECONTAMINATION OF WORK AREA.
   4. Respiratory protection shall be worn in affected area until area is cleared for reoccupancy.
   5. Leave critical barriers in place until completion of work and ensure that the operation of the negative pressure system in the work area results in a flow of air from the balance of the building into the affected area.
   6. If the exit from the Clean Room of the personnel decontamination unit enters the affected area, establish a temporary decontamination facility consisting of a Shower Room and Changing Room. After cleaning and decontamination of the affected area, remove the Shower Room and leave the Changing Room in place as an air lock.
   7. After certification of visual inspection in the work area, remove critical barriers separating the work area from the affected area. Final air samples will be taken within the entire area as set forth in the Subsection entitled WORK AREA CLEARANCE.

B. Fibers Counted: The following procedure will be used to resolve any disputes regarding fiber types when a project has been stopped due to excessive airborne fiber counts. "Airborne Fibers" referred to above include all fibers regardless of composition as counted in the NIOSH 7400 Procedure. If work has stopped due to high airborne fiber counts, air samples will be secured in the same area by the Owner for analysis by electron microscopy. "Airborne Fibers" counted in samples analyzed by Scanning or Transmission Electron microscopy shall be only asbestos fibers, but of any diameter and length. Subsequent to analysis by electron microscopy the number of "Airborne Fibers" shall be determined by multiplying the number of fibers, regardless of composition, counted by the NIOSH 7400 procedure by a number equal to asbestos fibers counted divided by all fibers counted in the electron microscopy analysis.

C. Effect On Contract Sum: If Electron microscopy is used to arrive at the basis for determining "Airborne Fiber" counts in accordance with the above paragraph, and if the average of airborne asbestos fibers in all samples taken outside the work area exceeds the base line, then the cost of such analysis will be born by the Contractor, at no additional cost to the Owner.

1.20 ANALYTICAL METHODS

A. The following methods will be used by the Owner in analyzing filters used to collect air samples.
   1. Phase Contrast Microscopy (PCM): Phase contrast microscopy will be performed using NIOSH 7400. This analysis will be carried out at the job site.

2. Transmission Electron Microscopy (TEM): Transmission electron microscopy will be performed using the "Interim Mandatory Transmission Electron Microscopy Analytical Method" contained in 40 CFR 763, Appendix A to Subpart E.
3. Base Line: Base Line is an action level expressed in fibers per cubic centimeter which is twenty-five percent greater than the largest of the following:
   a. Average of the PCM samples collected outside each work area.
   b. Average of the PCM samples collected outside the building.
   c. 0.0l fibers per cubic centimeter
4. Samples collected for TEM analysis will be held without analysis. These samples will be analyzed under the conditions and terms set forth in paragraph entitled FIBERS COUNTED and paragraph entitled EFFECT ON CONTRACT SUM.

B. Laboratory Testing: The services of a testing laboratory will be employed by the Owner to perform laboratory analysis of the air samples. A microscope and technician will be setup at the job site, so that verbal reports on daily ambient air samples can be obtained immediately. A complete record, certified by the testing laboratory, of all air monitoring tests and results will be furnished to the Engineer, Owner's Representative, the Owner and the Contractor.

1.21 TEST RESULTS

A. Asbestos-Containing Materials: Results of tests of asbestos-containing materials taken from surfaces within the scope of this project are available for inspection at the office of the Owner.
   1. Test results are for general information only and are provided by the building owner or his authorized representative. Test results will not necessarily be representative of all asbestos-containing materials within the scope of this project.

1.22 JOB CONDITIONS

A. Do not commence asbestos abatement work until:
   1. Arrangements have been made for disposal of waste at an acceptable site.
   2. Arrangements have been made for containing and disposal of wastewater resulting from wet stripping.
   3. Work areas and decontamination enclosure systems and parts of the building required to remain in use are effectively segregated.
   4. Tools, equipment, and material waste receptors are on hand.
   5. Arrangements have been made for building security.
   6. All other preparatory steps have been taken and applicable notices posted and permits obtained.

B. Title To Materials: All materials resulting from demolition work, except as specified otherwise, shall become the property of the Contractor and shall be disposed of as specified herein.

C. Protection of Existing Work To Remain: Perform demolition work without damage or contamination of adjacent work except as noted on the Drawings. Where such work is damaged or contaminated, it shall be restored to its original condition at no additional cost to the Owner.

1.23 PERSONNEL PROTECTION

A. Prior to commencement of work, the workers shall be instructed in, and shall be knowledgeable of, the hazards of asbestos exposure; use and fitting of respirators; protective

dress; use of showers; entry and exit from work areas, and all aspects of work procedures and protective measures.

1. It is the responsibility of the Contractor to assure that all personnel entering the work area wear approved respirator and protective clothing.

B. Worker Training: All asbestos abatement workers shall receive training and shall be accredited as required by 40 CFR 763.90(g). Training and accreditation shall be in accordance with 40 CFR 763, Appendix C to Subpart E. Training shall also be provided to meet the requirements of OSHA Regulations contained in 29 CFR l926, and SCDHEC Regulation No. 6l-86.l.

C. Medical Records: Maintain complete and accurate records of employee's medical examinations, during employment, for a period of 30 years after termination of employment and make records of the required medical examinations available for inspection and copying to: The Assistant Secretary of Labor for Occupational Safety and Health, The Director of The National Institute for Occupation Safety and Health (NIOSH), authorized representatives of either of them, and an employee's physician upon the request of the employee or former employee.

D. Worker Protective Clothing: Provide personnel exposed to airborne concentrations of asbestos fibers with fire retardant disposable protective whole body clothing, headcoverings, gloves, and foot coverings. Provide gloves to protect hands. Make sleeves secure at the wrists and make foot coverings secure at the ankles by the use of tape. Contractor shall require and monitor the use of complete protective clothing. A competent person designated by the contractor in accordance with 29 CFR 1926.1101 shall periodically examine protective clothing worn by employees in the work area for rips or tears. When rips or tears are detected, they shall be immediately mended or replaced.

E. Eye Protection: Provide goggles to personnel engaged in asbestos operations when the use of a full-face respirator is not required.

F. Visitor Protective Clothing: Provide authorized visitors with suitable protective clothing, headgear, eye protection and footwear, as described in paragraph entitled WORKER PROTECTIVE CLOTHING, whenever they are required to enter the work area, to a maximum of 3 changes for 3 visitors per day. One of the sets of protective clothing must be available for full time use by the Engineer.

G. Worker Respirator Equipment: Provide all persons with personally issued and marked respirators In accordance with 29 CFR 1910.134 for the hazard in the workplace.Selection shall be made for a reasonable expectation of exposure to which the worker will experience. Ensure that all persons properly use this equipment during abatement of asbestos containing materials and decontamination of the work area; and at all other times which air monitoring verifies that measured average airborne fiber concentrations measure 0.l fibers per cubic centimeter or greater. Under no circumstances will anyone be allowed in the work area during abatement activities (except as provided herein) without proper respirators.

1. Once air monitoring has been conducted to establish 8-hour TWA exposure levels, the type of respirators may be downgraded but never below the exposure levels within those allowed in 29 CFR 1926.1101(h) and provide for concentrations within the respirator of 0.01 f/cc or less.
2. If the permissible respirators fail to provide sufficient protection against volatiles emitted by any sealants used, the services of a qualified industrial hygienist will be procured, at

the Contractor's expense, to determine proper respiratory protection. The Owner will not be liable for the cost of increased respiratory protection.

3. Respirators: Select respirators from those certified by the National Institute for Occupational Safety and Health (NIOSH).
4. Air Supply (If brought onto site): At all times air supplied to type "C" respirators shall be Grade "D" Breathable Air as described by 29 CFR l9l0.l34 (D) (1), containing less than the following:

Carbon Monoxide:	10 parts per million
Carbon Dioxide:	1,000 parts per million
Condensed Hydrocarbons:	5 milligrams per cubic meter
Objectionable Odors:	None

   a. The air quality of the system shall be certified prior to beginning asbestos abatement work and every 30 days during asbestos abatement work by an independent laboratory certified by the American Board of Industrial Hygiene. Samples shall be collected under the supervision of a certified Industrial Hygienist. Copies of certified test results shall be submitted to the Engineer within 5 days of the sample collection.
5. Air Compressor: The air compressor used to supply Grade "D" Breathable Air to the Type "C" respirators shall be equipped with an intake filter, automatic start-stop pressure switch, high air temperature shutdown switch, low oil level shutdown switch, and pressure gauges. The compressor shall be equipped with an alarm system (audible and light) that will function when the system is shutdown for any of the above situations. The compressor shall have, following each stage, condensate traps, intercooler or after cooler, and safety valves.
   a. A gasoline or diesel engine driven compressor will be accepted provided the compressor intake is located a minimum of 15 feet above ground level, and 20 feet from the exhaust of the compressor engine. Gasoline or diesel driven compressors shall not be located inside the building.
   b. Ambient air pumps providing air at pressures less than 30 psig will not be allowed on this project.
6. Air Purification Unit: Following the air compressor shall be an air purification unit for the removal of moisture, odors, oil, hydrocarbons, and carbon monoxide. The first stage of the purification unit shall be one or more coalescing filters for the removal of water, oil, and solid particles larger than 10 micrometers in diameter. Following the coalescing filter(s) shall be two adsorption filters, the first consisting of a column packed with a molecular sieve to remove water vapor, gaseous hydrocarbons, nitrogen oxides, sulfur compounds, and other odors. The second adsorption filter shall be a column containing activated charcoal to remove additional unpleasant odors and oil vapor. Each of these sorbent materials must be checked routinely and replaced according to manufacturer's recommendations. Finally there shall be a mechanical filter to remove any particles larger than 0.5 micrometers in diameter.
   a. Following the air purification unit, but prior to an air storage system, the system must be equipped with a carbon monoxide monitor. This instrument must be calibrated daily using procedures specified by the manufacturer. The carbon monoxide monitor shall be equipped with a visual and audible alarm to alert the operator of a high carbon monoxide level in the air supply. Such an alarm

condition will shut down the air compressor (CO level exceeds the value specified for Grade "D" Breathable Air). The unit shall have an air-powered horn to alert the operator of electrical power failure since the carbon monoxide monitor will not function without electricity.

7. Air Storage System: The air storage system shall be capable of supplying Grade "D" Breathable Air to a full complement of workers for a minimum of one hour after compressor shutdown. The air supply system shall switch over to the air storage system automatically upon shutdown of the air compressor. Manual switchover to air storage system upon alarm signal is not acceptable. The reserve "escape" capacity shall be demonstrated as follows to the satisfaction of the Engineer prior to commencement of any abatement activities:
   a. The compressor shall be started and allowed to bring the system up to operating capacity;
   b. A full compliment of workers shall be connected to the system. "Full compliment" is defined as the maximum number of workers that will be simultaneously using the system during the course of the job;
   c. The compressor shall be stopped and escape timing started simultaneously;
   d. A minimum period of one hour shall elapse prior to cessation of flow of Grade "D" Breathable Air;
   e. At no time during the course of the test shall the compressor be restarted.
   f. All pressure vessels, valves, gauges, tubing, and fittings shall meet applicable ASME Codes for pressure operation.
   g. In lieu of an air storage system, Contractor may use Type "C" respirators equipped with HEPA cartridges. Failure of the supplied air shall result in the automatic switchover to the HEPA filters. Should the air supply system fail, workers shall proceed immediately to the decontamination enclosure system and exit the work area using procedures described herein. Under no circumstances are abatement activities to proceed without the outside supplied air. Workers shall not use the HEPA filters to enter the work area and proceed to the location of air supply lines. The respirator connection end of all air supply lines shall terminate in the clean room or shower of the decontamination unit so that workers can connect their respirators to supplied air BEFORE entering the work area.
8. Visitor Respirator Equipment: Provide authorized visitors with new suitable respirators, as described in paragraph entitled WORKER RESPIRATOR EQUIPMENT, whenever they are required to enter the work area, to a maximum of 3 visitors per day. One of these respirators must be available for full time use by the Engineer. One airline from the air supply system must be specifically assigned to the Engineer and must be available for his use immediately upon arrival to the site. This line shall not be used by workers in the work area. The length of the Engineer's air line(s) must be sufficient to allow the Engineer access to all work areas at all times.

1.24 DANGER SIGNS AND LABELS

A. Posting: Provide and display danger signs at each location where airborne concentrations of asbestos fibers may be in excess of 0.01 fibers/cc. Post signs at such a distance from such a location so that an employee may read the signs and take necessary protective steps before entering the area marked by the signs. Post signs at all approaches to work areas or areas containing excessive concentrations of airborne asbestos fibers.

B. OSHA Danger Signs: panel: Provide 20" x 14" vertical format signs with the following legend in the lower

DANGER

ASBESTOS

CANCER AND LUNG DISEASE HAZARD

AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE
CLOTHING ARE REQUIRED IN THIS AREA

1. The sign shall also contain a pictorial representation of possible danger or hazard, or other suitable warning as approved by the Engineer. Sign shall meet the requirements of 29 CFR 1926.200.
2. A sample of the signs to be used shall be submitted to the Engineer for approval prior to beginning work area preparation.

C. Danger Labels: Affix danger labels to all raw materials, mixtures, scrap, waste, debris, and other products containing asbestos fibers, or to their containers, except that no label is required where asbestos fibers have been modified by a bonding agent, coating, binder, or other material so that during any reasonably foreseeable use, handling, storage, disposal, processing, or transportation, no airborne concentrations of asbestos fibers in excess of 0.01 fibers/cc. Labels shall be black letters on a yellow background and shall read:

DANGER

CONTAINS ASBESTOS FIBERS

AVOID CREATING DUST

CANCER AND LUNG DISEASE HAZARD

1. In addition, each container shall be labeled in accordance with the U.S. Department of Transportation regulations as contained in 49 CFR Parts 171 and 172. The label shall contain the following wording:

RQ ASBESTOS
CLASS 9
NA 2212, III

1. Lettering shall be of a size that is easily read and be reproduced in sharp relief against the background on which printed. The label shall be affixed to an area of the container away from any markings or labels which could reduce the effectiveness of the label.

D. Bag Labels: Additionally, <u>each bag</u> shall be labeled in accordance with EPA NESHAPS rule 40 CFR 61.150(a)(1(v) to include the following information:

General: ~~Contractors Name~~

Contractors Address

Date:

Waste From: Project Name

Project Address

1.25 PERSONNEL DECONTAMINATION UNIT

A. Prior to any asbestos abatement work, including placement of plastic on walls that will contact or disturb asbestos containing surfaces, or removal of light fixtures or any items on asbestos containing surfaces, construct a Personnel Decontamination Unit consisting of a serial arrangement of connected rooms or spaces, Changing Room, Shower Room, and Equipment Room. Require all persons without exception to pass through this decontamination unit for entry into and exiting from the work area for any purpose. Do not allow parallel routes for entry or exit. Do not remove equipment or materials through Personnel Decontamination Unit. Provide temporary lighting within decontamination units as necessary to reach a lighting level of 100-foot candles.

B. Build suitable framing or use existing rooms, with the Owner's written approval, connected with framed-in tunnels if necessary; line with 6-mil plastic; seal with tape at all lap joints in the plastic for all enclosures and decontamination enclosure system rooms. Decontamination units and access tunnels constructed outside must be constructed with tops made of 5/8" plywood, or approved equal. In all cases, access between contaminated and uncontaminated rooms or areas shall be through an airlock. In all cases, access between any two rooms within the decontamination enclosure systems shall be through a curtained doorway, or rigid (wood or fiberglass) self-closing doors.

1. Clean Room: Provide a room that is physically and visually separated from the rest of the building for the purpose of changing into protective clothing. Construct using polyethylene sheeting, at least 6-mil in thickness, to provide an airtight seal between the Clean Room and the rest of the building. Locate so that access to work area from Clean Room is through Shower Room. Separate Clean Room from the building by a sheet polyethylene flapped doorway, or rigid self-closing doors.
    a. Require workers to remove all street clothes in this room, dress in clean disposable coveralls, and don respiratory protection equipment. Do not allow asbestos contaminated items to enter this room. Require workers to enter this room either from outside the structure dressed in street clothes, or naked from the showers.
    b. An existing room may be utilized as the Clean Room if it is suitably located and of a configuration whereby workmen may enter the Clean Room directly from the Shower Room. Protect all surfaces of room with sheet plastic. Authorization for this must be obtained from the Owner's Representative in writing prior to start of construction.
    c. Maintain floor of Clean Room dry and clean at all times. Do not allow overflow water from shower to wet floor in Changing Room.
    d. Damp wipe all surfaces twice after each shift change with a disinfectant solution.
    e. Provide a continuously adequate supply of disposable bath towels.
    f. Provide posted information for all emergency phone numbers and procedures.

g. Provide one storage locker per employee.
h. Provide all other components indicated on the contract drawings.

2. Shower Room: Provide a completely water tight operational shower to be used for transit by cleanly dressed workers heading for the work area from the Clean Room, or for showering by workers headed out of the Work Area after undressing in the Equipment Room.
   a. Construct room by providing a shower pan and 2 shower walls in a configuration that will cause water running down walls to drip into pan. Install a freely draining wooden floor in shower pan at elevation of top of pan.
   b. Separate this room from the rest of the building with airtight walls fabricated of 6-mil polyethylene.
   c. Separate this room from the Clean and Equipment Rooms with airtight walls fabricated of 6mil polyethylene.
   d. Provide showerhead and controls.
   e. Provide temporary extensions of existing hot and cold water and drainage, as necessary for a complete and operable shower.
   f. Provide a soap dish and a continuously adequate supply of soap and maintain in sanitary condition.
   g. Arrange so that water from showering does not splash into the Clean or Equipment Rooms.
   h. Arrange water shut off and drain pump operation controls so that a single individual can shower without assistance from either inside or outside of the work area.
   i. Provide flexible hose showerhead.
   j. Pump waste water to drain or to storage for use in amended water. If pumped to drain, provide 20 micron and 5 micron waste water filters in line to drain or waste water storage. Locate filters inside shower unit so that water lost during filter changes is caught by shower pan.
3. Equipment Room (Contaminated Area): Require work equipment, footwear and additional contaminated work clothing to be left here. This is a change and transit area for workers. Separate this room from the work area by a 6-mil polyethylene flap doorway, or rigid self-closing door.
   a. Separate this room from the rest of the building with airtight walls fabricated of 6-mil polyethylene.
   b. Separate this room from the Shower Room and work area with airtight walls fabricated of 6mil polyethylene.

C. Work Area: Separate work area from the Equipment Room by polyethylene barriers. If the airborne asbestos level in the work area is expected to be high, add an intermediate cleaning space between the Equipment Room and the work area. Damp wipe clean all surfaces after each shift change.

D. Equipment Removal Procedures: Clean surfaces of contaminated containers and equipment thoroughly by wet sponging or wiping and HEPA vacuuming before moving such items into the equipment decontamination enclosure system washroom for final cleaning and removal to uncontaminated areas. Ensure that personnel do not leave work areas through the equipment decontamination enclosure.

1.26 EQUIPMENT DECONTAMINATION UNITS

A. Provide an Equipment Decontamination Unit consisting of a serial arrangement of rooms: Clean Room, Holding Room, Wash Room for removal of equipment and material from work area. Do not allow personnel to enter or exit work area through Equipment Decontamination Unit.
   1. Wash Down Station: Provide an enclosed shower unit located in work area just outside Wash Room as an equipment, bag and container cleaning station.
   2. Wash Room: Provide Wash Room for cleaning of bagged or containered asbestos-containing waste materials passed from the work area. Construct Wash Room of 2 by 4 inch (minimum) wood framing and polyethylene sheeting, at least 6-mil in thickness and located so that packaged materials, after being wiped clean can be passed to the Holding Room. Separate this room from the work area by flaps of 6-mil polyethylene sheeting, or rigid self closing doors.
   3. Holding Room: Provide Holding Room as a drop location for bagged asbestos-containing materials passed from the Wash Room. Construct Holding Room of 2 by 4 inch (minimum) wood framing and polyethylene sheeting, at least 6-mil in thickness and located so that bagged materials cannot be passed from the Wash Room through the Holding Room to the Clean Room.
   4. Clean Room: Provide Clean Room to isolate the Holding Room from the building exterior. Construct Clean Room of 2 by 4 inch (minimum) wood framing and polyethylene sheeting, at least 6-mil in thickness and locate to provide access to the Holding Room from the building exterior. Separate this room from the exterior by flaps of 6-mil polyethylene sheeting, or rigid self closing doors.

1.27 SECURITY

A. Provide barricades and adequate protection for persons at all times in all areas in which work is being performed while the work is in progress. A 24 hour security program for the duration of the contract is mandatory. Any item that is reported to be damaged, missing, or stolen from the building under the control of the Contractor shall be repaired or replaced by the Contractor at no additional cost to the Owner.
   1. Close the designated job area to the public. Establish a security system so that only authorized personnel can enter the asbestos abatement work areas. Maintain a list of those so authorized at the entrance to the project. No other persons shall be admitted. State and Federal Inspectors may enter only if carrying proper identification.
   2. Station a competent person at the entrance to the building or work area at all times that workers are present in the work area. Maintain emergency exits or alternate exits during construction. Secure any additional areas that might be affected by the work. At all times when workers are not present in the work area, the work area must be secured by either locking the entrance or stationing a competent person at the entrance.
      a. Logs: Maintain a 24 hour per day visitor and worker log including name, address, company name, time in, time out, date, and reason for being on the job. Require that each and every person entering the work area sign in and out. The competent person stationed at the entrance to the work area shall be responsible for this. Include notations of any safety irregularity. Make the log available to the Owner and Engineer at all times.
      b. Safety: Ensure the safe passage of persons around the area of demolition. Conduct operations to prevent injury or damage to building structure, other facilities, and persons. Notify local medical emergency personnel, both ambulance crews and

hospital emergency room staff, as to the possibility of having to handle contaminated injured and advise as to safe decontamination procedures.

3. Designate and mark emergency exits from the work area. Arrows indicating direction to emergency exits shall be located throughout the work area.
   a. Police and Fire Departments: Before starting actual removal of the asbestos material, notify the local police and fire departments as to the dangers of entering the work area. Make every effort to help these agencies form plans of action should their personnel need to enter the contaminated area, including decontamination.

PART 2 - PRODUCTS

2.1 QUALITY ASSURANCE

A. Services Of Manufacturer's Representative: Obtain asbestos abatement materials only from manufacturers who will, if required, send a qualified technical representative to the project site, at no additional cost to the Owner, for the purpose of advising the Contractor of proper procedures and precautions for the use of the materials.

2.2 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver all materials in the original packages, containers, or bundles bearing the name of the manufacturer and the brand name.

B. Storage: Store all materials subject to damage off the ground, away from wet or damp surfaces, and under cover sufficient to prevent damage or contamination.

C. Do not use damaged or deteriorating materials; remove from the premises. Dispose of material that becomes contaminated with asbestos in accordance with the applicable regulations.

2.3 MATERIALS

A. Plastic Sheet: Plastic sheet, (0.006”) 6-mil minimum thickness, unless otherwise specified, in sizes to minimize the frequency of joints.

B. Tape: Capable of sealing joints of adjacent sheets of plastic and for attachment of plastic sheet to finished or unfinished surfaces of dissimilar materials and capable of adhering under dry and wet conditions, including use of amended water. Provide tape which minimizes damage to surface finishes.

C. Cleaning Materials: Use materials recommended by manufacturer of surface to be cleaned. Use cleaning materials only on surfaces recommended by the cleaning material manufacturer.

D. Surfactant (Wetting Agent): 50% polyoxyethylene ether and 50% polyoxyethylene ester, or equivalent, and mixed with water to provide a concentration of one ounce surfactant to 5 gallons of water. Equivalent should be nontoxic and non-irritating to skin and eyes, and non-carcinogenic, as approved by EPA and the owners representative.

E. Plastic Bags: 6-mil (0.006") thickness with caution labels in accordance with OSHA Regulation 29 CFR 1910.1001(g).

F. Impermeable Containers: Suitable to receive and retain any asbestos-containing or contaminated materials until disposal at an approved site. Containers must be both air-and water-tight.

1. Bags and containers in which asbestos-contaminated material has been placed must remain under the positive control of the Contractor and must never be left unattended in an area or on a vehicle where unauthorized persons could gain access. Bags shall immediately be placed in drums when full.
2. Provide metal or fiber drums with tightly fitting lids and double thickness 6-mil plastic bags capable of being sealed, and sized to fit within the drums.

2.4 ENCLOSURE MATERIALS

A. Other Materials: Provide all other materials, such as lumber, nails and hardware, which may be required to construct and dismantle the decontamination area and the barriers that isolate the work area.

2.5 EQUIPMENT

A. Negative Air Machines: Supply the required number of asbestos air filtration units to the site in accordance with these specifications. Each unit shall include the following:
   1. Cabinet: Constructed of steel or other durable materials able to withstand damage from rough handling and transportation. Cabinet shall be factory sealed to prevent asbestos-containing dust from being released during use, transport, or maintenance. Access to and replacement of all air filters shall be from intake end. Unit shall be mounted on casters or wheels.
   2. Fans: Rate capacity of fan according to useable air-moving capacity under actual operating conditions. Use centrifugal-type fan.

B. HEPA Filters: The final filter shall be the HEPA type. The filter media (folded into closely pleated panels) must be completely sealed on all edges with a structurally rigid frame. A continuous rubber gasket shall be located between the filter and the filter housing to form a tight seal. Each filter shall be individually tested and certified by the manufacturer to have an efficiency of not less than 99.97 percent when challenged with 0.3 ȝm dioctylphthalate (DOP) particles. Testing shall be in accordance with Military Standard Number 282 and Army Instruction Manual 136-300-175A. Each filter shall bear a UL 586 label to indicate ability to perform under specified conditions. Each filter shall be marked with the name of the manufacturer, serial number, air flow rating, efficiency and resistance, and the direction of test air flow.
   1. Prefilters: Prefilters which protect the final filter by removing the larger particles are required to prolong the operating life of the HEPA filter. Two stages of prefiltration are required. The first-stage prefilter shall be a low-efficiency type (e.g., for particles 10 um and larger). The second-stage (or intermediate) filter shall have a medium efficiency (e.g., effective for particles down to 5 um). Prefilters and intermediate filters shall be installed either on or in the intake grid of the unit and held in place with special housings or clamps.
   2. Instrumentation: Each unit shall be equipped with a Magnahelic gauge or manometer to measure the pressure drop across filters and indicate when filters have become loaded and need to be changed. A table indicating the useable air-handling capacity for various static pressure readings on the Magnahelic gauge shall be affixed near the gauge for reference, or the Magnahelic reading indicating at what point the filters should be changed, noting Cubic Feet per Minute (CFM) air delivery at that point. Provide units equipped with an elapsed time meter to show the total accumulated hours of operation.
   3. Safety and Warning Devices: The unit shall have an electrical (or mechanical) lockout to prevent fan from operating without a HEPA filter. Units shall be equipped with automatic

shutdown system to stop fan in the event of a major rupture in the HEPA filter or blocked air discharge. Indicator lights are required to indicate normal operation, too high a pressure drop across the filters (i.e., filter overloading), and too low of a pressure drop (i.e., major rupture in HEPA filter or obstructed discharge).

4. Electrical Components: Provide electrical components which are approved by the National Electrical Manufacturers Association (NEMA) and Underwriter's Laboratories (UL). Each unit shall be equipped with overload protection sized for the equipment. The motor, fan, fan housing, and cabinet shall be grounded.
   a. Auxiliary Generator: Provide a gasoline powered self starting generator with a capacity adequate to power a minimum of 50% of the negative air machines in operation at any time during the work.

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION

A. Examine the areas and conditions under which asbestos will be abated and notify the Engineer in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.

B. Danger Signs: Before any work commences, post danger signs in and around the Work Area to comply with 29 CFR l926.1101(k)(1) as required by federal and state regulations, and as specified herein.

C. Electrical Work: Perform all necessary electrical work using qualified electricians.

3.2 WORK PROCEDURE

A. Perform asbestos related work in accordance with 29 CFR 1926.1101 and as specified herein. Use wet removal procedures. Personnel shall wear and utilize protective clothing and equipment as specified herein. Eating, smoking, or drinking shall not be permitted in the asbestos control area. Personnel of other trades not engaged in the removal and demolition of asbestos shall not be exposed at any time to airborne concentrations of asbestos unless all the personnel protection provisions of this specification are complied with by the trade personnel. Removal of lights and other objects in contact with asbestos containing materials are considered as asbestos abatement activities. Thus, individuals involved in such activities must meet all requirements of federal and state regulations for asbestos abatement workers, including training and medical examinations. Workers release forms are required from these individuals.

B. Provide and post, in the Equipment Room and the Clean Room, the decontamination and work procedures to be followed by workers, as described hereinafter.

C. Worker Protection Procedures: Each worker and authorized visitor shall, upon entering the job site, remove street clothes in the Clean Room and put on a respirator and clean protective clothing before entering the Equipment Room or the work area. All workers shall remove gross contamination before leaving the work area. All clothing (coveralls, head covers, boots, etc.) shall be removed and properly disposed of before leaving Equipment Room. Naked, with the exception of their respirators, the workers shall proceed to the Shower Room. Under the shower, respirators will be removed and cleaned. Cleaned respirators will be placed in suitable clean plastic bags and carried by employees to Clean Room. Soap, towels, etc., shall be

furnished by the Contractor. The Contractor shall maintain proper sanitary conditions. The contractor's designated competent person shall ensure that these practices are being adhered to.

1. Following showering and drying off, each worker and authorized visitor shall dispose of towels as contaminated waste, and proceed directly to the Clean Room and dress in clean clothes at the end of each day's work, or before eating, smoking, or drinking. Before re-entering the work area from the Clean Room, each worker and authorized visitor shall put on the applicable respirator and shall dress in clean protective clothing.
2. Contaminated work footwear shall be stored in the Equipment Room when not in use in the work area. Upon completion of asbestos abatement, dispose of footwear as contaminated waste.
3. Workers removing waste containers from the Equipment Decontamination Enclosure shall enter the holding area from outside wearing a respirator and dressed in clean coveralls. No worker shall use this system as a means to leave or enter the washroom or the work area.
4. Workers shall not eat, drink, smoke, or chew gum or tobacco in asbestos abatement work areas.
5. Workers shall be fully protected with respirators and protective clothing immediately prior to the first disturbance of asbestos-containing or contaminated materials and until final clean-up is completed. This includes the removal of any equipment in contact with asbestos-containing material, such as lights, HVAC grills, etc.

3.3 PREPARATION OF THE WORK AREA

A. Completely isolate the work area from other parts of the building so as to prevent asbestos-containing dust or debris from passing beyond the isolated area. Should the area beyond the work area(s) become contaminated with asbestos-containing dust or debris as a consequence of the work, clean those areas in accordance with the procedures specified herein. Perform all such required cleaning or decontamination at no additional cost to Owner. Place all tools, scaffolding, staging, etc. necessary for the work in the area to be isolated prior to erection of plastic sheeting temporary enclosure.

B. Electric Power: Shut down electric power. Provide temporary power and lighting and ensure safe installation of temporary power sources and equipment in accordance with applicable electrical code requirements. Provide 24-volt safety lighting or provide ground-fault interrupter circuits as power source for lights and electrical equipment.

C. HVAC: Shut down and isolate heating, cooling, and ventilating air systems in the contaminated areas to prevent contamination and fiber dispersal to other areas of the structure. During the work, seal vents within the work area with tape and plastic sheeting, or as indicated on the drawings.
   1. Remove all HVAC system filters in work area. Pack disposable filters in sealable double 6-mil plastic bags for burial in the approved waste disposal site; replace with new filters after final cleanup. Wet-clean permanent filters; reinstall after final cleanup.
   2. Remove all heating and ventilating equipment, grills, diffusers, returns, and other items located on the asbestos bearing surfaces. Clean, seal with 4-mil plastic and remove from the work area. Reinstall after final clean-up.
   3. Thoroughly clean all HVAC equipment.

D. LIGHT FIXTURES: Remove all light fixtures bearing on the asbestos material using qualified electricians. Clean, seal with 6-mil plastic.

1. Seal with plastic all fixtures noted "abandoned" on the Drawings. Dispose of these fixtures as contaminated asbestos waste.

E. FIXED OBJECTS: Preclean non-removable furniture, book shelving, equipment, heat fans, fire alarms, pipes, ductwork, wires and conduits, lockers, skylights, speakers, and other fixed objects within the proposed work areas, using HEPA filtered vacuum equipment and wet cleaning methods as appropriate prior to abatement activities, and enclose with minimum 4-mil plastic sheeting sealed with tape. Existing pipe insulation which does not contain asbestos materials and is not scheduled for removal shall be protected with plastic and joints glued or taped to keep dry and free of asbestos fibers.

F. Openings: Seal off all openings, including but not limited to corridors, doorways, windows, skylights, ducts, grills, diffusers, and any other penetrations of the work areas, with 6-mil plastic sheeting and sealed with tape.

G. Floor, Wall, And Ceiling Penetrations: Prior to any abatement activities, seal all floor, wall, and ceiling openings or penetrations that have not already been sealed. This includes penetrations through ceiling and floor slabs, both empty holes and holes accommodating items such as cables, pipes, ducts, conduit, etc.; and expansion joints in floors and wall and floor slab assemblies.

1. Use a combination fire stop foam and fire stop sealant equivalent to Dow Corning Fire Stop Foam and Dow Corning Fire Stop Sealant. Material shall be applied in accordance with manufacturer's recommendations.

H. Carpet: Remove all carpet in work areas and dispose of as asbestos contaminated waste. HEPA vacuum carpet prior to applying plastic to walls and floor, but after negative air units are in place, all openings in HVAC system are sealed off, and floor penetrations are sealed off.

1. After HEPA vacuuming, remove carpet. Large pieces of carpet can be rolled and wrapped in two layers of 6-mil polyethylene, or cut into smaller pieces and placed in double thickness 6-mil polyethylene bags. Label as described herein for asbestos waste.
2. Workers shall be equipped in protective clothing and respirators during HEPA vacuuming and removal of carpet. As a minimum, cartridge type respirators are required.

I. Ceiling Mounted Objects: Remove and clean all ceiling mounted objects, such as lights, HVAC grills, etc. and other items not previously sealed off, that interfere with asbestos abatement. Use localized water spraying or HEPA filtered vacuum equipment during fixture removal to reduce fiber dispersal.

J. Fire Exits: Maintain emergency and fire exits from the work areas, or establish alternative exits satisfactory to the local fire officials. Coordinate project with local fire and police departments, and Owner's Representative.

3.4 TUNNEL TO WORK AREA

A. General: Access to the work areas from which asbestos is to be removed may require access through uncontaminated areas. Construct tunnels of 2 by 4 inch (minimum) wood and 6-mil polyethylene sheeting from the entrance into the decontamination unit to these work areas. Install the 2 by 4 inch (minimum) wood tunnel framing "free standing"; do not attach in any way to existing walls, floors, or ceilings unless instructed otherwise on the Drawings. Completely enclose the tunnel, including top and floor, with two layers of 6-mil polyethylene. Install one layer of polyethylene on the walls and ceiling on each side of the framing. If the

tunnel is visible to the outside, cover with a minimum of one layer of opaque 4-mile poly-ethylene sheeting.

3.5 SEPARATION OF WORK AREAS FROM OCCUPIED AREAS

A. General: Separate parts of the building required to remain in use (as shown on Drawings) from parts of the building that will undergo asbestos abatement by means of airtight barriers.

3.6 MAINTENANCE OF ENCLOSURE SYSTEMS

A. Ensure that barriers and plastic linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately upon discovery. Visually inspect enclosures at the beginning of each work period. Use smoke methods to test effectiveness of barriers when directed by the Engineer.

3.7 CONTROL ACCESS

A. Permit access to the work area only through the Decontamination Unit. All other means of access shall be closed off and sealed and warning signs displayed on the clean side of the sealed access.

B. Visual Barrier: Where the work area is immediately adjacent to or within view of occupied areas, provide a visual barrier of opaque polyethylene sheeting at least 4 mil in thickness so that the work procedures are not visible to building occupants. Where this visual barrier would block natural light, substitute frosted sheet plastic in locations approved by the Engineer.

C. Physical Barrier: Where the area adjacent to the work area is accessible to the public, construct a solid barrier on the public side of the sheeting to protect the sheeting. Construct barrier with nominal 2 by 4 inch (minimum) wood or metal studs 16 inches on centers, securely anchored to prevent movement, covered with minimum 1/4 inch thick hardboard, 1/2 inch gypsum wall board, or 1/2 inch plywood.

3.8 CRITICAL BARRIERS

A. Completely separate the work area from other portions of the building, and the outside by sheet plastic barriers at least 4 mil in thickness, or by sealing with duct tape.
   1. Individually seal all ventilation openings (supply and exhaust), lighting fixtures, clocks, doorways, windows, convectors and speakers, and other openings into the work area with duct tape alone or with polyethylene sheeting at least 2 layers of 6 mil poly taped securely in place with duct tape. Maintain seal until all work including work area decontamination is completed. Take care in sealing off lighting fixtures to avoid melting or burning of sheeting.
   2. Provide sheet plastic barriers at least 4-mil in thickness as required to completely seal openings from the work area into adjacent areas. Seal the perimeter of all sheet plastic barriers with duct tape.
   3. Mechanically support sheet plastic independently of duct tape so that seals do not support the weight of the plastic. Following are acceptable methods of supporting sheet plastic barriers. Alternative support methods may be used if approved in writing by the Engineer.
      a. Plywood squares 6" x 6" x 3/8" held in place with one 6-penny smooth masonry nail or electo-galvanized common nail driven through center of the plywood and duct tape on plastic so that plywood clamps plastic to the wall. Locate plywood squares at each end, corner and at maximum of 4 feet on centers.

b. Nylon or polypropylene rope minimum 1/4 inch in diameter suspended between supports securely fastened on either side of opening at maximum one foot below ceiling. Tighten rope so that it has 2 inch maximum dip. Drape plastic over rope from outside work area so that a 2 foot flap of plastic extends over rope into work area. Staple or wire plastic to itself one inch below rope at maximum 6 inches on centers to form a sheath over rope. Lift flap seal to ceiling with duct tape or spray cement. Seal loop at bottom of flap with duct tape. Erect entire assembly so that it hangs vertically without a "shelf" upon which debris could collect.

3.9 PRIMARY BARRIER

A. Pre-Cleaning: Clean all contaminated furniture, equipment, and or supplies with a HEPA filtered vacuum cleaner or by wet cleaning prior to being moved or covered. Clean all surfaces in work area with a HEPA filtered vacuum or by wet wiping prior to the installation of any sheet plastic.

B. Floors: Cover floor of work area (except in areas from which floor tile is to be removed) with 2 individual layers of clear polyethylene sheeting, each at least 6-mil in thickness, turned up walls at least 12 inches. Form a sharp right angle bend at junction of floor and wall so that there is no radius which could be stepped on causing the wall attachment to be pulled loose. Duct tape all seams in floor covering. Locate seams in top layer six feet from, or at right angles to, seams in bottom layer. Install sheeting so that top layer can be removed independently of bottom layer.

C. Miscellaneous Item Removal: Remove all general construction items such as cabinets, casework, doors and window trim, moldings, ceilings, trim, etc., which cover the surface of the work as required to prevent interference with the work. Clean, decontaminate and reinstall, unless otherwise indicated, all such materials, upon completion of all removal work with materials, finishes, and workmanship to match existing installations before start of work.

D. Walls: Cover all walls in work area including CRITICAL BARRIER sheet plastic barriers with one layer of polyethylene sheeting, at least 4 mil in thickness, mechanically supported and sealed with duct tape in the same manner as CRITICAL BARRIER sheet plastic barriers. Tape all joints including the joining with the floor covering with duct tape or as otherwise indicated on the contract documents or in writing by the Engineer.

E. Stairs and Ramps: Do not cover stairs or ramps with unsecured sheet plastic. Where stair or ramps are covered with plastic provide ¾ inch exterior grade plywood treads securely held in place, over plastic. Do not cover rungs or rails with any type of protective materials.

F. Extension Of Work Area: If the enclosure barrier is breeched in any manner that could allow the passage of asbestos debris or airborne fibers, then add affected area to the work area, enclose it as required by this section of the specification and decontaminate it as specified herein.

G. Construct a clear viewing port (24”x24”) in an external wall of each containment area to allow unobstructed observation of the abatement in the work area.

3.10 NEGATIVE PRESSURE

A. Establish negative pressure in the work area by installation of High Efficiency Particulate Air (HEPA) filter air purifying devices. Comply with ANSI Z9.2, Local Exhaust Ventilation Requirements. Maintain system in operation 24 hours per day until decontamination of the

work area is completed and area has been certified clean by air monitoring tests and visual inspections. Discharge of asbestos fibers to the outside of the building will not be permitted.

1. Size negative air pressure system(s) to provide a minimum of one air change every l5 minutes for the area under negative pressure. Locate the exhaust unit(s) so that makeup air enters the work area primarily through the decontamination unit and traverses the work area as much as possible. The intent is to provide the air change specified in each work area (room), not just the specified negative pressure. Place the end of the unit or its exhaust duct through an opening in the plastic barrier or wall covering. Seal the plastic around the unit or duct with tape. Wherever possible, the units shall exhaust to the outside of the building and away from walkways.
2. The system shall maintain an air pressure differential of minus 0.02 inch of water. Test the negative pressure system prior to any abatement actions to insure that the 0.02 inch differential is present. The Engineer may require the use of ventilation smoke tubes to check the system performance.

B. Alternate Containment System: In lieu of the containment system previously described consisting of a decontamination enclosure system utilizing curtained doorway, and a negative air system to exhaust sufficient air to achieve one air change every 15 minutes, the following system will be allowed:

1. Construct a decontamination unit consisting of a totally enclosed Equipment Room, Shower Room, Air Locks, and Clean Room as described above except that instead of curtained doorways between rooms, doorways shall be solid core rigid wooden or fiberglass doors. Door at entrance into Clean Room from the uncontaminated area shall contain a HEPA filter. This doorway shall have gasketed seals around the HEPA filter and the edges of the door to provide a tight seal. HEPA filter shall be mounted in the door securely using a mechanical fastening system. Each door shall be equipped with a self closing mechanism.
2. Negative pressure units as described previously shall be utilized to create a pressure differential of 0.02 inches of water between the work area and the outside uncontaminated area. Only the required air volume to create the negative pressure shall be exhausted through the HEPA filter unit outside the work area. Additional HEPA filter units shall be located within the work area to provide for air circulation. Enough units to provide an air change every 15 minutes shall be located within the work area, but shall not exhaust air outside of the work area. They can exhaust air from one room to another, within the same containment area.

C. Pressure Differential Measurements: Pressure differential recordings for each work day shall be submitted to the Engineer or Owner’s Representative at the end of each week. The Contractor shall notify the Engineer and Owner’s Representative immediately of any variance in the pressure differential which could cause exposure of adjacent unsealed areas to asbestos fiber concentrations in excess of ambient concentrations. Pressure recordings shall be by a continuous recorder. Pressure differential recorders shall be checked weekly against a manometer and shall be calibrated weekly by a qualified individual. Certificates of calibration describing the calibration methods and corrections needed or adjustments made to the pressure differential recorder shall be submitted to the Engineer and Owner’s Representative within three days of the date of calibration.

3.11 REMOVAL OF ASBESTOS-CONTAINING MATERIALS

A. Wet Removal: Thoroughly wet to satisfaction of Engineer asbestos-containing materials to be removed prior to stripping and/or tooling to reduce fiber dispersal into the air. Accomplish wetting by a fine spray (mist) of amended water or removal encapsulant. Saturate material sufficiently to wet to the substrate without causing excess dripping. Allow time for water or removal encapsulant to penetrate material thoroughly. If amended water is used, spray material repeatedly during the work process to maintain a continuously wet condition. If a removal encapsulant is used, apply in strict accordance with manufacturer's written instructions. Perforate outer covering of any insulation which has been painted and/or jacketed in order to allow penetration of amended water or removal encapsulant, or where necessary, carefully strip away while simultaneously spraying amended water or removal encapsulant on the installation to minimize dispersal of asbestos fibers into the air.
   1. Mist work area continuously with amended water whenever necessary to reduce airborne fiber levels.
   2. Remove saturated asbestos-containing material in small sections from all areas. Do not allow material to dry out. As it is removed, simultaneously pack material while still wet into disposal bags. Twist neck of bags, bend over and seal with minimum three wraps of duct tape. Clean outside and move to washdown station adjacent to material decontamination unit.

B. Sprayed-on Fireproofing or Architectural Finish on Scratch Coat: Spray asbestos-containing architectural acoustic finish with a fine mist of amended water or removal encapsulant. Allow time for amended water or removal encapsulant to saturate materials substrate. Do not over saturate to cause excess dripping. Scrape materials from substrate. Remove materials in manageable quantities and control the decent to staging or floor below, if over 20 feet use drop chute to contain material through decent. If using amended water, spray mist surface continuously during work process. If using removal encapsulant follow manufacturer's written instructions. Remove residue remaining on substrate after scraping using stiff nylon bristled hand brush, or high pressure washer (note, use of a high pressure washer must be approved by state regulatory authority). If a removal encapsulant is used remove residue completely before encapsulant dries. If substrate dries before complete removal of residue, re-wet with amended water or removal encapsulant.

C. Removal of Over-Spray: Remove all asbestos containing material oversprayed onto surfaces not intended to be sprayed using the procedures described above. Brush surfaces clean and apply a sealant to the surface using the procedures described in this Section.
   1. Inspect all adjoining surfaces, all HVAC ducts, all recessed light fixtures, and all other potential locations of overspray to determine if over-spray is present. Remove all overspray.

D. Removal of Pipe Insulation: The density of asbestos-containing pipe covering seldom allows the material to be removed in a completely wet state. However, every attempt should be made to keep the insulation material as wet as possible to prevent release of asbestos fibers.
   1. Cut the cloth covering on the pipe insulation along the top seam to allow wetting of the asbestos insulation. Do not allow the pipe insulation to fall to the ground or adjacent surfaces. Wet the insulation material and immediately place in a double 6-mil, minimum thickness, labeled plastic bag.
   2. If the pipe insulation has been protected with a metal jacket, remove the jacket and place in a metal or fiber drum with a plastic liner. Leave the fasteners, used to affix the

insulation material, in place while wetting the material. Once the asbestos has been properly wetted, cut the fasteners and place the insulation in a double 6-mil, minimum thickness, labeled plastic bag. Do not allow the pipe to fall to the ground or adjacent surfaces.

3. After removal of asbestos material, all surfaces shall be brushed with a nylon brush and wet cleaned to remove all visible material. Surfaces being cleaned must be kept wet during brushing.
4. Pipes scheduled for removal may be removed with the asbestos insulation in place by wrapping the entire length of pipe and associated insulation with double thickness 6-mil plastic secured with duct tape. Cut insulation and piping simultaneously into lengths suitable for transportation to disposal area, but no greater than l0 feet in length. Continuously wet the cutting site during the process. As soon as a length of pipe is completely cut loose, cover exposed ends with double thickness 6-mil plastic secured with duct tape.

E. Exposed Pipe Insulation Edges: Contain edges of asbestos insulation to remain that is exposed by a removal operation. Wet and cut the rough ends true and square with sharp tools and then encapsulate the edges with a l/4-inch-thick layer of insulating cement troweled to a smooth hard finish. When cement is dry, lag the end with a layer of fiber glass cloth, overlapping the existing ends by 4 inches. When insulating cement and cloth is an impractical method of sealing a raw edge of asbestos, take appropriate steps to seal the raw edges as approved by the Engineer.

F. Glove Bag Procedure: In removing asbestos insulation from small sections of pipe, instead of sealing off the entire work area for removal of asbestos, a glove bag can be used to remove the asbestos. The glovebag procedure may be performed only by two persons who have received training in the use of the glove bag procedure, as required by SCDHEC Regulation 61-86.1, and provide proof of such training to the Engineer. At any time should there be a bag failure or if fiber counts reach 0.01 fibers/cc or greater, the glove bag procedure shall be terminated immediately and full enclosure procedures shall be required. All glove bag work shall be in complete accordance with OSHA Regulation 29 CFR 1926.1101. All glovebags shall be smoke tested prior to removal of asbestos materials. A minimum of two people are required for the use of a glovebag.

G. Removal of Vinyl Asbestos Floor Tiles: Remove vinyl asbestos floor tiles from areas designated on the Drawings. Remove floor tiles along with floor tile adhesive material with the work area properly prepared, negative pressure system operational, and personnel in proper protective equipment.

1. Prepare the work area by constructing a worker decontamination unit as described in the section entitled PERSONNEL DECONTAMINATION UNIT. Cover all walls with one layer of 4 mil polyethylene sheeting. Place one layer of 4 mil polyethylene sheeting between the floor tile to be removed and the ceiling material, with this layer of ceiling protecting sheeting being adequately supported throughout the room.
2. The use of high RPM power equipment, such as floor sanders, is not permitted for the removal of floor tiles or adhesive.
3. Where water damage to lower floors or adjacent flooring finishes are not a consideration, controlled flooding of the work area with amended water shall be used during the process of removing the floor tiles. Alternate removal procedures must be approved by the Engineer.

4. All traces of floor tile adhesive must be removed. Mechanical scraping shall be done with the floor being thoroughly wetted with amended water. Dissolving agents will be allowed to aid in the removal of the adhesive. Dissolving agents containing any methylene chloride or polychlorinated bipheynls (PCB's) will not be allowed. The Contractor shall submit a Material Safety Data Sheet (MSDS) to the Engineer for approval.
5. Deposit removed floor tiles in a container lined with 6-mil polyethylene. When box is full, duct tape closed and place in disposal bag.

H. Ductwork: Prior to final cleanup, remove the plastic covering openings in ductwork originally covered by grills, diffusers, and returns and remove all asbestos overspray in the ductwork. After removal of the overspray, reseal the openings with plastic, uncontaminated ductwork maybe removed, cleaned and disposed of prior to abatement.

3.12 DECONTAMINATION OF WORK AREA

A. General: Maintain premises and public properties free from accumulation of waste, debris, and rubbish, caused by operations. Remove visible accumulations of asbestos material and debris. Wet clean all surfaces within the work area.
   1. Remove the plastic sheets from walls and floors only. Take proper care in folding up plastic sheeting to minimize dispersal of residual asbestos-containing debris. Critical barriers shall remain in place.
   2. Leave the windows, doors, and HVAC vents sealed. Maintain HEPA filtered negative air pressure systems, air filtration and decontamination enclosure systems in service.

B. Cleaning: Clean all surfaces in the work area and any other contaminated areas with water and with HEPA filtered vacuum equipment. After cleaning the work area, wait 24 hours to allow for settlement of dust, and again wet clean and clean with HEPA filtered vacuum equipment all surfaces in the work area. After completion of the second cleaning operation, perform a complete visual inspection of the work area to ensure that the work area is free of visible asbestos debris. Negative air machines are to remain in operation until final clearance has been obtained.
   1. Include sealed drums and all equipment used in the work area in the cleanup and remove from work areas, via the equipment decontamination enclosure system, at an appropriate time in the cleaning sequence.
   2. Conduct cleaning and disposal operations to comply with applicable ordinances and anti-pollution laws. Do not burn or bury rubbish and waste materials on job site. Do not dispose of volatile wastes in storm or sanitary drains. Do not dispose of wastes into streams or waterways.
   3. Execute cleaning to ensure that buildings, grounds, and public properties are maintained free from waste materials and rubbish accumulation. Wet down dry materials and rubbish to settle dust and prevent blowing dust. Vacuum clean interior areas when ready for finishing and vacuum clean on an as-needed basis until work is ready for occupancy. Manage materials in a controlled manner with as few handlings as possible; do not throw or drop materials from heights. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on newly finished surfaces.

C. Hazards Control: Store volatile wastes in covered metal containers during work hours and remove from premises at end of workday. Prevent accumulation of wastes which create hazardous conditions. Provide adequate ventilation during use of volatile or noxious substances.

D. Inspection: If the Engineer within 24 hours after the second cleaning, finds visible accumulations of asbestos debris in the work area, repeat the wet cleaning until the work area is in compliance, at no additional expense to the Owner.

3.13 WORK AREA CLEARANCE

A. Contractor Release Criteria: The work is complete when the work area is visually clean and airborne fiber levels have been reduced to the level specified below.

B. Air Monitoring: To determine if the elevated airborne fiber counts encountered during abatement operations have been reduced to the specified level, the Owner will secure samples and analyze them according to the following procedures. Sampling shall not begin until the air sampler has performed a visual inspection and authorized final clearance air monitoring. Sampling shall be conducted only after all interior wall, ceiling, and floor polyethylene sheeting has been removed. Critical barriers and decontamination enclosure systems shall remain in place until the abated areas has passed final clearance. Sampling shall not begin until wet cleaning has been completed and no visible pools of water or condensation remain. Sufficient time shall be allowed for all surfaces to dry. The sampling zone shall be representative of the building occupants' breathing zone.

C. Fibers Counted: "Fibers" referred to in this section shall be asbestos fibers of any size as counted using Transmission Electron Microscope.

D. Asbestos Structures: An "Asbestos Structure" is defined as a microscopic bundle, cluster, fiber, or matrix of asbestos.

E. Aggressive Sampling: All air samples will be taken using aggressive sampling techniques as follows:
   1. Before sampling pumps are started the exhaust from forced air equipment (leaf blower) will be swept against all walls, ceilings, floors, ledges and other surfaces in the room.
   2. A fan will be mounted in a central location at approximately 2 meters above floor, directed toward ceiling and operated at low speed for the entire period of sample collection.
   3. Air samples will be collected in areas subject to normal air circulation away from room corners, obstructed locations, and sites near windows, doors or vents.
   4. After air sampling pumps have been shut off, fans will be shut off.

F. Schedule of Air Samples: The number and volume of air samples taken and analytical methods used by the Owner will be in accordance with the schedule given below. Sample volumes given may vary depending upon the analytical instruments used.

G. Analytical Procedures for Clearance: Based on the size of the projects at the various schools included in this contract, both phase contrast and transmission electron microscopy will be used for clearance monitoring. The procedure to be used in an individual work area is determined by the criteria established in EPA's "Asbestos-Containing Materials in Schools Regulation," 40 CFR 763. Specifically, PCM clearance is allowed for projects which are less than or equal to 160 square fee or 260 linear feet of ACM. All projects are to be cleared using TEM.

H. Analytical Procedures for Clearance: TEM clearance air monitoring is required on this project.
   1. Transmission Electron Microscopy (TEM): For each homogeneous work area where TEM air clearance is required, after completion of all cleaning work, a minimum of l3

samples will be taken and analyzed using the procedures outlined in the "Interim Mandatory Transmission Electron Microscopy Analytical Methods" contained in 40 CFR 763, Appendix A to Subpart E.

The minimum number of samples collected will be:

Location Sampled	Number of Samples	Minimum Volume (Liters)	Rate LPM
Each Work Area	5	ll99	2-l2
Outside Work Area	5	ll99	2-l2
Field Blanks	2	0	0
Sealed Blank		0	0

a. Samples will be sent by overnight courier for analysis by Transmission Electron Microscopy. Verbal results will be available during the 2nd working day after receipt of sample by the laboratory. A complete record, certified by the testing laboratory, of all Transmission Electron Microscopy results will be furnished to the Engineer, Owner's Representative, the Owner, and the Contractor.

b. Release Criteria: Decontamination of a work area will be considered complete if either:

The arithmetic mean of the asbestos structure concentrations of all samples collected inside the work area is less than or equal to 70 structures/square millimeter of filter; or

The three blank samples have an arithmetic mean of asbestos structure concentration of less than or equal to 70 structures/square millimeter of filter, and the average airborne asbestos concentration measured inside the work area is not statistically higher than the average airborne asbestos concentration measured outside the work area, as determined by the Z-test. The Z-test is carried out by calculating:

$$Z \quad \frac{Y_I - Y_O}{0.8(1/n_I + 1/n_O)^{1/2}}$$

where: Y_1 = the average of the natural logarithms of the inside samples

Y_0 = the average of the natural logarithms of the outside samples

n_I = the number of inside samples

n_0 = the number of outside samples

Decontamination will be considered complete if Z is less than or equal to l.65. If the average of the work area samples is statistically larger than the average of the outside samples, then the decontamination is incomplete and the cleaning procedures shall be repeated at no additional cost to the Owner. Should this occur, the Contractor shall pay for the cost of all additional TEM analysis required for this work area. If additional cleaning is required, the number of samples and procedures specified above will be used to determine if the Contractor meets the release criteria.

3.14 DISPOSAL OF ASBESTOS-CONTAINING MATERIAL AND ASBESTOS-CONTAMINATED WASTE

A. General: As the work progresses, and to prevent exceeding available storage capacity on site, remove sealed and labeled containers of asbestos waste and dispose of such containers at an authorized disposal site in accordance with the requirements of disposal authority. Comply with 29 CFR l926.1101 SCDHEC Regulation No. 6l-86.l.

B. Sealing Of Containers: Seal all asbestos and asbestos-contaminated waste material in rigid fiber or metal drums lined with double thickness 6-mil, sealable plastic bags. Label the drums and the plastic bags; transport and dispose of, all in accordance with the applicable OSHA and EPA regulations. At the conclusion of the job, place all polyethylene material, tape, cleaning material and clothing in the plastic lined drum. Seal, correctly label, and dispose of as asbestos waste material.

C. Disposal: Transport the sealed drums to the approved waste disposal site. The sealed plastic bags may be removed from the drums and placed into the burial site unless the bags have been broken or damaged. Leave damaged bags in the drums and bury the entire contaminated drum. Uncontaminated drums may be recycled. The sealed bags or drums must be covered the day of disposal. Contractor shall obtain trip tickets at the landfill to document disposal of asbestos containing materials. Copies of all trip tickets shall be submitted to the Engineer.
   1. A rental vehicle may not be used to transport asbestos waste.

D. Waste Water: Consider waste water from showers and sinks to be contaminated waste and dispose of in accordance with this Subsection, unless water has been filtered through a 5 micron filter.

3.15 DISPOSAL OF NON-CONTAMINATED WASTE

A. General: Remove from the site all non-contaminated debris and rubbish resulting from demolition operations. Burning of removed materials from demolished areas will not be permitted. Transport materials removed from demolished areas and dispose of off site in a legal manner.
   1. During progress of work, clean site and public properties, and dispose of waste materials, debris, and rubbish. Provide on-site containers for collection of waste materials, debris, and rubbish. Remove waste materials, debris, and rubbish from site and legally dispose of at public or private dumping areas off Owner's property.

3.16 RE-ESTABLISHMENT OF OBJECTS AND SYSTEMS

A. General: After asbestos abatement work and decontamination is complete, the work is complete. This portion of the building is schedule for demolition.

3.17 FINAL CLEAN UP

A. General: Employ experienced workmen for final cleaning. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials, from interior and exterior finished surfaces.
   1. Repair, patch, and touch-up marred surfaces to specified finish, to match adjacent surfaces.
   2. Broom clean paved surfaces; rake clean other surfaces of grounds. Remove waste materials, rubbish, tools, equipment, machinery, and surplus materials, and clean all exposed-to-view surfaces; leave site clean and ready for occupancy or use.

END OF SECTION

June 13, 2011

University of South Carolina, Upstate Campus
800 University Way
Spartanburg, South Carolina 29303

Attention: Mr. Fred Scott

Reference: **Limited Asbestos Evaluation Report**
Rooms 201A, 202, 226, and 227 - Administration Building
Spartanburg, South Carolina
S&ME Project No. 1265-11-070

Dear Mr. Scott:

S&ME, Inc. (S&ME) is pleased to submit the following limited asbestos evaluation report for the referenced project. The evaluation was performed to test suspect carpet adhesive and residual floor mastics for asbestos. This work was performed at your request in general accordance with the terms set forth in our IDC with the University of South Carolina.

INTRODUCTION

On June 8, 2011 S&ME (George Flores) was requested to collect samples of suspect carpet adhesive and residual floor mastics in rooms 201A, 202, 226, and 227 in the Administration Building located at the University of South Carolina Upstate campus; this data would be used to supplement previous sampling performed by S&ME. It is our understanding that the flooring in these rooms is scheduled for replacement.

S&ME performed our services on June 8, 2011. This evaluation consisted of sampling and analyzing suspect carpet adhesives and mixed residual mastics that were apparently left in-place during previous renovation projects in the above areas. The scope of this evaluation fulfills the requirements of the United States Environmental Protection Agency (US EPA) National Emissions Standards for Hazardous Air Pollutants (NESHAPS) asbestos regulation, 40 CFR, Part 61, Subpart M, which requires an asbestos evaluation of suspect materials scheduled for renovation or demolition.

EVALUATION PROCEDURES

The asbestos evaluation process focused on sampling suspect building materials that may be disturbed during the replacement of the existing flooring material in the above rooms of the Administration Building. Bulk sampling was conducted by Mr. George Flores, a South Carolina licensed asbestos inspector (License No. BI-01000). Each sample was extracted with a pre-cleaned sampling instrument then placed in a plastic bag. Each bag was numbered and data (including sample number, sample location, type of suspect material, and material condition) was recorded.

The bulk samples were submitted through chain-of-custody procedures to SAI, Inc. in Greensboro, North Carolina for analysis of asbestos type and content by Polarized Light Microscopy (PLM) and Transmission Electron Microscopy (TEM). This laboratory is accredited under the National Voluntary Laboratory Accreditation Program (NVLAP) administered by the National Institute of Standards and Technology.

FINDINGS & RECOMMENDATIONS

A total of 13 samples were collected of the various mastics and carpet adhesive. Laboratory data results are summarized in Table 1, attached. Approximate sample locations are depicted on Figure 1, also attached. **Chrysotile asbestos was detected in the yellow and black (mixed) mastic in each of the four rooms sampled.**

Laboratory sample analysis and chain-of-custody forms for the suspect samples collected are included in Appendix A. Photographs of suspect building materials sampled as part of this limited evaluation are included in Appendix B.

Based on the above results, removal of the flooring and underlying mastics should be performed by a licensed abatement contractor in accordance with SCDHEC Regulation 61-86.1. Carpeting over these areas should be treated as contaminated (as mastics will adhere to carpeting when removed) and disposed of as asbestos waste. Typically removal of non-friable materials do not require third party air monitoring, however some removal techniques may render the material friable and thus would be subject to the requirements for removal of regulated asbestos-containing materials and would require monitoring.

A copy of this report must be submitted to SCDHEC ten (10) days prior to demolition when applying for a demolition permit. Federal, state and local regulations should be referred to in order to verify compliance before any actions are initiated on an ACM.

If additional suspect materials are discovered during renovation activities, bulk samples must be collected and analyzed for asbestos content prior to continuation of work.

QUALIFICATIONS

This report has been prepared in accordance with generally accepted practices for specific application to this project. The conclusions and/or recommendations contained in this report are based on our understanding of the applicable standards at the time this report was prepared. No other warranty, express or implied, is made.

The findings of the asbestos evaluation are based largely on visual observations within the amount of time available. The findings do not warrant that all asbestos-containing materials have been identified; asbestos-containing materials could be present in areas not readily accessible to observation. In addition, the actual locations and quantities of materials determined to contain asbestos will vary from those herein. Apparent homogeneous sampling areas may vary in actual asbestos content due to previous renovations, maintenance, or related operations.

If additional suspect materials are found, our firm should be notified so that our findings can be reviewed for modification or verification.

CLOSING

S&ME appreciates the opportunity to provide these services to the University of South Carolina. If you should have any questions concerning this evaluation, please do not hesitate to contact us at (864) 574-2360.

Sincerely,

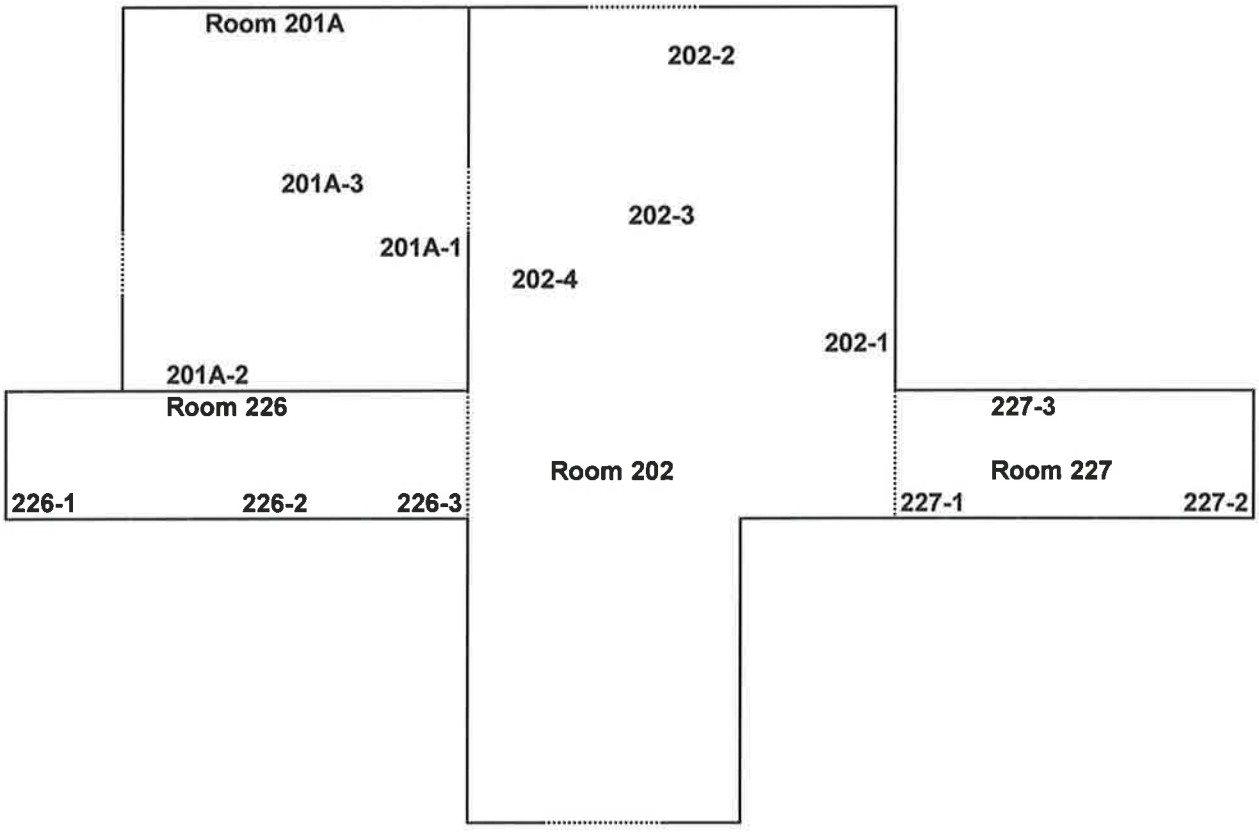
S&ME, Inc.

George Flores
Sr. Environmental Professional
gflores@smeinc.com

Jeff Gurrie
Industrial Hygiene Project Manager
jgurrie@smeinc.com

GKF/JAG S:\ENVIRON\2011\1265\6511070 USC Upstate Asbestos Reinspection\Admin Building Sampling\Administration Building Limited ACM Report.doc

att: Laboratory Data Reports
Table 1 - Summary of Asbestos Results
Figure 1 - Sampling Location Map



Partial Layout - Second Floor

SCALE:	NTS	S&ME	General Site Sketch USC Upstate, Administration Bldg. Spartanburg, South Carolina S&ME Project No. 1265-11-070	FIGURE NO. 1
CHECKED BY:				
DRAWN BY:	GKF			
DATE:	6/10/2011			

TABLE 1
ASBESTOS RESULTS SUMMARY

USC UPSTATE
ADMINISTRATION BUILDING
SPARTANBURG, SOUTH CAROLINA
S&ME PROJECT NO. 1265-11-070

Sample Number	Sample Description	Homogeneous Area	Analytical Results	Classification	Friable / Non-Friable	Current Condition	Potential for Disturbance	Estimated Quantity
Admin 201A-1	Floor / Carpet Mastic - Room 201A	A	3.0-6.4% Chrysotile Analyzed by PLM & TEM	Miscellaneous	Non-Friable	Good	LPD	875 SF
Admin 201A-2								
Admin 201A-3								
Admin 202-1	Floor / Carpet Mastic - Room 202	B	4% Chrysotile Analyzed by PLM & TEM	Miscellaneous	Non-Friable	Good	LPD	1,100 SF
Admin 202-2								
Admin 202-3								
Admin 202-4								
Admin 226-1	Floor / Carpet Mastic Room 226	C	0.73 - 3% Chrysotile Analyzed by PLM & TEM	Miscellaneous	Non-Friable	Good	LPD	725 SF
Admin 226-2								
Admin 226-3								
Admin 227-1	Floor / Carpet Mastic Room 227	D	1.8-4.0% Chrysotile Analyzed by PLM & TEM	Miscellaneous	Non-Friable	Good	LPD	210 SF
Admin 227-2								
Admin 227-3								

NOTE: Quantities listed above are estimates to be used for inspection purposes only. Quantities should be field verified for all other uses. Sample Locations are noted on Figure 1.

NAD - No Asbestos Detected
PLM - Polarized Light Microscopy
TEM - Transmission Electron Microscopy

LPD - Low potential for disturbance,
PD - Potential for disturbance,
PSD - Potential of significant disturbance

SF - square feet,
LF - linear feet,
CF - cubic feet,

Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 600/M4-82-020

NVLAP Lab Code: 200664-0

Customer: S&ME
301 Zima Park Drive
Spartanburg, SC 29301

Attn: George Flores

Lab Order ID: 1107994
Analysis ID: 1107994PLM
Date Received: 6/9/2011
Date Reported: 6/9/2011

Project: USC Upstate Admin Bldg 1265-11-070

Sample ID / *Lab Sample ID*	Description / *Lab Notes*	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes / Treatment
Admin 201A-1 / *1107994PLM_1*	*mixed mastics*	3% Chrysotile	5% Cellulose	92% Other	Yellow, Black Non Fibrous Heterogeneous Dissolved
Admin 201A-2 / *1107994PLM_2*	*mixed mastics*	5% Chrysotile	2% Cellulose	93% Other	Yellow, Black Non Fibrous Heterogeneous Dissolved
Admin 202-1 / *1107994PLM_3*		None Detected		100% Other	Tan Non Fibrous Heterogeneous Dissolved
Admin 202-2 / *1107994PLM_4*		None Detected		100% Other	Tan Non Fibrous Heterogeneous Dissolved
Admin 202-3 / *1107994PLM_5*		None Detected		100% Other	Tan Non Fibrous Heterogeneous Dissolved
Admin 226-1 / *1107994PLM_6*	*mixed mastics*	5% Chrysotile	5% Cellulose	90% Other	Yellow, Black Non Fibrous Heterogeneous Dissolved
Admin 226-2 / *1107994PLM_7*	*yellow mastic only*	None Detected	5% Synthetic Fibers	95% Other	Yellow Non Fibrous Heterogeneous Dissolved
Admin 227-1 / *1107994PLM_8*	*mixed mastics*	4% Chrysotile	3% Cellulose	93% Other	Yellow, Black Non Fibrous Heterogeneous Dissolved

Disclaimer: Due to the nature of the EPA 600 method, asbestos may not be detected in samples containing low levels of asbestos. We strongly recommended that analysis of floor tiles, vermiculite, and/or heterogeneous soil samples be conducted by TEM for confirmation of "None Detected" by PLM. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAI. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. government. Estimated MDL is 0.1%.

Dorlos Ammerman (9)
Analyst

Nathaniel Durham, MS or Approved Signatory

Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 600/M4-82-020

NVLAP Lab Code: 200664-0

Customer: S&ME
301 Zima Park Drive
Spartanburg, SC 29301

Attn: George Flores

Project: USC Upstate Admin Bldg 1265-11-070

Lab Order ID: 1107994
Analysis ID: 1107994PLM
Date Received: 6/9/2011
Date Reported: 6/9/2011

Sample ID *Lab Sample ID*	Description *Lab Notes*	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes Treatment
Admin 227-2		5% Chrysotile	5% Cellulose	90% Other	Yellow, Black Non Fibrous Heterogeneous
1107994PLM_9	*mixed mastics*				Dissolved

Dorlos Ammerman (9)
Analyst

Nathaniel Durham, MS or Approved Signatory

1107994

Scientific Analytical Institute
302-L Pomona Dr. Greensboro, NC 27407
Phone: 336.292.3888 Fax: 336.292.3313
www.sailab.com lab@sailab.com

Lab Use Only
Lab Order ID: _____
Client Code: _____

Company Contact Information	
Company: S&ME, Inc.	Contact: GEORGE FLORES
Address: 301 Zima Park Drive	Phone ☐:
Spartanburg, SC 29301	Fax ☐:
	Email ☒: GFLORES@SMEINC.com

Billing/Invoice Information	Turn Around Times	
Company: AS ABOVE	90 Min. ☐	48 Hours ☐
Contact:	3 Hours ☐	72 Hours ☐
Address:	6 Hours ☐	96 Hours ☐
	12 Hours ☐	120 Hours ☐
	24 Hours ☒	144+Hours ☐

Asbestos Test Types	
PLM EPA 600/R-93/116	☒
Positive stop	☒
PLM Point Count	☐
PCM NIOSH 7400	☐
TEM AHERA	☐
TEM Level II	☐
TEM NIOSH 7402	☐
TEM Bulk Qualitative	☐
TEM Bulk Chatfield	☒
TEM Bulk Quantitative	☐
TEM Wipe ASTM D6480-99	☐
TEM Microvac ASTM D5755-02	☐
TEM Water EPA 100.2	☐
Other: _____	☐

PO Number: 1265
Project Name/Number: USC UPSTATE ADMIN BLDG 1265-11-0704

Sample ID #	Description/Location	Volume/Area	Comments
ADMIN 201A-1			
" -2			
" -3			TEM
ADMIN 202-1			
" -2			
" -3			
" -4			TEM
ADMIN 226-1			
" -2			
" -3			TEM
ADMIN 227-1			
" -2			
" -3			TEM

Received ☑
Relinquished

Total # of Samples 13

Relinquished by	Date/Time	Received by	Date/Time
	6/8/11	FED EX	6/8/11
FED EX	6/9/11		6-9:30A

Page 1 of 1

Scientific Analytical Institute

TEM ON RECEIPT 6/8/11

Bulk Asbestos Analysis
by Transmission Electron Microscopy
Semi-Quantitative
Chatfield SOP 1988-02 Rev. 1

Client: S&ME
301 Zima Park Drive
Spartanburg, SC 29301

Attn: George Flores

Lab Order ID: 1108008
Analysis ID: 1108008_TBS
Date Received: 6/9/2011
Date Reported: 6/10/2011

Project: USC Upstate Admin Bldg 1265-11-070

Sample ID / *Lab Sample ID*	Description / *Lab Notes*	Organic *(Wt. %)*	Acid Sol. *(Wt. %)*	Asbestos *(Wt. %)*		*LCL-UCL (Wt. %)*
Admin 201A-3 / *1108008TBS_1*		58%	-%	**6.4%**	**Chrysotile**	*5.7% - 7.0%*
Admin 202-4 / *1108008TBS_2*		61%	-%	**4.0%**	**Chrysotile**	*3.6% - 4.3%*
Admin 226-3 / *1108008TBS_3*		64%	-%	**0.73%**	**Chrysotile**	*0.66% - 0.80%*
Admin 227-3 / *1108008TBS_4*		63%	-%	**1.8%**	**Chrysotile**	*1.7% - 2.0%*

Matt Thomas (4)

Analyst

Approved Signatory

1108008

Scientific Analytical Institute
302-L Pomona Dr. Greensboro, NC 27407
Phone: 336.292.3888 Fax: 336.292.3313
www.sailab.com lab@sailab.com

Lab Use Only
Lab Order ID: _____
Client Code: _____

Company Contact Information	
Company: S&ME, Inc.	Contact: GEORGE FLORES
Address: 301 Zima Park Drive	Phone ☐:
Spartanburg, SC 29301	Fax ☐:
	Email ☒: GFLORES@SMEINC.COM

Billing/Invoice Information	Turn Around Times	
Company: AS ABOVE	90 Min. ☐	48 Hours ☐
Contact:	3 Hours ☐	72 Hours ☐
Address:	6 Hours ☐	96 Hours ☐
	12 Hours ☐	120 Hours ☐
	24 Hours ☒	144*Hours ☐

Asbestos Test Types	
PLM EPA 600/R-93/116	☒
Positive stop	☒
PLM Point Count	☐
PCM NIOSH 7400	☐
TEM AHERA	☐
TEM Level II	☐
TEM NIOSH 7402	☐
TEM Bulk Qualitative	☐
TEM Bulk Chatfield	☒
TEM Bulk Quantitative	☐
TEM Wipe ASTM D6480-99	☐
TEM Microvac ASTM D5755-02	☐
TEM Water EPA 100.2	☐
Other: _____	☐

PO Number: 1265
Project Name/Number: USC UPSTATE ADMIN BLDG 1265-11-0706

Sample ID #	Description/Location	Volume/Area	Comments
ADMIN 201A-1			
" -2			
" -3			TEM
ADMIN 202-1			
" -2			
" -3			
" -4			TEM
ADMIN 226-1			
" -2			
" -3			TEM
ADMIN 227-1			
" -2			
" -3			TEM

Accepted ☑
Rejected

Total # of Samples 13

Relinquished by	Date/Time	Received by	Date/Time
[signature]	6/8/11	FED EX	6/8/11
FED EX	6/9/11	[signature]	6-9-11:30A

Page 1 of 1

Scientific Analytical Institute

TEM ON RECEIPT [signature] 6/8/11

SECTION 02090 – LEAD RELATED CONSTRUCTION

PART 1 - GENERAL

1.01 SUMMARY

A. This section specifies the methods, procedures, and requirements related to the removal and disposal of lead-based paint including, but not limited to:
   1. Regulatory requirements
   2. Submittals
   3. Personal protective measures
   4. Execution
   5. Inspections
   6. Waste handling

1.02 SCOPE OF WORK

A. The work of this section includes the provision for all labor, materials, equipment and services necessary to effect the preparation, removal, cleaning, and disposal of lead-containing paint and components coated with lead paint as indicated by the contract drawings and within Section 02010 of this specification.
   1. Administrative Requirements necessary to execute the Work, including but notlimited to: Preparation and delivery of all required submittals;
   2. Packaging, transportation and disposal (including all prescribed, implied or otherwise required waste characterization and analysis) of all hazardous and non-hazardous materials and components shown, specified or otherwise implied.

1.03 SUBMITTALS

A. Schedule: Submit three (3) days before starting work and include specific dates and tasks, including man-loading for the beginning and ending of each phase of the work and dates for testing.

B. Respiratory Protection Program: Submit three (3) days before starting work copy of Respiratory Protection Program which is in compliance with ANSI 288.2-1980, OSHA 29 CFR 1910 and 1926.

C. Hazard Communication Program: Submit three (3) days before starting work copy of Hazard Communication Program which is in compliance with 29 CFR 1910.1200.

D. OSHA Lead Compliance Plan: Submit a detailed plan of the procedures proposed in order to comply with the requirements of 29 CFR 1926.62. Include in the plan all components required under the standard.

E. Hazardous Waste Management Plan: Submit three (3) days before starting work copy of Hazardous Waste Management plan which is in compliance with federal, state, and local hazardous waste regulations and addresses:
   1. Identification of hazardous wastes associated with the work.
   2. Sampling and Analysis Plan: The contractor shall conduct additional waste characterization for disposal purposes, a Plan detailing the following elements is required to be submitted and approved:
      a. Identification of material(s): location, component, color, substrate;

b. Proposed sample collection methods to be employed;
c. Proposed analytical methods to be used;
d. Proposed analytical laboratory and associated qualifications;
e. Proposed methods of data interpretation.

3. Note: Sampling or date interpretation methods which commingle or otherwise combine multiple waste streams for the purpose of dilution shall not be permitted.
4. Estimated quantities of wastes to be generated and disposed of.
5. Names and qualifications of each contractor that will be transporting, storing, treating, and disposing of the wastes. Include the facility location and a 24 hour point of contact. Furnish two (2) copies of EPA, state, and local permit applications, permits, and EPA Identification numbers.
6. Names and qualifications (experience and training) of personnel who will be working on-site with hazardous wastes.
7. List of waste handling equipment to be used in performing the work, to include cleaning, volume reduction, and transport equipment.
8. Spill prevention, containment, and cleanup contingency measures to be implemented.
9. Names of EPA approved hazardous waste treatment or disposal facility for lead disposal.

F. Emergency Procedures Plan: Submit three (3) days before starting work three (3) copies of the Emergency Procedures Plan. This Plan shall be prominently posted in the clean change area. All persons entering the work area shall read and sign the procedures to acknowledge receipt and understanding of the work site layout, location of emergency exits, and emergency procedures.

G. Contractor Qualifications: Submit certificate of completion of approved lead abatement training course. Submit copies of valid DHS certification card.

H. Worker Protection Records:
1. Training: Submit a list of all workers and a copy of DHS training certificates for each worker to the Observation Service prior to start of work.
2. Blood tests: Submit test results within five (5) days of test to OBSERVATION SERVICE.
3. Daily log: Keep a daily log listing workers names and hours worked and detailing each entry and exit. Submit a copy to OBSERVATION SERVICE at interim clearance and final clearance.

1.04 CLOSEOUT SUBMITTALS

A. Waste Disposal Records:
1. A written record of receipts with certified weight for disposal of materials containing lead and lead based paint contaminated items shall be furnished to the Owner within forty eight (48) hours after disposal has taken place.
2. Provide a schedule showing date, amount, type of material and location disposed of within five (5) working days of disposal.

1.05 POTENTIAL LEAD HAZARD

A. The disturbance of lead containing painted building materials may cause lead contaminated dust to be released in to the environment, thereby creating a potential health hazard to workers and occupants. Ingestion or inhalation of lead contaminated dust can cause various health concerns, including but not limited to nausea, anemia, vomiting, kidney disease, nervous system disorders, and reproductive problems. All contractors, sub-contractors, consultants, and other

occupants in the vicinity of a potential lead hazard should be apprised, by the responsible parties and applicable warning signs per OSHA requirements cited herein.

B. Significant lead exposure may result from activities such as demolition of components, scraping, sanding, or grinding lead-based paint, abrasive blasting of surface coatings, welding, torch cutting, or related procedures. Where in performance of the work specified herein, a lead exposure is potential, strict adherence to the measures and procedures of these specifications shall be mandatory.

1.06 REGULATIONS

A. Code of Federal Regulations (CFR) 29 CFR 1926, Construction Standards 29 CFR 1926.62, Lead in Construction Standard 40 CFR Part 50.12, Ambient Air Quality Standard for Lead 40 CFR Parts 261, 265, and 268, Hazardous Waste Management 49 CFR Parts 172, 173, 178, 179, Hazardous Material Transportation

B. Lead-Based Paint; Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing (6/1995 and Chpt. 7 Revision 10/1997)

1.07 DEFINITIONS

A. General: Definitions contained in this Section are not necessarily complete, but are general to the extent that they are not defined more explicitly elsewhere in the Contract Documents.
   1. Action Level: An airborne concentration of 30 micrograms per cubic meter (30 ug/m3) of air as an eight (8) hour time weighted average (TWA) as covered by OSHA regulations 29 CFR 1926.62.
   2. Air Monitoring: The process of measuring the lead levels of a specific volume of air.
   3. Authorized Visitor: The Owner, testing lab personnel, or a representative of any federal, state and local regulatory or other agency having authority over the project.
   4. Breathing Zone: A hemisphere forward of the shoulders with a radius of approximately 6 inches to 9 inches.
   5. Certified Industrial Hygienist (C.I.H.): A person certified in comprehensive practice by the American Board of Industrial Hygiene and qualified by training and/or experience to specify measures for the recognition, evaluation, and control of occupational health hazards.
   6. Construction Barrier: Demarcation of the work area limiting access by unauthorized personnel.
   7. Disposal Bag: A 6 mil. thick leak-tight plastic bag used for transporting lead waste from work area to disposal site.
   8. Elevated Blood Lead Level: Means a blood lead concentration equal to or greater than twenty-five (25) micrograms per deciliter (ug/dl).
   9. Encapsulation: Involves resurfacing or covering surfaces, and sealing or caulking with durable materials, so as to prevent or control chalking, flaking lead-containing substances from becoming part of house dust or accessible to children.
   10. Enclosure: The construction of an air-tight, impermeable, permanent barrier around lead-containing material to control the release of lead dust into the air.
   11. Filter: A media component used in respirators to remove solid or liquid particles from the inspired air.
   12. Final Inspection: Inspection by a qualified inspector, industrial hygienist, or local public health official to determine whether abatement and cleanup are complete.

13. Hazardous Waste: As defined in 40 Code of Federal Regulation Part 261 Resource Conservation Recovery Act (RCRA), the term "hazardous waste" means a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed. Federal levels of hazardous waste levels for lead are as follows:
    a. Total Threshold Limit Concentration (TTLC): $\geq$1,000 milligrams per kilogram (mg/kg)
    b. Soluble Threshold Limit Concentration (STLC): $\geq$5.0 milligrams per liter (mg/l)
    c. Toxic Characteristic Leachate Procedure (TCLP): $\geq$5.0 milligrams per liter (mg/l)
14. HEPA Filter: A High Efficiency Particulate Air filter capable of trapping and retaining 99.97% of particles greater than 0.3 microns in diameter.
15. HEPA Filter Vacuum Collection Equipment (or vacuum cleaner): High Efficiency Particulate Air (absolute) filtered vacuum collection equipment with a filter system capable of collecting and retaining 99.97% of particles of 0.3 microns in diameter or larger.
16. Detergent: Any good detergent is acceptable.
17. Lead-Based Paint: Any surface coating with detectable concentration of lead exceeding 5,000 parts per million or 1.0 ug/cm^2 by XRF
18. Lead Containing Paint: Any surface coatings containing detectable concentrations of Lead.
19. lead-Containing Construction Materials: Any building system or component containing detectable concentrations of Lead.
20. Lead Permissible Exposure Limit (PEL): The employer shall ensure that no employee is exposed to an airborne concentration of lead in excess of 50 micrograms per cubic meter (50 ug/m3) of air as an eight (8) hour time weighted average (TWA) as covered by OSHA regulations 29 CFR 1926.62.
21. Negative Pressure: Air pressure lower than surrounding areas, generally caused by exhausting air from a sealed space (work area).
22. Negative Pressure Respirator: A respirator in which the air pressure inside the respiratory-inlet covering is positive during exhalation in relation to the air pressure of the outside atmosphere and negative during inhalation in relation to the air pressure of the outside atmosphere. Negative pressure respirators include all powered-air purifying respirators (PAPRs).
23. Negative Pressure Ventilation System: A local exhaust system utilizing HEPA filtration capable of maintaining a negative pressure inside the work area and a constant air flow from adjacent areas into the work area and exhausting that air outside the work area.
24. Observation Service: The Owner’s contracted environmental consultant.
25. Personal Monitoring: Sampling of lead concentrations within the breathing zone of an employee.
26. Respirator: A device designed to protect the wearer from the inhalation of harmful atmospheres.
27. RCRA: Resource Conservation and Recovery Act of 1976. RCRA is an amendment to the Solid Waste Disposal Act of 1965. RCRA was amended in 1980 and most recently on November 8, 1984 by Hazardous and Solid Waste Amendments.

28. Testing Laboratories: A "testing laboratory" is an independent entity engaged to perform specific inspections or tests, either at the project site or elsewhere, and to report on, and, if required, to interpret, results of those inspections or tests.
29. Time Weighted Average (TWA): The average concentration of a contaminant in air during a specific time period.
30. Visible Emissions: Any emissions containing particulate lead material that are visually detectable without the aid of instruments. This does not include condensed uncombined water vapor.
31. Wet Cleaning: The process of eliminating lead contamination from building surfaces and objects by using cloth, mops, or other cleaning utensils which have been dampened with detergent and afterwards thoroughly decontaminated or disposed of as lead contaminated waste.
32. Work Area: The area where lead related work or removal operations are performed which is defined and/or isolated to prevent the spread of lead dust, or debris, and entry by unauthorized personnel.
33. Lead-Related Construction Work: Any construction, alteration, painting, demolition, salvage, renovation, repair, or maintenance of any residential or public building, including preparation and cleanup, that, by using or disturbing lead-containing material or soil, may result in significant exposure of adults or children to lead.
34. (Initial) Exposure Assessment: Must be performed in all workplaces where employees may be exposed to lead. An assessment of potential exposure to lead as delineated in OSHA’s “trigger task” definitions. Until such time that an appropriate, trigger task and job-specific exposure assessment has been conducted, all employers are mandated to provide appropriate respiratory protection, personal protective clothing, change areas, hand washing facilities, biological monitoring and training.
35. Presumed Lead-Containing Paint: Paint or surface coating affixed to a component in or on a structure, excluding paint of surface coating affixed to a component in or on a residential dwelling constructed on or after January 1, 1979, or a school constructed on or after January 1, 1993.

1.08 OBSERVATION SERVICE

A. The Owner may authorize an Observation Service and a Certified Industrial Hygienist to provide the following inspection, testing, and monitoring services including, but not limited to:
   1. Wipe lead testing to establish pre-abatement and post abatement lead concentrations.
   2. Visual inspections to verify Contractor's compliance with the specifications, as well as applicable regulations, regarding hazard control measures, and related decontamination procedures.
   3. Wipe Sampling for lead contamination to determine whether Contractor has successfully completed clean-up and met the project decontamination criteria.
   4. Interpretation of technical sections of the contract documents, and coordination with Owner and Contractor for enforcement of regulatory and contractual conformance, including stop work issues.

B. The cost of the Owner's Representative will generally be the responsibility of the Owner except under special circumstances. The Contractor shall be responsible for the cost of the Owner's Representative for additional services performed when:
   1. The Contractor's Work Area fails final clearance inspection and/or testing.
   2. Additional workdays or workday hours (overtime) are required by the Contractor.
   3. The Contractor exceeds the allowable time frame for completion.

4. Additional services associated with response to an uncontrolled, unauthorized release to the environment as a result of the Contractor's performance of the work.

1.09 CONTRACTOR QUALIFICATIONS

A. General Superintendent: Provide a General Superintendent whenever Contractor's personnel are on site who is experienced in administration and supervision of lead-related construction projects including work practices, protective measures for building and personnel, disposal procedures, etc. This person is the Contractor's Representative responsible for compliance with all applicable federal, state and local regulations, particularly those relating to lead-containing materials.

B. Experience and Training: The General Superintendent/Supervisor and workers must be DHS Certified and have had on-the-job training in lead abatement procedures. Submit documentation for each worker per section 1.06 of these Specifications.

C. Contractor shall use only workers medically qualified and trained for lead work and respirator usage.
   1. The General Superintendent/Supervisor and workers must be DHS Certified in their respective disciplines, and have had on-the-job training in lead abatement procedures. Submit documentation for each worker per section 1.6 of these Specifications.
   2. Contractor shall submit documentation that all employees engaged in surface preparation/lead paint disturbance activities have had the appropriate medical examinations within the prescribed time periods immediately preceding project start-up. Documentation shall include, but is not limited to, baseline blood lead levels performed in accordance with 8 CCR 1532.1.
   3. Contractor shall submit statement from examining physician that each employee is fit to wear a respirator in accordance with 8 CCR 5144 within the last twelve months.
   4. Documentation that all employees have passed respiratory fit tests within the past six months.
   5. The Contractor will provide a copy of their lead compliance program specific for this project, as specified in 8 CCR 1532.1. and indicated in Section 1.05 -Submittals, above.

PART 2 - PRODUCTS

2.01 PROTECTIVE COVERING

A. Polyethylene sheets, of 6 mil thickness, in dimensions of adequate width to minimize frequency of joints.

2.02 TAPE

A. Duct tape, two inches or wider, capable of sealing joints of adjacent sheets of plastic sheeting or for attachment of plastic sheeting to finished or unfinished surfaces.

2.03 CLEANERS

A. Wet wiping for decontamination shall be accomplished with a detergent wash solution. Alternate cleaning and decontamination agents shall be subject to approval by the Owner' Representative.

2.04 SPRAY ADHESIVE

A. Spray adhesive shall not contain methylene chloride, as listed on the MSDS. Provide spray adhesive that is specially formulated to adhere to polyethylene sheeting.

2.05 DISPOSAL CONTAINERS

A. Provide 6-mil thick polyethylene sheeting, 6 mil leak-tight polyethylene bags and other impervious containers as required by applicable regulations. All waste shall be labeled as potentially hazardous waste unless proven otherwise by appropriate sampling and laboratory analysis.

B. All hazardous waste shipping containers shall meet federal requirements.

2.06 WARNING SIGNS AND LABELS

A. Caution signs are to be a minimum of 14 x 20 inches and include phrase "CAUTION LEAD HAZARD -KEEP OUT UNLESS AUTHORIZED" in lettering at least 2" in height. These signs shall be posted at each approach to the work area.

B. Lead Warning Posters: "WARNING --LEAD WORK AREA—NO SMOKING OR EATING" shall be posted at the entrance to each work area.

C. Hazardous waste labels in accordance with federal, state and local regulations.

2.07 PERSONAL PROTECTIVE EQUIPMENT

A. Workers shall wear full body disposable TYVEK type suits with hoods and separate booties, tape around ankles, wrists, under arms and neck. Suits will be worn inside the work area after the area passes pre-abatement inspection and shall remain in use until the area passes final clearance inspection.

B. Goggles with side shields will be worn when working with a material that may splash or fragment, or if protective eye wear is specified on the Material Safety Data Sheets (MSDS) for that product.

C. Additional respiratory protection by supplemental filters, such as organic vapor cartridges, may be needed when handling some coating products. Consult the MSDS and obtain the proper filters as necessary. The following guideline indicates types of respirators appropriate for adequate protection against varying lead exposures:

RESPIRATORY PROTECTION FACTORS
ASSOCIATED WITH LEAD EXPOSURE OPERATIONS

Respirator Type	Protection Factor	Airborne Concentration of Lead
Air purifying, negative pressure respirator, half-face, HEPA filter	10	Not in excess of 500 ug/m3
Air purifying, negative full-face, HEPA filter	50	Not in excess of 2,500 ug/m3
Powered-air purifying positive pressure respirator full or half-face, HEPA	50	Not in excess of 2,500 ug/m3
Type C supplied air positive pressure respirator continuous flow mode half-face	1000	Not in excess of 50,000 ug/m3
Type C supplied air positive pressure respirator pressure demand mode full facepiece	2000	Not in excess of 100,000 ug/m3
Type C supplied air positive pressure respirator pressure demand mode full facepiece, equipped with auxiliary positive pressure self contained breathing apparatus (SCBA)	over 2000	Greater than 100,000 ug/m3
Self contained breathing apparatus (SCBA) positive pressure demand mode full facepiece	over 2000	Greater than 100,000 ug/m3

D. In addition, all OSHA requirements, such as hard hats, hearing protection, etc. are required.

2.08 TOOLS AND EQUIPMENT

A. Provide suitable tools for the decontamination and removal of lead-based-paint including required HEPA vacuums and exhaust units, airless sprayers, ground fault interrupters, hand tools, wipes, ladders, and scaffolds. Mechanical abrasion tools shall be equipped with local HEPA exhaust and subject to approval by the Owner's representative. All tools and equipment brought on site shall be clean and free of contamination from lead and other hazardous materials. HEPA filtered equipment shall be labeled with a warning label and dedicated to lead based paint work to prevent combining hazardous wastes of differing characteristics.

B. Provide adequate support equipment, including, but not limited to lumber, hardware, decontamination showers, sprayers, hoses, drain pans, miscellaneous collection devices, and secure holding facilities.

PART 3 - EXECUTION

3.01 GENERAL

A. Several levels of preparation and lead abatement alternatives are outlined in this section to address various conditions and methods of lead paint removal.

3.02 SITE PREPARATION

A. The level of preparation described in this section is appropriate for removal of lead-containing painted architectural components, and for the demolition of wall and ceiling systems containing in-tact lead based paint as specified in these contract documents.
   1. Post Caution signs (described in Section 2.08) at all exterior approaches to the work area, and in addition, post OSHA warning signs at all immediate entrances to work area

2. Cover all floors and non-moveable objects (within 10 feet of the affected area, or otherwise in accordance with applicable Lead Hazard Guidelines) with 6 mil polyethylene sheeting and seal with duct tape.

3.03 WORKER SAFETY/DECONTAMINATION PROCEDURES

A. The contractor shall employ only workers medically qualified and trained for lead work and respirator usage.
   1. Medically qualified shall mean that the worker has had an occupational medical exam for lead exposure and respirator use within the last 12 months, in accordance with 29 CFR 1926.62, and shall have had a blood lead test within the last 6 months.
   2. Each worker shall have completed formal documented training in lead hazards and lead abatement.
   3. The Contractor's superintendent (Competent Person) shall have received at least 32 hours of formal training in lead hazards and abatement methods.
   4. The Contractor shall assure that no worker is permitted to perform lead abatement work until the Owner representative has received and approved all of that worker's medical, training, and respirator fit test certifications.

B. The Contractor shall perform an initial exposure assessment in accordance with 8 CCR 1532.1. This includes, but is not limited to, collecting personal air samples to determine the employees actual exposure to lead dust during construction activities. Personal samples will be collected by the contractor pursuant to OSHA regulations. Each task performed will be monitored at a flow rate of 1-4 liters per minute on MCE 37mm 0.8 um pore size cassettes. One lab blank will be submitted with each set of samples.

C. Each worker, upon entering the job location, shall proceed to the designated clean room/area and don on a half-mask, negative pressure respirator equipped with HEPA filters, and disposable, full-body, tyvek suit, gloves, and other safety apparel as required (i.e. hard-hats, steel toed shoes, etc.) before entering the Work Area. The above PPE must be worn during all phases of the paint and/or component removal process. This personal protective equipment (PPE) must be worn for the duration of this project, **or until the initial exposure assessment indicates that exposure to lead dust during these activities will not exceed the action level (30 ugIm').**

D. All disposable clothing worn in each work shift shall be HEPA vacuumed and removed prior to exiting the Work Area and shall be properly segregated and placed in containers for non-hazardous disposal. Workers shall then proceed to the designated wash station before removing respirator to adequately wash face, hands, arms, etc.

E. All tools and equipment shall be decontaminated by HEPA vacuuming and/or wet wiping prior to being taken out of the Work Area.

F. Workers shall not eat, drink, smoke, or chew gum or tobacco at the work site.

G. Each worker shall have a final medical blood lead laboratory test within one week of job completion and before engaging in other lead related work.
   1. Blood Level Monitoring: All workers must have blood lead levels tested as Baseline (prior to beginning of work) and at the completion of Job.

H. The Contractor shall provide all workers, foremen, and superintendents with properly fitted respirators approved by NIOSH and OSHA at no cost to worker. Authorized visitors (i.e.

Federal, State and Local inspectors) must provide a current medical report certifying they are approved to wear respirators. When respirators and disposable filters are employed, sufficient replacement filters will be provided by the Contractor for the workers and any visitors. All workers must be properly trained in the care, use and maintenance of respirators. The Contractor is responsible for requiring worker fit tests within the last six (6) months.

I. The minimum respiratory protection required for this project will be a half mask, air purifying respirators, equipped with HEPA filters for airborne lead dust, in accordance with Section 2.09.

J. Contractor will perform air monitoring as required by Title 8, Section 5216 in order to determine 8-Hour Time Weighted Averaqe: (TWA) of lead dust to which any worker may be exposed shall not exceed the following: Permissible Exposure Limit Lead-50 micrograms per cubic meter of air (50uglm3) for the 8-hour Time Weighted Average (TWA).

3.04 GENERAL REMOVAL PROCEDURES (THE PROCEDURES INCLUDED HEREIN ARE NOT PRESENTED IN A REQUIRED PHASED APPROACH

A. DISMANTLING/REPLACEMENT
   1. Prepare work site and provide protective measures in accordance with Section 3.2, above.
   2. Building components to be dismantled shall be carefully removed in manageable sections and all work shall be performed over protective polyethylene sheeting. Workers shall exercise caution to avoid release of lead contaminated dust into the air. Do not saw or cut the materials unnecessarily. Dismantling operations shall be conducted in a careful, safe manner, insuring that intact lead-based paint remains so.
   3. Separate building components with intact, well grounded lead-based paint from other accumulated debris. Collect small debris off dropcloth and place in 6 mil bags for appropriate storage in the designated waste storage area.
   4. Properly decontaminate the work area in accordance with procedures outlined in Section 3.03, Part A, above.

3.05 INSPECTION PROCEDURE WORK AREA CLEARANCE

A. After the final clean-up, a preliminary visual inspection will be conducted by the Owner's representative to ensure that all visible dust and debris has been removed. The Contractor shall provide the Owner's representative at least 24 hours notice prior to scheduling inspection.

B. If the Work Area is not visibly clean, as determined by the preliminary visual inspection by the Owner's representative, the Contractor shall re-clean and decontaminate as described in Section 3.3, A., at its own costs, until the work area passes inspection.

C. Clearance criteria to release contractor from each work area is as follows:
   1. No visible debris
   2. Native Soil: $\leq$400 parts per million (TTLC)

D. A work area shall be considered cleared only after all areas within the work area have met the above criteria.

E. If any of the native soil samples exceed the clearance criteria, the entire work area must be re-cleaned and retested until the clearance criteria is met.

F. If a work area fails the clearance criteria specified above, the Contractor shall be responsible to re-clean the area at no additional cost to the Owner and shall be responsible for associated additional re-inspection costs, including laboratory fees.

3.06 WASTE HANDLING AND DISPOSAL

A. The Contractor shall provide for secure on-site storage of lead related waste. Waste storage location, equipment, containers and methods shall be in compliance with the requirements of 40 CFR 262 and 265.

B. The Owner's Representative has determined through sampling and analysis, that various building components contain lead which exceeds the TTLC limits of hazardous waste. These items have been presented in the Section 02010 and the associated Hazardous Material Abatement Plans which are part of these documents.

C. The contractor shall remove, handle and dispose of all loose and flaking paint as a RCRA Hazardous Waste.

D. The contractor shall remove, handle and dispose of all listed building components containing lead which exceeds the TTLC limits of hazardous waste as a RCRA Hazardous Waste.

E. At the contractor's sole option and expense, additional waste characterization necessary to determine the soluble characteristics of identified waste streams may be performed. Such additional sampling and analysis shall be performed in accordance with Section 1.7E of this Section. The contractor shall provide all required details of 1.07E in a manner which provides 7 days for review and comment. The contractor shall not proceed with its own waste characterization without achieving written approval from the Owner's Representative. If the contractor chooses this option, it must demonstrate and certify that the sampling performed is in accordance with Title 22, CCR 66261.20 and EPA SW-846 (most current version) including the Chapter 9 Statistical evaluations.

F. To the extent that the contractor chooses option 3.06E, above, all waste containers and packaged waste shall be stored in a designated, secure waste storage area and labeled "PENDING ANALYSIS" with the following information:
   1. Waste Category (Chip/Dust and Removed Components)
   2. Date Accumulated
   3. Name and Address of Owner
   4. Origin of Waste

G. To the extent that the contractor chooses option 3.6E, above, based on the testing protocols. H&S code 25257.8 states that waste that contains total lead (TTLC) between 350 and 1000 ppm, and is not otherwise hazardous waste, will be disposed of as a nonhazardous waste at a Class I Hazardous Waste Disposal Facility.

H. The Contractor is responsible for all costs associated with characterization and landfill profiling of waste.

I. DISPOSAL
   1. The Contractor shall submit name, address, and telephone number of landfill or landfills and transporter to Observation Service for approval, prior to disposal. This includes those landfills used for waste categories determined to be non-hazardous.

2. The Contractor shall have all waste transported from the site in accordance with the requirements of 40 CFR 263 and 264, and disposed of properly in accordance with 40 CFR 268, 49 CFR Parts 172, 173, 178, and 179.
3. The Contractor shall prepare waste shipping manifests for review by the Owner. The manifests shall be signed by the duly authorized representative of the Owner and copies retained by the Owner.
4. Copies of the landfill weight tickets shall be provided to the Owner to verify the amount of waste disposed of at the site.
5. The Contractor is responsible for all costs associated with transportation and disposal of the waste.

3.07 STOP WORK ORDERS

A. The Owner or Owner representative has the authority to stop work if it is determined that conditions or procedures are not in compliance with the Work Plan and/or applicable regulations; the Contractor is deficient in providing required submittals; the waste is not securely stored; or a potential release of lead dust to outside the Work Area is imminent based on the Owner's or the Owner's representative's judgment.

B. The work stoppage shall remain in effect until conditions have been corrected and corrective measures have been taken to the satisfaction of the Owner and/or Owner's representative.

END OF SECTION 02090

November 2, 2012

University of South Carolina Upstate Campus
800 University Way
Spartanburg, South Carolina 29303

Attention: Mr. Fred Scott

Reference: **Limited Lead-Based Paint Evaluation Report**
Administration Building – Restrooms
University of South Carolina Upstate Campus
Spartanburg, South Carolina
S&ME Project No. 1265-12-179

Dear Mr. Scott:

S&ME, Inc. (S&ME) is pleased to submit the following limited lead-based paint evaluation report for the referenced project. The evaluation was performed to test lead-based paint (LBP) that may be present in glazing associated with ceramic tiles in the Administration Building. Additional painted surfaces inside the restrooms were also tested. It is our understanding that this information is required for possible future renovation activities. This work was performed in general accordance with our Indefinite Delivery Contract (IDC) for Environmental Services, dated December 15, 2010 and Work Order CP00340300/FM00394934.

INTRODUCTION

S&ME was retained to perform a limited lead-based paint evaluation of the glazing and other selected painted surfaces of the restrooms in the Administration Building of the USC Upstate located in Spartanburg, South Carolina. S&ME was requested to evaluate the paint and determine if LBP is present.

Representative paints on various interior and exterior surfaces of the structures were tested in situ using a RMD Lead Analyzer. Painted surfaces tested were selected based on the color of the topcoat, the underlying layers, and/or the substrate on which it was painted. Currently, the South Carolina Department of Health and Environmental Control (SCDHEC) define LBP as paint containing greater than 0.7 milligrams per square centimeter (mg/cm^2) lead.

EVALUATION SUMMARY

On November 1, 2012, S&ME performed an evaluation of the paint in the Administration Building restrooms.

A total of 43 areas of suspect LBP were analyzed in the building. The approximate locations of the paint samples collected and analytical results are presented in Table 1, Summary of Paint Results which is attached. Currently, SCDHEC defines LBP as paint containing greater than 0.7 milligrams per square centimeter (mg/cm^2) lead.

Lead-based paint (above 0.7 mg/cm^2) was detected in the following material:

- Red ceramic wall tile
- Light tan ceramic wall tile, and
- Mustard ceramic wall tile.

The ceramic wall tile is not painted, but contains lead in the glazing finish of the tile.

RECOMMENDATIONS

Currently, SCDHEC defines LBP as paint containing greater than or equal to 0.7 mg/cm^2 of lead. Building materials painted with LBP should be disposed in a landfill which accepts LBP coated debris. Building materials that are not painted with LBP may be disposed of in a construction and demolition landfill. However, the landfill should be contacted to determine their specific disposal requirements prior to the material being shipped offsite.

QUALIFICATIONS

This report has been prepared in accordance with generally accepted practice for specific application to this project. The conclusions and/or recommendations contained in this report are based on our understanding of the applicable standards at the time this report was prepared. No other warranty, express or implied, is made.

The findings of the lead-based paint evaluation are based largely on furnished information and visual observations within the amount of time available, and the specific number of areas analyzed. The findings do not warrant that all painted surfaces containing lead have been identified; different underlying painted surfaces which contain lead could exist under similar top layers. Also apparent similarly painted surfaces may vary in actual lead content.

CLOSURE

S&ME appreciates the opportunity to provide lead-based paint consulting services to USC Upstate. If you should have any questions concerning this evaluation, please do not hesitate to contact us at (864) 297-9944.

Sincerely,

S&ME, Inc.

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BM/SW S:\ENVIRON\2012\1265 Projects\6512179 USC Upstate Update\Administration Bld - Restroom glazing LBP\USC Admin Restroom LBP Report.doc

TABLE 1
SUMMARY OF PAINT RESULTS
Administration Building - Restrooms
USC Upstate
Spartanburg, South Carolina
XRF Device Serial No. 3525 (Source Serial No. I2-975)
S&ME Project No. 1265-12-179

Number	Building	Floor/ Level	Location	Substrate	Source	Feature	Color	Lead (mg/cm^2)
	Calibrate							1.1
	Calibrate							1.1
	Calibrate							1.0
1	Admin	1	Rm 106 - men's	Ceramic	Wall	1'x2' Tile	Beige	<0.1
2	Admin	1	Rm 106 - men's	Concrete	Wall	Block	White	<0.1
3	Admin	1	Rm 106 - men's	Drywall	Ceiling	Ceiling	White	<0.1
4	Admin	1	Rm 106 - men's	Ceramic	Floor	Small tile	Brown	<0.1
5	Admin	1	Rm 106 - men's	Metal	Door	Louvered	Beige	<0.1
6	Admin	1	Rm 106 - men's	Metal	Door	Frame	Beige	<0.1
7	**Admin**	**1**	**Rm 106 - men's**	**Ceramic**	**Wall**	**1'x2' Tile**	**Red**	**2.9**
8	Admin	1	Rm 106 - men's	Metal	Door	Partition	Brown	<0.1
9	Admin	1	Rm 106 - men's	Metal	Door	Frame	Brown	<0.1
10	Admin	1	Rm 106 - men's	Wood	Window	Frame	White	<0.1
11	Admin	1	Rm 106 - men's	Wood	Window	Sill	White	<0.1
12	Admin	1	Rm 106 - men's	Vinyl	Window	Blind	White	<0.1
13	Admin	1	Rm 106 - men's	Porcelain	Wall	Basin	White	<0.1
14	**Admin**	**1**	**Rm 107 ladies**	**Ceramic**	**Wall**	**1'x2' Tile**	**Light Tan**	**0.7**
15	Admin	1	Rm 107 ladies	Concrete	Wall	Block	White	<0.1
16	Admin	1	Rm 107 ladies	Drywall	Ceiling	Ceiling	White	<0.1
17	Admin	1	Rm 107 ladies	Ceramic	Floor	Small tile	Light brown	<0.1
18	Admin	1	Rm 107 ladies	Metal	Door	Louvered	White	<0.1
19	Admin	1	Rm 107 ladies	Metal	Door	Frame	White	<0.1
20	Admin	1	Rm 107 ladies	Metal	Door	Partition	Yellow	<0.1
21	Admin	1	Rm 107 ladies	Metal	Door	Frame	Yellow	<0.1
22	Admin	1	Rm 107 ladies	Wood	Window	Frame	White	<0.1
23	Admin	1	Rm 107 ladies	Wood	Window	Sill	White	<0.1
24	Admin	1	Rm 107 ladies	Vinyl	Window	Blind	White	<0.1
25	Admin	1	Rm 107 ladies	Porcelain	Wall	Basin	White	<0.1
26	Admin	2	Rm 203 men's	Ceramic	Wall	1'x2' Tile	Beige	<0.1
27	**Admin**	**2**	**Rm 203 men's**	**Ceramic**	**Wall**	**1'x2' Tile**	**Red**	**3.0**
28	Admin	2	Rm 203 men's	Ceramic	Floor	Small tile	Brown	<0.1
29	Admin	2	Rm 203 men's	Concrete	Wall	Block	White	<0.1
30	Admin	2	Rm 203 men's	Metal	Door	Louvered	White	<0.1
31	Admin	2	Rm 203 men's	Metal	Door	Frame	Tan	<0.1
32	Admin	2	Rm 204 ladies	Ceramic	Wall	1'x2' Tile	Light Tan	0.8
33	Admin	2	Rm 204 ladies	Ceramic	Wall	1'x2' Tile	Mustard	0.6
34	Admin	2	Rm 204 ladies	Ceramic	Floor	Small tile	Brown	<0.1
35	Admin	2	Rm 204 ladies	Concrete	Wall	Block	White	<0.1
36	Admin	2	Rm 204 ladies	Metal	Door	Partition	Beige	<0.1
37	Admin	2	Rm 204 ladies	Metal	Door	Frame	Beige	<0.1
38	**Admin**	**3**	**Rm 305 men's**	**Ceramic**	**Wall**	**1'x2' Tile**	**Red**	**2.4**
39	Admin	3	Rm 305 men's	Ceramic	Wall	1'x2' Tile	Beige	<0.1
40	Admin	3	Rm 305 men's	Ceramic	Floor	Small tile	Brown	<0.1
41	Admin	3	Rm 306 ladies	Ceramic	Wall	1'x2' Tile	Light Tan	0.0
42	**Admin**	**3**	**Rm 306 ladies**	**Ceramic**	**Wall**	**1'x2' Tile**	**Mustard**	**1.0**
43	Admin	3	Rm 306 ladies	Ceramic	Floor	Small tile	Brown	<0.1
	Calibrate							1.0
	Calibrate							1.0
	Calibrate							1.0

SECTION 02223 - MINOR DEMOLITION FOR REMODELING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Removal of designated building equipment and fixtures.

B. Removal of designated construction.

C. Disposal of materials.

D. Identification of utilities.

1.02 RELATED SECTIONS

A. Section 01500 - Temporary Facilities and Controls: Temporary enclosures.

B. Section 01780 - Closeout Submittals: Project record documents.

1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Project Record Documents: Accurately record actual locations of capped utilities.
   1. Indicate unanticipated structural, electrical, or mechanical conditions.

1.04 REGULATORY REQUIREMENTS

A. Conform to applicable code for demolition work, dust control, products requiring electrical disconnection and re-connection.

B. Obtain required permits from authorities.

C. Do not close or obstruct egress from any building exit or site exit.

D. Do not disable or disrupt building fire or life safety systems without 5 days' prior written notice to Owner.

E. Conform to applicable regulatory procedures when hazardous or contaminated materials are discovered.

1.05 SCHEDULING

A. Schedule work under the provisions of Section 01325.

B. Arrange schedule so as not to interfere with the Owner's operations.

C. Describe demolition removal procedures and schedule.

D. Perform noisy work:
   1. Coordinate times with the Owner representative. Owner will coordinate with building occupants.

1.06 PROJECT CONDITIONS

A. Conduct demolition to minimize interference with adjacent and occupied building areas.

B. Cease operations immediately if structure appears to be in danger and notify GMK Associates. Do not resume operations until directed.

C. Occupancy:
   1. The Owner will continue to occupy portions of the existing building.
   2. Adjacent spaces will not be vacated during demolition activities.

D. Existing Conditions:
   1. After the project is begun, the Contractor is responsible for the condition of structures 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.
   2. Cover existing carpet in all interior spaces with polyethelene sheets. Overlap and tape all joints. Inspect and repair damage to polyethelene sheets daily. Protect carpet throughout construction duration.

E. Unforeseen Conditions: Should unforeseen conditions be encountered that affect design or function of project, investigate fully and submit an accurate, detailed, written report to the architect. While awaiting the architect's response, reschedule operations if necessary to avoid delay of overall project.

F. The fire alarm system must remain functional throughout construction. During required shut downs a fire watch must be provided 24 hours a day by a dedicated full time trained employee of the contractor.

PART 2 PRODUCTS - NOT USED.

PART 3 EXECUTION

3.01 EXAMINATION

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

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

C. Perform continuing surveys as the work progresses to detect hazards resulting from demolition or construction activities.

D. Verify actual conditions to determine in advance whether removal or demolition of any element will result in structural deficiency, overloading, failure, or unplanned collapse.

3.02 PREPARATION

A. Provide, erect, and maintain temporary barriers at locations indicated.

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

C. Erect and maintain weatherproof closures for exterior openings.

D. Erect and maintain temporary partitions to prevent spread of dust, odors, and noise to permit continued building occupancy. Insulate to provide noise protection to occupied areas.

E. Construct temporary partitions in a manner at least equal to the following (or superior, if necessary to provide effective protection specified):
   1. Gypsum-board surfaces adjacent to occupied areas, with joints taped.

F. Protect existing materials that are not to be demolished.

G. Prevent movement of structure; provide bracing and shoring.

H. Notify affected utility companies before starting work and comply with their requirements.

I. Mark location and termination of utilities.

J. Provide appropriate temporary signage including signage for exit or building egress.

K. Damages: Without cost to the Owner and without delay, repair any damages caused to facilities to remain.

L. Cover existing carpet in all interior spaces with polyethelene sheets. Overlap and tape all joints. Inspect and repair damage to polyethelene sheets daily. Protect carpet throughout construction duration.

3.03 POLLUTION CONTROLS

A. Control as much as practicable the spread of dust and dirt.

B. Observe environmental protection regulations.

C. Do not allow water usage that results in freezing or flooding.

D. Do not allow adjacent improvements to remain to become soiled by demolition operations.

3.04 DEMOLITION

A. Disconnect, remove, and identify designated utilities within demolition areas.

B. Demolish in an orderly and careful manner. Protect existing supporting structural members.

C. Remove demolished materials from site except where specifically noted otherwise. Do not burn or bury materials on site.

D. Remove materials as demolition progresses. Upon completion of demolition, leave areas in clean condition.

E. Remove temporary facilities.

F. Remove: Unless items are otherwise indicated to be reinstalled or salvaged, remove and scrap.

G. Remove and Reinstall: Remove items indicated; clean, service, and otherwise prepare for service; reinstall in the same location (or in the location indicated).

H. Remove and Install New: Remove and dispose of items indicated and install new items in the same location (or in the location indicated).

I. Remove and Salvage: Items indicated to be salvaged will remain the Owner's property. Carefully remove and clean items indicated to be salvaged; pack or crate to protect against damage; identify contents of containers; deliver to the locations indicated.

J. Remove and Scrap: Remove and dispose of items indicated.
   1. All demolished or removed items and materials shall be considered scrap except for those indicated to remain, those indicated to be reinstalled, and those indicated to be salvaged.
   2. Items of value to the contractor:

a. Do not store removed items on site.

K. Existing to Remain: Construction or items indicated to remain shall be protected against damage during demolition operations. Where practicable, and with the Architect's permission, the Contractor may elect to remove items to a suitable storage location during demolition and then properly clean and reinstall the items.

L. Detailed requirements for cutting are specified under cutting and patching in Division 1.

M. Perform work in a systematic manner.

N. Demolish and remove existing construction only to the extent required by new construction and as indicated in the contract documents.

O. Perform selective demolition using methods which are least likely to damage work to remain and which will provide proper surfaces for patching.

P. Remove debris daily.

Q. Masonry: Detach masonry to be demolished from adjoining construction to remain with power-driven masonry saws or hand tools.

R. Use any methods permitted by governing regulations and the requirements of the contract documents.

3.05 REPAIRS AND PATCHING

A. Perform repairs in accordance with patching requirements specified in Division 1 under cutting and patching.

3.06 CLEANING

A. Remove tools and equipment. Dispose of scrap.

B. Broom clean interior areas.

C. Clean soil, smudges, and dust from surfaces to remain.

D. Leave exterior areas free of debris.

E. Return structures and surfaces to remain to condition existing prior to commencement of demolition.

END OF SECTION

SECTION 02230 - SITE CLEARING

PART 2 PRODUCTS

1.01 MATERIALS

PART 3 EXECUTION

2.01 SITE CLEARING

A. Comply with other requirements specified in Section 01700.

B. Minimize production of dust due to clearing operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

2.02 VEGETATION

A. Do not remove or damage vegetation beyond the following limits:
   1. 40 feet outside the building perimeter.
   2. 10 feet each side of surface walkways, patios, surface parking, and utility lines less than 12 inches in diameter.
   3. 15 feet each side of roadway curbs and main utility trenches.
   4. 25 feet outside perimeter of pervious paving areas that must not be compacted by construction traffic.

B. Install substantial, highly visible fences at least 3 feet high to prevent inadvertent damage to vegetation to remain:
   1. At vegetation removal limits.

C. In areas where vegetation must be removed but no construction will occur other than pervious paving, remove vegetation with minimum disturbance of the subsoil.

D. Vegetation Removed: Do not burn, bury, landfill, or leave on site, except as indicated.
   1. Chip, grind, crush, or shred vegetation for mulching, composting, or other purposes; preference should be given to on-site uses.
   2. Trees: Sell if marketable; if not, treat as specified for other vegetation removed; remove stumps and roots to depth of 18 inches.
   3. Sod: Re-use on site if possible; otherwise sell if marketable, and if not, treat as specified for other vegetation removed.

E. Restoration: If vegetation outside removal limits or within specified protective fences is damaged or destroyed due to subsequent construction operations, replace at no cost to Owner.

2.03 DEBRIS

A. Remove debris, junk, and trash from site.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

D I V I S I O N 3

C O N C R E T E

Applicable Portions Of The Conditions Of The Contract And Division 1 General Requirements Apply To The Work Of This Division.

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each concrete mixture.

C. Shop Drawings: For steel reinforcement.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
   1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5
   2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

PART 2 - PRODUCTS

2.01 STEEL REINFORCEMENT

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

B. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice."

2.02 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
   1. Portland Cement: ASTM C 150, Type I/II; Supplement with the following:
      a. Fly Ash: ASTM C 618, Class F.
      b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33, graded, 3/4-inch nominal maximum coarse-aggregate size.
   1. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M and potable.

D. Air-Entraining Admixture: ASTM C 260.

E. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
   2. Retarding Admixture: ASTM C 494/C 494M, Type B.
   3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
   4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
   5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
   6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.03 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.04 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

2.05 CONCRETE MIXTURES

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

B. Proportion normal-weight concrete mixture as follows:
   1. Minimum Compressive Strength: 4000 psi at 28 days.
   2. Maximum Water-Cementitious Materials Ratio: 0.53.
   3. Slump Limit: 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.

2.06 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.07 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
   1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.01 FORMWORK

A. Design, erect, shore, brace, and maintain formwork according to ACI 301 to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Chamfer exterior corners and edges of permanently exposed concrete.

3.02 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.03 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
   1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.04 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
   1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

C. Cold-Weather Placement: Comply with ACI 306.1.

D. Hot-Weather Placement: Comply with ACI 301.

3.05 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.

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.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
   1. 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.
   2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
   3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

D. 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.

3.06 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in 1 direction.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated. While concrete is still plastic, slightly scarify surface with a fine broom.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

3.07 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
   2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
      a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
   4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.08 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

3.09 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
   1. Testing Services: Tests shall be performed according to ACI 301.

END OF SECTION

D I V I S I O N 4

M A S O N R Y

Applicable Portions Of The Conditions Of The Contract And Division 1 General Requirements Apply To The Work Of This Division.

SECTION 04810 - UNIT MASONRY ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete Block.

B. Mortar and Grout.

C. Reinforcement and Anchorage.

D. Accessories.

1.02 REFERENCE STANDARDS

A. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries; American Concrete Institute International; 2011.

B. ACI 530.1/ASCE 6/TMS 602 - Specification For Masonry Structures; American Concrete Institute International; 2005.

C. ASTM A82/A82M - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement; 2007.

D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

E. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 2012.

F. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2012.

G. ASTM C91/C91M - Standard Specification for Masonry Cement; 2012.

H. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units; 2011.

I. ASTM C140 - Standard Test Methods of Sampling and Testing Concrete Masonry Units and Related Units; 2012.

J. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2011.

K. ASTM C150/C150M - Standard Specification for Portland Cement; 2012.

L. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).

M. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2012.

N. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2011.

O. ASTM C476 - Standard Specification for Grout for Masonry; 2010.

P. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2012.

1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.

C. Shop drawings including complete details for all reinforcing required by contract documents and Building Code Requirements for Masonry Structures.

D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

1.04 QUALITY ASSURANCE

A. Comply with provisions of ACI 530/530.1/ERTA, except where exceeded by requirements of the contract documents.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

B. Store masonry accessories to prevent corrosion, dirt accumulation, and other deterioration.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Maintain materials and surrounding air temperature to minimum 50 degrees F prior to, during, and 48 hours after completion of masonry work.

B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. Manufacturers:
   1. Metromont Materials Corporation..
   2. E. Dillon & Company.
   3. Oldcastle.

B. Concrete Block: Comply with referenced standards and as follows:
   1. Size: Standard units with nominal face dimensions of 16 x 8 inches and nominal depths as indicated on the drawings for specific locations.
   2. Special Shapes: Provide non-standard blocks configured for corners.
   3. Load-Bearing Units: ASTM C90, normal weight.
      a. Hollow block, as indicated.
      b. Type II - Nonmoisture-controlled; lightweight.
      c. Pattern: Standard texture and color - All interior block masonry.
   4. Non-Loadbearing Units: ASTM C129.
      a. Hollow block, as indicated.
      b. Type I: Moisture-controlled; lightweight.

2.02 MORTAR AND GROUT MATERIALS

A. Masonry Cement: ASTM C91, Type S.

B. Portland Cement: ASTM C150, Type I.
   1. Not more than 0.60 percent alkali.

2. Hydrated Lime: ASTM C207, Type S.
3. Mortar Aggregate: ASTM C144.
4. Grout Aggregate: ASTM C404.

C. Water: Clean and potable.

2.03 REINFORCEMENT AND ANCHORAGE

A. Manufacturers of Joint Reinforcement and Anchors:
1. Dur-O-Wal: www.dur-o-wal.com.
2. Hohmann & Barnard, Inc: www.h-b.com.
3. WIRE-BOND: www.wirebond.com.
4. Substitutions: See Section 01600 - Product Requirements.

B. Reinforcing Steel: ASTM A615/A615M Grade 40 (280) deformed billet bars; galvanized.

C. Single Wythe Joint Reinforcement: Ladder type; ASTM A82/A82M steel wire, hot dip galvanized after fabrication to ASTM A153/A153M, Class B; 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.

2.04 ACCESSORIES

A. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials. Provide cleaning solution and methods as recommended by the masonry manufacturer.

2.05 MORTAR AND GROUT MIXES

A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
1. All masonry: Type S.

B. Grout: ASTM C476. Consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

C. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:
   1. Bond: Stacked.
   2. Coursing: One unit and one mortar joint to equal 16 inches.
   3. Mortar Joints: Match existing.

3.04 PLACING AND BONDING

A. Lay hollow masonry units with face shell bedding on head and bed joints.

B. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

C. Remove excess mortar and mortar smears as work progresses.

D. Interlock intersections and external corners.

E. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

F. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

G. Cut mortar joints flush where wall tile is scheduled, cement parging is required, resilient base is scheduled, or bitumen dampproofing is applied.

3.05 REINFORCEMENT AND ANCHORAGE - GENERAL

A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches.

E. Reinforce joint corners and intersections with strap anchors 16 inches on center.

F. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 36 inches horizontally and 24 inches vertically.

3.06 REINFORCEMENT AND ANCHORAGE - SINGLE WYTHE MASONRY

A. Install horizontal joint reinforcement 8 inches on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches.

E. Reinforce joint corners and intersections with strap anchors 16 inches on center.

3.07 REINFORCED COMPONENTS

A. Reinforce walls as indicated on drawings.

B. Lap splices as indicated on drawings.

C. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

D. Place and consolidate grout fill without displacing reinforcing.

E. At bearing locations, fill masonry cores with grout for a minimum 12 inches either side of opening.

3.08 BUILT-IN WORK

A. As work progresses, install built-in metal door frames and fabricated metal frames and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

C. Bed anchors of metal door frames in adjacent mortar joints. Fill frame voids solid with grout.
   1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.

D. Do not build into masonry construction organic materials that are subject to deterioration.

3.09 TOLERANCES

A. Maximum Variation from Alignment of Columns: 1/4 inch.

B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

F. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.

G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.10 CUTTING AND FITTING

A. Cut and fit for pipes, conduit, sleeves, and grounds. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.11 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01400.

B. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C140 for conformance to requirements of this specification.

C. Mortar Tests: Test each type of mortar in accordance with ASTM C780, testing with same frequency as masonry samples.

3.12 CLEANING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

3.13 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

D I V I S I O N 5

M E T A L S

Applicable Portions Of The Conditions Of The Contract And Division 1 General Requirements Apply To The Work Of This Division.

SECTION 05120 - STRUCTURAL STEEL

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes structural steel.

1.02 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand ASD-service loads indicated and comply with other information and restrictions indicated.

1. Select and complete connections using schematic details indicated and AISC's "Manual of Steel Construction, Allowable Stress Design," Part 4.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication of structural-steel components.

C. Welding certificates.

D. Mill test reports.

E. Source quality-control test reports.

1.04 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category Sbd.

B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

C. Comply with applicable provisions of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

PART 2 - PRODUCTS

2.01 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992/A 992M, Grade 50.

B. Channels, Angles: ASTM A 36/A 36M, Grade 36.

C. Plate and Bar: ASTM A 36/A 36M.

D. Metal grating bearing bars: ASTM A1011, Fs = 18 KSI.

E. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

F. Wire Rod for Grating Crossbars: ASTM A 510.

G. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.

H. Welding Electrodes: Comply with AWS requirements.

2.02 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.

1. Finish: Plain.

B. High-Strength Bolts, Nuts, and Washers: ASTM A 490, Type 1, heavy hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers, plain.

C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1 round head steel structural bolts with splined ends; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.

1. Finish: Plain.

D. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.

E. Threaded Rods: ASTM A 36/A 36M.

1. Finish: Plain, Hot-dip zinc coating, ASTM A 153/A 153M, Class C, or Mechanically deposited zinc coating, ASTM B 695, Class 50.

2.03 PRIMER

A. Primer: SSPC-Paint 25, Type II, iron oxide, zinc oxide, raw linseed oil, and alkyd.

B. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.

2.04 GROUT

A. Metallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.

B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.05 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design**"**.

B. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

C. Metal Bar-Grating: Comply with NAAMM MBG 531, "Metal Bar Grating Manual."
1. Fabricate treads and platforms from steel grating with 1” by 3/16” bearing bars at 1 3/16 inch o.c. and crossbars at 4 inches o.c. Bearing bars to have dovetail slots that are solidly filled by cross-bars.

D. Steel Tube Railings: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.
1. Configuration: 1-1/2-inch- diameter top and intermediate rails and posts. Space intermediate rails less than 21 inches clear.
2. Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose.
3. Close exposed ends of railing members with prefabricated end fittings.
4. Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work.

2.06 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened, unless noted otherwise.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

2.07 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials.
5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 2, "Hand Tool Cleaning."
2. SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.08 SOURCE QUALITY CONTROL

A. Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports. Comply with testing and inspection requirements of Part 3, Article "Field Quality Control."

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding.

PART 3 - EXECUTION

3.01 ERECTION

A. Examination: Verify elevations of concrete and masonry bearing surfaces and locations of anchor rods, bearing plates, and other embedments with steel erector present for compliance with requirements.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."

C. Base and Bearing Plates: Clean concrete and masonry bearing surfaces of bond reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.

D. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.02 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened, unless noted otherwise.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

3.03 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.

D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

END OF SECTION 05120

SECTION 05310 - STEEL DECK

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Noncomposite form deck.

1.02 SUBMITTALS

A. Welding certificates.

B. Product Data: For each type of deck, accessory, and product indicated.

C. Product certificates.

D. Evaluation reports.

E. Field quality-control reports.

1.03 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

1.04 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

B. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.02 NONCOMPOSITE FORM DECK

A. Noncomposite Form Deck: Fabricate ribbed-steel-sheet noncomposite form-deck panels to comply with "SDI Specifications and Commentary for Noncomposite Steel Form Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:

1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 zinc coating.

2. Profile Depth: 9/16 inch.
3. Design Uncoated-Steel Thickness: 0.0179 inch.

2.03 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.

G. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B, with dry film containing a minimum of 94 percent zinc dust by weight.

H. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

B. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

C. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

D. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

E. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

F. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

G. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

H. Pour Stops and Girder Fillers: Weld steel-sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.

I. Floor-Deck Closures: Weld steel-sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.02 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.03 PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

END OF SECTION

D I V I S I O N 6

W O O D & P L A S T I C S

Applicable Portions Of The Conditions Of The Contract And Division 1 General Requirements Apply To The Work Of This Division.

SECTION 06114 - WOOD BLOCKING AND CURBING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Blocking in wall openings.

B. Preservative treatment of wood.

C. Concealed wood blocking for support of toilet and bath accessories, wall cabinets, and wood trim.

1.02 QUALITY ASSURANCE

A. Lumber: Comply with PS 20 and approved grading rules and inspection agencies.
   1. Acceptable Lumber Inspection Agencies: Any agency with rules approved by American Lumber Standards Committee.
   2. Lumber of other species or grades, or graded by other agencies, is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.

B. Plywood: Comply with PS 1.

PART 2 PRODUCTS

2.01 DIMENSION LUMBER

A. Grading Agency: Southern Pine Inspection Bureau, Inc. (SPIB).

B. Moisture Content: S-dry or MC19.

C. Miscellaneous Blocking, Furring, and Nailers:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

2.02 ACCESSORIES

A. Fasteners and Anchors:
   1. Fasteners: Hot-dipped galvanized steel per ASTM A 153/A 153M for high humidity and treated wood locations, unfinished steel elsewhere.
   2. Anchors: Bolt or ballistic fastener for anchorages to steel.

2.03 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.

B. Preservative Pressure Treatment of Lumber Above Grade: AWPA Use Category UC3B, Commodity Specification A (Treatment C2) using waterborne preservative to 0.25 lb/cu ft retention.
   1. Kiln dry after treatment to maximum moisture content of 19 percent.
   2. Treat wood in contact with roofing, flashing, or waterproofing.
   3. Treat wood in contact with masonry or concrete.
   4. Treat wood less than 18 inches above grade.

C. Pressure Treatment of Lumber in Contact with Soil: AWPA Treatment C2 using waterborne preservative to 0.4 lb/cu ft retention.

PART 3 EXECUTION

3.01 FRAMING INSTALLATION

A. Set members level and plumb, in correct position.

B. Place horizontal members with crown side up.

C. Provide miscellaneous members as indicated or as required to support finishes, fixtures, specialty items, and trim.

END OF SECTION

SECTION 06410 - CUSTOM CABINETS

PART 1 GENERAL

2.01 SECTION INCLUDES

A. Specially fabricated cabinet units.

B. Countertops.

C. Cabinet hardware.

D. Factory finishing.

2.02 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2009.

B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2009.

C. AWI 400 - Architectural Woodwork Quality Standards Illustrated; Architectural Woodwork Institute; 2005, 8th Ed., Version 2.0.

D. BHMA A156.9 - American National Standard for Cabinet Hardware; Builders Hardware Manufacturers Association; 2010 (ANSI/BHMA A156.9).

E. NEMA LD 3 - High-Pressure Decorative Laminates; National Electrical Manufacturers Association; 2005.

F. PS 1 - Structural Plywood; 2009.

G. PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology (Department of Commerce); 2005.

2.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location and schedule of finishes. Show field measurements.

C. Product Data: Provide data for hardware accessories. Maintenance data. Operation Data.

D. Plastic Laminate:
1. Product data.
2. For initial selection, submit manufacturers standard full range of colors on a bead chain.
3. Samples for verification: 8- by 10-inch piece of each type, pattern, and color.
4. Maintenance data.

E. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner 's name and registered with manufacturer.

2.04 QUALITY ASSURANCE

A. Perform work in accordance with AWI/AWMAC Architectural Woodwork Quality

Standards Illustrated, Premium quality with modifications as specified.

B. Perform cabinet construction in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Premium quality with modifications as specified.

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

D. All work of this section shall be fabricated by a single firm.

E. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

2.05 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

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

C. Deliver inserts and anchors required to be built into concrete masonry before start of construction of these substrates.

2.06 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

2.07 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 woodwork.

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

D. Coordination Data:
1. Furnish locations and types of all blocking and other anchors to be built into substrates to installers of such work.

E. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

2.08 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

3.01 CABINETS

A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI//AWMAC/WI Architectural Woodwork Standards for Premium Grade.

3.02 WOOD MATERIALS

A. Softwood Lumber: NIST PS20; Graded in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Grade I/ Premium; average moisture content of 4-9 percent.
   1. Cabinet Frame: Species Southern Yellow Pine.
      a. Grading Agency: Southern Pine Inspection Bureau, Inc. (SPIB).
      b. Sizes: Nominal sizes as indicated on drawings or as required for proper support of unit, S4S.
      c. Moisture Content: S-dry or MC19.
      d. Miscellaneous Blocking, Furring, and Nailers:
         1) Lumber: S4S, No. 2 or Standard Grade.
         2) Boards: Standard or No. 3.
      e. Pressure Treatment of Lumber Above Grade: AWPA Treatment C2 using waterborne preservative to 0.25 lb/cu ft retention.
         1) Kiln dry after treatment to maximum moisture content of 19 percent.
         2) Treat wood in contact with masonry or concrete.

B. Provide lumber dressed on all exposed faces, unless otherwise indicated.

C. Do not use twisted, warped, bowed, or otherwise defective lumber.

D. Sizes indicated are nominal, unless otherwise indicated.

3.03 PANEL MATERIALS

A. Softwood Plywood: HPVA HP-1;, core materials of lumber, type of glue recommended for application. Exterior grade veneer core plywood and exterior glue when used in counters with sinks:
   1. Door and Drawer Fronts: Species Southern Yellow Pine.
   2. Countertops: Species Southern Yellow Pine.

B. Particleboard: ANSI A208.1; medium density industrial type as specified in AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, composed of wood chips bonded with moisture resistant adhesive under heat and pressure; sanded faces; thickness as required; use for components indicated on drawings.

3.04 LAMINATE MATERIALS

A. Manufacturers:
   1. Formica Corporation: www.formica.com.
   2. Panolam Industries International, Inc\Nevamar: www.nevamar.com.
   3. Wilsonart International, Inc: www.wilsonart.com.

B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications and as follows:
   1. All exposed surfaces, including all surfaces of open front cabinets and glass door cabinets shall be finished with "General Purpose GP-50" plastic laminate, except postformed surfaces which shall be finished with type PF-42.
   2. All exposed and semi-exposed surfaces (backs) of doors and drawer fronts, shall be finished with "General Purpose GP-50" plastic laminate.
   3. All edges shall be finished with 3 mm pvc edge treatment, hot glue applied.

3.05 COUNTERTOPS

A. Natural Stone Countertops: Stone slabs bonded to substrate; use as large pieces as possible with inconspicuous adhesive joints.
   1. Stone: Granite without cracks, voids, or pin holes; filling with matching epoxy resin is acceptable.
   2. Color: As selected by the architect.
   3. Stone Thickness: 3/4 inch, minimum.
   4. Surface Finish: Polished.
   5. Exposed Edge Treatment: Square profile stone, 1-1/2 inch thick, with 3/16 inch radius corner.
   6. Back and End Splashes: Same material, same thickness; for field attachment.

B. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
   1. Flat Sheet Thickness: 3/4 inch, minimum.
   2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISSFA-2 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
      a. Surface Burning Characteristics: Flame spread 25, maximum; smoke developed 450, maximum; when tested in accordance with ASTM E84.
      b. Finish on Exposed Surfaces: Semi-gloss, gloss rating of 25 to 50.
      c. Color and Pattern: As selected by GMK Associates from manufacturer's full line.
      d. Manufacturers:
         1) Dupont: www.corian.com.
         2) Formica Corporation: www.formica.com.
         3) Wilsonart International, Inc: www.wilsonart.com.
   3. Other Components Thickness: 1/2 inch, minimum.
   4. Exposed Edge Treatment: Built up to minimum 1-1/2 inch thick; square edge.
   5. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.

3.06 ACCESSORIES

A. Adhesive: Solvent-based contact type, as recommended by manufacturer of plastic laminate for applicable substrates and laminate(s).

B. Fasteners: Size and type to suit application.

C. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel, or chrome-plated finish in exposed locations.

D. Concealed Joint Fasteners: Threaded steel.

E. Screws: Select material, type, size and finish required for each use. Comply with FS FF-S-111 for applicable requirements.
   1. For metal framing supports, provide screws as recommended by metal framing manufacturer.

F. Anchors: Select material, type, size and finish required by each substrate for secure anchorage. Provide non-ferrous metal or hot-dip galvanized anchors and inserts for exterior

installations and elsewhere as required for corrosion-resistance. Provide toothed steel for lead expansion bolt devices for drilled-in-place anchors. Furnish inserts and anchors, as required, to be set into concrete or masonry work for subsequent woodwork anchorage.

3.07 HARDWARE

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets in accordance with the following and as detailed. See Division 8 section "Finish Hardware" for additional requirements.

3.08 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

C. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.

D. Apply wood laminate by grain matching adjacent sheets to book matching.

E. Mechanically fasten back splash to countertops with steel brackets at 16 inches on center.

F. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

PART 3 EXECUTION

4.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

4.02 PREPARATION

A. Condition woodwork to average prevailing humidity conditions in installation areas prior to installing.

B. Pre-Installation Meeting: Meet at project site prior to delivery of architectural woodwork and review coordination and environmental controls required for proper installation and ambient conditioning in areas to receive work. Include in meeting the Contractor; Architect and other Owner Representatives; Installers of architectural woodwork, wet work such as plastering, other finishes, painting, mechanical work and electrical work; and firms or persons responsible for continued operation (whether temporary or permanent) of HVAC system as required to maintain temperature and humidity conditions. Proceed with woodwork installation only when everyone concerned agrees that required ambient conditions can be maintained.

4.03 INSTALLATION

A. Set and secure casework in place; rigid, plumb, and level. Shim as required using concealed shims. Install to a tolerance of 1/8" in 8'-0" for plumb and level (including tops); and with

no variations in flushness of adjoining surfaces.

B. Use fixture attachments in concealed locations for wall mounted components.

C. Use concealed joint fasteners to align and secure adjoining cabinet units and countertops.

D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

E. Secure cabinets and counter bases to floor using appropriate angles and anchorages.

F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

G. Anchor woodwork to anchors or blocking built-in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where prefinished matching fasteners heads are required, use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork, and matching final finish where transparent finish is indicated.

H. Cabinets: Install without distortion so that doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated.

I. Tops: Anchor securely to base units and other support systems as indicated.

J. Under counter Lights: Installed by Division 16, which shall also provide wiring to and between lights.

K. Complete the finishing work specified as work of this section, to whatever extent not completed at shop or prior to installation of woodwork.

4.04 ADJUSTING

A. Adjust installed work.

B. Adjust moving or operating parts to function smoothly and correctly.

C. Clean, lubricate and adjust hardware.

D. Repair damaged and defective woodwork where possible to eliminate defects functionally and visually; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

4.05 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures. Touch-up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

D I V I S I O N 7

Applicable Portions Of The Conditions Of The Contract And Division 1 General Requirements Apply To The Work Of This Division.

THERMAL & MOISTURE PROTECTION

SECTION 07214 - FOAMED-IN-PLACE INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Foamed-in-place insulation.
   1. Underside of roof deck.
   2. In exterior framed walls.
   3. In exterior wall crevices.
   4. At junctions of dissimilar wall and roof materials.

B. Protective intumescent coating.

1.02 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.

B. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2006.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2012.

D. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2010.

E. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

F. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials; 2011.

G. Internation Code Council Evaluation Services AC377, appendix X

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing work of this section.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, insulation properties, overcoat properties, and preparation requirements.

C. Manufacturer's Installation Instructions: Indicate special procedures, and perimeter conditions requiring special attention.

D. Certificates: Certify that products of this section meet or exceed specified requirements.

E. ICCES Evaluation Report demostrating the submitted system meets the ignition barrier requirements for attics and crawlspaces

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type

specified in this section, with not less than five years of documented experience.

B. Applicator Qualifications: Company specializing in performing work of the type specified, with minimum 3 years of experience.

1.06 REGULATORY REQUIREMENTS

A. Conform to applicable code for flame and smoke limitations.

1.07 MOCK-UP

A. Provide mock-up, 10 feet long by 10 feet wide; include insulation overcoat in mock-up.

B. Mock-up may remain as part of the Work.

1.08 FIELD CONDITIONS

A. Do not install insulation when ambient temperature is lower than 70 degrees F.

B. Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.

C. Do not apply foam when temperature is within 5 F of dew point.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Foamed-In-Place Insulation:
1. Demilec (USA) LLC; SEALection 500: www.demilecusa.com.
2. Icynene Inc; Icynene LD-C-50: www.icynene.com.
3. Certainteed; Product Certaspray.www.certainteed.com
4. Substitutions: See Section 01600 - Product Requirements.

2.02 MATERIALS

A. Foamed-In-Place Insulation: Low-density, flexible, open celled, water vapor permeable polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.
1. Aged Thermal Resistance (R-value): 3 (deg F hr sq ft)/Btu, minimum, when tested at 1 inch thickness in accordance with ASTM C518 after aging for 180 days at 41 degrees F.
   a. R-21 Minimum at 6 inches.
2. Air Permeance: 0.004 cfm/sq ft, maximum, when tested at intended thickness in accordance with ASTM E2178 or ASTM E283 at 1.5 psf.
3. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.

2.03 ACCESSORIES

A. Primer: As required by insulation manufacturer.

B. Overcoat: Intumescent coating of type recommended by insulation manufacturer and as required to comply with applicable codes.

C. Flat Rib Metal Lath: ASTM C847, galvanized; 1/8 inch thick.

1. Weight: 1.8 lb/sq yd.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify work within construction spaces or crevices is complete prior to insulation application.

B. Verify that surfaces are clean, dry, and free of matter that may inhibit insulation or overcoat adhesion.

3.02 PREPARATION

A. Mask and protect adjacent surfaces from over spray or dusting.

B. Apply primer in accordance with manufacturer's instructions.

3.03 APPLICATION

A. Install metal lath to underside of decking.

B. Apply insulation in accordance with manufacturer's instructions.

C. Apply insulation by spray method, to a uniform monolithic density without voids.

D. Apply to a minimum cured thickness of 6 inch.

E. Apply overcoat monolithically, without voids to fully cover foam insulation, to achieve fire rating required.

F. Patch damaged areas.

G. Where applied to voids and gaps assure space for expansion to avoid pressure on adjacent materials that may bind operable parts.

H. Trim excess away for applied trim or remove as required for continuous sealant bead.

3.04 FIELD QUALITY CONTROL

A. Field inspections and tests will be performed by an independent testing agency under provisions of Section 01400.

B. Inspection will include verification of insulation and overcoat thickness and density.

3.05 PROTECTION

A. Do not permit subsequent construction work to disturb applied insulation.

END OF SECTION

SECTION 07720 - ROOF ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof hatches, manual and automatic operation, including smoke vents.

1.02 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2012.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2011.

D. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2010.

E. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.

F. UL (BMD) - Building Materials Directory; current edition.

1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used.
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Maintenance requirements.

C. Shop Drawings: For non-penetrating rooftop supports, submit detailed layout developed for this project, with design calculations for loadings and spacings.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store products under cover and elevated above grade.

PART 2 PRODUCTS

2.01 ROOF HATCHES, MANUAL AND AUTOMATIC OPERATION

A. Manufacturers - Roof Hatches:
   1. Acudor Products Inc: www.acudor.com.
   2. Bilco Company; Type S (ladder access, standard size, solid cover): www.bilco.com.
   3. Dur-Red Products: www.dur-red.com.
   4. Milcor by Commercial Products Group of Hart & Cooley, Inc: www.milcorinc.com.
   5. Substitutions: See Section 01600 - Product Requirements.

B. Roof Hatches: Factory-assembled steel frame and cover, complete with operating and

release hardware.
1. Style: Provide flat metal covers unless otherwise indicated.
2. Size: As indicated on drawings; single-leaf style unless indicated as double-leaf. Coordinate with existing opening.
3. Frames/ Curbs: Existing.

C. Metal Covers: Flush, insulated, hollow metal construction.
1. Capable of supporting 40 psf live load.
2. Material: Galvanized steel; outer cover 14 gage, 0.0747 inch thick, liner 22 gage, 0.03 inch thick.
3. Material: Mill finished aluminum; outer cover 0.125 inch thick, liner 0.04 inch thick.
4. Insulation: 2 inches rigid glass fiber.
5. Gasket: Neoprene, continuous around cover perimeter.

D. Hardware: Steel, zinc coated and chromate sealed, unless otherwise indicated or required by manufacturer.
1. Lifting Mechanisms: Compression or torsion spring operator with shock absorbers that automatically opens upon release of latch; capable of lifting covers despite 10 psf load.
2. Hinges: Heavy duty pintle type.
3. Hold open arm with vinyl-coated handle for manual release.
4. Latch: Upon closing, engage latch automatically and reset manual release.
5. Manual Release: Pull handle on interior.
6. Locking: Padlock hasp on interior.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify GMK Associates of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Field measure existing opening prior to ordering roof hatch.

B. Prepare existing frame and curb to receive new roof hatch.

C. Clean surfaces thoroughly prior to installation.

D. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions, in manner that maintains roofing weather integrity.

3.04 CLEANING

A. Clean installed work to like-new condition.

3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 07815 - SPRAYED-ON FIREPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Repair of damage fireproofing of interior structural steel.

1.02 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2012.

B. ASTM E605 - Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members; 1993 (Reapproved 2011).

C. ASTM E736 - Standard Test Method For Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members; 2000 (Reapproved 2011).

D. ASTM E760 - Standard Test Method for Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members; 1992 (Reapproved 2011).

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with placement of ceiling hanger tabs, mechanical component hangers, and electrical components.

B. Preinstallation Meeting: Convene one week before starting work of this section.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittals procedures.

B. Product Data: Provide data indicating product characteristics.

C. Test Reports: Reports from reputable independent testing agencies for proposed products, indicating compliance with specified criteria, conducted under conditions similar to those on project, for:
   1. Bond Strength.
   2. Bond Impact.
   3. Density.
   4. Fire tests using substrate materials similar those on project.

D. Manufacturer's Installation Instructions: Indicate special procedures.

E. Manufacturer's Certificate: Certify that sprayed-on fireproofing products meet or exceed requirements of contract documents.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified in this section, and:
   1. Having minimum 5 years of documented experience.

1.06 FIELD CONDITIONS

A. Do not apply spray fireproofing when temperature of substrate material and surrounding air is below 40 degrees F.

B. Provide ventilation in areas to receive fireproofing during application and 24 hours afterward, to dry applied material.

C. Provide temporary enclosure to prevent spray from contaminating air.

1.07 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.
   1. Include coverage for fireproofing to remain free from cracking, checking, dusting, flaking, spalling, separation, and blistering.
   2. Reinstall or repair failures that occur within warranty period.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Sprayed-On Fireproofing:
   1. Carboline Company: www.carboline.com.
   2. Grace Construction Products: www.na.graceconstruction.com.
   3. Isolatek International Inc: www.isolatek.com.
   4. Substitutions: See Section 01600 - Product Requirements.

2.02 FIREPROOFING ASSEMBLIES

A. Provide assemblies as indicated on the drawings.

2.03 MATERIALS

A. Sprayed Fire-Resistive Material for Interior Applications: Manufacturer's standard factory mixed material, which when combined with water is capable of providing the indicated fire resistance, and conforming to the following requirements:
   1. Bond Strength: 150 psf, minimum, when tested in accordance with ASTM E736 when set and dry.
   2. Dry Density: As required by fire resistance design.
   3. Effect of Impact on Bonding: No cracking, spalling or delamination, when tested in accordance with ASTM E760.
   4. Corrosivity: No evidence of corrosion, when tested in accordance with ASTM E937.
   5. Surface Burning Characteristics: Maximum flame spread of 0 and maximum smoke developed of 0, when tested in accordance with ASTM E84.

2.04 ACCESSORIES

A. Primer Adhesive: Of type recommended by fireproofing manufacturer.

B. Overcoat: As recommended by manufacturer of fireproofing material.

C. Water: Clean, potable.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive fireproofing.

B. Verify that clips, hangers, supports, sleeves, and other items required to penetrate fireproofing are in place.

C. Verify that ducts, piping, equipment, or other items that would interfere with application of fireproofing have not been installed.

D. Verify that voids and cracks in substrate have been filled. Verify that projections have been removed where fireproofing will be exposed to view as a finish material.

3.02 PREPARATION

A. Perform tests as recommended by fireproofing manufacturer in situations where adhesion of fireproofing to substrate is in question.

B. Remove incompatible materials that could affect bond by scraping, brushing, scrubbing, or sandblasting.

C. Prepare substrates to receive fireproofing in strict accordance with instructions of fireproofing manufacturer.

D. Apply fireproofing manufacturer's recommended bonding agent on primed steel.

E. Protect surfaces not scheduled for fireproofing and equipment from damage by overspray, fall-out, and dusting.

F. Close off and seal duct work in areas where fireproofing is being applied.

3.03 APPLICATION

A. Apply primer adhesive in accordance with manufacturer's instructions.

B. Apply fireproofing in thickness and density necessary to achieve required ratings, with uniform density and texture.

C. Apply overcoat at the rate recommended by fireproofing manufacturer.

3.04 FIELD QUALITY CONTROL

A. Inspect the installed fireproofing after application and curing for integrity, prior to its concealment. Ensure that actual thicknesses, densities, and bond strengths meet requirements for specified ratings.

B. Re-inspect the installed fireproofing for integrity of fire protection, after installation of subsequent Work.

3.05 CLEANING

A. Remove excess material, overspray, droppings, and debris.

B. Remove fireproofing from materials and surfaces not required to be fireproofed.

C. At exposed fireproofing, clean surfaces that have become soiled or stained, using manufacturer's recommended procedures.

END OF SECTION

SECTION 07840 - FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of all penetrations through fire barriers.

C. Extent of fire barriers is indicated on drawings.

D. All work of this section shall be performed by a single firm.

E. Work Not Included: Repairing penetrations made in error and repairing penetrations which are too large to be sealed by the methods indicated; these are to be repaired using the original material of the construction.

F. Products Furnished but Not Installed:
   1. Sleeves which are an integral part of the firestopping assembly but which must be set by installer of other construction.

G. Firestopping of all joints and penetrations in fire-resistance rated assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 REFERENCE STANDARDS

A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2012.

B. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops; 2011a.

C. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.

D. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.

E. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.

C. Product Data: Provide data on product characteristics.

D. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.04 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with ASTM E 814 and ASTM E 119.
   1. Listing in the current-year classification or certification books of UL, FM, or ITS (Warnock Hersey) will be considered as constituting an acceptable test report.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section and:
   1. With minimum 3 years documented experience installing work of this type.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Coordinate delivery of products to minimize storage time at site.

B. Deliver products to project site in original unopened containers bearing the name of the manufacturer, product name, type, and testing agency's identification mark.

C. Store products in accordance with manufacturer's instructions.

1.06 MOCK-UP

A. Install one firestopping assembly representative of each fire rating design required on project.
   1. Where one design may be used for different penetrating items or in different wall constructions, install one assembly for each different combination.
   2. Where firestopping is intended to fill a linear opening, install minimum of 2 linear ft.

B. Obtain approval of Architect before proceeding.

C. If accepted, mock-up will represent minimum standard for the Work.

D. If accepted, mock-up may remain as part of the Work. Remove and replace mock-ups not accepted.

1.07 SEQUENCING AND SCHEDULING

A. Perform firestopping work after completion of work which penetrates fire barriers, but prior to covering up or eliminating access to the penetration. Coordinate with installers of such other work.

1.08 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.

B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 FIRESTOPPING - GENERAL REQUIREMENTS

A. Manufacturers:
   1. A/D Fire Protection Systems Inc: www.adfire.com.
   2. 3M Fire Protection Products: www.3m.com/firestop.
   3. Hilti, Inc: www.us.hilti.com.
   4. Nelson FireStop Products: www.nelsonfirestop.com.

B. Firestopping: Any material meeting requirements.

C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for

tested assembly design.

2.02 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. Perimeter Fire Containment Firestopping: Use any system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of the floor assembly.
   1. Movement: In addition, provide systems that have been tested to show movement capability as indicated.
   2. Temperature Rise: In addition, provide systems that have been tested to show T Rating as indicated.
   3. Air Leakage: In addition, provide systems that have been tested to show L Rating as indicated.
   4. Where floor assembly is not required to have a fire rating, provide systems that have been tested to show L Rating as indicated.

B. Head-of-Wall Firestopping at Joints Between Non-Rated Floor and Fire-Rated Wall: Use any system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of floor or wall, whichever is greater.
   1. Movement: In addition, provide systems that have been tested to show movement capability as indicated.

C. Floor-to-Floor, Wall-to-Wall, and Wall-to-Floor Joints, Except Perimeter, Where Both Are Fire-Rated: Use any system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
   1. Movement: In addition, provide systems that have been tested to show movement capability as indicated.
   2. Air Leakage: In addition, provide systems that have been tested to show L Rating as indicated.
   3. Listing by UL, FM, or Intertek in their certification directory will be considered evidence of successful testing.

D. Through Penetration Firestopping: Use any system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
   1. Temperature Rise: In addition, provide systems that have been tested to show T Rating as indicated.
   2. Air Leakage: In addition, provide systems that have been tested to show L Rating as indicated.
   3. Listing by UL, FM, or Intertek in their certification directory will be considered evidence of successful testing.

2.03 FIRESTOPPING FOR FLOOR-TO-FLOOR, WALL-TO-FLOOR, AND WALL-TO-WALL JOINTS

A. Concrete and Concrete Masonry Walls and Floors:
   1. Floor to Floor Joints:
      a. 1 Hour Construction: UL System FF-D-1013; Hilti CFS-SP WB Firestop Joint Spray and CP 672.

B. Gypsum Board Walls:

1. Wall to Wall Joints:
2. Top of Wall Joints at Underside of Steel Beam and Concrete Over Metal Deck Floor with Sprayed On Fireproofing:
   a. 1 Hour Construction: UL System HW-D-0259; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
3. Top of Wall Joints at Concrete Over Metal Deck, Wall Parallel to Ribs:
   a. 1 Hour Construction: UL System HW-D-0049; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
   b. 1 Hour Construction: UL System HW-D-0184; Hilti CP 606 Flexible Firestop Sealant.
4. Top of Wall Joints at Concrete Over Metal Deck, Wall Perpendicular to Ribs, Cut to Fit Ribs:
   a. 1 Hour Construction: UL System HW-D-0045; Hilti CP 606 Flexible Firestop Sealant.
5. Top of Wall Joints at Concrete Over Metal Deck, Wall Perpendicular to Ribs, Not Cut to Fit:
   a. 1 Hour Construction: UL System HW-D-0042; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
   b. 1 Hour Construction: UL System HW-D-0045; Hilti CP 606 Flexible Firestop Sealant.

2.04 FIRESTOPPING PENETRATIONS THROUGH CONCRETE AND CONCRETE MASONRY CONSTRUCTION

A. Penetrations Through Floors or Walls By:
   1. Multiple Penetrations in Large Openings:
      a. 1 Hour Construction: UL System C-AJ-8143; Hilti FS-ONE Intumescent Firestop Sealant.
   2. Uninsulated Metallic Pipe, Conduit, and Tubing:
      a. 1 Hour Construction: UL System C-AJ-1421; Hilti FS-ONE Intumescent Firestop Sealant or CP 604 Self-Leveling Firestop Sealant.
   3. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
      a. 1 Hour Construction: UL System C-AJ-2567; Hilti FS-ONE Intumescent Firestop Sealant.
   4. Insulated Pipes:
      a. 1 Hour Construction: UL System C-AJ-5048; Hilti FS-ONE Intumescent Firestop Sealant, CP 606 Flexible Firestop Sealant, CP 601S Elastomeric Firestop Sealant, or CP 604 Self-Leveling Firestop Sealant.
   5. HVAC Ducts, Uninsulated:
      a. 1 Hour Construction: UL System C-AJ-7084; Hilti FS-ONE Intumescent Firestop Sealant, CP 606 Flexible Firestop Sealant, CP 601S Elastomeric Firestop Sealant, or CP 604 Self-Leveling Firestop Sealant.

B. Penetrations Through Floors By:
   1. Multiple Penetrations in Large Openings:
      a. 1 Hour Construction: UL System F-A-8012; Hilti CP 604 Self-Leveling Firestop Sealant.
   2. Uninsulated Metallic Pipe, Conduit, and Tubing:
      a. 1 Hour Construction: UL System F-A-1016; Hilti CP 680-P/M Cast-In Device.

3. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
   a. 1 Hour Construction: UL System F-A-2058; Hilti FS-ONE Intumescent Firestop Sealant.

C. Penetrations Through Walls By:
   1. HVAC Ducts, Insulated:
      a. 1 Hour Construction: UL System W-J-7112; Hilti FS-ONE Intumescent Firestop Sealant.

2.05 FIRESTOPPING PENETRATIONS THROUGH GYPSUM BOARD WALLS

A. Blank Openings:
   1. 1 Hour Construction: UL System W-L-3334; Hilti CP 653 Speed Sleeve.

B. Penetrations By:
   1. Multiple Penetrations in Large Openings:
      a. 1 Hour Construction: UL System W-L-1389; Hilti FS-ONE Intumescent Firestop Sealant.
   2. Uninsulated Metallic Pipe, Conduit, and Tubing:
      a. 1 Hour Construction: UL System W-L-1054; Hilti FS-ONE Intumescent Firestop Sealant.
   3. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
      a. 1 Hour Construction: UL System W-L-2078; Hilti CP 643N/644 Firestop Collar.
   4. Electrical Cables Not In Conduit:
      a. 1 Hour Construction: UL System W-L-3065; Hilti FS-ONE Intumescent Firestop Sealant, CP 606 Flexible Firestop Sealant, CD 601S Elastomeric Firestop Sealant, or CP 618 Firestop Putty Stick.
   5. Insulated Pipes:
      a. 1 Hour Construction: UL System W-L-5028; Hilti FS-ONE Intumescent Firestop Sealant.
   6. HVAC Ducts, Insulated:
      a. 1 Hour Construction: UL System W-L-7156; Hilti FS-ONE Intumescent Firestop Sealant.

2.06 MATERIALS

A. Manufacturers: Provide products complying with requirements of the contract documents and made by one of the following:
   1. Hilti Construction Chemicals, Inc.
   2. Minnesota Mining & Mfg. Co.
   3. 3M Ceramic Materials Department.
   4. Tremco Incorporated.

B. Firestopping Materials: Provide penetration seal assemblies whose fire-resistance ratings have been determined by testing in the configurations required and which have fire-resistance ratings at least as high as that of the fire-rated assembly in which they are to be installed.
   1. Use the materials required for the tested assemblies indicated on the drawings.
      a. Where no tested assembly is indicated for a particular penetration, use any tested assembly which complies with the requirements of the specification.
   2. T rating: Not less than one-half of F rating.

3. Provide products which:
   a. Allow normal expansion and contraction movement of the penetrating item without failure of the penetration seal.
   b. Emit no hazardous, combustible, or irritating by-products during installation or curing period.
   c. Do not require special tools for installation.

C. Labels: Red, permanent marking using the words "Fire-Rated Assembly - Do not disturb - See maintenance instructions" and the testing agency designation, or equivalent as approved by the authority having jurisdiction.
   1. For marking fire and smoke barriers themselves, use letters at least 2 inches high.

D. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

C. Install backing materials to arrest liquid material leakage.

3.03 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by authority having jurisdiction.

C. Install labeling required by code.

3.04 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.05 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 07900 - JOINT SEALERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sealants and joint backing.

B. The sealing of joints indicated on schedule at the end of this section.

C. The sealing of joints in interior wet areas, including:
   1. Toilet rooms.

D. The sealing of concealed joints in sound-retardant assemblies, including:
   1. Around all outlet boxes, thru the wall penetrations, between top and bottom stud runners and structure and where indicated on the drawings to reduce transmission of airborne sound.

E. The sealing of other joints indicated on drawings.

F. Joints of a nature similar to that of joints indicated on the schedule shall be sealed with same sealer, whether indicated on drawings to be sealed or not.

1.02 REFERENCE STANDARDS

A. ASTM C834 - Standard Specification for Latex Sealants; 2010.

B. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2012.

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2011.

D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2011a.

E. ASTM D1667 - Standard Specification for Flexible Cellular Materials--Poly(Vinyl Chloride) Foam (Closed-Cell); 2005 (Reapproved 2011).

1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.

C. Samples: Submit two samples, illustrating sealant colors for selection.

D. Manufacturer's Installation Instructions: Indicate special procedures, surface preparation, and perimeter conditions requiring special attention.

E. Field Installation Test Reports.

F. Certificates: For each sealer, provide manufacturer's certificate stating that the product complies with the specifications and is appropriate for the use it is being put to.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.

B. Applicator Qualifications: Company specializing in performing the work of this section

with minimum five years experience.

1.05 MOCK-UP

A. Provide mock-up of sealant joints in conjunction with window, wall, and adjacent materials under provisions of Section 01400.

B. Construct mock-up with specified sealant types and with other components noted.

C. Locate where directed.

D. Mock-up may remain as part of the Work.

1.06 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.

1.07 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

B. 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.

C. 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.

1.08 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal and watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 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: To match Architect's samples.

B. Products: The design is based on the product(s) listed for each generic type. Comparable products of the manufacturers listed will be considered for substitution.

2.02 MANUFACTURERS

A. Silicone Sealants:
   1. Bostik Inc: www.bostik-us.com.
   2. Pecora Corporation: www.pecora.com.
   3. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
   4. Substitutions: See Section 01600 - Product Requirements.

B. Polyurethane Sealants:
   1. Bostik Inc: www.bostik-us.com.
   2. Pecora Corporation: www.pecora.com.
   3. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
   4. Substitutions: See Section 01600 - Product Requirements.

C. Butyl Sealants:
   1. Bostik Inc: www.bostik-us.com.
   2. Pecora Corporation: www.pecora.com.
   3. Substitutions: See Section 01600 - Product Requirements.

D. Acrylic Emulsion Latex Sealants:
   1. Bostik Inc: www.bostik-us.com.
   2. Pecora Corporation: www.pecora.com.
   3. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.

2.03 SEALANTS

A. Type 1 - General Purpose Exterior Sealant: Polyurethane; ASTM C920, Grade NS, Class 25, Uses M, G, and A; single component.
   1. Color: two.
   2. Product: Dymeric 511 manufactured by Tremco, Inc.

B. Type 5 - Exterior Metal Lap Joint Sealant: Butyl or polyisobutylene, nondrying, nonskinning, noncuring.
   1. Product: Tremco Butyl Sealant manufactured by Tremco, Inc.

C. Type 6 - General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, Type OP, Grade NF single component, paintable.
   1. Color: Colors as selected.
   2. Product: Tremco Acrylic Latex 834 manufactured by Tremco, Inc.

D. Type 7 - Bathtub/Tile Sealant: White silicone; ASTM C920, Uses I, M and A; single component, mildew resistant.
   1. Product: Tremsil 200 manufactured by Tremco, Inc.

E. Type 8 - Acoustical Sealant for Concealed Locations:
   1. Product: Tremco Acoustical Sealant manufactured by Tremco, Inc.

2.04 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: Round foam rod compatible with sealant; closed cell polyethylene; oversized 30 to 50 percent larger than joint width.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces and joint openings are ready to receive work.

B. Verify that joint backing and release tapes are compatible with sealant.

C. Do not begin joint sealer work until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean and prime joints in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Protect elements surrounding the work of this section from damage or disfigurement.
   1. 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.

E. Install fillers where needed to provide proper joint depth or support for sealant backers.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Perform acoustical sealant application work in accordance with ASTM C919.

D. 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.

E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

G. Tool joints concave.

3.04 CLEANING

A. Clean adjacent soiled surfaces.

3.05 PROTECTION

A. Protect sealants until cured.

3.06 SCHEDULE

A. Exterior Joints for Which No Other Sealant Type is Indicated: Type 1; colors as selected.

B. Control, Expansion, and Soft Joints in Masonry, and Between Masonry and Adjacent Work: Type 6.

C. Under Exterior Door Thresholds: Type 1.

D. Interior Joints for Which No Other Sealant is Indicated: Type 6; colors as shown on the drawings.

E. Joints Between Plumbing Fixtures and Walls and Floors: Type 7.

F. In STC-Rated Walls, Between Metal Stud Track/Runner and Adjacent Construction and Between Outlet Boxes and Gypsum Board: Type 8.

END OF SECTION

D I V I S I O N 8

Applicable Portions Of The Conditions Of The Contract And Division 1 General Requirements Apply To The Work Of This Division.

D O O R S & W I N D O W S

SECTION 08115 - STEEL DOOR FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated steel frames for non-steel doors.

B. Fire-rated steel door frames for non-steel doors.

1.02 REFERENCE STANDARDS

A. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.

B. ANSI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 1998 (R2011).

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2011.

D. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames; 2006.

E. DHI A115 Series - Specifications for Steel Doors and Frame Preparation for Hardware; Door and Hardware Institute; 2000 (ANSI/DHI A115 Series).

F. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; The National Association of Architectural Metal Manufacturers; 2007.

G. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2013.

H. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association; 2012.

I. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.

J. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.

D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

E. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

1.04 QUALITY ASSURANCE

A. Conform to requirements of NAAMM Hollow Metal Manual and ANSI A117.1.

B. Provide custom hollow metal frames manufactured by a single firm specializing in the production of this type of work, unless otherwise acceptable to the Architect.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.

1.05 REGULATORY REQUIREMENTS

A. Fire Rated Frame Construction: Conform to NFPA 252.
   1. Listed and classified by UL as suitable for the purpose specified and indicated.

B. Installed Frame Assembly: Conform to NFPA 80 for fire rated class same as fire door.
   1. Where fire-rated door assemblies are indicated or required, provide fire-rated door and frame assemblies that comply with NFPA 80 Standard for Fire Doors and Windows ' and have been tested, listed, and labeled in accordance with ASTM E 152 Standard Methods of fire Tests of Door Assemblies by a nationally recognized independent testing and inspection agency acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store in accordance with NAAMM HMMA 840.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

C. Deliver hollow metal work cartoned or crated to provide protection during transit and job storage.

D. Inspect hollow metal work upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to the Architect; otherwise remove and replace damaged items as directed.

E. Store doors and frames at the building site under cover. Place units on minimum 4" high wood blocking. Avoid the use of non-vented plastic or canvas shelters which could create a humidity chamber. If cardboard wrappers on doors become wet, remove cartons immediately. Provide 1/4" spaces between stacked doors to promote air circulation.

F. Accept frames on site in manufacturer's packaging. Inspect for damage.

G. Break seal on-site to permit ventilation.

1.07 PROJECT CONDITIONS

A. Coordinate the work with frame opening construction, door and hardware installation.

B. Sequence installation to ensure wire connections are achieved in an orderly and expeditious manner.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Steel Frames with Integral Casings:
   1. Ceco Door Products: www.cecodoor.com.
   2. Windsor Republic Doors: www.republicdoor.com.
   3. Steelcraft: www.steelcraft.com.

4. Curries Mfg., Inc..
5. D & D Specialties, Inc.
6. Deronde Products.
7. Pioneer Industries/Div. CORE Industries, Inc.
8. Metal Products, Inc.
9. Palmetto Wholesale Company.
10. Substitutions: See Section 01600 - Product Requirements.

2.02 STEEL DOOR FRAMES - GENERAL REQUIREMENTS

A. Refer to Door and Frame Schedule on the drawings for frame sizes, fire ratings, sound ratings, finishing, door hardware to be installed, and other variations, if any.

B. Door Frame Type: Provide steel door frames with integral casings, for field finishing.

C. Accessibility: Comply with ANSI/ICC A117.1.

D. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with all the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

E. Hardware Preparation: In accordance with BHMA A156.115, with reinforcement welded in place, in addition to other requirements specified.

2.03 STEEL DOOR AND INTERIOR GLAZED LIGHT FRAMES

A. Finish: Factory primed, for field finishing.

B. Requirements for All Frames:
1. Accessibility: Comply with ANSI/ICC A117.1.
2. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
3. Hardware Preparation: In accordance with BHMA A156.115, with reinforcement welded in place, in addition to other requirements specified in door grade standard.
4. Galvanizing: All components hot-dipped zinc-iron alloy-coated (galvannealed) per ASTM A653/A653M, with manufacturer's standard coating thickness.
5. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with all the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.
6. Provide 0.0179 inch thick steel mortar guard boxes welded to frame for hardware cut-outs in frames to be installed in masonry or to be grouted.
7. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.
8. Frames Wider than 48 Inches: Reinforce with steel channel fitted tightly into frame head, flush with top.
9. Frames Installed Back-to-Back: Reinforce with steel channels anchored to floor and overhead structure.
10. Fabricate hollow metal units to be rigid, neat in appearance, and free from defects,

warp, or buckle. Accurately form metal to required sizes and profiles. Wherever practicable, fit and assemble units in the manufacturer's plant. Clearly identify work that cannot be permanently factory-assembled before shipment, to assure proper assembly at the project site. Weld exposed joints continuously; grind, dress, and make smooth, flush, and invisible. Metallic filler to conceal manufacturing defects is not acceptable.

11. Locate finish hardware as shown on final shop drawings, or if not shown, in accordance with Recommended Location for Builder's Hardware for Custom Steel Doors and Frames , published by Door and Hardware Institute.

C. Interior Door Frames, Non-Fire-Rated: Fully welded with corners mitered, reinforced, continuously welded full depth and width of frame. Knock-down type frames are not acceptable..
   1. Grade: Comply with frame requirements specified in NAAMM HMMA 861; 0.0598 inch thick frames up to 3'-0" in width, and 0.747 inch thick metal frames over 3'-0" in width.

D. Interior Door Frames, Fire-Rated: Fully welded with corners mitered, reinforced, continuously welded full depth and width of frame. Knock-down type frames are not acceptable.
   1. Grade: Comply with frame requirements specified in NAAMM HMMA 850; 0.0747 inch thick metal frames.
   2. Fire Rating: As indicated on Door and Frame Schedule, tested in accordance with UL 10C ("positive pressure").
      a. Provide units listed and labeled by UL.
      b. Attach fire rating label to each fire rated unit.
   3. Smoke and Draft Control Doors (Indicated as "S" on Drawings): Provide frames capable of enabling door assembly to comply with air leakage requirements of UL 1784 - Standard for Air Leakage Tests of Door Assemblies 2001; if necessary, provide additional gasketing or edge sealing.

2.04 ACCESSORY MATERIALS

A. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions. Install plastic plugs to keep holes clear during construction.

B. Removable Stops: Formed of not less than 0.0359 inch thick steel sheets matching steel of frames, shape as indicated on drawings, butted hairline joint corners; Secure with countersunk machine screws spaced uniformly not more than 12 inches on center.

C. Grout for Frames: Portland cement grout of maximum 4-inch slump for hand troweling; thinner pumpable grout is prohibited.

D. Temporary Frame Spreaders: Provide for all factory- or shop-assembled frames. Tack welded to jambs and mullions.

E. Supports and Anchors: Fabricate of not less than 0.0598" thick sheet metal. Galvanize after fabrication units to be built into exterior walls, complying with ASTM A 153, Class B.

F. Inserts, Bolts and Fasteners: Manufacturer's standard units, except hot-dip galvanize items to be built into exterior walls, complying with ASTM A 153, Class C or D as applicable.

2.05 FINISH MATERIALS

A. Primer: Rust-inhibiting, complying with ANSI A250.10 Zinc chromate type.

B. Bituminous Coating: Fibered asphalt emulsion.

2.06 FABRICATION

A. Finish Hardware Reinforcement: Reinforce frames for required finish hardware, as follows:
   1. Hinges and Pivots: Steel plate 3/16" thick x 1-1/2" wide x 6" longer than hinge, secured by not less than 6 spot-welds.
   2. Strike Plate Clips: Steel plate 3/16" thick x 1-1/2" wide x 3" long.
   3. Surface-Applied Closers: 0.1046" thick steel sheet, secured with not less than 6 spot-welds.
   4. Concealed Closers: Removable steel access plate, 0.1046" thick internal reinforcement of size and shape required, and enclosing housing to keep closer pocket free of mortar or other materials.

B. Jamb Anchors: Furnish jamb anchors as required to secure frames to adjacent construction, formed of galvanized steel with a minimum thickness of 0.0478", before galvanizing.
   1. Metal Stud Partitions: Insert type with notched clip for fastening to channel type metal stud, or toothed perforated anchors for wire attachment to truss- type studs. Weld anchors to back of frames. Provide at least 4 anchors for each jamb for frames up to 7'-6" in height; 5 anchors up to 8'-0" jamb height; one additional anchor each 24" or fraction thereof over 8'-0" height.

C. Floor Anchors: Provide floor anchors for each jamb and mullion which extends to floor, formed of galvanized steel sheet, not less than 0.0747" thick before galvanizing, and as follows:
   1. Monolithic Concrete Slabs: Clip type anchors, with 2 holes to receive fasteners, welded to bottom of jambs.

D. Head Anchors: Provide 2 anchors at head of frames exceeding 42" wide for frames mounted in steel stud walls.

E. Head Strut Supports: Provide 3/8" x 2" vertical steel struts extending from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable bolted anchorage to frame jamb members.

2.07 STOPS AND MOLDINGS

A. Provide stops and moldings around solid, glazed, and louvered panels in hollow metal units and in frames to receive doors, where indicated.

B. Form fixed stops and moldings integral with frame, unless otherwise indicated.

C. Coordinate width of rabbet between fixed and removable stops with type of glass or panel and type of installation indicated.

2.08 FINISH

A. Interior Units: ASTM A 525 G60.

B. Shop Painting:
   1. Clean, treat, and paint exposed surfaces of fabricated hollow metal units, including galvanized surfaces, but excluding stainless steel surfaces.
   2. Clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before application of paint.
   3. Apply pretreatment to cleaned metal surfaces, using cold phosphate solution (SSPC-PT2), hot phosphate solution (SSPC-PT4) or basic zinc chromate- vinyl butyral solution (SSPC-PT3).
   4. Apply shop coat of prime paint within time limits recommended by pretreatment manufacturer. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 2.0 mils.

C. Coat inside of frame profile with bituminous coating to a thickness of 1/16 inch.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

A. Install frames in accordance with manufacturer's instructions and recommendations and as follows.

B. Install in accordance with the requirements of the specified door grade standard and NAAMM HMMA 840.

C. In addition, install fire rated units in accordance with NFPA 80.

D. Coordinate frame anchor placement with wall construction.

E. Grout frames using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

F. Coordinate installation of glazing.

G. Coordinate installation of hardware specified in Section 08710.

H. Coordinate installation of electrical connections to electrical hardware items.

I. Setting Masonry Anchorage Devices: Provide masonry anchorage devices where required for securing hollow metal frames to in-place concrete or masonry construction.
   1. Set anchorage devices opposite each anchor location, in accordance with details on final shop drawings and anchorage device manufacturer’s instructions. Leave drilled holes rough, not reamed, and free from dust and debris.

J. Placing Frames: Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
   1. Remove spreader bars only after frames or bucks have been properly set and secured.
   2. Make field splices in frames as detailed on final shop drawings, welded and finished to match factory work.

3.04 PROTECTION OF INSTALLED WORK

A. Provide acceptable temporary protection of installed work so as to prevent damage from movement of materials through openings and subsequential construction activities, until such time that risk of damage has been minimized. Hollow metal work suffering physical damage will be repaired or replaced at no additional cost to the Contract and in such manner acceptable to Architect.

3.05 TOLERANCES

A. Clearances Between Door and Frame: As specified in ANSI A250.8.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edges, crossed corner to corner.

3.06 SCHEDULE

A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

SECTION 08211 - FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush wood doors; flush configuration; fire rated and non-rated.

1.02 RELATED REQUIREMENTS

A. Section 08115 - Steel Door Frames.

B. Section 08800 - Glazing.

1.03 REFERENCE STANDARDS

A. AWI/AWMAC (QSI) - Architectural Woodwork Quality Standards Illustrated; Architectural Woodwork Institute and Architectural Woodwork Manufacturers Association of Canada; 2005, 8th Ed., Version 2.0.

B. ICC (IBC) - International Building Code; 2009.

C. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.

D. NEMA LD 3 - High-Pressure Decorative Laminates; National Electrical Manufacturers Association; 2005.

E. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2013.

F. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.

G. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements for submittal procedures.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. Specimen warranty.

D. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, factory machining criteria, factory finishing criteria, identify cutouts for glazing and louvers.
   1. For factory-premachined doors, indicate dimensions and locations of cutouts for locksets and other cutouts adjacent to light openings.

E. Samples: Submit samples, 1-0" square or as indicated, for the following:
   1. Doors for Plastic Laminate Finish: 6 inches (150 mm) square, for each color, texture, and pattern selected.
   2. Metal Frames for Light Openings: Metal light frames in 6" lengths; for each material, type and finish required.

F. Manufacturer's Installation Instructions: Indicate special installation instructions.

G. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE

A. Quality Standards: Comply with the following standards:
   1. NWWDA Quality Standard: I.S.1 Industry Standard for Wood Flush Doors , of National Wood Window and Door Association (NWWDA).
   2. AWI Quality Standard: Architectural Woodwork Quality Standards , including Section 1300 Architectural Flush Doors , of Architectural Woodwork Institute (AWI) for grade of door, core construction, finish and other requirements exceeding those of NWWDA quality standard.

B. Perform work in accordance with AWI Quality Standards, Section 1300, Custom Grade.

C. Finish doors in accordance with AWI Quality Standards, Section 1500, grades identified in schedule.

D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

E. Obtain doors from a single manufacturer.

F. Installed Fire Rated Door Assembly: Conform to NFPA 80 for fire rated class as indicated.

G. Smoke and Draft Control Doors: In addition to required fire rating, comply with air leakage requirements of International Building Code, Sections 709 and 714; with "S" label; if necessary, provide additional gasketing or edge sealing.

1.06 REGULATORY REQUIREMENTS

A. Fire Door and Panel Construction: Conform to NFPA 252.
   1. Listed and classified by UL as suitable to for the purpose specified and indicated.

B. Installed Fire Rated Door and Transom Panel Assembly: Conform to NFPA 80 for fire rated class as indicated.

C. Smoke Barrier Door Assembly: In addition to required fire rating, provide astragals at meeting edges of smoke barrier double doors.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect doors during transit, storage and handling to prevent damage, soiling and deterioration. Comply with requirements of referenced standards and recommendations of NWWDA pamphlet How to Store, Handle, Finish, Install, and Maintain Wood Doors , as well as with manufacturer’s instructions.

B. Package, deliver and store doors in accordance with specified quality standard.

C. Accept doors on site in manufacturer's packaging. Inspect for damage.

D. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

E. Identify each door with individual opening numbers which correlate with designation system used on shop drawings for door, frames, and hardware, using temporary, removable or concealed markings.

1.08 PROJECT CONDITIONS

A. Conditioning: Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized and will be maintained in storage and installation areas during remainder of construction period to comply with the following requirements applicable to project's geographical location:
   1. Referenced AWI quality standard including Section 100-S-3 Moisture Content .

B. Coordinate the work with door opening construction, door frame and door hardware installation.

1.09 WARRANTY

A. General: Warranties shall be in addition to, and not a limitation of, other rights the Owner may have under the Contract Documents.

B. See Section 01780 - Closeout Submittals for additional warranty requirements.

C. Interior Doors: Provide manufacturer's warranty for the life of the installation.

D. Door Manufacturer's Warranty: Submit written agreement on door manufacturer's standard form signed by Manufacturer, Installer and Contractor, agreeing to repair or replace defective doors that have warped (bow, cup or twist) or that show telegraphing of core construction in face veneers, or do not conform to tolerance limitations of referenced quality standards.
   1. Warranty shall also include reinstallation which may be required due to repair or replace.
   2. Warranty shall be in effect during following period of time after date of Substantial Completion.
      a. Solid Core Interior Doors: Life of installation.

E. Provide warranty for the following term:
   1. Interior Doors: Life of installation.

F. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Veneer Faced Doors:
   1. Algoma Hardwoods, Inc.
   2. Buell Door Company
   3. Eggers Industries: www.eggersindustries.com.
   4. Mohawk Flush Doors, Inc.: www.mohawkdoors.com
   5. VT Industries, Inc.
   6. Substitutions: See Section 01600 - Product Requirements.

2.02 DOORS

A. All Doors: See drawings for locations and additional requirements.
   1. Quality Level: Premium Grade with A grade veneer, in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Section 1300.

2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.

B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
1. Provide solid core doors at all locations.
2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with International Building Code ("positive pressure"); UL or WH (ITS) labeled without any visible seals when door is open.
3. Wood veneer facing with factory transparent finish.

2.03 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type staved lumber core (SLC), plies and faces as indicated above.

B. Fire Rated Doors: Mineral core, Type FD, plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.
1. Edge Construction: Provide manufacturer's standard laminated edge construction for improved screw-holding capability and split resistance as compared to edges composed of a single layer of treated lumber.
a. Provide laminated edge construction and blocking with paired and single switch doors having 3/4 hour or greater label to accept mortise butts, using #12 x 1-1/4" type A fully threaded screws in factory predrilled pilot holes.
2. Provide fire-rated pairs with fire-retardant stiles which are labeled and listed for kinds of applications indicated without formed steel edges and astragals.

2.04 DOOR FACINGS

A. Wood Veneer Facing for Transparent Finish: Natural birch, veneer grade as specified by quality standard, plain sliced, book veneer match, running assembly match; unless otherwise indicated.
1. Vertical Edges: Any option allowed by quality standard for grade.
2. Pairs: Pair match each pair; set match pairs within 10 feet of each other when doors are closed.

B. Facing Adhesive: Type I - waterproof. Use hot press method for crossbands and face veneers.

2.05 DOOR CONSTRUCTION

A. Fabricate doors in accordance with AWI Quality Standards requirements.

B. Cores Constructed with stiles and rails:

C. Fabricate fire rated doors in accordance with UL requirements. Attach fire rating label to door.

D. Astragals for Non-Rated Double Doors: Steel, T shaped, overlapping and recessed at face edge.

E. Astragals for Fire Rated Double Doors: Steel, T shaped, overlapping and recessed at face edge, specifically for double doors.

F. Provide solid blocks at lock edge for hardware reinforcement.
1. Provide solid blocking for other throughbolted hardware.

G. Fit door edge trim to edge of stiles after applying veneer facing.

H. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

I. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
   1. Exception: Doors to be field finished.

J. Provide edge clearances in accordance with the quality standard specified.

2.06 FACTORY FINISHING - WOOD VENEER DOORS

A. Factory finish doors in accordance with specified quality standard:

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

D. Reject doors with defects.

E. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.
   1. Install fire-rated doors in accordance with NFPA 80 requirements.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Adjust width of non-rated doors by cutting equally on both jamb edges.
   1. Trim fire-rated doors in strict compliance with fire rating limitations.

D. Use machine tools to cut or drill for hardware.

E. Coordinate installation of doors with installation of frames and hardware.

F. Coordinate installation of glazing.

3.03 TOLERANCES

A. Conform to specified quality standard for fit and clearance tolerances.

B. Conform to specified quality standard for telegraphing, warp, and squareness.

C. Maximum Vertical Distortion (Bow): 1/8 inch measured with straight edge or taut string, top to bottom, over an imaginary 36 by 84 inches surface area.

D. Maximum Width Distortion (Cup): 1/8 inch measured with straight edge or taut string, edge to edge, over an imaginary 36 by 84 inches surface area.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

C. Rehang or replace doors which do not swing or operate freely.

D. Refinish or replace doors damaged during installation.

E. Protect doors as recommended by door manufacture to ensure that wood doors will be without damage or deterioration at time of Substantial Completion.

3.05 SCHEDULE - See Drawings

END OF SECTION

SECTION 08310 - ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Ceiling access door and frame units.

B. Access door and frame units, fire-rated and non-fire-rated, in ceiling locations.

1.02 RELATED REQUIREMENTS

A. Section 09900 - Paints and Coatings: Field paint finish.

1.03 REFERENCE STANDARDS

A. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

C. Shop Drawings: Indicate exact position of all access door units.

D. Manufacturer's Installation Instructions: Indicate installation requirements.

E. Project Record Documents: Record actual locations of all access units.

PART 2 PRODUCTS

2.01 ACCESS DOOR AND PANEL APPLICATIONS

A. Fire Rated Ceilings: See drawings for ceiling fire ratings.
   1. Material: Steel.
   2. Size: 48x48 inches, unless otherwise indicated.
   3. Standard duty, hinged door.
   4. Tool-operated spring or cam lock; no handle.

2.02 MANUFACTURERS

A. Access Doors:
   1. Acudor Products Inc: www.acudor.com.
   2. J.L. Industries, Inc.; Product FD2D- fire rated double door access panels for ceilings: www.activarcpg.com/jl-industries
   3. Karp Associates, Inc: www.karpinc.com.
   4. Milcor by Commercial Products Group of Hart & Cooley, Inc: www.milcorinc.com.
   5. Substitutions: See Section 01600 - Product Requirements.

2.03 ACCESS DOORS AND PANELS

A. All Units: Factory fabricated, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with assemblies units are to be installed in.

2.04 WALL AND CEILING UNITS

A. Manufacturers:
   1. Acudor Products Inc: www.acudor.com.
   2. Cendrex, Inc: www.cendrex.com.
      a. Units in Walls, Unless Otherwise Indicated: Cendrex CTR, concealed frame, pantograph hinge.

B. Door and Frame Units: Formed steel.
   1. Frames, flush installation: 0.058 inch steel.
   2. Steel Finish: Primed.
   3. Primed Finish: Polyester powder coat; manufacturer's standard color.
   4. Size(s): As required.
   5. Hardware:
      a. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.
      b. Hinge: 175 degree stainless steel piano hinge with removable pin.
      c. Latch/Lock: Screw driver slot for quarter turn cam latch.
   6. Prime coat with alkyd primer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings are correctly sized and located.

3.02 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings. Secure rigidly in place.

C. Position units to provide convenient access to the concealed work requiring access.

END OF SECTION

SECTION 08710 - FINISH HARDWARE

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

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

B. Hollow metal frames are specified with door frames elsewhere in Division 8.

C. Wood doors are specified elsewhere in Division 8.

D. Paint - Division 9.

1.02 DESCRIPTION OF WORK:

A. Definition: "Finish Hardware" includes items known commercially as finish hardware which are requested for swinging, sliding and folding doors, except special types of unique and non-matching hardware specified in the same section as the door and door frame.

B. Extent of finish hardware required is indicated on drawings and in schedules.

1.03 QUALITY ASSURANCE:

A. Supplier: A recognized AHI certified architectural finish hardware supplier, with warehousing facilities, who has been furnishing hardware in the project's vicinity for a period of not less than 2 years, and who is available, at reasonable times during the course of the work, for consultation about project's hardware requirements, to Owner, Architect and Contractor.
   1. Information contained below describes the grade and general functional intent of the design. If additional hardware devices are required or if hardware specified isn't appropriate to provide a functional and code compliant opening, or if hardware indicated below has been discontinued, the supplier shall include correct devices in his scope of work at no cost to the Owner.

B. 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 for types and sizes of doors required and complies with requirements of the door and door frame labels.

C. Americans with Disabilities Act (ADA): Provide and install finish hardware in accordance with requirements of Americans with Disabilities Act (ADA). Specifically, comply with ADA sections relating to accessibility and usability.
   1. Notification of Architect: Before installation of finish hardware, notify Architect of any Contract Document requirements that are suspected to be in noncompliance with ADA.
   2. ANSI Standards for Physically Handicapped: Finish Hardware shall comply with:
   3. American National Standard for Buildings and Facilities -- Providing Accessibility and Usability for Physically Handicapped People" (ANSI A117.1-1986). 1986 edition, by American National Standards Institute, Inc.; New York, New York. Before installation of finish hardware, Notify Architect of any Contract Document requirements that are suspected to be in noncompliance with ANSI A117.1-1986. In addition, before installation of finish hardware, notify Architect of conflicting requirements of ADA and ANSI A117.1-1986.

1.04 SUBMITTALS:

A. Product Data: Submit manufacturers technical product data for each item of hardware in accordance with Division-1 section "Submittals". Include whatever information may be necessary to show compliance with requirements, and include instructions for installation and for maintenance of operating parts and finish.

B. Vertical Hardware Schedule: Submit final hardware schedule in manner indicated below. Coordinate hardware with doors, frames, and related work to ensure proper size, thickness, hand, function and finish of hardware.
   1. Final Hardware Schedule Content: Based on finish hardware indicated, organize hardware schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:
      a. Type, style, function, size and finish of each hardware item.
      b. Name and manufacturer of each item.
      c. Fastening and other pertinent information.
      d. Location of hardware set cross-referenced to indications on Drawings both on floor plans and in door schedule.
      e. Explanation of all abbreviations, symbols, codes, etc. contained in schedule.
      f. Door and frame sizes and materials.
      g. Keying information.

C. Submittal Sequence: Submit schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work (e.g.,hollow metal frames) which is critical in the project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by finish hardware, and other information essential to the coordination review of hardware schedule.

D. Templates: Furnish hardware templates to each fabricator of doors, frames, and other work being factory-prepared for the installation of hardware. Upon request, check shop drawings of other such others work to confirm that adequate provisions are made for proper location and installation of hardware.

E. Operations and Maintenance Data: After installation, representative templates, instructions sheets and installation details shall be provided to the owner when building is accepted. Include one copy of each hardware schedule, keying and wiring diagrams.

1.05 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 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 or more identical sets may be packaged in the same container.

C. Inventory hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.

D. Deliver individually packaged hardware items at the proper times to the proper locations (shop or project site) for installation.

PART 2 PRODUCTS

2.01 SCHEDULED HARDWARE:

A. Requirements for design, grade, function, finish, size and other distinctive qualities of each type of finish hardware is indicated in the Hardware Schedule at the end of this section. Products are identified by using hardware designation numbers of the following.
   1. Manufacturer's Product Designations: One or more manufacturers are listed for each hardware type required.
   2. Warranty: Provide published warranties in accordance this Section .
      a. LOCKSETS: 7 years
      b. DOOR CLOSERS: 10 years
      c. EXIT DEVICES: 2 years
      d. OTHER HARDWARE: One year
   3. Maintenance Materials: Provide special wrenches and tools applicable to each different or special hardware component. Provide maintenance tools and accessories supplied by hardware component manufacturer to owner representative.

2.02 ACCEPTABLE MANUFACTURES:

A. Hinges: PBB Inc., Stanley , McKinney
   1. Locksets: Corbin Russwin
   2. Exit Device: Corbin Russwin, Sargent, Yale
   3. Closers: Norton, Sargent, Yale,
   4. Flat Goods: McKinney, Trimco, BBW, Quality
   5. Gasketing: McKinney, Pemko, Reese, Zero
   6. Cores: Best
   7. Key cabinet: Telkee, Lund, Key Control
   8. Substitutions: In accordance with Instructions to Bidders.

B. Provide free wheeling outside trim when unit is locked. Provide locksets with one piece lever handles both sides not less than 4 ½ inches and 3 ½ inch diameter rose cold forged, for accessibility by Handicapped. Torqued tested at 1300 lbs.

C. Provide closers with the following functions: Unitrol shock absorber foot, independent sweep, fast latch, hydraulic check “V” grooved valves, accessibility by Handicapped, delay action, adjustable spring tensions. Closers must meet barrier free requirements. Closers must have two-tooth engagement rack and pinion. All valves must be accessible without removing closer from the door. Cover must not have slotted cover. Cover must be secured with screw holes in cover. Provide installation and sizing instructions in cover.

D. Closers shall have cast aluminum alloy shell. Closer shall be surface mounted and shall project no more than 2 1/8" from the surface of the door. Closer shall be non-handed. Closers shall be mounted on side of door not seen from common area.

E. Exit Devices (as scheduled) "touchbar" Provide all exposed surfaces same material and finish. Exit device must have free wheeling outside trim when device is locked. Touch bar must not protrude from housing when pad is compressed.

F. Latchbolt shall be investment cast stainless steel pullman type with 3/4" throw. All devices to be furnished with auxiliary dead-latching mechanism. Roller strike shall be furnished.

G. Unless otherwise specified. Vandal resistant outside lever escutcheon trim shall be heavy duty cold forged constructed incorporating four threaded studs for through-bolting. All escutcheon trim shall be UL listed and constructed with beveled edges. Rigid levers while locked or manual type clutch mechanisms are not acceptable.

2.03 MATERIALS AND FABRICATION:

A. General: Hand of Door: Drawings show direction of slide, swing or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.

B. Base Metals: Produce hardware units of basic metal and forming method indicated, using manufacture's standard metal alloy, composition, temper, and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units by applicable ANSI A 156 series standard for each type hardware item and with ANSI A156.18 for finish designations indicated. Do not furnish "optional" materials or forming methods for those indicated, except as otherwise specified.

C. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation. Do not provide hardware which has been prepared for self-tapping sheet metal screws, except as specifically indicated.

D. Furnish screws for installation, with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of such other work as closely as possible, including "prepared for paint"in surfaces to receive painted finish.

2.04 KEYING

A. Door Locks: Grand master keyed.
1. Include control keying with removable core cylinders.
2. Key to existing keying system.
3. During the construction period all exterior doors and (20) specific interior doors to be designated after construction begins, shall be keyed to a Construction Master Key System by Best Lock Corporation that shall remain operative until Final Acceptance of building by the Owner.
4. Base the permanent keying system on the Owner's existing Great Grand Master system, which is the Best Lock Corporation. Determine keyed-alike sets jointly by the Owner's Representative and the Contractor immediately after contract award. Perform keying and biting by and registered with the lock manufacturer.
5. Final keying shall be keyed to a 7-pin Master Keyed plan by Best Lock Corporation. All keying and bitting shall be performed by and registered with the lock manufacturer.
6. Provide key control system with a capacity of 1.75 times the number of door locks, with complete dual tag system.
7. Tags: set for permanent attachment of file key without the use of tools and one set with snap hook holding at least four keys.

2.05 HARDWARE FINISHES:

A. Provide matching finishes for hardware units at each door or opening, to the greatest extent

possible, and except as otherwise indicated. Reduce differences in color and textures as much as commercially possible where the base metal or metal forming process is different for individual units of hardware exposed at the same door opening. In general, match items to the manufacture's standard finish for the latch and lockset or (push-pull units if no latch-lock sets) for color and texture.

B. Provide finishes which match those established by BHMA.

C. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness and other qualities complying with manufacturer's standards, but in no cases less than specified for the applicable units of hardware by referenced standards.

D. Provide unless specified in schedule.
   1. 652 satin chrome plated on steel US26D
   2. 626 satin chrome plated on brass or bronze US26D
   3. 630 satin stainless steel US32D
   4. 689 satin aluminum sprayed AL

PART 3 EXECUTION

3.01 INSTALLATION:

A. Mount hardware units at heights indicated in "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware institute, except as specifically indicated or required to comply with governing regulations, and except as may be otherwise directed by Architect.

B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, coordinate removal, storage and reinstallation or application of surface preparations with finishing work specified in Division - 9 sections. Do not install surface-mounted items until finishes have completed on the substrate.

C. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

D. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

E. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant.

3.02 ADJUST AND CLEAN:

A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made at no expense to the Owner.

B. Clean adjacent surfaces soiled by hardware installation.

C. Instruct Owner's Personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.

END OF SECTION

SECTION 08800 - GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glass.

B. Types of work in this section include glass and glazing for:
   1. Wood Doors.

C. Glazing compounds and accessories.

1.02 REFERENCE STANDARDS

A. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2011).

B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2011.

C. ASTM C1036 - Standard Specification for Flat Glass; 2011e1.

D. ASTM C1048 - Standard Specification for Heat-Treated Flat Glass--Kind HS, Kind FT Coated and Uncoated Glass; 2012.

E. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2009e1.

F. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2011a.

G. GANA (GM) - GANA Glazing Manual; Glass Association of North America; 2009.

H. GANA (SM) - GANA Sealant Manual; Glass Association of North America; 2008.

1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.

C. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.

D. Certificates: Certify that products meet or exceed specified requirements.
   1. Separate certification will not be required for glazing materials bearing manufacturer's permanent labels designating type and thickness of glass, provided labels represent a quality control program involving a recognized certification agency or independent testing laboratory acceptable to authorities having jurisdiction.

1.04 QUALITY ASSURANCE

A. Safety Glazing Standard: Where safety glass is indicated or required by authorities having jurisdiction, provide type of products indicated which comply with ANSI Z97.1 and testing requirements of 16 CFR, Part 1201 for category II materials.
   1. Subject to compliance with requirements, provide safety glass permanently marked with certification label of safety Glazing Certification Council (SGCC) or other certification agency acceptable to authorities having jurisdiction.

2. Manufacture and label tempered glass in accordance with Consumer Product Safety Commission's Safety Standards for Architectural Glazing Materials , 16 CFR, Part 1201.

B. Fire Resistance Rated Wire Glass: Provide wire glass products that are identical to those tested per ASTM E 163 (UL 9) and are labeled and listed by UL or other testing and inspecting agency acceptable to authorities having jurisdiction.

C. Single Source Responsibility for Glass: To ensure consistent quality of appearance and performance, provide materials produced by a single manufacturer or fabricator for each kind and condition of glass indicated and composed of primary glass obtained from a single source for each type and class required.

D. Use glazing sealants which have been proven to be fully adherent to glass types involved and compatible with substrates.

1.05 DELIVERY, STORAGE AND HANDLING

A. Protect glass and glazing materials during delivery, storage and handling to comply with manufacturer's directions and as required to prevent edge damage to glass, and damage to glass and glazing materials from effects of moisture including condensation, of temperature changes, of direct exposure to sun, and from other causes.

1.06 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer's Special Project Warranty on Laminated Glass: Provide written warranty signed by manufacturer of laminated glass agreeing to provide replacements for those laminated glass units which develop manufacturing defects. Manufacturing defects are defined as edge separation or delamination which materially obstructs vision through glass.
   1. Warranty Period: Manufacturer's standard but not less that 4 years after date of Substantial Completion.

PART 2 PRODUCTS

2.01 GLAZING TYPES

A. Type S-2 - Fire-Protection-Rated Glazing:
   1. IBC Fire Protection Rating: D-H-T-90 or W-90, minimum.
   2. Applications: Provide this type of glazing in the following locations:
      a. Glazed lites in fire doors.
   3. Thickness: 1/4 inch.
   4. Glazing Method: As required for fire rating.

2.02 GLASS MATERIALS

A. Float Glass Manufacturers:
   1. AGC Flat Glass North America, Inc: www.na.agc-flatglass.com.
   2. Pilkington North America Inc: www.pilkington.com/na.
   3. PPG Industries, Inc: www.ppgideascapes.com.
   4. Falconer Glass Industries.
   5. Hordis Brothers, Inc.
   6. LOF Glass, Inc.

7. Saint-Gobain/Euroglass.
8. Viracon.
9. Substitutions: Refer to Section 01600 - Product Requirements.

B. Fire-Protection-Rated Glazing:
1. IBC Fire Protection Rating: D-H-T-90 or W-90, minimum.
2. Safety Certification: 16 CFR 1201 Category II.

2.03 GLAZING COMPOUNDS

A. Manufacturers:
1. Dow Corning Corp; Product Dow Corning 790: www.dowcorning.com.
2. Pecora Corporation; Product 864: www.pecora.com.
3. Bostik Construction Products Div; Product Chem-Calk 1000.
4. Sonneborn Building Products Div., Rexnord Chemical Products, Inc.; Product Omniseal.
5. Tremco, Inc; Product Spectrum 1.
6. Substitutions: Refer to Section 01600 - Product Requirements.

B. General: Provide product of type indicated and complying with the following requirements:
1. Compatibility: Select glazing sealants and tapes of proven compatibility with other materials with which they will come into contact, including glass products, seals of insulating glass units, and glazing channel substrates, under conditions of installation and services, as demonstrated by testing and field experience.
2. Suitability: Comply with recommendations of sealant and glass manufacturers for selection of glazing sealants and tapes which have performance characteristics suitable for applications indicated and conditions at time of installation.
3. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated which complies with ASTM C 920 requirements, including those for Type, Grade, Class and Uses.
4. Colors: Provide color exposed sealants indicated or, if not otherwise indicated, as selected by Architect from manufacturer's standard colors.

C. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C 920, Type S, Grade NS, Class 25, Uses M, A, and G; cured Shore A hardness of 15 to 25; color as selected.

2.04 GLAZING ACCESSORIES

A. Preformed Butyl-Polyisobutylene Glazing Tape Without Spacer Rod:
1. Pecora Corporation; Product Extru-Seal: www.pecora.com.
2. Tremco, Inc; Product Tremco 440 Tape: www.tremcosealants.com.
3. Bostik Construction Products Div; Product Chem-Tape 40.
4. Protective Treatments, Inc.; Product PTI 303 Glazing Tape.

B. Preformed Butyl-Polyisobutylene Glazing Tape With Spacer Rod:
1. Pecora Corporation; Product Extru-Seal: www.pecora.com.
2. Tremco, Inc; Product Tremco 440 Tape: www.tremcosealants.com.
3. Bostik Construction Products Div; Product Chem-Tape 40.
4. Protective Treatments, Inc.; Product PTI 303 Glazing Tape.
5. Substitutions: Refer to Section 01600 - Product Requirements.

C. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness, ASTM C864 Option I. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.

D. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness, ASTM C 864 Option I. Minimum 3 inch long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.

E. Glazing Tape: Preformed butyl compound with integral resilient tube spacing device; 10 to 15 Shore A durometer hardness; coiled on release paper; black color.
   1. Manufacturers:
      a. Pecora Corporation: www.pecora.com.
      b. Tremco Global Sealants: www.tremcosealants.com.
      c. Substitutions: Refer to Section 01600 - Product Requirements.

F. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings for glazing are correctly sized and within tolerance. Obtain Glazier's written report listing conditions detrimental to performance of glazing work. Do not allow glazing work to proceed until unsatisfactory conditions have been corrected. Accuracy of sizing rest with glazier.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing. Obtain Glazier's written report listing conditions detrimental to performance of glazing work. Do not allow glazing work to proceed until unsatisfactory conditions have been corrected. Accuracy of sizing rest with glazier.

3.02 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant.

D. Install sealants in accordance with ASTM C1193 and GANA Sealant Manual.

E. Install sealant in accordance with manufacturer's instructions.

3.03 INSTALLATION - INTERIOR DRY METHOD (TAPE AND TAPE)

A. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch (1.6 mm) above sight line.

B. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.

C. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.

D. Place glazing tape on free perimeter of glazing in same manner described above.

E. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.

F. Knife trim protruding tape.

3.04 INSTALLATION - INTERIOR WET METHOD (COMPOUND AND COMPOUND)

A. Install glazing resting on setting blocks. Install applied stop and center pane by use of spacer shims at 24 inch centers, kept 1/4 inch below sight line.

B. Locate and secure glazing pane using glazers' clips.

C. Fill gaps between glazing and stops with glazing compound until flush with sight line. Tool surface to straight line.

3.05 INSTALLATION - WIRE GLASS

A. Wire Glass: Take care in cutting and installing square mesh wire glass so that vertical wires run parallel to jamb members.

3.06 CLEANING

A. Remove glazing materials from finish surfaces.

B. Remove labels after Work is complete.

C. Clean glass and adjacent surfaces.

END OF SECTION

D I V I S I O N 9

F I N I S H E S

Applicable Portions Of The Conditions Of The Contract And Division 1 General Requirements Apply To The Work Of This Division.

SECTION 09260 - GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Metal stud wall framing.

C. Metal channel ceiling framing.

D. Acoustic insulation.

E. Fiberglass Reinforced Wall Panels

F. Gypsum wallboard.

G. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

A. Section 06114 - Wood Blocking and Curbing: Wood blocking for support of wall-mounted equipment.

B. Section 07900 - Joint Sealers: Acoustic sealant.

1.03 REFERENCE STANDARDS

A. AISI SG02-1 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2001 with 2004 supplement. (replaced SG-971)

B. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 2012.1.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2011.

D. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2002 (Reapproved 2007).

E. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2011a.

F. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.

G. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2011.

H. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2011.

I. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2007.

J. ASTM C1325 - Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cement

Substrate Sheets; 2008b.

K. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2011.

L. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2012.

M. ASTM E72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction; 2010.

N. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.

O. ASTM E413 - Classification for Rating Sound Insulation; 2010.

P. GA-216 - Application and Finishing of Gypsum Board; Gypsum Association; 2010.

Q. GA-600 - Fire Resistance Design Manual; Gypsum Association; 2009.

R. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.04 SYSTEM DESCRIPTION

A. Acoustic Attenuation for Interior Partitions: STC of 45-49 calculated in accordance with ASTM E 413, based on tests conducted in accordance with ASTM E 90.

1.05 DEFINITIONS

A. Gypsum Board Construction Terminology: Refer to ASTM C 11 and GA 505 for definitions of terms for gypsum board construction not otherwise defined in this section or other referenced standards.

1.06 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

D. Test Reports: For all stud framing products that do not comply with ASTM C645 or C 754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

E. Certification from supplier, in writing to the Architect, that metal studs and related accessories delivered to project site comply with these specifications, including but not limited to required metal gages.

1.07 QUALITY ASSURANCE

A. Perform in accordance with ASTM C 840. Comply with requirements of GA-600 for fire-rated assemblies.

B. Installer Qualifications: Company specializing in performing gypsum board application and finishing, with minimum 5 years of documented experience.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic and other causes. Neatly stack gypsum boards flat to prevent sagging.

C. Handle gypsum boards to prevent damage to edges, ends, and surfaces. Do not bend or otherwise damage metal corner beads and trim.

1.09 PROJECT CONDITIONS

A. Minimum Room Temperatures: For non adhesive attachment of gypsum board to framing, maintain not less than 40 deg F (4 deg C). For adhesive attachment and finishing of gypsum board maintain not less than 50 deg F (10 deg C) for 48 hours prior to application and continuously thereafter until drying is complete.

1.10 REGULATORY REQUIREMENTS

A. Conform to applicable code for fire rated assemblies as indicated on drawings.
   1. Fire-Resistance Ratings: Where indicated, provide materials and construction which are identical to those of assemblies whose fire resistance rating has been determined per ASTM E 119 by a testing and inspecting organization acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

B. Interior Partitions Indicated as Acoustic: Provide completed assemblies with the following characteristics:
   1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

C. Fire Rated Assemblies: Provide completed assemblies complying with applicable code.

2.02 METAL FRAMING MATERIALS

A. Manufacturers - Metal Framing, Connectors, and Accessories:
   1. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com.
   2. Dietrich Metal Framing: www.dietrichindustries.com.
   3. Marino\Ware: www.marinoware.com.
   4. Substitutions: See Section 01600 - Product Requirements.

B. Non-Loadbearing Framing System Components: ASTM C 645; galvanized sheet steel, ASTM A525 G-60 coating, of size and properties necessary to comply with ASTM C 754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.
   1. Exception: The minimum metal thickness and section properties requirements of ASTM C 645 are waived provided steel of 40 ksi minimum yield strength is used, the metal is continuously dimpled, the effective thickness is at least twice the base metal thickness, and maximum stud heights are determined by testing in accordance with

ASTM E 72 using assemblies specified by ASTM C 754.

2. Thickness: 20 gauge minimum.
3. Depth: As indicated on drawings.
4. Studs: C shaped. Flange edges of studs bent back 90 deg and hemmed to form 3/16" minimum lip (return).
5. Runners: U shaped, sized to match studs. Hemmed to form 3/16" minimum lip (return).
6. Ceiling Channels: C shaped. Cold-rolled steel, 0.0598 inch minimum thickness of base (uncoated) metal and 7/16 inch wide flanges, protected with rust-inhibitive paint for interior elements or hot-dip galvanized coating complying with ASTM A525 , G-60, when used as follows:
   a. Carrying Channels: 1-1/2 inch deep, 475 lbs per 1000 ft., unless otherwise indicated.
7. Furring: Hat-shaped sections, minimum depth of 7/8 inch.
8. Fasteners: Provide fasteners of type, material, size, corrosion resistance, holding power and other properties required to fasten steel framing and furring members securely to substrates involved; complying with the recommendations of gypsum drywall manufacturers for applications indicated.

C. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper.

D. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

E. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
   1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI North American Specification for the Design of Cold-Formed Steel Structural Members.
   2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot dipped galvanized coating.
   3. Provide components UL-listed for use in UL-listed fire-rated head of partition joint systems specified in this section.
   4. Deflection and Firestop Track:
      a. Provide mechanical anchorage devices as described above that accommodate deflection while maintaining the fire-rating of the wall assembly.
   5. Provide top track preassembled with connection devices spaced to fit stud spacing indicated on drawings; minimum track length of 12 feet.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. CertainTeed Corporation: www.certainteed.com.
   2. Georgia-Pacific Gypsum: www.gpgypsum.com.
   3. National Gypsum Company: www.nationalgypsum.com.
   4. USG Corporation: www.usg.com.
   5. Substitutions: See Section 01600 - Product Requirements.

B. Backing Board For Wet Areas: One of the following products:
   1. Application: Surfaces behind tile in wet areas including toilet rooms.

2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
   a. Thickness: 5/8 inch.
   b. Products:
      1) Custom Building Products; Wonderboard.
      2) National Gypsum Company; PermaBase Brand Cement Board.
      3) National Gypsum Company; PermaBase Flex Brand Cement Board.
      4) USG Corporation; Durock Brand Cement Board.

C. Gypsum Wallboard: ASTM C 1396/C 1396M. Sizes to minimize joints in place; ends square cut.
   1. Regular Type:
      a. Application: Use for vertical surfaces, unless otherwise indicated.
   2. Thickness: 5/8 inch.
   3. Edges: Tapered.

D. Fire Resistant Type: Complying with Type X requirements; UL or WH rated.
   1. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X.
   2. Application: Where required for fire-rated assemblies, unless otherwise indicated.
      a. Thickness: 1/2 inch, 5/8 inch, as indicated.
   3. Ceiling Board: Special sag-resistant type.
      a. Application: Ceilings, unless otherwise indicated.
      b. Thickness: 1/2 inch.
      c. Edges: Tapered.

E. Water-Resistant Gypsum Backing Board: ASTM C 1396/C 1396M; ends square cut.
   1. Application: toilet rooms on walls where tile isn't specified.
   2. Edges: Tapered.

F. Shaftwall and Coreboard: Type X; 1 inch thick by 24 inches wide, beveled long edges, ends square cut.
   1. Paper Faced Type: Gypsum shaftliner board or gypsum coreboard as defined ASTM C1396/C1396M; water-resistant faces.

2.04 ACCESSORIES

A. Sound Attenuation Blankets: Unfaced mineral fiber blanket insulation produced by combining glass or slag mineral fibers with thermosetting resins to comply with ASTM C 665 for Type I (blankets without membrane facing).

B. Fiberglass Reinforced Plastic Panels
   1. Manufacturers:
      a. Panolam
      b. Crane Composites

C. Acoustic Insulation: ASTM C 665; preformed glass fiber, friction fit type, unfaced.Thickness as indicated.

D. Acoustic Sealant: As specified in Section 07900.

E. Corner bead and Edge Trim for Interior Installation: Provide formed metal Galvanized steel corner beads, edge trim and control joints which comply with ASTM C 1047 and requirements indicated below:
   1. For use at all gypsum wallboard, except where special aluminum edge trim is indicated.

F. Joint Materials: ASTM C475.
   1. Joint Tape: Paper reinforcing tape, unless otherwise indicated.
   2. Use pressure sensitive or staple-attached open-weave glass fiber reinforcing tape with compatible joint compound where recommended by manufacturer of gypsum board and joint treatment materials for application indicated.
   3. Ready-mixed vinyl-based joint compound.
      a. Where setting-type joint compounds are indicated for use as taping and topping compounds, use formulation for each which develops greatest bond strength and crack resistance and is compatible with other joint compounds applied over it.
      b. For filling joints and treating fasteners of water-resistant gypsum backer board behind base for ceramic tile, use formulation recommended by gypsum board manufacturer for this purpose.

G. Screws for Attachment to Steel Members Less Than 0.03 inch In Thickness, to Wood Members, and to Gypsum Board: ASTM C1002; self-piercing tapping type; cadmium-plated for exterior locations.

H. Screws: ASTM C 1002; self-piercing tapping type.

I. Grout: Sanded gypsum plaster for grouting hollow metal door frames.

J. Contractor to use fire-resistive treated wood blocking where indicated.

K. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

B. Examine substrates to which gypsum board construction attaches or abuts, preset hollow metal frames, cast-in-anchors, and structural framing, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of gypsum board construction. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Ceiling Anchorages: Coordinate installation of ceiling suspension system with installation of overhead structural systems to ensure that inserts and other structural anchorage provisions have been installed to receive ceiling anchors in a manner that will develop their full strength and at spacing required to support ceiling.
   1. Furnish concrete inserts and/or other required devices, to other trades for installation well in advance of time needed for coordination with other construction.

3.03 SHAFT WALL INSTALLATION

A. Before sprayed-on fireproofing is applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed-on fireproofing. Where offset anchor plates are required, provide continuous units fastened to building structure not more than 24 inches on center and to ceiling runners.

B. After sprayed-on fireproofing has been applied, remove only as much fireproofing as needed to complete installation of shaft wall systems. Protect fireproofing that remains from damage. Comply with shaft wall manufacturers requirements for replacement of fireproofing as required to re-establish its continuity.

C. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.
   1. Fasten runners to structure with short leg to finished side, using appropriate power-driven fasteners at not more than 24 inches on center.
   2. Install studs at spacing required to meet performance requirements.

D. Do not bridge building expansion joints with shaft wall system, frame both sides of joints with furring and other support as indicated.

E. Install supplementary framing, blocking and bracing to support gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings and similar work which cannot be adequately supported directly by regular framing of gypsum board shaft wall system.
   1. Where handrails or wall hung casework or equipment are indicated for direct attachment to gypsum board shaft wall system, provide no less than 16 gage thick by widths required, but not less than 4 inch wide, galvanized steel reinforcement strip, accurately positioned and secured behind not less than one gypsum board face layer of 1/2 inch or 5/8 inch thickness. Supports shall be designed to accommodate a 250 pound per lineal food load in addition to weight of that which is to be hung.
   2. Coordinate gypsum board shaft wall construction with sprayed-on fireproofing of the structure, so that both remain complete and undamaged. Patch or replace sprayed-on fireproofing removed or damaged during the installation of the shaft wall system.
   3. At penetrations in shaft wall, maintain fire resistance rating of entire shaft wall assembly by installing supplementary fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.
   4. Isolate shaft wall system from transfer of structural loading to system, both horizontally and vertically. Provide slip or cushioned type joints to attain lateral support and avoid axial loading. Comply with details shown and with manufacturer's instructions.

F. Shaft Wall Liner: Cut panels to accurate dimension and install sequentially between special friction studs.
   1. On walls over sixteen feet high, screw-attach studs to runners top and bottom.
   2. Seal perimeter of shaft wall and penetrations with acoustical sealant.

3.04 FRAMING INSTALLATION

A. Metal Framing: Comply with ASTM C 754, ASTM 840 requirements that apply to framing installation and manufacturer's instructions.

B. Install supplementary framing, blocking and bracing at terminations in the work and for support of fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, and similar construction to comply with details indicated and with recommendations of gypsum board manufacturer, or if none available, with Gypsum

Construction Handbook published by United States Gypsum Company.

1. Wood Blocking: Secure wood blocking to metal studs with self-tapping pan head screws.
2. Provide 12 gauge or heavier C-studs or channels when required to accommodate heavy wall-hung items.

C. Isolate steel framing from building structure to prevent transfer of loading imposed by structural movement, at locations indicated below to comply with this section:
   1. Where edges of suspended ceilings abut building structure horizontally at ceiling perimeters or penetration of structural elements.
   2. Where partition and wall framing abuts overhead structure.
   3. Provide slip or cushioned type joints as detailed to attain lateral support and avoid axial loading.

D. Do not bridge building expansion and control joints with steel framing or furring members; independently frame both sides of joints with framing or furring members or as indicated.

E. Fire rated partitions shall be constructed independently from non-rated partitions.

F. Install runners (tracks) at floors, ceilings and structural walls and columns where gypsum drywall stud system abuts other construction. Align floor and ceiling tracks to assure plumb partitions. Secure track with suitable fasteners spaced 24 inches on center, maximum.

G. Installation Tolerances: Install each steel framing and furring member so that fastening surfaces do not vary more than 1/8 inch from plane of faces of adjacent framing.

H. Extend all partition framing full height to structural supports or substrates above suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.

I. Partitions 10 feet or more in height shall be braced horizontally, for lateral strength, with 3/4 inch channels wired or screw attached permanently to inside of studs. Channels shall be spaced not more than 6 feet on center.

J. Install studs and furring in sizes indicated and spaced 16 inches on center, unless otherwise indicated. Secure each stud to both top and bottom runners with screws, or other accepted fastening method, through each stud flange and runner flange.

K. Install studs so that flanges point in the same direction.

L. Frame door openings to comply with details indicated, with GA-219 and with applicable published recommendations of gypsum board manufacturer. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
   1. Extend vertical jamb studs through suspended ceilings and attach to underside of floor or roof structure above.

M. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
   1. Secure hangers to structural support by connecting directly to structure where possible, otherwise connect to cast-in concrete inserts or other anchorage devices or fasteners as indicated. Provide additional structural members if required for hanger spacing.
      a. Do not attach hangers to metal deck tabs.

b. Do not attach hangers to metal roof deck.
c. Do not attach hangers to underside of concrete slabs with powder-actuated fasteners; use drilled-in type anchors instead.

2. Do not connect or suspend steel framing from ducts, pipes or conduit.
3. Keep hangers and braces 2 inches clear of ducts, pipes and conduits.
4. Sway-brace suspended steel framing with hangers used for support.
5. Where, indicated, incorporate isolation hangers into supporting wires.
6. Level Installation Tolerances: Install steel framing components for suspended ceilings so that cross furring members or grid suspension members are level to within 1/8 inch in 12 ft. as measured both lengthwise on each member and transversely between parallel members.ceiling1/1200.
7. Install suspended steel framing components in sizes and at spacings indicated but not less than that required by referenced steel framing installation standard and conforming to ASTM E580 - Seismic Restraint.
   a. Wire Hangers: 0.1620 inch diameter (8 gage), 4ft. on center (maximum).
   b. Carrying Channels (Main Runners): 4 ft. on center.
   c. Rigid Furring Channels (Furring Members): 16 inches on center.
8. Level ceiling system to a tolerance of 1/1200.
9. Laterally brace entire suspension system.

N. Studs: Space studs at 16 inches on center.
   1. Extend partition framing to structure in all locations.
   2. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

O. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

P. Blocking: Install blocking for support of plumbing fixtures, wall cabinets, toilet accessories, hardware, and base cabinets. Bolt or screw steel channels to studs.

3.05 ACOUSTIC ACCESSORIES INSTALLATION

A. Where walls with acoustic insulation are indicated, provide a single bead of acoustical sealant at center of floor, ceiling and wall tracks, seal construction at perimeters, control and expansion joints, openings and penetrations with a continuous bead of acoustical sealant including a bead at both faces of partitions. Comply with ASTM C 919 and manufacturer’s recommendations for location of edge trim, and close off sound-flanking paths around or through construction, including sealing of partitions above acoustical ceilings.
   1. Minimum size of sealant bead shall be 1/4 inch, but size must be increased as necessary to assure positive seal.

B. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

C. Acoustic Sealant: Install in accordance with manufacturer's instructions.

3.06 BOARD INSTALLATION

A. Comply with ASTM C 840 and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
   1. Locate exposed end-butt joints as far from center of walls and ceilings as possible, and stagger not less than 24 inches in alternate courses of board.
   2. Install ceiling boards across framing in the manner which minimizes the number of end-butt joints, and which avoids end joints in the central area of each ceiling. Stagger end joints at least 24 inches.
   3. Install wall/partition boards in manner which minimizes the number of end-butt joints or avoids them entirely where possible. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs.
   4. Install sound attenuation or thermal blankets where indicated, prior to gypsum board unless readily installed after board has been installed. Completely fill stud space, full height of wall/partition.
   5. Install exposed gypsum board with face side out. Do not install imperfect , damaged or damp boards. Butt boards together for a light contact at edges and ends with not more than 1/16 inch open space between boards. Do not force into place.
   6. Locate either edge or end joints over supports. Position boards so that like edges abut, tapered edges against tapered edges and mill-cut or field-cut ends against mill-cut or field-cut ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions.
   7. Attach gypsum board to steel studs so that leading edge or end of each board is attached to open (unsupported) edge of stud flange first.
   8. Grout hollow metal door frames solid with sanded gypsum plaster. Grouting shall be done before adjacent studs are installed.
   9. Fit gypsum board around ducts, pipes, and conduits.
   10. Isolate perimeter of non-load-bearing drywall partitions at structural abutments. Provide 1/4 inch to 1/2 inch space. Seal joints with acoustical sealant.

B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

C. Double-Layer Non-Rated: Use gypsum board for first layer, placed perpendicular to framing or furring members, with ends and edges occurring over firm bearing. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.

D. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

E. Installation on Metal Framing: Use screws for attachment of all gypsum board except face layer of non-rated double-layer assemblies, which may be installed by means of adhesive lamination.
   1. On partitions/walls apply gypsum board vertically (parallel to framing) and provide sheet lengths which will minimize end joints.

F. Moisture Protection: Treat cut edges and holes in moisture resistant gypsum board with sealant.

3.07 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as follows:

1. Not more than 30 feet apart on walls and ceilings over 50 feet long.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials and as indicated.

3.08 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   2. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.

B. Finish interior gypsum wall board by applying the following joint compounds in a minimum of 3 coats (not including pre-fill of openings in base), and sand between coats and after last coat:
   1. Embedding and First Coat: Setting-Type Joint Compound.
   2. Fill (Second) Coat: Setting-type joint compound.
   3. Finish (Third) Coat: Ready-mix drying-type all-purpose or topping compound.

C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Where perimeter wall angles of acoustic tile ceilings contact wallboard encased columns, the contact are between corner beads shall be made true to line using joint compound which is then tapered to a feather edge.
   2. Feather coats of joint compound so that camber is maximum 1/32 inch.
   3. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.

D. Fire-rated Partitions: Where multiple layers of gypsum board are used, all layers must be taped and filled and all seams staggered.

E. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.09 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 09300 - TILE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Cementitious backer board as tile substrate.

D. Stone thresholds.

E. Ceramic trim.

F. Non-ceramic trim.

1.02 RELATED REQUIREMENTS

A. Section 07900 - Joint Sealers.

1.03 REFERENCE STANDARDS

A. ANSI A108 Series/A118 Series/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2012.1.
   1. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2012.1.
   2. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar; 2012.1.
   3. ANSI A108.1c - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex Portland Cement Mortar; 2012.1.
   4. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive; 2012.1.
   5. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar; 2012.1.
   6. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy; 2012.1.
   7. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout; 2012.1.
   8. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 2012.1.
   9. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 2012.1.
   10. ANSI A108.11 - American National Standard for Interior Installation of Cementitious Backer Units; 2012.1.
   11. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior glue plywood) Latex-Portland Cement Mortar; 2012.1.
   12. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded,

Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2012.1.
13. ANSI A118.1 - American National Standard Specifications for Dry-Set Portland Cement Mortar; 2012.1.
14. ANSI A118.4 - American National Standard Specifications for Latex-Portland Cement Mortar; 2012.1.
15. ANSI A118.6 - American National Standard Specifications for Standard Cement Grouts for Tile Installation; 2012.1.
16. ANSI A118.7 - American National Standard Specifications for Polymer Modified Cement Grouts for Tile Installation; 2012.1.

B. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2012.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Samples of standard line of colors for final color selection.

C. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

D. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, and setting details.

E. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

F. Selection Samples: Color charts illustrating full range of colors and patterns.

G. Selection Samples: Samples of actual tiles for selection.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01600 - Product Requirements, for additional provisions.
2. Extra Tile: 20 square feet of each size, color, and surface finish combination.

1.05 QUALITY ASSURANCE

A. Maintain one copy of The Tile Council of North America Handbook and ANSI A108 Series/A118 Series on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum 5 years of documented experience.

C. Installer Qualifications: Company specializing in performing tile installation, with minimum of 5 years of documented experience.

1.06 MOCK-UP

A. See Section 01400 - Quality Requirements, for general requirements for mock-up.

B. Construct tile mock-up where indicated on the drawings, incorporating all components specified for the location.

C. Approved mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not install solvent-based products in an unventilated environment.

B. Maintain ambient and substrate temperature of 50 degrees F during installation of mortar materials.

C. Deliver supply of maintenance materials to the owner. Furnish maintenance materials from same lot as materials installed, and enclosed in protective packaging with appropriate identifying labels.

PART 2 PRODUCTS

2.01 TILE

A. Manufacturers: All products by the same manufacturer.
   1. American Olean: www.americanolean.com.
   2. Dal-Tile Corporation: www.daltile.com.
   3. Summitville Tiles, Inc: www.summitville.com.
   4. Substitutions: See Section 01600 - Product Requirements.

B. ColorBody Porcelain Tile
   1. Basis of Design: Refer to drawings for color selections

C. Glass Mosaic Tile:
   1. Basis of Design: Refer to drawings for details.
   2. Base: Same as floor tile.
      a. Length: Same as tile length.
      b. Height: 5 inch.
      c. Surface Finish: As Scheduled.

D. Glazed Wall Tile:
   1. Basis of Design: Refer to drawings for details

2.02 TRIM AND ACCESSORIES

A. Ceramic Trim: Matching cove base ceramic shapes in sizes coordinated with field tile.
   1. Applications: Use in the following locations:
      a. Floor to Wall Joints: Cove base.
   2. Manufacturer: Same as for tile.

B. Non-Ceramic Trim: Brushed stainless steel, style and dimensions to suit application, for setting using tile mortar or adhesive.
   1. Applications: Use in the following locations:
      a. Open edges of wall tile.
      b. Open edges of floor tile.
      c. Wall corners, outside and inside.
      d. Transition between floor finishes of different heights.
   2. Manufacturer:

a. Schluter-Systems: www.schluter.com.
b. Genesis APS International: www.genesis-aps.com.

C. Thresholds: Marble, white or gray, honed finish; 2 inches wide by full width of wall or frame opening; 1/2 inch thick; beveled one long edge with radiused corners on top side; without holes, cracks, or open seams.
1. Applications: Provide at the following locations:
a. At doorways where tile terminates.
b. At open edges of floor tile where adjacent finish is a different height.

2.03 SETTING MATERIALS

A. Provide setting materials made by the same manufacturer as grout.

B. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.
1. Application(s): Use this type of bond coat where indicated and where no other type of bond coat is indicated.
2. Products:
a. ARDEX Engineered Cements; ARDEX X 77 MICROTEC: www.ardexamericas.com.
b. AVM Industries, Inc; Thin-Set 780: www.avmindustries.com.
c. LATICRETE International, Inc; LATICRETE 254 Platinum: www.laticrete.com.

2.04 ADHESIVE MATERIALS

A. Manufacturers:
1. Bostik Inc; Product Hydroment Ultra-Set: www.bostik-us.com.
2. Mapei Corporation; Product Planicrete W: www.mapei.com.
3. Substitutions: See Section 01600 - Product Requirements.

B. Organic Adhesive: ANSI A136.1, thinset bond type; use Type I in areas subject to prolonged moisture exposure.

2.05 MORTAR MATERIALS

A. Manufacturers:
1. Bostik Inc: www.bostik-us.com.
2. Custom Building Products: www.custombuildingproducts.com.
3. Substitutions: See Section 01600 - Product Requirements.

B. Mortar Bond Coat Materials:
1. Dry-Set Portland Cement type: ANSI A118.1.
2. Latex-Portland Cement type: ANSI A118.4.

2.06 GROUTS

A. Manufacturers:
1. ARDEX Engineered Cements: www.ardexamericas.com.
2. ProSpec, an Oldcastle brand; ProColor Sanded Tile Grout: www.prospec.com.
3. LATICRETE International, Inc; LATICRETE SpectraLOCK PRO Premium Grout: www.laticrete.com.
4. Substitutions: See Section 01600 - Product Requirements.

B. Standard Grout: Any type specified in ANSI A118.6 or A118.7.

2.07 THICK-BED MATERIALS

A. Mortar Bed Materials: Portland cement, sand, latex additive, and water.
   1. Products:
      a. LATICRETE International, Inc; LATICRETE 3701 Fortified Mortar Bed: www.laticrete.com.
      b. Merkrete, by Parex USA, Inc.; Merkrete Underlay C: www.merkrete.com.
      c. Substitutions: See Section 01600 - Product Requirements.

B. Grout: Any type specified in ANSI A118.6 or A118.7 used for interior walls with cementitious backer board/underlayment.

2.08 THIN-SET ACCESSORY MATERIALS

A. Tile Cleaner: Product specifically acceptable to tile manufacturer and grout manufacturer for application indicated and as recommended by National Tile Promotion Federation or Ceramic Tile Institute.
   1. Manufacturers: Provide products complying with requirements of the contract documents and made by one of the following:
      a. Mapei Corporation.

B. Temporary Protective Coating: Factory-apply product listed to protect exposed tile surfaces from mortar and grout residue.
   1. Grout release: Manufacturer's standard liquid coating.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.

D. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.

3.02 PREPARATION

A. Factory-Blending: Before start of installation verify that tile with an anticipated range of colors has been correctly blended to achieve a uniform color range from tile package to tile package

B. Field-Applied Temporary Protective Coating: Coat exposed tile surfaces with temporary protective coating indicated to comply with manufacturer's recommendations. Do not coat unexposed surfaces.
   1. Grout release.

C. Protect surrounding work from damage.

D. Vacuum clean surfaces and damp clean.

E. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

F. Install cementitious backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of dry-set mortar to a feather edge.

G. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL

A. Install tile and thresholds and grout in accordance with applicable requirements of ANSI A108.1 through A108.13, manufacturer's instructions, and The Tile Council of North America Handbook recommendations.

B. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

C. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

D. Form internal angles coved and external angles bullnosed.

E. Install non-ceramic trim in accordance with manufacturer's instructions.

F. Install thresholds where indicated.

G. Sound tile after setting. Replace hollow sounding units.

H. Keep control joints free of adhesive or grout. Apply sealant to joints.

I. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

J. Grout tile joints. Use standard grout unless otherwise indicated.

K. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

3.04 INSTALLATION - FLOORS - MORTAR BED METHODS

A. Over interior concrete substrates, install in accordance with The Tile Council of North America Handbook Method F112, bonded.

B. Mortar Bed Thickness: 1-1/4 inch, unless otherwise indicated.

3.05 INSTALLATION - WALL TILE

A. Over cementitious backer units on studs, install in accordance with The Tile Council of North America Handbook Method W244.

B. Over interior concrete and masonry install in accordance with The Tile Council of North America Handbook Method W202, thin-set with dry-set or latex-Portland cement bond coat.

3.06 CLEANING

A. Clean tile and grout surfaces after installation is complete.

1. Wipe latex-portland cement residue from tile with a damp cloth or sponge as soon as possible after tile installation.
2. Temporary protective coating: Remove from tile surfaces in strict accordance with manufacturer's instructions. Collect and dispose of coating material off project site.

3.07 PROTECTION

A. Protection: Apply neutral protective cleaner to tile after installation if recommended by tile manufacturer. Overlay completed tile installation with kraft paper for protection from subsequent construction activities.
   1. Do not permit traffic over finished floor surface for 4 days after installation.
   2. Remove protection, rinse, and dry tile installations before final review and acceptance.

END OF SECTION

SECTION 09511 - SUSPENDED ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

C. Seismic grid restraint.

1.02 REFERENCE STANDARDS

A. ASTM C635 - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2007.

B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels; 2008.

C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2011.

D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2008e1.

1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on suspension system components and acoustical units.

C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.04 QUALITY ASSURANCE

A. Seismic Grid Restraint: Design and install in accordance to International Building Code Section 1708.6 and ASCE 7.

B. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.05 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

1.06 PROJECT CONDITIONS

A. In a timely manner, furnish to affected installers, attachment devices for incorporation into other work.

B. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

C. Coordination Data: Prepare and distribute to affected installers, data necessary for coordination with related work. Include setting diagrams showing placement of attachment devices for acoustical ceiling hangers.

D. Install acoustical units after interior wet work is dry.

E. Work above ceilings has been finished, tested, and approved.

F. Coordinate ceiling system installation with work of other sections as required, including the following:
   1. Light fixtures.
   2. HVAC equipment.
   3. Fire suppression system components.
   4. Fire Alarm System Components.
   5. Partitions.

G. Do not begin installation of ceiling system until building's normal operating temperature and humidity levels have been reached and will be maintained.

1.07 EXTRA MATERIALS

A. See Section 01600 - Product Requirements, for additional provisions.

B. Provide 2.5 percent of total acoustical unit area of each type of acoustical unit for Owner's use in maintenance of project.

PART 2 PRODUCTS

2.01 ACOUSTICAL UNITS

A. Manufacturers:
   1. Armstrong World Industries, Inc: www.armstrong.com.
   2. CertainTeed Corporation: www.certainteed.com.
   3. USG: www.usg.com.
   4. Substitutions: See Section 01600 - Product Requirements.

B. Acoustical Units - General: ASTM E1264, Class A.

C. Acoustical Tile Type 1: Painted mineral fiber, ASTM E1264 Type III, with to the following characteristics:
   1. Size: 24 x 24 inches (600 x 600 mm).
   2. Thickness: 7/8 inches.
   3. Composition: Water felted.
   4. Edge: Square.
   5. Surface Color: White.
   6. Surface Pattern: Non-directional fissured.
   7. Product: Fine Fissured by Armstrong World Industries.

D. Acoustical Tile Type 2: Plastic faced mineral fiber, ASTM E1264 Type IV, with the following characteristics:
   1. Size: 24 x 24 inches (600 x 600 mm).
   2. Thickness: 7/8 inches.
   3. Composition: Water felted.
   4. Surface Pattern: Perforated, small holes with mylar film.

5. Product: Clean Room Mylar by Armstrong World Industries.
6. For use in all toilet rooms only.

2.02 SUSPENSION SYSTEM(S)

A. Manufacturers:
   1. Armstrong World Industries, Inc: www.armstrong.com.
   2. Chicago Metallic Corporation: www.chicagometallic.com.
   3. USG: www.usg.com.
   4. Substitutions: See Section 01600 - Product Requirements.

B. Suspension Systems - General: ASTM C635; die cut and interlocking components, with stabilizer bars, clips, splices, and perimeter moldings as required. Grids in toilet and utility rooms shall be aluminum, all others are to be electro-galvanized unless noted otherwise.

C. Colors: Provide colors as selected by the architect from manufacturer's complete set of standard colors.

D. Finishes: Manufacturer's standard shop-applied finishes.

E. Attachment Devices for Suspension System:

F. Anchors and intermediate support members: Provide sizes capable of sustaining 5 times the load-carrying capabilities shown in ASTM C 635, Table 1, "Direct Hung" column.

G. Deck inserts and hanger clips: Fabricate from hot-dip galvanized sheet steel with loops or holes for attachment at hanger wires.

H. Hanger wire: Zinc-coated (galvanized) carbon steel wire, ASTM A 641, soft temper, with Class 1 coating, minimum 10 gage (0.135 inch diameter).

I. Exposed Steel Suspension System Type 1: Formed steel, commercial quality cold rolled; heavy-duty.

2.03 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Perimeter Moldings: Same material and finish as grid.
   1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.

C. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions under which products of this section are to be installed and verify that the work properly may commence.

B. Verify existing conditions before starting work.

C. Verify that layout of hangers will not interfere with other work.

D. Verify that products furnished as work of this section, but not installed under this section,

have been properly installed by the entity performing the installation.

3.02 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C 636, ASTM E 580, and manufacturer's instructions and as supplemented in this section.

B. Install suspension system in accordance with Guideline CISCA 3-4.

C. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

D. Layout: Position ceiling components to maximize use of full-sized acoustical units and to provide border units which are equal in size and shape at opposing ceiling edges. Use of acoustical units which are smaller than 1/2 full-width is prohibited at ceiling perimeters. Conform to reflected ceiling plans to greatest extent possible.

E. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

F. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.

G. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members. Do not allow hangers to contact any objects or materials in ceiling plenum which are not actual components of ceiling system.
   1. Splay hangers only where necessary to avoid obstacles. Provide counter splaying, bracing, or other acceptable devices to compensate for lateral stresses caused by splayed hangers.
   2. Install splay hangers or other means of seismic restraint as required to meet the requirements of International Building Code Section 1621.2.5.2.2, ASTM E 580, and ASCE 7.
   3. Do not attach hangers to piping, conduit, or duct. Provide carrying channel trapeze support where obstruction cannot be avoided by splaying hanger 45 degrees from vertical or less.

H. Space hangers at not more than 48 inches on center and within 6 inches of ends of each direct-hung runner or carrying channel, unless indicated otherwise.

I. Loop and tie wire hangers securely to building's structural members; to attachment devices indicated; or, where not indicated, to devices suitable for substrate and capable of permanently supporting ceiling weight without failure or deterioration.

J. Level ceiling suspension system to tolerance of 1/8 inch in 12 feet, with cumulative tolerance not to exceed 1/4 inch. Bending or kinking of hangers is not allowed.

K. Exposed (Lay-in) Grid Installation: Install grid members square, with ends of members securely interlocked. Remove and replace dented, bent, or kinked members.

L. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

M. Do not support components on main runners or cross runners if weight causes total dead

load to exceed deflection capability.

N. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

O. Do not eccentrically load system or induce rotation of runners.

P. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Molding and trim attachment: Space screws not more than 16 inches on center and within 3 inches of ends of each trim-piece being installed. Install moldings and trim level with suspension system and within tolerance specified for suspension system.
   2. Use longest practical lengths.
   3. Miter corners and align butt joints carefully to form tight hairline joints.
   4. Face-riveting of trim and moldings is not allowed.

3.03 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install units after above-ceiling work is complete.

E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustical Units:
   1. Make field cut edges of same profile as factory edges.

3.04 ADJUST AND CLEAN

A. Use ceiling manufacturer's recommended methods and materials to clean and touch-up exposed components of ceiling system.

B. Replace ceiling system components which are discolored or damaged in any way, in a manner which results in the ceiling system showing no evidence of replacement work.

3.05 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

SECTION 09650 - RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient tile flooring.

B. Resilient base.

C. Installation accessories.

1.02 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2010e1.

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.

C. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile; 2004 (Reapproved 2010)e1.

D. ASTM F1303 - Standard Specification for Sheet Vinyl Floor Covering with Backing; 2004 (Reapproved 2009).

E. ASTM F1861 - Standard Specification for Resilient Wall Base; 2008.

F. ASTM F 1869 -Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Sub-floor Using Anhydrous Calcium Chloride; 1998

G. ASTM F1913 - Standard Specification for Vinyl Sheet Floor Covering Without Backing; 2004 (Reapproved 2010).

1.03 PERFORMANCE REQUIREMENTS

A. Conform to applicable code for fire performance ratings as follows:
   1. Critical radiant flux (CRF): Minimum 0.22 watt per square centimeter, per ASTM E 648.
   2. Flame spread: Maximum 75, per ASTM E 84.
   3. Smoke developed: Maximum 450, per ASTM E 84.
   4. Smoke density: Maximum 450, per ASTM E 662.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

D. Slab moisture tests as per ASTM F 1869-98. Submit written copy of test results.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect roll materials from damage by storing on end.

1.06 FIELD CONDITIONS

A. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

B. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

1.07 EXTRA MATERIALS

A. See Section 01600 - Product Requirements, for additional provisions.

B. 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.
   1. Resilient tile: 10 percent of each variety installed.
   2. Resilient base: 10 percent of each variety installed.
   3. Sheet flooring: 10 percent of each variety installed.

PART 2 PRODUCTS

2.01 TILE FLOORING

A. Vinyl Composition Tile: Homogeneous, with color extending throughout thickness, and:
   1. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
   2. Size: 12 x 12 inch.
   3. Manufacturers:
      a. Armstrong World Industries, Inc: www.armstrong.com.
      b. Mannington Mills, Inc: www.mannington.com.
      c. Tarkett Inc: www.tarkett.com.
      d. As scheduled.
      e. Substitutions: See Section 01600 - Product Requirements.

2.02 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove, and as follows:
   1. Height: 6 inch.
   2. Thickness: 0.125 inch thick.
   3. Finish: Satin.
   4. Length: 4 foot sections.
   5. Color: Selected from full range of manufacturer's colors.
   6. Accessories: Premolded external corners, internal corners, and end stops.
   7. Manufacturers:
      a. Burke Flooring: www.burkemercer.com.
      b. Johnsonite, Inc: www.johnsonite.com.
      c. Roppe Corp: www.roppe.com.
      d. Marley Flexco.
      e. Substitutions: See Section 01600 - Product Requirements.

2.03 ACCESSORIES

A. Subfloor Filler: Latex leveling and patching compound; type recommended by adhesive material manufacturer.

B. Primers, Adhesives, and Seaming Materials: Waterproof; types recommended by flooring manufacturer.

C. Filler for Coved Base: Plastic.

D. Sealer and Wax: Types recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. General: Inspect substrates and conditions of installation to verify that work may properly commence. Do not proceed with the work until unsatisfactory conditions have been corrected.

B. Verify that sub-floor surfaces are dust-free and free of substances which would impair bonding of adhesive materials to sub-floor surfaces.

C. Verify that concrete sub-floor surfaces are dry enough and ready for resilient flooring installation by testing for moisture emission rate and alkalinity in accordance with ASTM F710; obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

B. Prohibit traffic until filler is cured.

C. Prepare concrete surface as per ASTM F 711 in conjunction with findings from the moisture test.

D. Clean substrate.

E. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install in accordance with manufacturer's instructions.

C. Spread only enough adhesive to permit installation of materials before initial set.

D. Fit joints tightly.

E. Set flooring in place, press with heavy roller to attain full adhesion.

F. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

G. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.

H. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.04 TILE FLOORING

A. Install in accordance with manufacturer's instructions.

B. Mix tile from container to ensure shade variations are consistent when tile is placed, unless manufacturer's instructions say otherwise.

C. 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.

D. Installation: Apply adhesive with notched trowel, following manufacturer's instructions. Install tile only after adhesive has developed sufficient tack, firmly butting tiles to achieve hairline joints. Roll each area of installation at regular intervals, to assure firm bonding of tiles to substrate.

E. Spread only enough adhesive to permit installation of materials before initial set.

F. Set flooring in place, press with heavy roller to attain full adhesion.

G. 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.
   1. Lay tile to achieve monolithic appearance, with pattern in all tiles oriented in same direction.
   2. Lay tile in patterns indicated on drawings.

H. Lay flooring with joints and seams parallel to building lines to produce symmetrical tile pattern.

I. Where floor finishes are different on opposite sides of door, terminate flooring under centerline of door.

J. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.

K. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

L. Install flooring in recessed floor access covers. Maintain floor pattern.

3.05 RESILIENT BASE

A. Apply base securely in locations indicated, using maximum lengths available to minimize joints. Adhere to substrate with full spread of adhesive, assuring continuous contact with vertical and horizontal surfaces. Provide preformed corner units at 90 degree intersections.
   1. Apply resilient base to columns and other fixed, freestanding elements in spaces where resilient base is scheduled.
   2. At irregular vertical surfaces where top edge of resilient base does not make continuous contact, fill voids with manufacturer's recommended adhesive compound.

B. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between

joints.

C. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.

D. Install base on solid backing. Bond tightly to wall and floor surfaces.

E. Scribe and fit to door frames and other interruptions.

3.06 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's instructions.

C. 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.

D. Final Cleaning: Remove scuff marks, excess adhesive, and other foreign substances, using only cleaning products and techniques recommended by manufacturer of resilient products.

E. Clean, seal, and wax resilient flooring products in accordance with manufacturer's instructions.

3.07 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

B. Construction Period: Cover traffic routes across completed resilient flooring with plywood, hardboard, or other durable material to protect against damage from loaded dollies and other construction traffic.
   1. Polish: Apply protective polish to clean resilient flooring surfaces, unless manufacturer of resilient product recommends otherwise.

C. Final Protection: Cover resilient floor surface with nonstaining building paper until substantial completion in each area.

END OF SECTION

SECTION 09685 - CARPET TILE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet tile, fully adhered.

1.02 REFERENCE STANDARDS

A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2006 (Reapproved 2011).

B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2010e1.

C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.

D. CRI (CIS) - Carpet Installation Standard; Carpet and Rug Institute; 2009.

E. CRI (GLA) - Green Label Testing Program - Approved Adhesive Products; Carpet and Rug Institute; Current Edition.

F. CRI (GLP) - Green Label Plus Carpet Testing Program - Approved Products; Carpet and Rug Institute; Current Edition.

G. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; National Fire Protection Association; 2011.

1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

D. Manufacturer's Installation Instructions: Indicate special procedures.

E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01600 - Product Requirements, for additional provisions.
   2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing carpet with minimum 5 years experience.

1.05 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Other Acceptable Manufacturers:
   1. Tandus: www.tandus.com.
   2. Interface, Inc: www.interfaceinc.com.
   3. Lees Carpets: www.leescarpets.com.
   4. Milliken & Company: www.milliken.com.
   5. Substitutions: See Section 01600 - Product Requirements.

2.02 MATERIALS

A. Carpet Tile: Tufted, manufactured in one color dye lot.
   1. Tile Size: 24 x 24 inch, nominal.
   2. Thickness:.387 inch.
   3. Critical Radiant Flux: Minimum of 0.22 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
   4. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
   5. VOC Content: Provide CRI Green Label Plus certified product; in lieu of labeling, independent test report showing compliance is acceptable.
   6. Primary Backing Material: cushion back.
   7. anitmicrobial, proprietary method
   8. Total Weight: 114 oz/sq yd.

2.03 ACCESSORIES

A. Sub-Floor Filler: White premix latex; type recommended by flooring material manufacturer.

B. Edge Strips: Rubber, black color.

C. Adhesives: Acceptable to carpet tile manufacturer, compatible with materials being adhered; maximum VOC of 50 g/L; CRI Green Label certified; in lieu of labeled product, independent test report showing compliance is acceptable.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet tile.

C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.

D. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for flooring installation by testing for moisture and pH.
   1. Obtain instructions if test results are not within limits recommended by flooring

material manufacturer and adhesive materials manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.

C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

D. Vacuum clean substrate.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install carpet tile in accordance with manufacturer's instructions and CRI Carpet Installation Standard.

C. Blend carpet from different cartons to ensure minimal variation in color match.

D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.

F. Fully adhere carpet tile to substrate.

G. Trim carpet tile neatly at walls and around interruptions.

H. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09900 - PAINTS AND COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints, stains, and other coatings.

C. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:

D. Do Not Paint or Finish the Following Items:
1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
2. Items indicated to receive other finishes.
3. Items indicated to remain unfinished.
4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
5. Floors, unless specifically so indicated.
6. Glass.
7. Concealed pipes, ducts, and conduits.

E. Surface preparation, priming and finish coats specified in this section are in addition to shop priming and surface treatment specified under other sections, unless otherwise indicated.

F. Paint exposed surfaces whether or not colors are designated in schedules, except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Architect will select from standard colors or finishes available.

G. Painting includes field painting exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment. Refer to mechanical and electrical contract documents and coordinate with Mechanical/Electrical Contractors/Subcontractors to determine extent of Work.

H. Prefinished items not to be painted, unless otherwise indicated, include the following factory-finish components.
1. Acoustic materials.
2. Architectural woodwork and casework.
3. Hospital or Laboratory casework.
4. Prefinished mechanical and electrical equipment, except for panel boxes in finished areas.
5. Light fixtures.

I. Finished metal surfaces not to be painted include:
1. Anodized aluminum.
2. Stainless steel.
3. Chromium plate.
4. Copper.
5. Bronze.

6. Brass.

J. Labels: Do not paint over Underwriter's Laboratories, Factory Mutual or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

1.02 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2012.

C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials; 2007.

1.03 DEFINITIONS

A. Paint includes coating systems materials, primers, emulsions, enamels, stains, sealers and fillers and other applied materials whether used as prime, intermediate, or finish coats.

B. Wall -vertical surfaces including interior fascias.

C. Ceiling -horizontal surfaces including interior soffits.

D. Conform to ASTM D 16 for interpretation of terms used in this section.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on all finishing products. Manufacturer's technical information, label analysis and application instructions for each material proposed for use.
   1. List each material and cross-reference this specific coating and finish system and application. Identify each material by the manufacturer's catalog number and general classification.
   2. Provide color samples for each material and color indicated to verify compliance with Architect's color selections.

C. Manufacturer's Instructions: Indicate special surface preparation procedures.

D. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum five years documented experience.

B. Single-Source Responsibility: Provide primers and undercoat paint produced by the same manufacturer as the finish coats.

C. Coordination of Work: Review other sections in which primers are provided to ensure compatibility of the total systems for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify the Architect of problems anticipated using the materials specified.

D. Material Quality: Provide the manufacturer's best quality trade sale paint material of the various coating types specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.

E. Proprietary names used to designate colors or materials are intended to convey the Architect's Design Intent and do not imply that products named are required nor to exclude equal products of other manufacturers.

F. Federal Specifications establish a minimum quality level of paint materials, except where other product identification is used. Provide written certification from the manufacturer that materials provided meet or exceed these criteria.

G. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience.

1.06 REGULATORY REQUIREMENTS

A. Certifications of Regulatory Compliance: Submit written certifications from manufacturers of painting materials that all products proposed for use on this project will conform with the following:
1. Will comply with local V.O.C. regulations and meet or exceed the quality and performance intent of these specifications.

B. Conform to applicable code for flame and smoke rating requirements for products and finishes.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

D. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

1.09 EXTRA MATERIALS

A. See Section 01600 - Product Requirements, for additional provisions.

B. Supply two gallons of each color; store where directed.

C. Label each container with color in addition to the manufacturer's label.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.

B. Paints:
1. Benjamin Moore & Co: www.benjaminmoore.com.
2. Devoe and Raynolds Co. (Devoe).
3. The Glidden Company (Glidden).
4. PPG Industries, Pittsburgh Paints (Pittsburgh).
5. Pratt and Lambert(P & L).
6. Sherwin Williams

C. Manufacturers - Interior Finish Paint Material:
1. Interior Semigloss Acrylic Latex Enamel: Acrylic latex semi-gloss enamel for use over a primer on ferrous and zinc-coated (galvanized) metal surfaces.
   a. Devoe: Wonder-Tones Interior Acrylic Latex Semi-Gloss Enamel 38XX.
   b. Glidden: Y-8200 Spred Ultra Semi-Gloss Enamel.
   c. Moore: Moorcraft Super-Hide Latex Semi-Gloss Enamel 283.
   d. Pittsburgh: Speedhide Semi-Gloss Latex Enamel 6-51.
   e. P & L: Accolade Interior Semi-Gloss.
   f. Sherwin Williams
2. Latex-based, Interior Flat Paint: Ready-mix, latex based paint for use over insulating jackets on piping, ductwork and equipment.
   a. Devoe: 36XX Wonder-Tones Latex Flat Wall Paint.
   b. Glidden: 3400 Spred Satin Latex Wall Paint.
   c. Moore: Regal Wall Satin #215.
   d. Pittsburgh: 50-35 Latex Ceiling Paint.
   e. P & L: Vapex Latex Flat Wall Finish.
   f. Sherwin Williams
3. Interior Satin Acrylic Latex Enamel: Acrylic latex satin enamel for use over a primer and undercoater on wood and over a primer on gypsum drywall:
   a. Devoe: Wonder-Tones Interior Acrylic Latex Enamel 35XX.
   b. Glidden: Y-4100 Spred Ultra Eggshell Latex Wall and Tim Paint.
   c. Moore: Moorcraft Super-Hide Latex Eggshell Enamel 286.
   d. Pittsburgh: Speedhide Eggshell Latex Enamel 6-411.
   e. P & L: Accolade Interior Velvet.
   f. Sherwin Williams

D. Synthetic, Rust-Inhibiting Primer: Quick-drying, rust-inhibiting primer for priming ferrous metal surfaces under semi-gloss acrylic latex enamel.
1. Devoe: 13101 Rust Penetrating Primer.
2. S & W: Kem Kromik Universal Metal Primer.
3. Moore: Iron Clad Retard-X-Rust Inhibitive Latex Primer 162.
4. Pittsburgh: Speedhide Water Base Inhibitive Metal Primer 6-712.

5. P & L: Interior/Exterior Latex Metal Primer.
6. Sherwin Williams

E. Galvanized Metal Primer: Primer used to prime interior and exterior zinc-coated (galvanized) metal surfaces under semi-gloss acrylic latex enamel:
1. Moore: Ironclad Galvanized Metal Latex Primer 155.
2. Pittsburgh: Speedhide Water Base Inhibitive Metal Primer 6-712.
3. P & L: Interior/Exterior Latex Metal Primer.
4. Sherwin Williams

F. Primer Sealers: Same manufacturer as top coats.
1. Latex-Based Interior White Primer: Latex-based primer coating used on interior gypsum drywall flat and satin acrylic latex enamel.
2. Devoe: 50801 Wonder-Tones Latex Primer and Sealer.
3. Glidden: Y-5111 Spred Ultra Latex Primer - Sealer.
4. Moore: Moorcraft Super-Hide Latex Primer - Undercoat 284.
5. Pittsburgh: Speedhide Quick-Drying Latex Primer - Sealer 6-2.
6. P & L: Vinyl Acrylic Wall Primer.
7. Sherwin Williams

G. Substitutions: See Section 01600 - Product Requirements.

2.02 PAINTS AND COATINGS - GENERAL

A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
1. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. Supply each coating material in quantity required to complete entire project's work from a single production run.
3. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

B. Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

C. Volatile Organic Compound (VOC) Content:
1. Provide coatings that comply with the most stringent requirements specified in the following:
a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
b. Architectural coatings VOC limits of State in which the project is located.
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

2.03 PAINT SYSTEMS - INTERIOR

A. Paint MI-OP-3L - Ferrous Metals, Unprimed, Latex, 3 Coat:
1. One coat of latex primer.
2. Gloss: Two coats of latex enamel.

B. Paint MI-OP-2L - Ferrous Metals, Primed, Latex, 2 Coat:
   1. Touch-up with latex primer.
   2. Gloss: Two coats of latex enamel.

C. Paint GI-OP-3LA - Gypsum Board/Plaster, Latex-Acrylic, 3 Coat:
   1. One coat of alkyd primer sealer.
   2. Semi-gloss: Two coats of latex-acrylic enamel.

2.04 ACCESSORY MATERIALS

A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Gypsum Wallboard: 12 percent.
   2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
   3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to coating application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Surfaces: Correct defects and clean surfaces which affect work of this section. 10

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.

H. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

I. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

J. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

K. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

L. Materials Preparation: Carefully mix and prepare paint materials in accordance with manufacturer's directions.

M. Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.

N. Stir material before application to produce a mixture of uniform density; stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

3.03 APPLICATION

A. Apply products in accordance with manufacturer's instructions. Use applicators and techniques best suited for substrate type of material being applied and to produce a uniform appearance. Paint film must be free of runs, skips, sags and other defects.

B. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. The number of coats and film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Sand between applications where sanding is required to produce an even smooth surface in accordance with the manufacturer's directions.

E. Apply each coat to uniform appearance.

F. Apply additional coats when undercoats, stains, or other conditions show through final coat of paint until paint film is of uniform coverage, finish, color, and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.

G. Sand wood and metal surfaces lightly between coats to achieve required finish.

H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

I. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only before final installation of equipment.

J. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.

K. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, nonspecular black paint.

L. Omit primer on metal surfaces that have been shop-primed and touch up painted, unless paint compatibility is questionable, then provide barrier coat and new prime coat.

M. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

N. Minimum Coating Thickness: Apply materials at not less than the manufacturer's recommended spreading rate. Provide a total dry film thickness of the entire system as recommended by the manufacturer.

O. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

P. Prime Coats: Before application of finish coats, apply a prime coat of material as recommended by the manufacturer to material that is required to be painted or finished and has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to assure a finish coat with no burn through or other defects due to insufficient sealing.

Q. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holiday, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

R. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not in compliance with specified requirements.

S. Pavement Marking Application:
1. Provide uniform coating.
2. Correct markings not having uniform appearance.
3. Protect neatly painted surfaces until paint is sufficiently dry to permit vehicles to cross paint without damage.

3.04 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

A. Refer to Section 15075 and Section 16075 for schedule of color coding of equipment, duct work, piping, and conduit.

B. Paint shop-primed equipment, where indicated.

C. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

D. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 SCHEDULE - SURFACES TO BE FINISHED

A. Do Not Paint or Finish the Following Items:
1. Items fully factory-finished unless specifically noted.

2. Fire rating labels, equipment serial number and capacity labels.

B. Paint the surfaces described inspection and.

END OF SECTION

D I V I S I O N 10

S P E C I A L T I E S

Applicable Portions Of The Conditions Of The Contract And Division 1 General Requirements Apply To The Work Of This Division.

SECTION 10171 - SOLID PHENOLIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Solid phenolic toilet compartments.

B. Solid phenolic urinal screens.

1.02 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Show layout of partitions, screens, and compartments.

C. Product Data: Manufacturer's catalog data on panels, pilasters, doors, hardware and fastening.

D. Color Charts: Manufacturer's complete range of colors.

E. Samples:
1. Actual panel material, not less than 6 inches square.
2. Actual hardware.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Capitol Partitions, Inc.

B. Columbia Partitions.

C. General Partitions.

D. Rockville Partitions.

E. Santana.

F. Substitutions: See Section 01600 - Product Requirements.

2.02 COMPARTMENTS AND SCREENS

A. Toilet Compartments: Solid phenolic.
1. Overhead braced.

B. Urinal Screens: Solid phenolic.
1. Wall hung.
2. Pilaster supported, floor braced.

2.03 SOLID PHENOLIC MATERIALS

A. Panels: Solid phenolic core material, compression molded, single piece construction with integral plastic laminate surface and uniformly machined edges; no two-piece construction.
1. Color: As selected from full range of formica's or architect approved equal's plastic laminate colors.
2. Panel Size: Nominal 3/4 inch thick by 58 inches high, of required depth.

B. Doors: Same design and construction as specified for panels; nominal 3/4 inch thick by 58

inches high.

C. Pilasters: Same design and construction as specified for panels and doors; nominal 3/4 inch thick.
   1. For Urinal Screens: 5 inches wide by 54 inches high.

D. Urinal Screens: Same design and construction as specified for panels; nominal 3/4 inch thick.
   1. Height: 58 inches.
   2. Depth: 24 inches.
   3. Provide pilasters for rigid support at exposed end.

E. Panel Anchors: Type 304 stainless steel, brush finish.
   1. Panels to Pilasters: Three U-brackets.
   2. Panels to Wall: Three double ear brackets.
   3. Pilasters to Wall: Continuous single ear bracket (panel height).

F. Overhead Braced: 80 inch high pilasters.
   1. Pilaster Floor Anchors: To mount pilasters 2 inches above finish floor; Type 304 stainless steel; 12 gage angle and two 5/16 inch threaded rods with leveling nuts and washers and lead double expansion shields.
   2. Top Bracing: Brite anodized aluminum channel 1-1/2 inch by 1 inch of anti-grip design to cap top of pilasters and secured on inside of compartment.
   3. Headrail Brackets: 18 gage stainless steel.
   4. Conceal floor fasteners with 4 inch high one-piece 20 gage Type 304 stainless steel floor shoe.

G. Urinal Screen Anchors:
   1. To Wall: One full length double ear bracket, fastened with 8 wall fasteners.
   2. To Pilasters: Continuous U-channel.
   3. To Floor: 1/8 inch aluminum angle with No. 14 by 1-3/4 inch tamper-proof screws into conical plastic anchors.
   4. Conceal floor anchors with 4 inch high one-piece 20 gage Type 304 stainless steel shoes.

2.04 HARDWARE

A. Hardware: Provide all hardware and fasteners for a complete installation.

B. Door Hinges: 1/8 inch thick heavy extruded brite anodized type 6463T5 aluminum hinges that wrap around both the door and pilaster.
   1. Solid Phenolic: Fasten hinges to door and pilaster with one-way head thru-bolts.
   2. Top Hinges: Opposing nylon cams factory set at 30 degrees open for in-swing and closed for out-swing.
   3. Reinforce top hinge with a 1/4 inch stainless steel rod.

C. Strike-Keeper and Throw Latch: 16 gage formed Type 304 stainless steel strike-keeper with rubber stop and cast stainless steel slide bar and knob that does not require gripping or turning, brushed finish.

D. Coat Hook and Wall Bumper: Heavy chrome-plated Zamac fastened with 5/8 inch stainless steel tamper-proof screws.

E. Fasteners:
   1. Tamper-Proof.
   2. Floor and wall fasteners: No. 14 by 1-3/4 inch tamper-proof screws with conical plastic anchors.
   3. All other fasteners: 5/8 inch stainless steel tamper-proof screws or chrome plated brass tamper-proof brass thru-bolts.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install partitions rigid, straight, plumb and level in accordance with manufacturer's instructions.

B. Set units with not more than 1/2 inch between pilasters and panels and not more than 3/4 inch between panels and walls.

C. Overhead-Braced: Secure to structural concrete floor.

D. Floor-Mounted: Secure to structural concrete floor.

E. Hollow Stud Partitions: Secure panels to wood blocking inside partitions.

F. Adjust and lubricate hardware for proper operation after installation.
   1. Set hinges on in-swing doors to hold doors in the open or closed position when unlatched as shown on drawings.
   2. Set hinges on out-swing doors to return to the fully closed position.
   3. Remove protective plastic coating.

END OF SECTION

SECTION 10260 - WALL AND CORNER GUARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Corner guards.

1.02 REFERENCE STANDARDS

A. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2012.

C. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2012.

1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Submit shop drawings showing location, extent and installation details of wall and corner guards, and other protection systems.

C. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.

D. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firm (material producer) with not less than 5 years of production experience, whose published literature clearly indicates general compliance of products with requirements of this section.

B. Installer Qualifications: Firm specializing in installation of wall protection systems with not less than 3 years experience in installations similar to that required for this project.

C. Single Source Responsibility: Provide material produced by a single manufacturer for each type of protective device.

D. Perform Work in accordance with ADA requirements for the physically handicapped.

1.05 TESTING

A. Fire Performance Characteristics: Provide material that is identical to that tested for the following fire performance requirements, according one or more of the test methods indicated, by UL or other testing and inspecting agency acceptable to authorities having jurisdiction.

B. Certification: Submit manufacturer’s certificate stating that materials furnished comply with specified requirements. Include supporting certified laboratory testing data indicating that material meets specified test requirements.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to project site in original factory wrappings and containers, clearly labeled with identification of manufacturer, brand name, quality or grade, fire hazard classification, and lot number. Store materials in original undamaged packages and containers, inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity; laid flat, blocked off ground to prevent sagging and warping.

B. Comply with instructions and recommendations of manufacturer for special delivery, storage, and handling requirements.

1.07 MAINTENANCE

A. Maintenance Instructions: Submit manufacturer's printed instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated traffic and use conditions. Include precautions against materials and methods which may be detrimental to finishes and performance.

B. Replacement Materials: After completion of work, deliver not less than 2 percent additional quantity of each type, color, and pattern of wall and corner guard, exclusive of material required to properly complete installation. Furnish accessory components as required. Furnish replacement materials from same production run as materials installed. Package replacement materials with protective covering, identified with appropriate labels.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wall and Corner Guards:
1. Construction Specialties, Inc: www.c-sgroup.com.
2. IPC/InPro Corporation: www.inprocorp.com.
3. Balco Metalines.
4. Substitutions: See Section 01600 - Product Requirements.

2.02 COMPONENTS

A. Corner Guards - Surface Mounted: High impact vinyl with extruded aluminum full height retainer and integral impact absorbing device.
1. Performance: Resist lateral impact force of 100 lbs at any point without damage or permanent set.
2. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
3. Size: 2 inches.
4. Corner: Square.
5. Color: As selected from manufacturer's standard colors.
6. Length: One piece.
7. Preformed end caps.

B. Mounting Brackets and Attachment Hardware: Appropriate to component and substrate.

2.03 FABRICATION OF WALL AND CORNER GUARDS

A. Fabricate components with tight joints, corners and seams.

B. Pre-drill holes for attachment.

C. Form end trim closure by capping and finishing smooth.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.

3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to wall framing members only.

B. Install surface mounted protective devices and accessories after other finishing operations, including painting, have been completed.

C. Do not use material with chips, cracks, voids, stains, or other defects which might be visible in the finished work.

D. Install material and assemblies to comply with drawings and final shop drawings in strict compliance with manufacturer’s printed instructions. Adjust accessories for proper system alignment.

E. Position corner guard 6 inches above finished floor to 60 inches high.

3.03 FIELD QUALITY CONTROL

A. Remove and replace material which is broken, chipped, stained or otherwise damaged and which does not match adjoining work. Provide new matching units, installed as specified and in manner to eliminate evidence of replacement.

3.04 TOLERANCES

A. Maximum Variation From Required Height: 1/4 inch.

B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch.

3.05 CLEANING

A. Immediately upon completion of installation, clean installed material using methods recommended by the manufacturer.

B. Remove excess adhesive, using methods and materials recommended by manufacturer.

C. Remove surplus materials, rubbish, and debris resulting from installation upon completion of work, and leave areas of installation in neat, clean condition.

END OF SECTION

SECTION 10270 - ACCESS FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Structural floor supported pedestal framing system.

B. Removable floor panels.

C. Accessories, including facia panels, grilles, ramps, stairs, and railings.

1.02 REFERENCE STANDARDS

A. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.

B. NFPA 75 - Standard for the Protection of Information Technology Equipment; National Fire Protection Association; 2013.

1.03 PERFORMANCE REQUIREMENTS

A. Pedestals:
   1. Maximum Axial Load: 5,000 lb without permanent deformation.
   2. Ultimate Strength: Not less than twice design load.

B. Floor Panels: Conform to the following:
   1. Live Load: 250 lb/sq ft.
   2. Maximum Deflection: 0.04 inch.
   3. Concentrated Load: 1,000 lb on 1 sq in at any location with maximum deflection of 0.08 inch.
   4. Permanent Deformation: 0.02 inch maximum at design load.
   5. Ultimate Strength: Not less than twice design load.

C. Lateral Stability: Design system for lateral stability in all directions, with or without panels in place.

D. Surface Electrical Resistance: Maximum 1 ohm per panel.

1.04 DESIGN REQUIREMENTS

A. System: Stringerless system.

B. Access flooring system to achieve finished floor elevation 12 inches nominal height above building structural floor.

C. Floor Panel Size: 24 x 24 inches.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for grid system, panels, and accessories; electrical resistance characteristics and ground connection requirements.

C. Shop Drawings: Indicate floor layout, interruptions to grid, special sized panels, panels requiring drilling or cut-out for services, appurtenances or interruptions, edge details,

elevation differences, ramps, grilles, and registers.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention.

F. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 75.

B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing the type of work required in this section, with minimum 3 years of experience.

1.07 REGULATORY REQUIREMENTS

A. Conform to applicable code for flame resistance of panels.

B. Conform to ANSI/ICC A117.1 for access for the handicapped.

1.08 MOCK-UP

A. Construct a mock-up, 10 feet long by 10 feet wide, with all specified accessories installed including ramp.

B. Locate where directed.

C. Mock-up may remain as part of the Work.

1.09 EXTRA MATERIALS

A. See Section 01600 - Product Requirements, for additional provisions.

B. Provide four of each size of floor panel.

C. Provide four spare pedestals and four stringers.

D. Panel Lifting Devices: One, of manufacturer's standard type.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Tate Access Floors, Inc: www.tateaccessfloors.com.
   1. Product: All Steel 1250

B. Other Acceptable Access Flooring Manufacturers:
   1. Free Axez USA: www.freeaxez.com.
   2. Haworth: www.haworth.com.
   3. Maxcess Technologies, Inc: www.aspmaxcess.com.
   4. Substitutions: See Section 01600 - Product Requirements.

2.02 ACCESS FLOORING

A. Access Flooring: Factory-fabricated system consisting of removable floor panels and supporting structure that allows access to each space below floor without requiring removal of panels other than the one directly above the space to which access is needed; provide all components and accessories required for complete installation and as indicated.
   1. Configuration: Stringerless system.
   2. Finished Floor Elevation: Top of access floor 12 inches nominal height above building structural floor.
   3. Floor Panel Size: 24 x 24 inches.

2.03 COMPONENTS

A. Pedestals: Steel with flat bottom base plate, threaded supporting rod, vibration proof lock nut to permit 1-1/2 inch adjustment, galvanized finish.

B. Floor Panels:
   1. Die formed steel top and bottom plates; steel reinforcement stiffeners.
   2. Panel Edge: Vinyl trim, slip-on type.
   3. Floor Panel Finish Adhesive: Moisture resistant type recommended by floor finish manufacturer.

C. Perforated Floor Panels: Same material, size, and construction as floor panels.
   1. Provide panels as required for 6300 cfm.
   2. Panel distribution to be determined once shop drawings have been submitted.
   3. Refer to mechanical drawings for additional information on air distribution and flow.

2.04 ACCESSORIES

A. Facia Panels: Laminated construction as follows:
   1. Front and Back Face Sheets: Aluminum sheet,.022 inch thick.
   2. Accessories: Include corner pieces, trim, reinforcing, and clip angles.

B. Ramps and Stairs: Same materials, structural strength, and construction as floor panels; flush extruded aluminum cover plates at junction with floor system. Comply with IBC chapter 10 requirements.

C. Ramp and Stair Hand Railings: Posts and rails of tubular; assembled with welded connections; cast metal end caps, floor sockets, collars, brackets, and fittings. Comply with IBC chapter 10 requirements.

2.05 FINISHES

A. Floor Panel Finish: High Pressure Decorative Laminate

B. Exposed Metal Surfaces: Baked enamel finish; color as selected.

C. Facia Panel: Baked enamel finish; color as selected.

D. Ramp Surface: Sheet rubber; color as selected.

2.06 SOURCE QUALITY CONTROL

A. Fabrication Tolerances:
   1. Floor Panel Flatness: Plus or minus 0.02 inch in any direction.
   2. Floor Panel Width or Length From Specified Size: Plus or minus 0.02 inch.
   3. Floor Panel Squareness: Plus or minus 0.03 inch difference between opposite diagonal

dimensions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify field measurements are as shown on shop drawings.

B. Verify that required utilities are available, in proper location, and ready for use.

3.02 PREPARATION

A. Vacuum clean substrate surfaces.

3.03 INSTALLATION

A. Install components in accordance with manufacturer's instructions.

B. Secure pedestal base plate to subfloor with adhesive.

C. Install additional pedestals where grid pattern is interrupted by room appurtenances or at cut-outs.

D. Install stringers and floor panels on pedestals with full bearing.

E. Facia Panels:
1. Install facia panels at exposed sides.
2. Secure panels to clip angles attached to structural floor and edge of floor panels.
3. Install metal trim at intersection of facia panels and access floor and at abutting walls and columns.

F. Railings:
1. Extend railing posts through floor panels to structural floor; secure to flange fittings anchored to structural floor.
2. Brace posts in position at floor panels with floor collar retainers.

3.04 TOLERANCES

A. Maximum Out of Level Floor Panel Tolerance: 1/16 inch in 10 ft, non-cumulative.

3.05 ADJUSTING

A. Adjust pedestals to achieve a level floor and to assure adjacent floor panel surfaces are flush.

3.06 PROTECTION

A. Do not permit traffic over unprotected floor surface.

END OF SECTION

SECTION 10523 - FIRE EXTINGUISHERS CABINETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguisher cabinets.

B. Accessories.

1.02 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers; 2010.

B. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.

1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate cabinet physical dimensions.

C. Product Data: Provide color and finish and anchorage details.

D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.04 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguisher Cabinets and Accessories:
   1. JL Industries, Inc: www.jlindustries.com.
   2. Larsen's Manufacturing Co: www.larsensmfg.com.
   3. Potter-Roemer: www.potterroemer.com.
   4. Johnson-Lee, Division of W.F. Lee Corp..
   5. Watrous, Inc.
   6. Substitutions: See Section 01600 - Product Requirements.

2.02 FIRE VALVE AND EXTINGUISHER CABINETS

A. Basis of design: JL Industries Crowneline FX valve and fire extinguisher cabinet.

B. Construction: Manufacturer’s standard enameled steel box, with trim, frame, door and hardware to suit cabinet type, trim style, and door style indicated. Weld all joints and grind smooth. Miter and weld perimeter door frames.

C. Cabinet Configuration: Recessed type.
   1. Sized to accommodate extinguisher and accessories.
   2. Exterior nominal dimensions of 26 inch wide x 26 inch high x 8 inch deep.
   3. Trim: Flat, 3/8 inch wide face.
   4. Form cabinet enclosure with right angle inside corners and seams. Form perimeter trim and door stiles.

D. Door: 0.036 inch thick, reinforced for flatness and rigidity; latch. Hinge doors for 180 degree opening with continuous piano hinge. Provide roller type catch.

E. Door Style: Vertical Duo.

F. Door Glazing: Glass, clear, 1/8 inch thick tempered. Set in resilient channel gasket glazing.

G. Cabinet Mounting Hardware: Appropriate to cabinet. Pre-drill for anchors.

H. Weld, fill, and grind components smooth.

I. Finish of Cabinet Exterior Trim and Door: Baked enamel, color as selected.

J. Finish of Cabinet Interior: White enamel.

K. Cabinet must be fire rated and tested.

2.03 ACCESSORIES

A. Graphic Identification: FIRE EXTINGUISHER.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings, 40 inches from finished floor to inside bottom of cabinet.

C. Secure rigidly in place.

D. Place extinguishers and accessories in cabinets.

E. Install punchouts for fire department valve as directed by manufacturer to maintain fire rating of fire valve and extinguisher cabinet.

3.03 IDENTIFICATION

A. Identify existence of fire extinguisher in cabinet with lettering spelling FIRE EXTINGUISHER applied to door. Provide lettering to comply with requirements indicated for letter style, color, size, spacing and location or, if not otherwise indicated, as selected by Architect from manufacturer’s standard arrangements.

END OF SECTION

SECTION 10800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Accessories for toilet rooms.

B. Grab bars.

1.02 REFERENCE STANDARDS

A. ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2010.

B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2010.

C. ASTM C1036 - Standard Specification for Flat Glass; 2011e1.

D. GSA CID A-A-3002 - Mirrors, Glass; U.S. General Services Administration; 1996.

1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on accessories describing size, finish, details of function, attachment methods.

C. Schedule: Submit complete schedule of accessories indicated type and location where each item is to be installed in accordance with groups specified.

D. Setting Drawings: Provide setting drawings, templates, instructions, and directions for installation of anchorage devices and cut-out requirements in other work.

E. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

1.04 QUALITY ASSURANCE

A. Inserts and Anchorages: Furnish inserts and anchoring devices which must be set in concrete or built into masonry; coordinate delivery with other work to avoid delay.

B. Accessory Locations: Coordinate accessory locations with other work to avoid interference and to assure proper operation and servicing of accessory units.

1.05 COORDINATION

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver items in manufacturer’s original unopened protective packages and store in these packages so as to prevent physical damage, soiling or wetting.

B. Handle accessories so as to prevent damage to finished surfaces and install with manufacturer’s protective covers in tact, as much as practical.

C. Maintain protective covers until final cleaning. Upon removal clean exposed surfaces as recommended by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Products listed are made by Bobrick Washroom Equipment, Inc.

B. Other Acceptable Manufacturers:
   1. Bradley Corporation: www.bradleycorp.com.
   2. Substitutions: Section 01600 - Product Requirements.

C. All items of each type to be made by the same manufacturer.

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
   1. Grind welded joints smooth.
   2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.

B. Keys: Provide 3 keys for each accessory to Owner; master key all lockable accessories.

C. Stainless Steel Sheet: ASTM A666, Type 304.

D. Stainless Steel Tubing: ASTM A269, Type 304 or 316.

E. Sheet Steel: Cold-rolled, commercial quality ASTM A 366, 20-gage (.040") minimum, unless otherwise indicated. Surface preparation and metal pretreatment as required for applied finish.

F. Mirror Glass: Float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

G. Fasteners, Screws, and Bolts: Hot dip galvanized, tamper-proof.

H. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FINISHES

A. Stainless Steel: No. 4 satin brushed finish, unless otherwise noted.

B. Back paint components where contact is made with building finishes to prevent electrolysis.

2.04 TOILET ROOM ACCESSORIES

A. Mirrors: Stainless steel framed, 6 mm thick float glass mirror.
   1. Size: 24 inch wide x 48 inch high.
   2. Frame: 0.05 inch angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; No.4 finish.
   3. Backing: Full-mirror sized, minimum 0.03 inch galvanized steel sheet and nonabsorptive filler material.
   4. Shelf: Stainless steel; gage and finish to match mirror frame, turned down edges,

welded to frame; 5 inches deep, full width of mirror.

5. Product: B-290 manufactured by Bobrick Washroom Equipment, Inc.

B. Grab Bars: Stainless steel, 1-1/2 inches outside diameter, minimum 0.05 inch wall thickness, nonslip grasping surface finish, concealed flange mounting; 1-1/2 inches clearance between wall and inside of grab bar.
   1. Length and configuration: As indicated on schedule.
   2. Product: 6806 manufactured by Bobrick.

C. Sanitary Napkin Disposal Unit: Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
   1. Product: B-270 manufactured by Bobrick Washroom Equipment, Inc.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. Verify that field measurements are as indicated on drawings.

D. See Section 09260 for installation of blocking, reinforcing plates, and concealed anchors in walls, and ceilings.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights and Locations: As required by accessibility regulations and as indicated on drawings

3.04 ADJUSTING AND CLEANING

A. Adjust toilet accessories for proper operation and verify that mechanisms function smoothly. Replace damaged or defective items.

B. Clean and polish all exposed surfaces after removing temporary labels and protective coatings.

3.05 SCHEDULE

A. General: For the purpose of identifying the types of accessories and the expected minimum quality intended for this project

B. Accessory Schedule
   1. Men's Toilet - 106, 203 and 306
      a. (2) Mirror

b. (1) 36" Grab Bar (Horizontal).
c. (1) 42" Grab Bar (Horizontal).
d. (1) 18" Grab Bar (Vertical)

2. Women's Toilet - 107, 204 and 307
   a. (2) Mirrors
   b. (1) 36" Grab Bar (Horizontal)
   c. (1) 42" Grab Bar (Horizontal)
   d. (1) 18" Grab Bar (Vertical)
   e. (3) Sanitary Napkin Disposal Unit

END OF SECTION

D I V I S I O N 13

SPECIAL CONSTRUCTION

Applicable Portions Of The Conditions Of The Contract And Division 1 General Requirements Apply To The Work Of This Division.

SECTION 13855 - FIRE ALARM SYSTEM - VOICE EVACUATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire alarm system installation, including all components, wiring, and conduit.

B. Transmitters for communication with supervising station.

C. Removal of existing fire alarm system components, wiring, and conduit.

D. Complete testing to meet project requirements and the requirements of all applicable codes.

E. Maintenance of fire alarm system under contract for specified warranty period.

1.02 SCOPE AND OPERATIONAL REQUIREMENTS

A. Fire Alarm System: Provide a new automatic fire detection and alarm system:
   1. Provide all components shown or implied by scope and referenced code requirements.
   2. Protected Premises: Entire building shown on drawings.
   3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
      a. The Americans With Disabilities Act (ADA).
      b. The requirements of the State Fire Marshall.
      c. The requirements of the Office of the State Engineer (OSE).
      d. The contract documents (drawings and specifications).
      e. All other applicable codes.
   4. Evacuation Alarm: general evacuation of entire premises.
   5. Voice Notification: Provide emergency voice/alarm communications with multichannel capability; digital.
   6. Program notification zones and voice messages as directed by Owner.
   7. Hearing Impaired Occupants: Provide visible notification devices in all public areas.
   8. Master Control Unit (Panel): New, located where indicated on the drawings.

B. Fire Alarm Control Units, Initiating Devices, and Notification Appliances: Analog, addressable type; listed by Underwriters Laboratories as suitable for the purpose intended.

C. Supervising Stations and Fire Department Connections:
   1. Public Fire Department Notification: By on-premises supervising station.
   2. Remote Supervising Station: Existing proprietary station operated by Owner, located at campus security office.
   3. Means of Transmission to Remote Supervising Station: Digital alarm communicator transmitter (DACT), 2 telephone lines. Verify this before shop drawings submittal.

D. Circuits:
   1. Signaling Line Circuits (SLC) Within Single Building: Class B.
   2. Notification Appliance Circuits (NAC): Class B.

E. Spare Capacity:
   1. Initiating Device Circuits: Minimum 25 percent spare capacity.
   2. Notification Appliance Circuits: Minimum 25 percent spare capacity.
   3. Speaker Amplifiers: Minimum 25 percent spare capacity.
   4. Master Control Unit: Capable of handling all circuits utilized to capacity without

requiring additional components other than plug-in control modules. Unit shall have auxillary inputs for radio controlled access to make announcements to all parts of the facility.

F. Power Sources:
1. Primary: Dedicated branch circuits of the facility power distribution system.
2. Secondary: Existing engine driven generator plus internal batteries in case of generator failure.
3. Capacity: Sufficient to operate the entire system for the period specified by NFPA 72.
4. Each Computer System: Provide uninterruptible power supply (UPS) sized to power the load plus 25% spare capacity for 90 minutes.

1.03 RELATED SECTIONS

A. Section 16123 - Building Wire and Cable.

1.04 REFERENCES

A. IEEE C62.41 - IEEE Recommended Practice on Surge Voltages in Low-Voltage Power Circuits; 1991 (R1995).

B. NFPA 70 - National Electrical Code; 2008.

C. NFPA 72 - National Fire Alarm Code : 2013.

D. IFC - International Fire Code: 2009.

E. International Building Code; 2009

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Proposal Documents: Submit the following:
1. NFPA 72 "Record of Completion", filled out to the extent known at the time.
2. Manufacturer's detailed data sheet for each control unit, initiating device, and notification appliance.

C. Drawings must be prepared using AutoCAD Release 2012.

D. Shop Drawings: Submit all information required for shop drawing review including but not limited to floor plans, riser diagrams, and description of operation:
1. NFPA 72 "Record of Completion", filled out to the extent known at the time.
2. Clear and concise description of operation, with input/output matrix and complete listing of software required.
3. System zone boundaries and interfaces to fire safety systems.
4. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
5. Circuit layouts; number, size, and type of raceways and conductors; notification appliance circuit voltage drop calculations.
6. List of all devices on each signaling line circuit, with spare capacity indicated.
7. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
8. Description of power supplies; if secondary power is by battery include calculations

demonstrating adequate battery power.
9. Do not show existing components to be removed.

E. Inspection and Test Reports:
1. Submit inspection and test plan prior to closeout demonstration.
2. Submit documentation of satisfactory inspections and tests.
3. Submit NFPA 72 "Inspection and Test Form," filled out.

F. Operating and Maintenance Data: Revise and resubmit until acceptable; have one set available during closeout demonstration:
1. Complete set of specified shop drawings documents, as approved by the engineer.
2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
4. List of recommended spare parts, tools, and instruments for testing.
5. Replacement parts list with current prices, and source of supply.
6. Detailed troubleshooting guide and large scale input/output matrix.
7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.

G. Project Record Documents: Have one set available during closeout demonstration:
1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
2. "As installed" wiring and schematic diagrams, with final terminal identifications.
3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.

H. Closeout Documents:
1. Certification by manufacturer that the system has been installed in compliance with his installation requirements, is complete, and is in satisfactory operating condition.
2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.
3. Maintenance contract.

1.06 QUALITY ASSURANCE

A. Manufacturer's Qualifications:
1. Company specializing in manufacturing the products specified in this section for at least ten years.
2. Name of manufacturer, part number, and serial number shall appear on all major components.
3. All devices, components, and equipment shall be the products of a single manufacturer.
4. All devices, components, and equipment shall be new and standard products of the manufacturer's latest design, suitable to perform the functions intended.

B. Installer's Qualifications:
1. Firm regularly engaged in installation of systems similar to those specified in this

section with five years minimum experience in installation, testing, and service of fire detection and control systems.

2. Trained and certified by the manufacturer to design, install, test, and service the fire detection and control system provided under this section.
3. Provide proof of emergency service available 24 hours a day, seven days a week.

1.07 WARRANTY

A. Guarantee all components furnished against defects in design, material, and workmanship for a period no less than five years.

B. Provide documented proof of a service contract by an authorized service contractor covering the full warranty period upon acceptance of the installation. Include cost of service contract in project bid.

1.08 MAINTENANCE SERVICE

A. Furnish service and maintenance of the fire detection and control system for a period of five years from the Date of Substantial Completion.

B. Include all labor and material required to maintain the system in this contract. Any perishable item supplied, such as batteries, shall be exempt from this requirement if indicated in the submitted documents.

1.09 EXTRA MATERIALS AND TOOLS

A. Provide spare parts of same manufacturer and model as those installed; deliver in original packaging, labeled in same manner as in operating and maintenance data and place in spare parts cabinet.

B. In addition to the items in quantities indicated in PART 2, provide the following:
   1. All tools, software, and documentation necessary to modify the fire alarm system using the owner's personnel; minimum modification capability to include addition and deletion of devices, circuits, and zones, and changes to system description, operation, and evacuation and instructional messages.
   2. CD-ROM copies, 2, of all software not resident in read-only-memory.
   3. Fuses, 2 for each installed fuse; store inside applicable control cabinet.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Alarm Control Units - Basis of Design: Honeywell Security & Fire Solutions/Fire Control Instruments, Inc ; 7100 Series: www.firecontrolinstruments.com.

B. Fire Alarm Control Units - Other Acceptable Manufacturers: Provided their products meet or exceed the performance of the basis of design product, products of the following are acceptable:
   1. Honeywell Security & Fire Solutions/Fire Control Instruments, Inc: www.firecontrolinstruments.com.
   2. Honeywell Security & Fire Solutions/Notifier: www.notifier.com.
   3. SimplexGrinnell: www.simplexgrinnell.com.
   4. Provide all control units made by the same manufacturer.

C. Initiating Devices, and Notification Appliances:
   1. Honeywell Security & Fire Solutions/Fire Control Instruments, Inc: www.firecontrolinstruments.com.
   2. Honeywell Security & Fire Solutions/Notifier: www.notifier.com.
   3. Siemens Building Technologies, Inc: www.sbt.siemens.com.
   4. Same manufacturer as control units.
   5. Provide all initiating devices and notification appliances made by the same manufacturer.

D. Substitutions: See Section 01600 - Product Requirements.
   1. For other acceptable manufacturers of control units specified, submit product data showing equivalent features and compliance with contract documents.
   2. For substitution of products by manufacturers not listed, submit product data showing features and certification that the installation will comply with contract documents.

2.02 FIRE ALARM CONTROL PANEL (FACP or FAC)

A. FACP or FAC: Micro-processor based system capable of communicating with smoke sensors, thermal sensors, contact monitoring modules, addressable supervised output modules, addressable releasing modules, and addressable relay modules.

B. System Capacity and General Operation:
   1. System capable of communicating and controlling up to 508 addressable analog devices and sensors; system supporting up to 240 software zones for configuring initiating devices and output functions.
   2. System shall respond to an alarm initiating device, including analog smoke sensors, within 3 seconds for a fully loaded system (508 devices); response times measured from activation of initiating device to activation of associated notification appliance circuit.
   3. System shall provide an Alarm, Trouble and Supervisory Form-C Relay contact rated 2.0 amps minimum at 30 VDC.
   4. System shall provide two configurable notification appliance circuits (NAC) at the FACP, each circuit rated 2.0 amps at 24 VDC with capability of adding at least two more circuits in the future or adding separate cabinets to increase NAC capacity.
   5. The system shall provide means for routing live and pre-recorded evacuation and/or emergency security instructions through the fire alarm speakers that also shall be used to sound alert tones, warbles or other evacuation signals as approved by the engineer and authority having juridiction. Related equipment shall include but not necessarily by limited to the following:
      a. Master microphone module
      b. Audio amplifiers rated to power all speakers plus 10% spare and 10 dB headroom.
      c. Signal processing module to route audio signals.
      d. Speaker circuit modules.
      e. A digital message module.
   6. FACP shall include a full featured operator interface control and annunciation panel that includes a LCD display, individual color coded system status LED's, and an alpha-numeric keypad for field programming of the fire alarm system.
   7. Programming or editing of the existing configuration program in the system shall not require use of special equipment, such as a laptop personal computer. Access to the

configuration program shall be limited by use of a password security system; three levels of access shall be used to isolate user, maintenance, and configuration operating portions of the system.

8. FACP shall provide the following features:
   a. Drift compensation for analog sensors.
   b. Sensitivity test in accordance with NFPA 72 requirements.
   c. Maintenance alert for sensors with excessive accumulations of dust or dirt.
   d. Alarm verification with individual counters for each sensor.
   e. Periodic calibration of smoke sensors.
   f. Day/Night automatic smoke sensor sensitivity adjustments.
   g. One man walk test with optional notification appliance testing.
   h. Two levels of adjustable pre-alarm for advanced warning.
   i. 1800 event history buffer, with dedicated 600 event alarm event buffer.

C. Central Microprocessor:
   1. Central microprocessor shall communicate, control, and monitor all external devices; custom operating parameters for the system stored in non-volatile memory to prevent loss during power outages.
   2. Provide real time clock to denote actual time of occurrence of system events for the display, history buffers, and external reporting devices.

D. Display:
   1. Eighty character LCD display shall annunciate system conditions and program system operating parameters.
   2. Provide eight status LED's: AC Power, Fire Alarm, Pre-Alarm Warning, Supervisory, Trouble, Alarm Silence, Supervisory Silence, and Trouble Silence
   3. Keypad: 25 key-pad with tactile feel membrane switches which provide operational feedback. Separate keys shall be dedicated to System Reset, Step, Alarm Silence, Acknowledge, and Drill. Key-pad shall be used to provide all control and programming functions for the system.

E. Signaling Line Circuits (SLC):
   1. Each SLC shall provide power and communication with up to 127 analog or addressable devices; basic system shall consist of two SLC (254 devices total) with expansion to four SLC (508 devices total). Each SLC shall be capable of meeting wiring requirements of NFPA 72.
   2. Each SLC shall communicate using a completely digital communication method, providing a more reliable, noise immune communication system. Communication between an addressable device or sensor shall use a validation method, such as providing a checksum for each message, to validate the integrity of each message; systems which use a hybrid analog and digital communication scheme will not meet the requirements of this section.
   3. Each SLC shall use an Interrupt driven communication scheme to rapidly identify alarm conditions of any connected device. Normal polling scheme of the system shall be interrupted by a device in alarm. Identification of alarming device shall be annunciated at the control system display within 2 seconds of activation.
   4. Control devices shall maintain local operating parameters and not require individual commands from the control system to activate.
   5. System shall meet NFPA 72 requirements as a calibrated smoke sensitivity fixture.

F. Enclosures:
   1. System shall be housed in a small footprint enclosure(s) with nominal dimensions not to exceed 24" wide by 6" deep.
   2. Enclosures capable of surface or semi-flush mounting without requiring additional hardware.
   3. Enclosures painted either red or gray with a corrosion protective, hardened finish.
   4. Enclosures shall be clearly labeled on the outside identifying the manufacture and systems series as a minimum.

G. Power Supplies:
   1. Power supply shall operate upon 120 VAC, 60 Hertz, providing all power necessary to operate the control system.
   2. Power supply shall provide 5.0 amps of power for use on notification appliance circuits or auxiliary power circuits.
   3. Provide capability to supply an additional 5.0 amps of power, bringing total output power capacity to 10.0 amps at 24 VDC.
   4. Each power supply shall provide battery charger capacity to sufficiently recharge a depleted set of 17 AH batteries within 48 hours.
   5. Provide auxiliary power output circuits for four wire detectors or addressable control modules. Provide separate circuit to allow resetting the auxiliary power during a system reset. All auxiliary power circuits shall be power limited.

H. Field Programming:
   1. System shall be programmable from the control panel without requiring use of personal computer.
   2. Programming shall be accomplished via the standard 25 key-pad.
   3. Provide two levels of password access to prevent unauthorized modifications to the system operating configuration. Within each access level, up to 16 unique users can be assigned. The history buffer will record the user for each action taken requiring a password.
   4. Provide a Learn Mode to identify changes in the installed system with the system configuration. Identified changes will then be presented to the user for validation. The Learn Mode shall also provide a means to program groups of devices with the same operating characteristics to minimize configuration times and errors.

2.03 EXISTING COMPONENTS

A. Existing Fire Alarm System: Remove existing system completely after new system is fully operational and tested.

B. Remove unused existing components and materials from site and dispose of as directed by the Owner.

2.04 FIRE SAFETY SYSTEMS INTERFACES

A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
   1. Elevator shut-down control circuits.

B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
   1. Elevator lobby, elevator hoistway, and elevator machine room smoke detectors.
   2. Duct smoke detectors.

C. Elevators:
   1. Elevator lobby, hoistway, and machine room smoke detectors: Elevator recall for fire fighters' service.

D. HVAC:
   1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated. Refer to Mechanical plans and specifications for sequence of operation and complete shut down requirements.

2.05 REMOTE ANNUNCIATORS

A. Provide remote annunciators as required by governing codes and the local fire marshall. Remote annunciators shall be alphanumeric display types that match the characteristics of the main fire alarm panel display. Locate the remote annunciators where shown on the plans and verify with local fire marshall's prior to installation. Additional functions and controls of the remote annunciator shall include but not necessarily be limited to: System Reset, Step, Alarm Silence, Acknowledge and Drill.

2.06 INITIATING DEVICES

A. Manual Pull Stations: Addressable, single action, die-cast aluminum designed for semi-flush mounting. Key lock and reset type with test position.
   1. Provide 3 extra.

B. Smoke Detector:
   1. The detectors shall include a red LED which shall pulse to indicate that power is on and shall glow continously to indicate alarm.
   2. Mounting Base: The detector shall be the twist-lock type with screw terminals for wiring. The dector shall plug into the base by a push-twist mechanism. Removal of the detector shall require a special tool, a feature that can be field removable.
   3. Each detector shall store the detector address and operating characteristics in non-volatile memory at the sensor. Sensor shall use a threshold received from the control unit to determine when an alarm condition exists.
   4. Smoke detectors shall be 4-wire type with separate alarm and power circuits.
   5. Each detector shall be capable of compensating for dust and dirt accumulation within the sensing chamber.
   6. Smoke detectors shall be analog addressable type and ionization or photoelectric type as inidicated. Sensitivity for photoelectric detectors shall be set and diplayed on the fire alarm control panel alphanumeric display in percent obsuration per foot. In addition, a calibrated light source shall be used to calibrate the fire level of the photoelectric sensor which shall be capable of field adjustment.
   7. Provide 3 extra.

C. Duct Smoke Detectors:
   1. Provide a complete assembly that includes a detector, housing, sampling tubes and remote test and alarm indicator.
   2. LED: POWER ON LED integral to housing.
   3. Test Switch: Key operated test switch
   4. Contacts: Form C contacts for control functions.
   5. Sampling Tubes: Provide lengths necessary for duct sizes encountered.
   6. Detector: Photo electric type unless noted otherwise.

7. Provide 3 extra.

D. Heat (or Thermal) Detectors:
   1. Operation: Combination rate of rise and fixed temperature.
   2. Sensor Address: Each sensor shall store the detector address and operating characteristics in non-volatile memory at the sensor. Sensors shall use a threshold received from the control panel to determine when an alarm condition exists.
   3. Alarm LED's: Each sensor shall have an alarm LED that will flash to indicate normal conditions and and shall illumitate steady during alarm conditions.
   4. Sensitivity Settings: Settings shall be set and displayed on the LCD in degrees fharenheit. The set point for the fixed temperature shall be adjustable between 100 degrees and 156 degress fharenheit. The rate of rise function shall be adjustable between 15 degrees and 25 degress fharenheit per minute.
   5. Provide 3 extra.

E. Addressable Interface Devices:
   1. Fast Response Contact Module:
      a. Contact modules shall provide monitoring of dry contacts as initiating devices.
      b. Each module shall store the sensor address and operating characteristics in non-volatile memory at the module.
      c. Mount module to a standard junction box and provide visual indication of status via a status LED. Optional mounting shall be available to allowing mounting the module in a junction box with a monitored contact.
   2. Supervised Output Module:
      a. Each supervised output module shall be rated to operate listed notification appliances.
      b. Circuit shall be rated for 2.0 amps at 24 VDC.
      c. Each module shall store the sensor address and operating characteristics in non-volatile memory at the module.
      d. Each module shall be individually selectable for silencing and walktest. A module programmed to operate during walktest will initiate the programmed pattern for 4 seconds when the appropriate initiating conditions are satisfied.
      e. Each module shall operate under up to 16 different conditions occurring in the system. These conditions include combining various zones and zone states.

2.07 NOTIFICATION APPLIANCES

A. Speakers:
   1. Construction: 8 ohm, 4" wide angle dispersion cone, ceramic magnet and 1" voice coil.
   2. Transformer: 70.7 volt with 1/4, 1/2, 1, and 2 watt taps standard. Where long throw applications are indicated, provided high rated taps and speakers.
   3. Rated Sound Pressure Level: 87 db with 1 watt at 4 foot.
   4. Mounting: Flush or semi-flush mount in Deep 4" square box or other speaker back box.
   5. Grill: Round or square metal grill to match speaker and mounting requirements.
   6. Provide 1 extra.

B. Strobes:
   1. Type: High intensity Xenon strobe silicon sealed within a clear lexan lens.
   2. Operating Voltage: 24 VDC polarized circuit.
   3. Flash Rate: One flash per second, self-synchronized.

4. Output: from 15 to 110 candela as indcated on plans.
5. Visibilty: Constructed or arranged for no less that 180 degree for wall mounted units and 360 degree for ceiling mounted units.
6. Construction: Rugged plastic housing for mounting semi-flush in a single or two-gang box opening.
7. Provide 3 extra.

C. Combination Audible Device/Strobes
1. Provide a strobe and audible device (Speaker) integrally mounted in a common plate or mounting assembly.

2.08 WIRING

A. All fire alarm system wiring shall be new and comply with local, state and national codes and according to munufacturers recommendations.

B. Sizes: As recommended by the manufactrurer but no less than 18 gage for initiating device or signal line circuits and 14 gage for notification appliace circuits.

C. Conductor Type: Copper.

D. All wiring and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.

E. All field wiring shall be supervised for open circuits, short circuits and grounded conditions.

2.09 SURGE PROTECTION

A. Standard: In accordance with IEEE C62.41 B3 combination waveform and NFPA 70; except for optical fiber conductors.
1. Equipment Connected to Alternating Current Circuits: Maximum let through voltage of 350 V(ac), line-to-neutral, and 350 V(ac), line-to-line; do not use fuses.
2. Initiating Device Circuits, Notification Appliance Circuits, and Communications Circuits: Provide surge protection at each point where circuit exits or enters a building; rated to protect applicable equipment; for 24 V(dc) maximum dc clamping voltage of 36 V(dc), line-to-ground, and 72 V(dc), line-to-line.
3. Signaling Line Circuits: Provide surge protection at each point where circuit exits or enters a building, rated to protect applicable equipment.

2.10 ADDITIONAL ACCESSORIES

A. Locks and Keys: Deliver keys to the Owner.
1. Provide the same standard lock and key for each key operated switch and lockable panel and cabinet; provide 5 keys of each type

B. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.
1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
2. Provide one for each control unit where operations are to be performed.
3. Obtain approval of Owner prior to mounting; mount in location acceptable to the Owner.
4. Provide extra copy with operation and maintenance data submittal.

C. Storage Cabinet for Spare Parts and Tools: Steel with baked enamel finish, size appropriate to quantity of parts and tools.
   1. Padlock eye and hasp for lock. Lock furnished by Owner.
   2. Locate as directed by Owner.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with all applicable codes, including but not limited to NFPA 72, NFPA 70, and the contract documents.

B. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.

C. Obtain Owner's approval of locations of devices, before installation.

D. Install instruction cards and labels.

E. Wiring shall be in accordance with manufacturers instructions and based on that which is typical for the system to be installed. Therefore refer to the manufacturer being used for complete wiring requirements. Wiring methods shall be in strict accordance with NEC Articles 725 and 760. Wiring shall be minimum 18 gauge, solid for initiating, supervisory and control circuits or where twisted pair data grade cable is used shall be minimum 24 gage. Wiring for notification appliances shall be minimum 14 gauge solid and installed in conduit. Label wires at all termination points to identify SLC circuit. Conduit shall be 3/4 inch minimum.

F. Circuits from the fire alarm control unit used for elevator control, HVAC system control, door release service, door unlocking, etc., shall be monitored for integrity.

G. Provide weather proof devices and equipment where installed outdoors or in locations otherwise subject moisture.

H. Indicate the location of the fire alarm power circuit disconnect by identifying the circuit number, panelboard and room in which the disconnecting device is located. An engraved, plastic, laminated, label shall be installed on the front cover of the fire alarm control unit for this purpose. An example of the label is as follows: POWER CIRCUIT: PANELBOARD "P1A"-CIRCUIT 12-ELECTRICAL ROOM 112". Also show the location of the device on graphic annunciators, shop drawings, permanent plaques, or other media that represents layouts of the fire alarm system.

3.02 HVAC SYSTEMS INTERFACES:

A. Furnish a signal or group of signals for proper operation of the fire alarm functions of the mechanical system to suit mechanical system shut down and smoke evacuation sequences. In the case of a general shutdown a single signal may be all that is required. However, in the case of zoned shutdowns and special operations multiple signals shall be provided. This work shall include all wiring and conduit to allow connection of the signal to the mechanical system controls by the mechanical contractor.

B. Where a central mechanical control system is being used provide the signal or signals to the to the main mechanical system control point. Where a centralized control system is not available a signal shall be provided to the controller of each air handling unit or supply fan which must be shutdown. The signals shall be programmed for a general shutdown or

individual shutdown to suit the mechanical system shutdown sequence. Refer to the appropriate Division 15 section of the specifications for description of associated operations and the signals required. Coordinate with the respective Division 15 Contractor to ensure that proper interpretation of the requirements has been made.

C. Duct smoke detectors shall be provided by the Fire Alarm System Contractor and installed on the duct system by the mechanical contractor. Fire alarm system wiring, wiring terminations and all remaining fire alarm work associated with the duct detectors shall be provided by the Fire Alarm System Contractor.

3.03 INSPECTION AND TESTING FOR COMPLETION

A. Notify Owner 7 days prior to beginning completion inspections and tests.

B. Owner will provide the services of USC Upstate Facilities/Engineering Department fire alarm technician(s) to observe all tests.

C. Notify authorities having jurisdiction, as well as the Owner, and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

D. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.

E. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.

F. Provide all tools, software, and supplies required to accomplish inspection and testing.

G. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.

H. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

I. Diagnostic Period: After successful completion of inspections and tests, Operate system in normal mode for at least 14 days without any system or equipment malfunctions.
   1. Record all system operations and malfunctions.
   2. If a malfunction occurs, start diagnostic period over after correction of malfunction.
   3. Owner will provide attendant operator personnel during diagnostic period; schedule training to allow Owner personnel to perform normal duties.
   4. At end of successful diagnostic period, fill out and submit NFPA 72 "Inspection and Testing Form."

3.04 FIRE ALARM SYSTEM CERTIFICATION

A. The NFPA and/or applicable national, state or local codes require Certification of fire alarm sytems for certain facilities and conditions. Provide Certification of the fire alarm system in such cases. Use a company that is approved by UL and the NFPA to provide certification and perform all required tests.

3.05 OWNER'S PERSONNEL INSTRUCTION

A. Provide the following instruction to designated Owner's personnel:
   1. Hands-On Instruction: On-site, using operational system.

B. Administrative: One-hour session(s) covering issues necessary for non-technical administrative staff; classroom:
   1. Sessions: 1 session pre-closeout.
   2. Refresher Training: 1 session post-occupancy.

C. Basic Operation: One-hour sessions for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:
   1. Sessions: 1 session pre-closeout.
   2. Refresher Training: 1 session post-occupancy.

D. Detailed Operation: Two-hour sessions for engineering staff; assume NICET level I qualifications or equivalent; combination of classroom and hands-on:
   1. Sessions: 1 session pre-closeout.
   2. Refresher Training: 1 session post-occupancy.

E. Maintenance Technicians: Detailed training for electrical technicians, on programming, maintaining, repairing, and modifying; factory training:
   1. Initial Training: One 3-day session, pre-closeout.
   2. Refresher Training: One 1-day session post-occupancy.

F. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data available during instruction.

3.06 CLOSEOUT

A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
   1. Be prepared to conduct any of the required tests.
   2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
   3. Have authorized technical representative of control unit manufacturer present during demonstration.
   4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
   5. Repeat demonstration until successful.

B. Occupancy of the project will not occur prior to Substantial Completion.

C. Substantial Completion of the project cannot be achieved until inspection and testing is successful and:
   1. Specified diagnostic period without malfunction has been completed.
   2. Approved operating and maintenance data has been delivered.
   3. Spare parts, extra materials, and tools have been delivered.
   4. All aspects of operation have been demonstrated to the owner.
   5. Final acceptance of the fire alarm system has been given by authorities having jurisdiction.
   6. Specified pre-closeout instruction is complete.

D. Perform post-occupancy instruction within 3 months after Substantial Completion.

3.07 MAINTENANCE

A. Provide to the Owner, at no extra cost, a written maintenance contract for entire manufacturer's warranty period, to include the work described below.

B. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:
   1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
   2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
   3. Record keeping required by NFPA 72 and authorities having jurisdiction.

C. Provide trouble call-back service upon notification by the Owner:
   1. Provide on-site response within 2 hours of notification.
   2. Include allowance for call-back service during normal working hours at no extra cost to the Owner.
   3. The Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

D. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

E. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.

F. Comply with the Owner's requirements for access to facility and security.

END OF SECTION

D I V I S I O N 15

M E C H A N I C A L

Applicable Portions Of The Conditions Of The Contract And Division 1 General Requirements Apply To The Work Of This Division.

SECTION 15010 - GENERAL MECHANICAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Work under Division 15 shall include furnishing of all labor, accessories, tools, equipment and material required to completely execute installation of the entire heating, ventilating and air conditioning systems, plumbing systems and fire protection systems as shown on the drawings and as specified. Work shall include but not be limited to the furnishing, unloading, handling distribution, setting, supporting and installation of all components required for the mechanical systems.

B. Mechanical specification Sections 15000 through 15299 generally apply to all mechanical trades. Sections 15300 through 15399 apply generally to fire protection work. Sections 15400 through 15499 apply generally to plumbing work. Sections 15500 through 15999 apply generally to HVAC work.

C. Drawings shall not be scaled. Refer to architectural and structural drawings for building construction and dimensions and to room finish schedule on architectural drawings for material, finish and construction method of walls, floor and ceiling in order to insure proper rough-in and installation of work.

1.02 REFERENCES

A. FM P7825 - Approval Guide; Factory Mutual; 1995.

B. NEMA MG 1 - Motors and Generators; 1993 (and Revision 1).

C. NFPA 70 - National Electrical Code; 2008

D. SSPC-Paint 15 - Steel Joist Shop Paint; Steel Structures Painting Council; Part of Painting Manual, Vol 2.

E. ASME American Society of Mechanical Engineers

F. ASTM American Society for Testing Materials

G. NEMA National Electrical Manufacturers Association

H. NFPA National Fire Protection Association

I. OSHA Occupational Safety and Health Act

J. SMACNA Sheet Metal and Air Conditioning Contractors National Association, Inc.

K. IBC International Building Code; 2009

L. IMC International Mechanical Code; 2009

M. IPC International Plumbing Code; 2009

N. IFC International Fire Code; 2009

O. IECC International Energy Conservation Code; 2009

1.03 Interpretation of Contract Documents:

A. Except where modified by a specific notation to the contrary, it shall be understood that the indication and/or description of any item, in the drawings or specifications or both, carries with it the instruction to furnish and install the item, regardless of whether or not this instruction is explicitly stated as part of the indication or description.

B. It shall be understood that the specifications and drawings are complimentary and are to be taken together for a complete interpretation of the work.

C. No exclusions from, or limitations in, the language used in the drawings or specifications shall be interpreted as meaning that the appurtenances or accessories necessary to complete any required system or item of equipment are to be omitted

D. The drawings of necessity utilize symbols and schematic diagrams to indicate various items of work. Neither of these have any dimensional significance nor do they delineate every item required for the intended installations. The work shall be installed in accordance with the diagrammatic intent expressed on the drawings, and in conformity with the dimensions indicated on final architectural and structural working drawings and on equipment shop drawings.

E. No interpretation shall be made from the limitations of symbols and diagrams that any elements necessary for complete work are excluded.

F. Certain details appear on the drawings which are specific with regard to the dimensioning and positioning of the work. These details are intended only for the purpose of establishing general feasibility. They do not obviate field coordination for the intended work.

G. Information as to the general construction shall be derived from structural and architectural drawings and specifications only.

H. The use of words in the singular shall not be considered as limiting where other indications denote that more than one item is referred to.

1.04 PERFORMANCE REQUIREMENTS

A. Work shall be installed to conform with any City or State law, regulation, code, ordinance, ruling or Fire Underwriters requirement applicable to this class of work.

B. All installations for construction purposes shall conform with the Department of Labor "Safety and Health Regulations for Construction".

C. All equipment with electrical components shall bear the UL label.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements for submittal procedures.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

1.07 Coordination of Fabrication Drawing:

A. Storm drain piping and sanitary waste piping, in which the grade must be maintained, shall have first priority. Ducts and pipes shall be offset to avoid them.

B. Service piping shall generally be run below ductwork so that they will be accessible for service and modification. The pipes will be offset as required to avoid interfering with access panels, dampers, etc.

C. Ducts will have second priority. Pipes will be offset as required to avoid them.

D. Where pipes of different trades conflict, such as domestic water vs. chilled water, the smaller pipe shall be offset.

1.08 Fabrication Drawings:

A. Prior to assembling or installing the work, the following fabrication drawings shall be submitted to the Architect and Owner for approval.

B. Scaled drawings (1/4" or larger) showing dimensional locations in plan and elevation of all items listed below. All items shall be located dimensionally from column lines and finished floor elevation. Location and size of access panels shall be shown.
1. HVAC ductwork and air distribution
2. HVAC piping
3. Plumbing piping
4. Wall and floor openings
5. Shafts and chases

C. 1/4" or larger scale drawings shall be prepared for all equipment rooms.

D. Furnish dimensioned setting location drawings, templates, instructions for installation of anchorages, such as concrete inserts, expansion joints, anchor bolts, pipe sleeves, and miscellaneous items having integral anchors, which are to be embedded in concrete, precast concrete, or masonry construction. Drawings will be coordinated amongst all pertinent prime and subcontractors prior to review and approval by General Contractor.

PART 2 PRODUCTS

2.01 Materials and Manufacturers:

A. Equipment and materials installed under this contract shall be new and without blemish or defect.

B. Each major component of equipment shall have the manufacturer's name, address, model number and rating on a plate securely affixed in a conspicuous place. The nameplate of a distributing agent will not be acceptable. ASME Code Ratings, UL label, or other data which is die-stamped into the surface of the equipment shall be stamped in a location easily visible.

C. In all cases the contractor shall be completely responsible for changes in dimension of other than first named manufacturer equipment, electrical changes, etc. required for proper function and final performance. Item shall comply with all requirements herein set forth and as required to perform as designed.

2.02 Electrical Equipment

A. Within 60 days of award of contract, the person responsible for work in this division shall verify that the appropriate number of contacts have been provided in the starters or drives and if a control power transformer is required that it has been provided to control the

equipment as described in Section 15940-HVAC Sequence of Operation.

B. If additional devices are required, it is the responsiblity of this Division to coorodinate and provide the devices required to control the equipment as specified.

C. The Division 15 contractor/s shall verify that all equipment is powered and that the power is of the correct characteristics. All equipment should be coordinated with the Division 16 contractor to ensure that the required power is provided to the device.

D. Where equipment requires low voltage power, the Division 15 contractor shall provide all transformers required that aren't provided elsewhere.

E. Power for controls shall be provided and coordinated with the controls contractor. All transformers shall be provided as required. Where network connections are required it is the controls contractor's responsibility to coordinate with the existing network and provide devices as required to connect.

F. The Division 15 contractor shall verify that all equipment requiring VFDs, starters and disconnects have them provided and that they are sized appropriately. Locations for these devices shall be coordinated with all other trades. These devices shall be accessible and rated for the location that they are installed.

2.03 Substitution of Specified Materials:

A. Throughout the drawings and specifications, equipment and systems have been selected and are referenced by name, manufacturer, model number, etc. These references are not intended to limit competition and in most cases materials and methods of construction equal to that specified will be accepted provided approval of any substitute item is obtained from the Architect/Engineer. Contractors and other manufacturers may submit requests to be listed as an acceptable manufacturer on the specified item by submitting documentation in accordance with the requirements of Section 1600. All bidders will be notified by addendum of any approved substitutions. Any item installed on the job which has not been approved in accordance with the noted procedure shall be removed and replaced with the appropriate approved item at the contractor's expense.

B. In all cases the contractor shall be completely responsible for changes in dimension of substituted manufacturer's equipment, electrical changes, etc. required for proper function and final performance. Item shall comply with all requirements herein set forth and as required to perform as designed.

PART 3 EXECUTION

3.01 Protection of Equipment:

A. Protect all materials and equipment from damage during storage at the site and throughout the construction period.

B. Protection from damage from rain, dirt, sun and ground water shall be accomplished by storing the equipment on elevated supports and covering them on all sides with protective rigid or flexible water proof coverings securely fastened.

C. Piping shall be protected by storing it on elevated supports and capping the ends with suitable material to prevent dirt accumulation in the piping.

3.02 COORDINATION OF WORK

A. All work shall be coordinated to avoid conflict with other contractors.

B. The contractor shall be responsible for checking to insure that the equipment to be installed will fit in the space shown on the drawings. If there is a conflict, the contractor shall notify the Engineer before bid. By submitting a bid the contractor assures that the equipment to be installed will fit or that previsions have been included in the bid to move the equipment to a location where it can be installed without conflict.

C. The Contractor shall review and coordinate the casework and millwork shop drawings to determine the location of sinks, range hoods, refrigerators, lab equipment, etc., and rough-in and install any and all items shown on the plans.

3.03 Contiguous Work:

A. If any part of the Contractor's work is dependent for its proper execution or for its subsequent efficiency or appearance on the character or conditions of contiguous work not executed by him, this contractor shall examine and measure such contiguous work and report to the Architect in writing any imperfection therein, or conditions that render it unsuitable for the reception of this work. Should the contractor proceed without making such written report, he shall be held to have accepted such work and the existing conditions and he shall be responsible.

3.04 Certificates of Inspection and Approval:

A. Upon completion of work, furnish to the Owner certificates of inspection or approval from the authorities having jurisdiction if certificates of inspection or approval are required by law or regulation.

3.05 Equipment Pads:

A. Provide concrete housekeeping pads under all equipment.

3.06 Access to Equipment and Valves:

A. All control devices, specialties, valves and removable panels on equipment shall be so located as to provide easy access for inspection and maintenance, including removal of any interior components.

B. Should any work, such as piping, ducts, conduit, etc. be installed without due regard to the accessibility of devices installed by other contractors, the installation shall be relocated, offset or rerouted without cost to the Owner.

3.07 Cutting and Patching:

A. Perform all cutting and patching required for installation of the work.

3.08 Welding:

A. Welders shall be qualified as prescribed by Section IX of the ASME Boiler Code. All weld joints shall conform to ANSI/ASME B-31.1.

3.09 Project Closeout:

A. Maintenance Manuals: At the end of construction, furnish to the Architect three (3) bound

and indexed sets of maintenance and operating instructions, parts lists, electrical wiring diagrams, balance data, and manufacturer's literature sufficient for operation and complete maintenance of all equipment by the Owner.

B. Approved submittals and shop drawings may be included in the Maintenance Manuals instead of being separately furnished, if desired.

C. It is intended that the documentation provided in maintenance manuals, along with as-built drawings, shall be complete and detailed enough to permit and facilitate troubleshooting, engineering analysis, and design work for future changes, without extensive field investigations and testing. Manuals shall be prepared so as to explain system operation and equipment to those not acquainted with the job.

D. Manuals shall be durably bound and clearly identified on the front cover (and on the spine of thick volumes). Identification shall include the building or project name, applicable trade (such as HVAC, Plumbing, Fire Protection, etc.), approximate date of completion (month and year) and contractor's name.

E. Manuals shall be organized into well defined and easy to locate sections, with index tabs or separators to divide the sections. A complete table of contents shall be provided at the front indicating the section or page number for each system, subsystem, or supplier/manufacturer.

F. Manuals shall include complete information and diagrams on all controls, indicators, sensors, and signal sources. Control diagrams are to show the locations of components and major equipment by room number or other identification when room numbers are not applicable. Locations of out-of-sight components, such as duct mounted sensors, flow switches, etc. should be clearly indicated. Control diagrams must include identification of components by make and model number, operating ranges, recommended set points, reset schedules, and other job-specific data useful for troubleshooting, calibration and maintenance. Complete narrative descriptions of operating sequences of control systems and subsystems shall be included on the prints adjacent to the corresponding schematics. Catalog data and cuts shall be clearly marked to indicate model numbers, sizes, capacities, operating points, and other characteristics of each item used. This should include accessories or special features provided. Where various sizes or variations of a series or model are used, documents should clearly show which are used where. Where quantities are appropriate, schedule of usage should be provided. Maintenance literature shall include complete information for identifying and ordering replacement parts, such as illustrated parts breakdowns.

G. Maintenance manuals must include complete balance data on all systems.

3.10 Instructions to Owner:

A. Contractor shall conduct a maintenance and operational instruction session for the Owner. Where highly technical or complex equipment is supplied, such as chillers and control systems, manufacturer's representatives, controls subcontractors, and other appropriate personnel who are particularly qualified, shall conduct training sessions pertaining to their equipment, or systems. Such training shall be scheduled with the Owner in advance.

3.11 Spare Filters:

A. Spare filters shall be delivered to Owner's representative.

3.12 Warranties:

A. This Contractor warrants the mechanical systems to be free of defects in materials and workmanship for a period of one year after date of final payment. The effective dates of this warranty apply to all components of the mechanical systems regardless of any equipment manufacturer's warranties which may expire at an earlier date. Any system malfunctions, or any previously undiscovered non-compliance with the plans and specifications, during the warranty period shall be repaired at no cost to the Owner.

B. Deliver to Owner all warranties, guarantees, etc. and obtain written receipts.

END OF SECTION

SECTION 15065 - MOTORS FOR MECHANICAL EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Three phase electric motors.

1.02 RELATED REQUIREMENTS

A. Section 16155 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; American Bearing Manufacturers Association, Inc.; 1990 (Reapproved 2008).

B. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators; Institute of Electrical and Electronic Engineers; 2004.

C. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2011.

D. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.

C. Operation Data: Include instructions for safe operating procedures.

D. Operation and Maintenance Manuals: Include in manuals the information listed below. For information on how to prepare and submit manuals see section 1780 (Closeout Submittals).
   1. Spare parts lists
   2. Operating instructions
   3. Maintenance instructions, including preventative and corrective maintenance.
   4. Copies of warranties
   5. Wiring diagrams
   6. Shop drawings and product data

1.05 QUALITY ASSURANCE

A. Conform to NFPA 70.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Lincoln Motors: www.lincolnmotors.com.

B. A. O. Smith Electrical Products Company: www.aosmithmotors.com.

C. Reliance Electric/Rockwell Automation: www.reliance.com.

D. Substitutions: See Section 01600 - Product Requirements.

2.02 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Electrical Service: Refer to Section 16155 for required electrical characteristics.

B. Construction:
1. Open drip-proof type except where specifically noted otherwise.
2. Design for continuous operation in 40 degrees C environment.
3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.

C. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

D. Wiring Terminations:
1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.03 APPLICATIONS

A. Motors located in exterior locations and air cooled condensers: Totally enclosed type.

2.04 THREE PHASE POWER - SQUIRREL CAGE MOTORS

A. Starting Torque: Between 1 and 1-1/2 times full load torque.

B. Starting Current: Six times full load current.

C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.

D. Design, Construction, Testing, and Performance: Conform to NEMA MG 1 for Design B motors.

E. Insulation System: NEMA Class B or better.

F. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.

G. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.

H. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay for wiring into motor starter; refer to Section 16423.

I. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

J. Sound Power Levels: To NEMA MG 1.

K. Part Winding Start Where Indicated: Use part of winding to reduce locked rotor starting current to approximately 60 percent of full winding locked rotor current while providing approximately 50 percent of full winding locked rotor torque.

2.05 MOTOR CONTROLLERS:

A. Division 15000 Contractors shall provide motor controls and controllers for all items installed under this division of the specifications except for the following equipment:
   1. Controllers to be installed in motor control centers.

B. Unless indicated otherwise, starters shall be magnetic starters.

C. Branch-circuit protective devices shall not be permitted to serve as controllers on any motors provided under this division of the specifications.

D. All motor controllers that are specified to be furnished by Division 15000 Contractors shall be turned over to Electrical Contractor for installation by Electrical Contractor unless otherwise specified.

E. Division 15000 Contractors shall provide motor controls and controllers packaged and pre-wired with equipment where specified or shown on drawings and schedules.

F. Floor mounted controllers and controllers for variable speed motors shall be set in place by Division 15000 Contractor and wired by Electrical Contractor.

G. Each controller shall be capable of starting and stopping the motor it controls and shall be capable of interrupting the locked-rotor current of the motor.

H. Each controller shall have a horsepower rating not lower than the horsepower rating of the motor it controls.

I. All motor controllers shall be furnished with an identification label designating service for which controller is used. Plate shall be firmly attached to controller or wall mounted adjacent to controller.

J. All indoor controller enclosures shall be NEMA Type 1 unless specified otherwise. All controller enclosures directly exposed to weather shall be NEMA Type 3R.

2.06 MAGNETIC STARTERS:

A. Unless otherwise indicated on the drawings, magnetic motor starters shall be full voltage and horsepower rated, across-the-line. Each magnetic starter shall be provided with green "run" pilot light and red "Stop" pilot light.

B. Pilot lights shall be provided with factory furnished legend plates indicating "Stop", "Run",

etc. Pilot lights shall be provided with interlocks controlled by the starter operating coil.

C. Thermal overloads shall be externally resettable. A thermal overload shall be provided in each phase. Thermal overloads shall be sized in accordance with the actual nameplate current of the motor served.

D. Each magnetic starter shall be provided with "Start" and "Stop " push buttons, and under voltage protection for manual or automatic operation.

E. Where required for automatic operation by a remote pilot device under the applicable sections of this Specification, magnetic starters shall be provided with a "Hand-Off-Automatic" selector switch.

F. Hand-Off-Automatic device shall not be wired to override safety device interlocks on starter. If selector is mounted remotely, provide test start push button on starter.

G. Each magnetic starter shall be provided with auxiliary contacts (N.O., N.C., or N.O.-N.C.) for interlocking and automatic operation required under the applicable sections of this Specification.

H. Except where indicated on the drawings, all pilot lights, push buttons, and selector switches shall be mounted in the motor starter cover.

I. Magnetic starters shall be Square D, General Electric, Cutler Hammer, or Westinghouse.

J. Provide solid state overload relays for phase loss protection and phase unbalance protection. Relays shall have a LED power indicator.

K. Coordinate coil voltage with controls contractor.

2.07 MANUAL DISCONNECT SWITCHES:

A. Division 15000 contractor shall provide manual disconnect switches where not indicated on Divsion 16000 drawings.

B. Disconnect switches shall be line voltage type with overload protection. Disconnect switches shall be quick make and break, toggle operated, trip free, and shall be provided with a lockoff handle guard and oversized enclosure.

C. Where required for automatic operation by a remote pilot device under the controls section of this specification, disconnect switches shall be provided with a "hand-off-automatic" selector switch in addition to the "on-reset-off" toggle switch.

D. All disconnect switch enclosures shall be NEMA Type 1 unless specified otherwise. All disconnect enclosures directly exposed to weather shall be NEMA Type 3R.

E. Disconnect switches shall be Square D Class 2510 Type F or approved equal by General Electric, Cutler Hammer, or Westinghouse.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

C. Check line voltage and phase and ensure agreement with nameplate.

END OF SECTION

SECTION 15066 - VARIABLE FREQUENCY CONTROLLERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Variable frequency controllers.

1.02 RELATED SECTIONS

A. Section 15075 - Mechanical Identification

1.03 REFERENCES

A. NEMA ICS 7.1 - Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable Speed Drive Systems; National Electrical Manufacturers Association; 1995.

B. NEMA ICS 7 - Industrial Control and Systems: Adjustable Speed Drives; National Electrical Manufacturers Association; 1993.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 1997.

D. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 1999.

E. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.

C. Shop Drawings: Indicate front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; and nameplate legends.

D. Test Reports: Indicate field test and inspection procedures and test results.

E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Manufacturer's Field Reports: Indicate start-up inspection findings.

G. Operation Data: NEMA ICS 7.1. Include instructions for starting and operating controllers, and describe operating limits that may result in hazardous or unsafe conditions.

H. Maintenance Data: NEMA ICS 7.1. Include routine preventive maintenance schedule.

I. Operation and Maintenance Manuals: Include in manuals the information listed below. For information on how to prepare and submit manuals see section 1780 (Closeout Submittals).
   1. Local representative
   2. Emergency instructions

3. Recommended spare parts
4. Spare parts lists
5. Operating instructions
6. Maintenance instructions, including preventative and corrective maintenance.
7. Copies of warranties
8. Wiring diagrams
9. Shop drawings and product data

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.

C. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to components, enclosure, and finish.

1.07 MAINTENANCE SERVICE

A. Provide service and maintenance of controller for one year from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB: www.abb.com

B. Eaton: www.eaton.com

C. Substitutions: See Section 01600 - Product Requirements.

2.02 DESCRIPTION

A. Variable Frequency Controllers: Enclosed controllers suitable for operating the indicated loads, in conformance with requirements of NEMA ICS 7. Select unspecified features and options in accordance with NEMA ICS 3.1.
   1. Employ microprocessor-based inverter logic isolated from power circuits.
   2. Employ pulse-width-modulated inverter system.
   3. Design for ability to operate controller with motor disconnected from output.
   4. Design to attempt five automatic restarts following fault condition before locking out and requiring manual restart.

B. Enclosures: NEMA 250, Type 1, suitable for equipment application in places regularly open to the public.

2.03 COMPONENTS

A. Display: Provide integral digital display to indicate output voltage, output frequency, and output current.

B. Status Indicators: Separate indicators for overcurrent, overvoltage, ground fault, overtemperature, and input power ON.

C. Furnish HAND-OFF-AUTOMATIC selector switch and manual speed control.

D. Include undervoltage release.

E. Control Power Source: Integral control transformer.

F. Door Interlocks: Furnish mechanical means to prevent opening of equipment with power connected, or to disconnect power if door is opened; include means for defeating interlock by qualified persons.

G. Safety Interlocks: Furnish terminals for remote contact to inhibit starting under both manual and automatic mode.

H. Control Interlocks: Furnish terminals for remote contact to allow starting in automatic mode.

I. Manual Bypass: Furnish contactor, motor running overload protection, and short circuit protection for full voltage, non-reversing operation of the motor. Include isolation switch to allow maintenance of inverter during bypass operation.

J. Emergency Stop: Use dynamic brakes for emergency stop function.

K. Disconnecting Means: Include integral fused disconnect switch on the line side of each controller.

L. Wiring Terminations: Match conductor materials and sizes indicated.

M. Manual Speed Control Potentiometer to set speed in the manual mode.

N. Minimum and maximum speed adjustment potentiometers.

O. Isolation transformer or live filters to guarantee compliance with FCC Rule 15, subpart J and IEEE STD 519-1981.

P. Speed indicating meter, calibrated in per cent speed, to indicate speed of the converter-powered motor.

Q. Status lights for all normal and alarm functions.

R. Over temperature trip and alarm light.

S. Ammeter - corresponding to motor rating.

T. Short circuit and ground fault protection.

U. Frequency meter - 0-120 Hz scale.

V. Manual - Auto bypass with across the line magnetic motor starter - To operate motor at constant speed.

W. Elapsed time meter to totalize converter running time.

X. Phase imbalance protection

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surface is suitable for controller installation.

B. Do not install controller until building environment can be maintained within the service conditions required by the manufacturer.

C. Verify that field measurements are as indicated on shop drawings.

3.02 INSTALLATION

A. Install in accordance with NEMA ICS 7.1 and manufacturer's instructions.

B. Tighten accessible connections and mechanical fasteners after placing controller.

C. Provide fuses in fusible switches; refer to Section 16491 for product requirements.

D. Select and install overload heater elements in motor controllers to match installed motor characteristics.

E. Provide engraved plastic nameplates; refer to Section 16075 for product requirements and location.

F. Neatly type label inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating. Place in clear plastic holder.

3.03 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01400.

B. Inspect and test in accordance with NETA STD ATS, except Section 4.

C. Perform inspections and tests listed in NETA STD ATS, Section 7.17.

3.04 MANUFACTURER'S FIELD SERVICES

A. Provide the service of the manufacturer's field representative to prepare and start controllers.

3.05 ADJUSTING

A. Make final adjustments to installed controller to assure proper operation of load system. Obtain performance requirements from installer of driven loads.

3.06 DEMONSTRATION

A. Demonstrate operation of controllers in automatic and manual modes.

END OF SECTION

SECTION 15073 - VIBRATION AND SEISMIC CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Equipment support bases.

B. Vibration isolators.

C. Vibration isolators.

D. Seismic restraints.

1.02 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. See Section 15010 - General Mechanical, for additional submittal procedures.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Isolation Technology, Inc: www.isolationtech.com.

B. Kinetics Noise Control, Inc: www.kineticsnoise.com.

C. Mason Industries: www.mason-ind.com.

2.02 VIBRATION ISOLATION AND SEISMIC RESTRAINTS

A. General:
   1. Housekeeping Pads
      a. Housekeeping pad reinforcement and monolithic pad attachment to the structure details and design shall be prepared by the restraint vendor if not already indicated on the drawings.
      b. Housekeeping pads shall be coordinated with restraint vendor and sized to provide a minimum edge distance of ten (10) bolt diameters all around the outermost anchor bolt to allow development of full drill-in wedge anchor ratings. If cast-in anchors are to be used, the housekeeping pads shall be sized to accommodate the ACI requirements for bolt coverage and embedment.
   2. Supplementary Support Steel
      a. Contractor shall supply supplementary support steel for all equipment, piping, ductwork, etc. including roof mounted equipment, as required or specified.
   3. Attachments:
      a. Contractor shall supply restraint attachment plates cast into housekeeping pads, concrete inserts, double sided beam clamps, etc. in accordance with the requirements of the vibration vendor’s calculations.

B. Specification Type “E”
   1. Spring isolators shall be free standing and laterally stable without any housing and complete with a molded neoprene cup or 1/4" (6mm) neoprene acoustical friction pad between the baseplate and the support. All mountings shall have leveling bolts that must be rigidly bolted to the equipment. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum

additional travel to solid equal to 50% of the rated deflection. Submittals shall include spring diameters, deflection, compressed spring height and solid spring height.
2. Mason Industries, Inc. type SLF

C. Specification Type "J"
1. Hangers shall consist of rigid steel frames containing minimum 1 1/4" (32mm) thick neoprene elements at the top and a steel spring with general characteristics as in specification E seated in a steel washer reinforced neoprene cup on the bottom. The neoprene element and the cup shall have neoprene bushings projecting through the steel box. To maintain stability the boxes shall not be articulated as clevis hangers nor the neoprene element stacked on top of the spring. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30 arc from side to side before contacting the rod bushing and short circuiting the spring. Submittals shall include a hanger drawing showing the 30 capability.
2. Mason Industries, Inc. type 30N.

D. Specification Type "JA"
1. Hangers shall be as described in J, but they shall be supplied with a combination rubberand steel rebound washer as the seismic upstop for suspended piping, ductwork, equipment and electrical cabletrays. Rubber thickness shall be a minimum of 1/4" (6mm). Submittals shall include a drawing of the hanger showing the installation of the rebound washer.
2. Mason Industries, Inc. type RW30N.

E. Specification Type "K"
1. Hangers shall be as described in J, but they shall be precompressed and locked at the rated deflection by means of a resilient seismic upstop to keep the piping or equipment at a fixed elevation during installation. The hangers shall be designed with a release mechanism to free the spring after the installation is complete and the hanger is subjected to its full load. Deflection shall be clearly indicated by means of a scale. Submittals shall include a drawing of the hanger showing the 30 capability.
2. Mason Industries, Inc. type PC30N.

F. Specification Type "L"
1. Seismic Cable Restraints shall consist of galvanized steel aircraft cables sized to resist seismic loads with a minimum safety factor of two and arranged to provide all-directional restraint. Cables must be prestretched to achieve a certified minimum modulus of elasticity. Cable end connections shall be steel assemblies that swivel to final installation angle and utilize two clamping bolts to provide proper cable engagement. Cables must not be allowed to bend across sharp edges. Cable assemblies shall have an Anchorage Preapproval "OPA" Number from OSHPD in the State of California verifying the maximum certified load ratings.
2. Mason Industries, Inc. type SCB at the ceiling and at the clevis bolt, SCBH between the hanger rod nut and the clevis or SCBV if clamped to a beam.
3. Specifications L applies to trapeze as well as clevis hanger locations. At trapeze anchor locations piping must be shackled to the trapeze.
4. Specification L applies to hanging equipment as well.

G. Specification Type "M"
1. Seismic solid braces shall consist of steel angles or channels to resist seismic loads

with a minimum safety factor of 2 and arranged to provide all directional restraint. Seismic solid brace end connectors shall be steel assemblies that swivel to the final installation angle and utilize two through bolts to provide proper attachment. Seismic solid brace assembly shall have anchorage preapproval "OPA" number from OSHPD in the state of California verifying the maximum certified load ratings.

2. Mason Industries, Inc. type SSB, SSBS or SSRF.
3. Specifications M applies to trapeze as well as clevis hanger locations. At trapeze anchor locations piping must be shackled to the trapeze.
4. Specification M applies to hanging equipment as well.

H. Specification Type "N"
   1. Steel angles, sized to prevent buckling, shall be clamped to pipe or equipment rods utilizing a minimum of three ductile iron clamps at each restraint location when required. Welding of support rods is not acceptable. Rod clamp assemblies shall have an Anchorage Preapproval "OPA" Number from OSHPD in the State of California.
   2. Mason Industries, Inc. type SRC or UC.
   3. Specifications N applies to trapeze as well as clevis hanger locations. At trapeze anchor locations piping must be shackled to the trapeze.
   4. Specification N applies to hanging equipment as well.

I. Specification Type "O"
   1. Pipe clevis cross bolt braces are required in all restraint locations. They shall be special purpose preformed channels deep enough to be held in place by bolts passing over the cross bolt. Clevis cross braces shall have an Anchorage Preapproval "OPA" Number from OSHPD in the State of California.
   2. Mason Industries, Inc. type CCB.

J. Specification Type "W"
   1. Flexible spherical expansion joints shall employ peroxide cured EPDM in the covers, liners and Kevlar® tire cord frictioning. Any substitutions must have equal or superior physical and chemical characteristics. Solid steel rings shall be used within the raised face rubber flanged ends to prevent pullout. Flexible cable bead wire is not acceptable. Sizes 2" (50mm) and larger shall have two spheres reinforced with a ductile iron external ring between spheres. Flanges shall be split ductile iron or steel with hooked or similar interlocks. Sizes 16"(400mm) to 24" (600mm) may be single sphere. Sizes ¾" (19mm) to 1½" (38mm) may have threaded two piece bolted flange assemblies, one sphere and cable retention. Connectors shall be rated at 250 psi (1.72MPa) up to 170F (77C) with a uniform drop in allowable pressure to 215 psi (1.48MPa) at 250F (121C) in sizes through 14" (350mm). 16" (400mm) through 24" (600mm) single sphere minimum ratings are 180 psi (1.24MPa) at 170F (77C) and 150 psi (1.03MPa) at 250F (121C). Higher rated connectors may be used to accommodate service conditions. All expansion joints must be factory tested to 150% of rated pressure for 12 minutes before shipment. Safety factors to burst and flange pullout shall be a minimum of 3/1. Concentric reducers to the above ratings may be substituted for equal ended expansion joints.
      a. Expansion joints shall be installed in piping gaps equal to the length of the expansion joints under pressure. Control rods need only be used in unanchored piping locations where the manufacturer determines the installation exceeds the pressure requirement without control rods. If control rods are used, they must have

½" (12mm) thick Neoprene washer bushings large enough in diameter to take the thrust at 1000 psi (.7 kg/mm2) maximum on the washer area.

b. Submittals shall include two test reports by independent consultants showing minimum reductions of 20 DB in vibration accelerations and 10 DB in sound pressure levels at typical blade passage frequencies on this or a similar product by the same manufacturer. All expansion joints shall be installed on the equipment side of the shut off valves.

2. Mason Industries, Inc. type SAFEFLEX SFDEJ, SFEJ, SFDCR or SFU and Control Rods CR.

K. Specification Type "X"

1. Flexible stainless steel hose shall have stainless steel braid and carbon steel fittings. Sizes 3" (75mm) and larger shall be flanged. Smaller sizes shall have male nipples. Minimum lengths shall be as tabulated:
   a. Flanged
      1) 3" x 14" (75 x 350mm)
      2) 6" x 20" (150 x 500mm)
      3) 12" x 28" (300 x 700mm)
      4) 4" x 15" (100 x 375mm)
      5) 8" x 22" (200 x 550mm)
      6) 14" x 30" (350 x 750mm)
      7) 5" x 19" (125 x 475mm)
      8) 10" x 26" (250 x 650mm)
      9) 16" x 32" (400 x 800mm)
   b. Male Nipples
      1) 1/2" x 9" (12 x 225mm)
      2) 1 1/4" x 12" (32 x 300mm)
      3) 2" x 14" (50 x 350mm)
      4) 3/4" x 10" (19 x 250mm)
      5) 1 1/2" x 13" (38 x 325mm)
      6) 2 1/2" x 18" (64 x 450mm)
      7) 1" x 11" (25 x 275mm)
   c. Hoses shall be installed on the equipment side of the shut-off valves horizontally and parallel to the equipment shafts wherever possible.
2. Mason Industries, Inc. type BSS.

L. Specification Type "Y"

1. All-directional acoustical pipe anchor, consisting of two sizes of steel tubing separated by a minimum 1/2" (12mm) thick 60 durometer neoprene. Vertical restraint shall be provided by similar material arranged to prevent vertical travel in either direction. Allowable loads on the isolation material should not exceed 500 psi (.35 kg/mm2) and the design shall be balanced for equal resistance in any direction.
2. Mason Industries, Inc. type ADA.

M. Specification Type "Z"

1. Pipe guides shall consist of a telescopic arrangement of two sizes of steel tubing separated by a minimum 1/2" (12mm) thickness of 60 durometer neoprene. The height of the guides shall be preset with a shear pin to allow vertical motion due to pipe expansion or contraction. Shear pin shall be removable and reinsertable to allow for

selection of pipe movement. Guides shall be capable of ±1 5/8" (41mm) motion, or to meet location requirements.

2. Mason Industries, Inc. type VSG.

N. Specification Type "AA"

1. Split Wall Seals consist of two bolted pipe halves with minimum 3/4" (19mm) thick neoprene sponge bonded to the inner faces. The seal shall be tightened around the pipe to eliminate clearance between the inner sponge face and the piping. Concrete may be packed around the seal to make it integral with the floor, wall or ceiling if the seal is not already in place around the pipe prior to the construction of the building member. Seals shall project a minimum of 1" (25mm) past either face of the wall. Where temperatures exceed 240F(115C), 10# (4.5kg) density fiberglass may be used in lieu of the sponge.
2. Mason Industries, Inc. type SWS.

2.03 VIBRATION ISOLATION OF PIPING

A. Horizontal pipe isolation:

1. The first four pipe hangers in the main lines near the mechanical equipment shall be as described in specification K. Brace hanger rods with SRC clamps specification N.
2. Horizontal runs in all other locations throughout the building shall be isolated by hangers as described in specification J & JA.
3. Floor supported piping shall rest on isolators as described in specification F.
4. Heat exchangers and expansion tanks are considered part of the piping run. The first three isolators from the isolated equipment will have the same static deflection as specified for the mountings under the connected equipment.
5. Piping connected to equipment located in basements and hangs from ceilings under occupied spaces the first three hangers shall have:
   a. 0.75" (19mm) deflection for pipe sizes up to and including 3" (75mm).
   b. 1 1/2" (38mm) deflection for pipe sizes up to and including 6" (150mm).
   c. 2 1/2" (64mm) deflection thereafter.
   d. Hangers shall be located as close to the overhead structure as practical. Hanger locations that also have seismic restraints attached must have type RW Rebound Washers to limit uplift.
6. Where piping connects to mechanical equipment install specification W expansion joints or specification X stainless hoses if W is not suitable for the service.

B. Riser isolation:

1. Risers shall be suspended from specification JA hangers or supported by specification E mountings, anchored with specification Y anchors, and guided with specification Z sliding guides.
2. Steel springs shall be a minimum of 0.75" (19mm) except in those expansion locations where additional deflection is required to limit load changes to ± 25% of the initial load.
3. Submittals must include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on the building structure, spring deflection changes and seismic loads. Submittal data shall include certification that the riser system has been examined for excessive stresses and that none will exist in the proposed design.

2.04 VIBRATION ISOLATION DUCTWORK

A. All discharge runs for a distance of 50' (15m) from the connected equipment shall be isolated from the building structure by means of specification J hangers. Spring deflection shall be a minimum of 0.75" (19mm).

B. All duct runs having air velocity of 1000 fpm (5 m/s)or more shall be isolated from the building structure by specification K hangers. Spring deflection shall be a minimum of 0.75" (19mm).

2.05 SEISMIC DESIGN

A. General
   1. Specifications and plans shall indicate minimum requirements and general intent. The actual requirements shall be determined by the seismic system designer but those requirements shall not be less than indicated on the plans and in these specifications.
   2. Calculations shall be submitted and signed by a licensed professional engineer in the state where the project is located.
   3. This project is subject to the seismic bracing requirements of the International Building Code, 2009 edition. The following criteria are applicable to this project.
      a. Occupancy Category (Table 1604.5): II
      b. Site Class Category (Table 1613.5.2): D
      c. Seismic Design Category: C
      d. Forces shall be calculated for the above requirements and the requirements of the International Building Code.

B. Seismic restraint of piping:
   1. Seismically restrain all piping listed as a or b below. Use specification M cables if isolated. Specification M or N restraints may be used on unisolated piping.
      a. Piping located in mechanical equipment rooms that is 1 1/4" (32mm) I.D. and larger.
      b. All other piping 2 1/2" (64mm) diameter and larger.
   2. Transverse piping restraints shall be at 40' (12m) maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.
   3. Longitudinal restraints shall be at 80' (24m) maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.
   4. Where thermal expansion is a consideration, guides and anchors may be used as transverse and longitudinal restraints provided they have a capacity equal to or greater than the restraint loads in addition to the loads induced by expansion or contraction.
   5. For fuel oil and all gas piping transverse restraints must be at 20' (6m) maximum and longitudinal restraints at 40' (12m) maximum spacing.
   6. Transverse restraint for one pipe section may also act as a longitudinal restraint for a pipe section of the same size connected perpendicular to it if the restraint is installed within 24" (600m) of the elbow or TEE or combined stresses are within allowable limits at longer distances.
   7. Hold down clamps must be used to attach pipe to all trapeze members before applying restraints in a manner similar to clevis supports.
   8. Branch lines may not be used to restrain main lines.
   9. Connection to the structure must be made with a non-friction connection (i.e. no “C” clamps)

10. Hanger locations that also have seismic restraints attached must have Specification JA.
11. Pipe Exclusions
    a. Piping in boiler and mechanical rooms less than 1 1/4" (32mm) inside diameter.
    b. All other piping less than 2 1/2" (64mm) inside diameter.
    c. All piping suspended by clevis hangers where the distance from the top of the pipe to the suspension point is 12" or less.
    d. All trapezed piping where the distance from the suspension point to the trapeze member is 12" or less.
    e. If any suspension location in the run exceeds the above, the entire run must be braced.

C. Seismic restraint of ductwork:
1. Seismic restraint of ductwork
    a. Seismically restrain all ductwork with specification L or M restraints as listed below:
        1) Restrain rectangular ducts with cross sectional area of 6 sq.ft. (.5 m2) or larger.
        2) Restrain round ducts with diameters of 28" (700mm) or larger.
        3) Restrain flat oval ducts the same as rectangular ducts of the same nominal size.
    b. Transverse restraints shall occur at 30' (9mm) intervals or at both ends of the duct run if less than the specified interval. Transverse restraints shall be installed at each duct turn and at each end of a duct run.
    c. Longitudinal restraints shall occur at 60' (18m) intervals with at least one restraint per duct run. Transverse restraints for one duct section may also act as a longitudinal restraint for a duct section connected perpendicular to it if the restraints are installed within 4' (1.2m) of the intersection of the ducts and if the restraints are sized for the larger duct. Duct joints shall conform to SMACNA duct construction standards.
    d. The ductwork must be reinforced at the restraint locations. Reinforcement shall consist of an additional angle on top of the ductwork that is attached to the support hanger rods. Ductwork is to be attached to both upper angle and lower trapeze.
    e. A group of ducts may be combined in a larger frame so that the combined weights and dimensions of the ducts are less than or equal to the maximum weight and dimensions of the duct for which bracing details are selected.
    f. Walls, including gypsum board non bearing partitions, which have ducts running through them may replace a typical transverse brace. Provide channel framing around ducts and solid blocking between the duct and frame.
    g. Connection to the structure must be made with a non-friction connection (i.e. no “C” clamps)
    h. Hanger locations that also have seismic restraints attached must have Specification JA.
    i. Ductwork Exclusions:
        1) Rectangular and square and ducts that are less than 6 square feet in cross sectional area.
        2) Oval ducts that are less than 6 square feet (.5m2) in cross sectional area based on nominal size.
        3) Round duct less than 28" (.5m2) in diameter.

4) All trapezed ductwork where the distance from the suspension point to the trapeze member is 12" or less.
5) Ductwork hung with straps where the top of the duct is 12" or less from the suspension point and the strap has 2 #10 sheet metal screws within 2" of the top of the duct.
6) If any suspension location in the run exceeds the above, the entire run must be braced.

PART 3 EXECUTION

3.01 GENERAL

A. All vibration isolators and seismic restraint systems must be installed in strict accordance with the manufacturers written instructions and all certified submittal data.

B. Installation of vibration isolators and seismic restraints must not cause any change of position of equipment, piping or ductwork resulting in stresses or misalignment.

C. No rigid connections between equipment and the building structure shall be made that degrades the noise and vibration control system herein specified.

D. The contractor shall not install any equipment, piping, duct or conduit which makes rigid connections with the building unless isolation is not specified. “Building” includes, but is not limited to, slabs, beams, columns, studs and walls.

E. Coordinate work with other trades to avoid rigid contact with the building.

F. Any conflicts with other trades which will result in rigid contact with equipment or piping due to inadequate space or other unforeseen conditions should be brought to the architects/engineers attention prior to installation. Corrective work necessitated by conflicts after installation shall be at the responsible contractors expense.

G. Bring to the architects/engineers attention any discrepancies between the specifications and the field conditions or changes required due to specific equipment selection, prior to installation. Corrective work necessitated by discrepancies after installation shall be at the responsible contractors expense.

H. Correct, at no additional cost, all installations which are deemed defective in workmanship and materials at the contractors expense.

I. Overstressing of the building structure must not occur because of overhead support of equipment. Contractor must submit loads to the structural engineer of record for approval. Generally bracing may occur from:
   1. Flanges of structural beams.
   2. Upper truss cords in bar joist construction.
   3. Cast in place inserts or wedge type drill-in concrete anchors.

J. Specification L cable restraints shall be installed slightly slack to avoid short circuiting the isolated suspended equipment, piping or conduit.

K. Specification L cable assemblies are installed taut on non-isolated systems. Specification M seismic solid braces may be used in place of cables on rigidly attached systems only.

L. At locations where specification L or M restraints are located, the support rods must be

braced when necessary to accept compressive loads with specification N braces.

M. At locations where specification L cable restraints are installed on support rods with spring isolators, the spring isolation hangers must be specification type JA.

N. At all locations where specification L or M restraints are attached to pipe clevis, the clevis cross bolt must be reinforced with specification type O braces.

O. Drill-in concrete anchors for ceiling and wall installation shall be specification type R, and specification type S female wedge type for floor mounted equipment.

P. Vibration isolation manufacturer shall furnish integral structural steel bases as required. Independent steel rails are not permitted on this project.

Q. Hand built elastomeric expansion joints may be used when pipe sizes exceed 24" or specified movements exceed specification W capabilities.

R. Where piping passes through walls, floors or ceilings the vibration isolation manufacturer shall provide specification AA wall seals.

S. Air handling equipment and centrifugal fans shall be protected against excessive displacement which results from high air thrust in relation to the equipment weight. Horizontal thrust restraint shall be specification type BB.

T. Locate isolation hangers as near to the overhead support structure as possible.

U. All mechanical equipment shall be vibration isolated and seismically restrained as per the schedules in the drawings.

V. VAV boxes and fan powered equipment weighing less than 50 lbs. (23kg) and rigidly connected to the supply side of the duct system and supported with a minimum of 4 hanger rods.

3.02 Equipment Isolation Schedule.

A. Suspended Fans
   1. Isolator Specification Type: JA, L
   2. Isolator Deflection: 2.5"

END OF SECTION

SECTION 15075 - MECHANICAL IDENTIFICATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Stencils.

D. Pipe Markers.

1.02 RELATED REQUIREMENTS

A. Section 09900 - Paints and Coatings: Identification painting.

1.03 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2007.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Product Data: Provide manufacturers catalog literature for each product required.

E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

F. Project Record Documents: Record actual locations of tagged valves.

G. Operation and Maintenance Manuals: Include in manuals the information listed below. For information on how to prepare and submit manuals see section 1780 (Closeout Submittals).
   1. Spare parts lists
   2. Shop drawings and product data

PART 2 PRODUCTS

2.01 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: White.
   2. Letter Height: 1/4 inch.
   3. Background Color: Black.

2.02 TAGS

A. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

B. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

C. Chart: Typewritten letter size list in anodized aluminum frame.

2.03 STENCILS

A. Stencils: With clean cut symbols and letters of following size:
   1. 3/4 to 1-1/4 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 1/2 inch high letters.

B. Stencil Paint: As specified in Section 09900, semi-gloss enamel, colors conforming to ASME A13.1.

2.04 PIPE MARKERS

A. Comply with ASME A13.1.

B. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

2.05 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color coded head.

B. Color code as follows:
   1. HVAC Equipment: Yellow.
   2. Plumbing Valves: Green.
   3. Heating/Cooling Valves: Blue.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Apply stencil painting in accordance with Section 09900.

D. Install plastic pipe markers in accordance with manufacturer's instructions.

E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

F. Use tags on piping 3/4 inch diameter and smaller.
   1. Identify service, flow direction, and pressure.
   2. Install in clear view and align with axis of piping.
   3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

G. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.

H. Identify control panels and major control components outside panels with plastic nameplates.

I. Identify thermostats relating to terminal boxes or valves with nameplates.

J. Identify valves in main and branch piping with tags.

K. Identify air terminal units with numbered tags.

L. Tag automatic controls, instruments, and relays. Key to control schematic.

M. Identify piping, concealed or exposed, with plastic pipe markers. Use tags on piping 3/4 inch diameter and smaller. 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 Tee, at each side of penetration of structure or enclosure, and at each obstruction.

N. Install ductwork with stencilled painting. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

O. Provide ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

3.03 SCHEDULES

A. Piping
   1. All pipe identification shall be color coded in accordance with the following:
      a. Chilled water supply and return - Blue
      b. Domestic cold water - Green
      c. Domestic hot water - Yellow
      d. Hot water supply and return - Yellow

END OF SECTION

SECTION 15080 - MECHANICAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

B. Duct Liner.

C. Piping insulation.

D. Equipment insulation.

E. Insulation jackets.

F. Jackets and accessories.

G. Covering.

1.02 SCOPE OF WORK:

A. Provide insulation as specified for heating water, domestic hot and cold water, roof drain leaders, make-up water, chilled water, steam, and condensate return piping systems, including valves, fittings, flanges, strainers, and mechanical couplings.

1.03 RELATED SECTIONS

A. Section 15075 - Mechanical Identification.

B. Section 15145 - Plumbing Piping: Placement of hangers and hanger inserts.

C. Section 15182 - Hydronic Piping: Placement of hangers and hanger inserts.

D. Section 15183 - Hydronic Specialties.

E. Section 15810 - Ducts.

1.04 REFERENCES

A. ASTM C 518 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 1991.

B. ASTM C 533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 1995.

C. ASTM C 553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 1992.

D. ASTM C 612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 1993.

E. ASTM C 1071 - Standard Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material); 1991.

F. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials; 1995.

G. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; 1996.

H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; 1993.

I. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; 1995.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Operation and Maintenance Manuals: Include in manuals the information listed below. For information on how to prepare and submit manuals see section 1780 (Closeout Submittals).

C. Shop drawings and product data

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.

1.07 REGULATORY REQUIREMENTS

A. Materials: Conform to maximum flame spread/smoke developed rating of 25/50 in accordance with ASTM E 84.

1.08 DELIVERY, STORAGE, AND PROTECTION

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.09 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 DUCT INSULATION

A. GLASS FIBER, FLEXIBLE
   1. Manufacturers.
      a. Provide products complying with the specifications by one of the following manufactures.
         1) Certain Teed Corporation.
         2) Johns Manville
         3) Knauf Fiberglass GmbH.
         4) Owens-Corning Fiberglass Corporation.
   2. Insulation: ASTM C 553; flexible, noncombustible blanket.
      a. 'K' value : ASTM C 518, 0.27 at 75 degrees F.
      b. Maximum service temperature: 250 degrees F.
      c. Maximum moisture absorption: 0.20 percent by volume.
   3. Vapor Barrier Jacket:
      a. Kraft paper with glass fiber yarn and bonded to aluminized film.

b. Moisture vapor transmission: ASTM E 96; 0.02 perm.
c. Secure with pressure sensitive tape.

4. Vapor Barrier Tape:
   a. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
5. Tie Wire: Annealed steel, 16 gage.

B. JACKETS
1. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire retardant lagging adhesive.

C. GLASS FIBER DUCT LINER, FLEXIBLE
1. Manufacturers.
   a. Provide products complying with the specifications by one of the following manufactures.
      1) Certain Teed Corporation.
      2) Johns Manville
      3) Knauf Fiberglass GmbH.
      4) Owens-Corning Fiberglass Corporation.
2. Insulation: ASTM C 1071; flexible, noncombustible blanket with acrylic polymer meeting ASTM G 21 impregnated surface and edge coat.
   a. 'K' Value: ASTM C 1071, maximum 0.25 at 75 degrees F.
   b. Maximum Service Temperature: 250 degrees F.
   c. Maximum Velocity on Coated Air Side: 5,000 fpm.
   d. Minimum Noise Reduction Criteria: ASTM C 1071 0.45 for 1 inch thickness.
3. Adhesive:
   a. Manufacture approved adhesive that conforms to ASTM C 916, and all exposed leading edges and transverse joints shall be coated with factory-applied or field-applied edge coating and shall be neatly butted without gaps.
4. Liner Fasteners: Galvanized steel, self-adhesive pad, impact applied, or welded with integral head.
5. The liner shall meet the Life Safety Standards as established by NFPA 90A and 90B, FHC 25/50 and Limited Combustibility and the airstream surface coating should contain an immobilized, EPA-registered, antimicrobial agent so it will not support microbial growth as tested in accordance with ASTM G 21 and G 22.
6. The liner shall be kept clean and dry during transportation, storage and installation. Care should be taken to protect the liner from exposure to the elements or damage from mechanical abuse.

2.02 PIPE INSULATION

A. Insulation shall have composite (insulation jacket or facing, and adhesive used to adhere the facing or jacket to the insulation) fire and smoke hazard ratings as tested by procedure ASTM E84, NFPA 255 or UL 723 not exceeding:
1. Flame Spread: 25.
2. Smoke Developed: 50.

B. Insulation shall be glass fiber with a maximum K factor of .24 at 75 degrees F mean temperature with factory applied fire resistant vapor barrier jacket, for cold piping and fire retardant jacket for hot water. Insulation for outdoor piping shall be rigid foam urethane,

Armalok II or equal.

1. For fittings and valve bodies 3" and smaller, insulation shall be one-pound density glass fiber blanket wrapped firmly under compression with No. 20 gauge galvanized annealed steel wire and given a smoothing coat of finishing cement.

C. Accessories such as adhesives, mastics, cements, tapes and cloth for fittings shall have the same component rating as listed above. All products or their shipping cartons shall bear a label indicating that flame and smoke ratings do not exceed requirements. Treatment of jackets or facings to impart flame and smoke-safety shall be permanent. The use of water-soluble treatments are prohibited.

1. Where Benjamin-Foster adhesives are specified equal products manufactured by 3M Company, or the manufacturer of the insulation are acceptable upon approval by the Engineer. Armstrong 520 adhesive shall be used for Armstrong insulation.
2. In lieu of longitudinal lap seam specified, self-sealing lapped jacket shall be acceptable with requirement for aluminum bands on concealed piping.

D. GLASS FIBER

1. Manufacturers.
   a. Provide products complying with the specifications by one of the following manufactures.
      1) Certain Teed Corporation.
      2) Johns Manville
      3) Knauf Fiberglass GmbH.
      4) Owens-Corning Fiberglass Corporation.
2. Insulation: ASTM C 547 and ASTM C 795; rigid molded, noncombustible.
   a. 'K' value: ASTM C 177, 0.24 at 75 degrees F.
   b. Maximum service temperature: 850 degrees F.
   c. Maximum moisture absorption: 0.2 percent by volume.
3. Insulation: ASTM C 795; semi-rigid, noncombustible, end grain adhered to jacket.
   a. 'K' value: ASTM C 177, 0.24 at 75 degrees F.
   b. Maximum service temperature: 650 degrees F.
   c. Maximum moisture absorption: 0.2 percent by volume.
4. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E 96 of 0.02 perm-inches.
5. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
6. Vapor Barrier Lap Adhesive:
   a. Compatible with insulation.

E. JACKETS

1. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire retardant lagging adhesive.
   a. Lagging Adhesive:
      1) Compatible with insulation.

2.03 EQUIPMENT INSULATION

A. Insulation for chilled water pumps shall be 6# per cubic foot density glass fiber with fire retardant vapor barrier facing and having a maximum K factor of 0.24 at 75 degrees F mean temperature.

B. Sections of equipment requiring periodic servicing shall be insulated with removable ArmourCote covers as manufactured by Insulcoustic Corporation or by Sheet Metal Casings with insulation applied to be interior surface of the casing.

C. Air elimination devices for chilled systems shall be insulated with foamed plastic sheet insulation, 1/2" thickness, applied with approved adhesives in strict accordance with manufacturer's recommendations, and finished with two (2) coats of Armstrong Insulcolor paint, color as directed.

D. GLASS FIBER, FLEXIBLE
   1. Manufacturers.
      a. Provide products complying with the specifications by one of the following manufactures.
         1) Certain Teed Corporation.
         2) Johns Manville
         3) Knauf Fiberglass GmbH.
         4) Owens-Corning Fiberglass Corporation.
   2. Insulation: ASTM C 553; flexible, noncombustible.
      a. 'K' Value: ASTM C 177 or ASTM C 518, 0.24 at 75 degrees F.
      b. Maximum Service Temperature: 250 degrees F.
      c. Maximum Moisture Absorption: 0.2 percent by volume.
      d. Density: 1.0 lb/cu ft.
   3. Vapor Barrier Jacket: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
      a. Moisture vapor transmission: ASTM E 96; 0.02 perm.
      b. Secure with self-sealing longitudinal laps and butt strips.
   4. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
   5. Vapor Barrier Lap Adhesive:
      a. Compatible with insulation.

E. GLASS FIBER, RIGID
   1. Manufacturers.
      a. Provide products complying with the specifications by one of the following manufactures.
         1) Certain Teed Corporation.
         2) Johns Manville
         3) Knauf Fiberglass GmbH.
         4) Owens-Corning Fiberglass Corporation.
   2. Insulation: ASTM C 612 or ASTM C 592; rigid, noncombustible.
      a. 'K' Value: ASTM C 177 or ASTM C 518, 0.24 at 75 degrees F.
      b. Maximum Service Temperature: 450 degrees F.
      c. Maximum Moisture Absorption: 0.1 percent by volume.
      d. Density: 1.0 lb/cu ft.
   3. Vapor Barrier Jacket:
      a. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
      b. Moisture vapor transmission: ASTM E 96; 0.02 perm.
      c. Secure with self-sealing longitudinal laps and butt strips.
      d. Secure with outward clinch expanding staples and vapor barrier mastic.
   4. Facing: 1 inch galvanized steel hexagonal wire mesh stitched on one face of insulation.

5. Vapor Barrier Lap Adhesive:
   a. Compatible with insulation.

F. CELLULAR FOAM
1. Insulation: ASTM C 534; flexible, cellular elastomeric, molded or sheet.
   a. 'K' Value: ASTM C 177; 0.25 at 75 degrees F.
   b. Minimum Service Temperature: -40 degrees F.
   c. Maximum Service Temperature: 220 degrees F.
   d. Maximum Moisture Absorption: ASTM D 1056; 1.0 percent by volume.
   e. Moisture Vapor Transmission: ASTM E 96; 0.05 perm-inches.
   f. Connection: Waterproof vapor barrier adhesive.
2. Elastomeric Foam Adhesive:
   a. Air dried, contact adhesive, compatible with insulation.

G. JACKETS
1. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire retardant lagging adhesive.
   a. Lagging Adhesive:
      1) Compatible with insulation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that ducts have been tested before applying insulation materials.

B. Verify that piping has been tested before applying insulation materials.

C. Verify that equipment has been tested before applying insulation materials.

D. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. DUCT INSULATION
1. Insulated ducts conveying air below ambient temperature:
   a. Provide insulation with vapor barrier jackets.
   b. Finish with tape and vapor barrier jacket.
   c. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
   d. Insulate entire system including fittings, joints, flanges, flexible connections, and expansion joints.
2. Ducts Exposed in Mechanical Equipment Rooms or Attic: Finish with canvas jacket sized for finish painting.
3. Duct and Plenum Liner Application:
   a. Adhere insulation with adhesive for 90 percent coverage.
   b. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) Standards for spacing.
   c. Seal and smooth joints. Seal and coat transverse joints.
   d. Seal liner surface penetrations with adhesive.
   e. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.

C. PIPE INSULATION
1. Longitudinal lap and 4" wide vapor barrier joint seal strips shall be adhered neatly in place with BF 85-20 adhesive or approved equal and banded.
2. The ends of pipe insulation shall be sealed off with BF 30-35 coatings at all flanges, valves and fittings and at intervals of not more than 21 feet on continuous runs or pipes.
3. Fittings shall be vapor sealed by applying a layer of white open weave glass fabric (20 x 20 between two 1/16" thick coats of BF 30-35.
4. Insulation shall be fastened in place with 16 gauge annealed wire on 18" centers maximum for piping runs and as required for a secure installation at fittings, valves, and appurtenances. Provide 8 ounce canvas jacket pasted in place and sized for all exposed piping.
5. Exposed Piping: Locate insulation and cover seams in least visible locations.
6. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
7. Glass fiber insulated pipes conveying fluids below ambient temperature:
   a. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   b. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.
8. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
9. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.
10. Glass fiber insulated pipes conveying fluids above ambient temperature:
    a. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
    b. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
11. Inserts and Shields:
    a. Application: Piping 1-1/2 inches diameter or larger.
    b. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
    c. Insert location: Between support shield and piping and under the finish jacket.
    d. Insert configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
    e. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
12. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07840.
13. Pipe Exposed in Mechanical Equipment Rooms, Mechanical Platforms, or crossing attic walkways: Finish with canvas jacket sized for finish painting.

D. EQUIPMENT INSULATION
1. Insulation shall be firmly held in place with galvanized steel wire or galvanized steel

bands on 12" centers.

2. All joints and voids in the insulation shall be filled with insulating and finishing cement. All joints and breaks in the vapor barrier shall be sealed strips of the vapor barrier facing adhered with Benjamin-Foster 85-20 adhesive.
3. Finish shall consist of imbedding an open weave glass fabric (20 x 20) into wet coating of Benjamin-Foster's 30-36 overlapping the seams at least two inches. A finished coat of BF 20-26 shall then be applied.
4. Factory Insulated Equipment: Do not insulate.
5. Exposed Equipment: Locate insulation and cover seams in least visible locations.
6. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
7. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.
8. Insulated equipment containing fluids below ambient temperature: Insulate entire system.
9. Fiber glass insulated equipment containing fluids below ambient temperature: Provide vapor barrier jackets, factory-applied or field-applied. Finish with glass cloth and vapor barrier adhesive.
10. For hot equipment containing fluids 140 degrees F or less, do not insulate flanges and unions, but bevel and seal ends of insulation.
11. For hot equipment containing fluids over 140 degrees F, insulate flanges and unions with removable sections and jackets.
12. Fiber glass insulated equipment containing fluids above ambient temperature: Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Finish with glass cloth and adhesive.
13. Inserts and Shields:
    a. Application: Equipment 1-1/2 inches diameter or larger.
    b. Shields: Galvanized steel between hangers and inserts.
    c. Insert location: Between support shield and equipment and under the finish jacket.
    d. Insert configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
    e. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
14. Finish insulation at supports, protrusions, and interruptions.
15. Equipment in Mechanical Equipment Rooms or Finished Spaces: Finish with canvas jacket sized for finish painting.
16. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.
17. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.

3.03 SCHEDULES

A. DUCTWORK INSULATION
   1. Exhaust Ducts Within 10 ft of Exterior Openings:
      a. Flexible Glass Fiber Duct Insulation: 1-1/2 inch thick.
   2. Outside Air Intake Ducts:
      a. Flexible Glass Fiber Duct Insulation: 1-1/2 inch thick.
   3. Transfer Ducts:

a. Flexible Glass Fiber Duct Liner Insulation: 1 inch thick.

4. Supply Ducts.
   a. Flexible Glass Fiber Duct Insulation: 2 inch thick.
5. Return and Relief Ducts conceled.
   a. Flexible Glass Fiber Duct Insulation: 1-1/2 inch thick.

B. PIPING INSULATION
1. Domestic hot, hot water recirculation and cold water piping (above ground):
   a. Pipe sizes 1/2 - 3 inches: 1-inch Glass fiber insulation.
2. Make-up water piping:
   a. All pipe sizes: 1-inch Glass fiber insulation.
3. Chilled water supply and return piping (aboveground):
   a. All pipe sizes: 1-1/2 inch Glass fiber insulation.
4. Heating water supply and return piping:
   a. All pipe sizes: 1-1/2 inch Glass fiber insulation.

C. EQUIPMENT INSULATION
1. Heating Systems:
   a. Pump Bodies:
      1) Glass Fiber, Flexible Insulation: 1-1/2 inches thick.
   b. Air Separators:
      1) Glass Fiber, Flexible Insulation: 1-1/2 inches thick.
2. Cooling Systems:
   a. Pump Bodies:
      1) Glass Fiber, Flexible Insulation: 1-1/2 inches thick.

END OF SECTION

SECTION 15122 - PIPING EXPANSION COMPENSATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flexible pipe connectors.

B. Expansion joints and compensators.

C. Pipe loops, offsets, and swing joints.

1.02 RELATED REQUIREMENTS

A. Section 15073 - Vibration and Seismic Controls

B. Section 15145 - Plumbing Piping.

C. Section 15182 - Hydronic Piping.

D. Section 15186 - Refrigerant Piping and Specialties.

1.03 REFERENCE STANDARDS

A. ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2010.

B. EJMA (STDS) - EJMA Standards; Expansion Joint Manufacturers Association; Ninth Edition.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data:
   1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
   2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

C. Design Data: Indicate selection calculations.

D. Manufacturer's Instructions: Indicate manufacturer's installation instructions, special procedures, and external controls.

E. Project Record Documents: Record installed locations of flexible pipe connectors, expansion joints, anchors, and guides.

F. Maintenance Data: Include adjustment instructions.

G. Operation and Maintenance Manuals: Include in manuals the information listed below. For information on how to prepare and submit manuals see section 1780 (Closeout Submittals).
   1. Safety instructions
   2. Recommended spare parts
   3. Spare parts lists

4. Operating instructions
5. Maintenance instructions, including preventative and corrective maintenance.
6. Inspection procedures
7. Shop drawings and product data

1.05 REGULATORY REQUIREMENTS

A. Conform to UL requirements.

PART 2 PRODUCTS

2.01 FLEXIBLE PIPE CONNECTORS - STEEL PIPING

A. Manufacturers:
   1. Mercer Rubber Company: www.mercer-rubber.com.
   2. Metraflex Company: www.metraflex.com.
   3. Flex-Hose Co., Inc.: www.flexhose.com
   4. Substitutions: See Section 01600 - Product Requirements.

B. Inner Hose: Stainless Steel.

C. Exterior Sleeve: Single braided, stainless steel.

D. Joint: Flanged.

E. Size: Use pipe sized units.

2.02 Construction to be 3 equal length sections of annular corrugated stainless steel close-pitch hose (made in USA) with stainless steel overbraid (made in USA) that will absorb or compensate for pipe movements in all 6 degrees of freedom (3 coordinate axes, plus rotation about those axes) simultaneously.

A. The corrugated metal hose, braid(s), and a stainless steel ring-ferrule/band (material gauge not less than .048") must be integrally seal-welded using a 100% circumferential, full penetration TIG welds. End fittings shall be selected per application. Fittings must be attached using a 100% circumferential TIG weld

B. Braided stainless steel Tri-Flex Loops must be suitable for operating temperatures up to 850 degrees F (455 degrees C).

C. Loop must be designed for pressure testing to 1.5 times their maximum rated working pressure and a minimum 4:1 (burst to working) safety factor.

D. Each braided Loop shall be individually leak tested by the manufacturer using air-under-water or hydrostatic pressure.

E. Loops shall be prepared for shipment using a cut-to-length metal shipping bar, tacked securely between the elbows of the two parallel legs, to maintain the manufactured length during shipping. Shipping bar must be removed prior to system start-up.

F. The hanger assembly kit shall be used to support and hang the Loop. The UL Listed Seismic Wire/Cable assemblies conform to the requirements of the ASCE (American Society of Civil Engineers) guidelines for structural applications of wire rope, in that the cable is pre-stretched and the permanent end fittings maintain the break strength of the cable with a safety factor of two.

G. The pre-manufactured flexible loop shall be installed and guided following the manufacturer's printed installation instructions. Other manufactured loops that require pipe alignment guides shall use "Spider" type with outer housing ring. Units shall be fabricated from carbon steel. Pipe hangers and/or roller supports shall not be considered acceptable for use as guides.

2.03 FLEXIBLE PIPE CONNECTORS - COPPER PIPING

A. Manufacturer:
1. Mercer Rubber Company: www.mercer-rubber.com.
2. Metraflex Company: www.metraflex.com.
3. Flex-Hose Co., Inc.: www.flexhose.com
4. Substitutions: See Section 01600 - Product Requirements.

B. Inner Hose: Bronze.

C. Exterior Sleeve: Braided bronze.

D. Joint: Flanged.

E. Size: Use pipe sized units.

F. Construction to be 3 equal length sections of annular corrugated bronze close-pitch hose (made in USA) with stainless steel bronze overbraid (made in USA) that will absorb or compensate for pipe movements in all 6 degrees of freedom (3 coordinate axes, plus rotation about those axes) simultaneously.

G. The corrugated metal hose, braid(s), and a stainless steel ring-ferrule/band (material gauge not less than .048") must be integrally seal-welded using a 100% circumferential, full penetration TIG welds. End fittings shall be selected per application. Fittings must be attached using a 100% circumferential TIG weld

H. Braided bronze Loops must be suitable for operating temperatures up to 400 degrees F (204 degrees C)

I. Loop must be designed for pressure testing to 1.5 times their maximum rated working pressure and a minimum 4:1 (burst to working) safety factor.

J. Each braided Loop shall be individually leak tested by the manufacturer using air-under-water or hydrostatic pressure.

K. Loops shall be prepared for shipment using a cut-to-length metal shipping bar, tacked securely between the elbows of the two parallel legs, to maintain the manufactured length during shipping. Shipping bar must be removed prior to system start-up.

L. The hanger assembly kit shall be used to support and hang the Loop. The UL Listed Seismic Wire/Cable assemblies conform to the requirements of the ASCE (American Society of Civil Engineers) guidelines for structural applications of wire rope, in that the cable is pre-stretched and the permanent end fittings maintain the break strength of the cable with a safety factor of two.

M. The pre-manufactured flexible loop shall be installed and guided following the manufacturer's printed installation instructions. Other manufactured loops that require pipe alignment guides shall use "Spider" type with outer housing ring. Units shall be fabricated

from carbon steel. Pipe hangers and/or roller supports shall not be considered acceptable for use as guides.

2.04 ACCESSORIES

A. Pipe Alignment Guides:
   1. Manufacturers:
      a. Metraflex Company: www.metraflex.com.
   2. Substitutions: See Section 01600 - Product Requirements.
   3. Pipe guide shall be spider type pre-insulated with no metal to metal contact.
   4. Primary and intermediate guides shall be of the radial type employing a heavy wall guide cylinder with weld down or bolt down anchor base.
   5. Insulation thickness shall match piping insulation.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Anchor pipe to building structure where indicated. Provide pipe guides so movement is directed along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.

C. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required.

END OF SECTION

SECTION 15128 - GAGES AND METERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pressure gages and pressure gage taps.

B. Thermometers and thermometer wells.

C. Static pressure gages.

D. Filter gages.

1.02 RELATED REQUIREMENTS

A. Section 15182 - Hydronic Piping.

B. Section 15926 - Digital Control Equipment.

C. Section 15940 - HVAC Sequence of Operation.

1.03 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; The American Society of Mechanical Engineers; 2005.

B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2007.

C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2007.

D. AWWA M6 - Water Meters -- Selection, Installation, Testing, and Maintenance; American Water Works Association; 2012.

E. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Operation and Maintenance Manuals: Include in manuals the information listed below. For information on how to prepare and submit manuals see section 1780 (Closeout Submittals).
   1. Local representative
   2. Recommended spare parts
   3. Spare parts lists
   4. Operating instructions
   5. Maintenance instructions, including preventative and corrective maintenance.
   6. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
   7. Copies of warranties
   8. Shop drawings and product data

PART 2 PRODUCTS

2.01 PRESSURE GAGES

A. Manufacturers:

1. Dwyer Instruments, Inc: www.dwyer-inst.com.
2. Moeller Instrument Co., Inc: www.moellerinstrument.com.
3. Omega Engineering, Inc: www.omega.com.
4. Weiss
5. Substitutions: See Section 01600 - Product Requirements.

B. Pressure Gages: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
1. Case: Steel with brass bourdon tube.
2. Size: 4-1/2 inch diameter.
3. Mid-Scale Accuracy: One percent.
4. Scale: Psi.

2.02 PRESSURE GAGE TAPPINGS

A. Gage Cock: Tee or lever handle, brass for maximum 150 psi.

B. Needle Valve: Brass, 1/4 inch NPT for minimum 150 psi.

2.03 SOLAR-POWERED THERMOMETERS

A. Manufacturers:
1. Dwyer Instruments, Inc: www.dwyer-inst.com.
2. Omega Engineering, Inc: www.omega.com.
3. Weiss
4. Substitutions: See Section 01600 - Product Requirements.

B. General
1. Shall be equal to SPT10 series solar powered thermometer.

C. Case: Hi-impact ABS

D. Range: -40 to150°C (-40 to 300°F)

E. Display: 9.5 mm (3?8") High LCD digits

F. Accuracy: 1% of reading or 1°, whichever is greater.

G. Autorange Resolution:
1. 1°: -40 to 27°C (-40 to 19°F)
2. 0.1°: -28.0 to 93.0°C (-19.9 to 199.9°F)
3. 1°: 94 to 150°C (200 to 300°F)

H. Recalibration: Internal potentiometer

I. Lux Rating: 10 Lux (1' candle)

J. Display Update: 10 seconds

K. Ambient Operating: -35 to 60°C (-30 to 140°F)

L. Ambient Temp Error: Zero

M. Humidity: 95% RH non-condensing

N. Sensor: Glass passivated thermistor

O. Stem Assemblies:
1. Industrial Glass: Full conformance with Fed Spec GG-T-321D; fully interchangeable with industrial glass thermometers.
2. Bimetallic: Full conformance with ASME B40.3 - 1990; fully
3. interchangeable with bimetallic dial thermometers

2.04 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

2.05 TEST PLUGS

A. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F.

2.06 STATIC PRESSURE GAGES

A. Manufacturers:
1. Dwyer Instruments, Inc: www.dwyer-inst.com.
2. Omega Engineering, Inc: www.omega.com.
3. Weiss
4. Weksler Glass Thermometer Corp: www.wekslerglass.com.
5. Substitutions: See Section 01600 - Product Requirements.

B. 3-1/2 inch diameter dial in metal case, diaphragm actuated, black figures on white background, front recalibration adjustment, 2 percent of full scale accuracy.

C. Inclined manometer, red liquid on white background with black figures, front recalibration adjustment, 3 percent of full scale accuracy.

D. Accessories: Static pressure tips with compression fittings for bulkhead mounting, 1/4 inch diameter tubing.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install positive displacement meters with isolating valves on inlet and outlet to AWWA M6. Provide full line size valved bypass with globe valve for liquid service meters.

C. Provide one pressure gage per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gage.

D. Install pressure gages with pulsation dampers. Provide gage cock to isolate each gage. Provide siphon on gages in steam systems. Extend nipples and siphons to allow clearance from insulation.

E. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

F. Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets. Refer to Section 15924. Where thermometers are provided on local panels, duct or pipe mounted thermometers are provided on local panels, duct or pipe mounted thermometers are not required.

G. Provide instruments with scale ranges selected according to service with largest appropriate scale.

H. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

END OF SECTION

SECTION 15145 - PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, valves, and connections for piping systems.
   1. Sanitary sewer.
   2. Domestic water.
   3. Sequence of work for group tiolet areas.
      a. The plumbing contractor shall review the phasing notes on the drawings and make allowance on his pricing for the extra work and piping required to accomplish this schedule of work.
      b. The plumbing contractor will have the latitude to install alternate piping arrangements that are code compliant and fulfill the function without compromising aesthetics, structural integrity or interfere with other disciplines.
   4. Gas.

1.02 RELATED REQUIREMENTS

A. Section 09900 - Paints and Coatings.

B. Section 15073 - Vibration and Seismic Controls

C. Section 15075 - Mechanical Identification.

D. Section 15080 - Piping Insulation.

E. Section 15122 - Piping Expansion Compensation.

1.03 REFERENCE STANDARDS

A. ANSI Z21.22 - American National Standard for Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems; 1999, and addenda A&B (R2004).

B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2012 (ANSI B16.18).

C. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2001 (R2010).

D. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2011 (ANSI/ASME B31.9).

E. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2009.

F. Pipe.ASTM B 32 - Standard Specification for Solder Metal; 2008.

G. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2010.

H. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2009.

I. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2011.

J. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 1992 (Reapproved 2008).

K. AWS A5.8/A5.8M - Specification for Filler Metals for Brazing and Braze Welding; American Welding Society; 2011 and errata.

L. AWWA C651 - Disinfecting Water Mains; American Water Works Association; 2005 (ANSI/AWWA C651).

M. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications; Cast Iron Soil Pipe Institute; 2009.

N. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; Cast Iron Soil Pipe Institute; 2011.

O. FM1680 - Standard for heavy duty couplings used to connect hubless cast iron pipe. (1989)

P. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2009.

Q. MSS SP-70 - Cast Iron Gate Valves, Flanged and Threaded Ends; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2011.

R. MSS SP-71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2011.

S. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.

T. NFPA 54 - National Fuel Gas Code; National Fire Protection Association; 2012.

1.04 SUBMITTALS

A. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

B. Shop drawings and product data

C. Provide UL listed numbers on all fire stopping

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with State of South Carolina, standards.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

1.06 REGULATORY REQUIREMENTS

A. Perform Work in accordance with 2009 International Plumbing Code.

1.07 PIPE MARKERS

A. Color: Conform to ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive

backing and printed markings.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.09 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74 service weight. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and listed NSF.
   1. Fittings: Cast iron.
   2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hubless.
   1. Fittings: Cast iron.
   2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.

2.02 SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A74 service weight. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and listed NSF.

B. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron.
   2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.03 WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B 88, Type L (B), Drawn (H).
   1. Fittings: ASME B16.22, wrought copper and bronze, or ASME B16.18 bronze sand castings. Fittings manufactured to copper tubing sizes.
   2. Fittings: Cast iron, coated.
   3. Joints: ASTM B 32, alloy lead free solder.

2.04 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
   1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
   2. Joints: NFPA 54, threaded or welded to ASME B31.1.

2.05 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:
   1. Ferrous pipe: Class 150 malleable iron threaded unions.
   2. Copper tube and pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Size Over 1 Inch:
   1. Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
   2. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

2.06 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
   3. Trapeze Hangers: Welded steel channel frames attached to structure.
   4. Vertical Pipe Support: Steel riser clamp.

B. Plumbing Piping - Drain, Waste, and Vent:
   1. Conform to ASME B31.9.
   2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
   3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
   4. Vertical Support: Steel riser clamp.

C. Plumbing Piping - Water:
   1. Conform to ASME B31.9.
   2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
   3. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
   4. Hangers for Hot Pipe Sizes 2 Inches to 4 Inches: Carbon steel, adjustable, clevis.
   5. Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.
   6. Vertical Support: Steel riser clamp.

2.07 BALL VALVES

A. Manufacturers:
   1. Apollo
   2. Grinnell:
   3. Nibco, Inc:
   4. Milwaukee Valve Company:
   5. Victaulic:
   6. Watts Regulator Co.:
   7. Substitutions: See Section 01600 - Product Requirements.

B. Construction 2 Inches and Smaller: Meets the intent of MSS SP-110, 300 psi CWP, forged brass body, two piece, chrome plated brass ball and stem, full port, Teflon seats, blow-out proof stem, lever handle, Vic Press 304™ ends.

2.08 FLOW CONTROLS

A. Manufacturers:
   1. ITT Bell and Gossett:
   2. Grinnell: www.grinnell.
   3. Griswold Controls:
   4. Taco, Inc:
   5. Watts Regulator:
   6. Substitutions: See Section 01600 - Product Requirements.

B. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.

C. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi psi.

2.09 SWING CHECK VALVES

A. Manufacturers:
   1. Apollo
   2. Grinnell: www.
   3. Hammond Valve:
   4. Nibco, Inc:
   5. Milwaukee Valve Company:
   6. Victaulic Company of America:
   7. Watts Regulator:
   8. Substitutions: See Section 01600 - Product Requirements.

B. Up to 2 Inches:
   1. MSS SP-80, Class 125, bronze body and cap, bronze swing disc with rubber seat, solder ends.

C. Over 2 Inches:
   1. MSS SP-71, Class 125, iron body, bronze swing disc, renewable disc seal and seat, flanged or grooved ends.

D. 2 Inches through 4 Inches:
   1. 300 psi CWP, ductile iron body, stainless steel clapper, stainless steel wetted parts, grooved ends.

2.10 SPRING LOADED CHECK VALVES

A. Manufacturers:
   1. Apollo
   2. Crane Valve:
   3. Milwaukee Valve Company:
   4. Victaulic Company of America:
   5. Substitutions: See Section 01600 - Product Requirements.

B. Class 125, iron body, bronze trim, stainless steel springs, bronze disc, Buna N seals, wafer style ends.

C. 300 psi CWP, ductile iron body, stainless steel spring and shaft, aluminum bronze or

elastomer encapsulated ductile iron disc, grooved ends.

2.11 WATER PRESSURE REDUCING VALVES

A. Manufacturers:
   1. Amtrol Inc:
   2. Honeywell:
   3. Watts Regulator Company:
   4. Substitutions: See Section 01600 - Product Requirements.

B. Up to 2 Inches:
   1. MSS SP-80, ASTM B 584, bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single union ends.

C. Over 2 Inches:
   1. MSS SP-85, cast iron body, bronze fitted, elastomeric diaphragm and seat disc, flanged.

2.12 RELIEF VALVES

A. Pressure Relief:
   1. Manufacturers:
      a. Milwaukee Valve:
      b. Watts Regulator Company:
      c. Substitutions: See Section 01600 - Product Requirements.
   2. AGA Z21.22 certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.

B. Temperature and Pressure Relief:
   1. Manufacturers:
      a. Milwaukee Valve:
      b. Watts Regulator Company:
      c. Substitutions: See Section 01600 - Product Requirements.
   2. AGA Z21.22 certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME (BPV IV) certified and labelled.

2.13 STRAINERS

A. Manufacturers:
   1. Armstrong International, Inc:
   2. Grinnell:
   3. ITT Fluid Handling:
   4. Victaulic Company of America:
   5. Watts Regulator:
   6. Substitutions: See Section 01600 - Product Requirements.

B. Size 2 inch and Under:
   1. Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel or groove plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges, grooved joint couplings or unions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

H. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08310.

I. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09900.

J. Install bell and spigot pipe with bell end upstream.

K. Install valves with stems upright or horizontal, not inverted.

L. Install water piping to ASME B31.9.

M. Sleeve pipes passing through partitions, walls and floors.

N. Inserts:
   1. Provide inserts for placement in concrete formwork.
   2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
   4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
   5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

O. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9.
   2. Support horizontal piping as scheduled.
   3. Where several pipes can be installed in parallel and at same elevation, provide multiple

or trapeze hangers.

4. Provide hangers adjacent to motor driven equipment with vibration isolation; refer to Section 15072.

3.04 APPLICATION

A. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

3.05 TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/8 inch per foot slope.

B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Disinfect water distribution system in accordance with Section 02515.

B. Prior to starting work, verify system is complete, flushed and clean.

C. Ensure Ph of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

D. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.

E. Maintain disinfectant in system for 24 hours.

F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.07 SCHEDULES

A. Pipe Hanger Spacing:
   1. Metal Piping:
      a. Pipe size: 1/2 inches to 1-1/4 inches:
         1) Maximum hanger spacing: 6.5 ft.
         2) Hanger rod diameter: 3/8 inches.
      b. Pipe size: 1-1/2 inches to 2 inches:
         1) Maximum hanger spacing: 10 ft.
         2) Hanger rod diameter: 3/8 inch.
      c. Pipe size: 2-1/2 inches to 3 inches:
         1) Maximum hanger spacing: 10 ft.
         2) Hanger rod diameter: 1/2 inch.
      d. Pipe size: 4 inches to 6 inches:
         1) Maximum hanger spacing: 10 ft.
         2) Hanger rod diameter: 5/8 inch.

END OF SECTION

SECTION 15146 - PLUMBING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Floor drains.

B. Cleanouts.

C. Hose bibbs.

D. Hydrants.

E. Backflow preventers.

F. Water hammer arrestors.

G. Thermostatic mixing valves.

1.02 RELATED REQUIREMENTS

A. Section 15145 - Plumbing Piping.

B. Section 15410 - Plumbing Fixtures.

1.03 REFERENCE STANDARDS

A. ASME A112.6.3 - Floor and Trench Drains; The American Society of Mechanical Engineers; 2001 (R2007).

B. ASSE 1011 - Hose Connection Vacuum Breakers; American Society of Sanitary Engineering; 2004 (ANSI/ASSE 1011).

C. PDI-WH 201 - Water Hammer Arresters; Plumbing and Drainage Institute; 2010.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.

D. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

E. Operation and Maintenance Manuals: Include in manuals the information listed below. For information on how to prepare and submit manuals see section 1780 (Closeout Submittals).
   1. Recommended spare parts
   2. Spare parts lists
   3. Operating instructions
   4. Maintenance instructions, including preventative and corrective maintenance.
   5. Copies of warranties
   6. Wireing diagrams
   7. Inspection procedures
   8. Shop drawings and product data

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.01 DRAINS

A. Manufacturers:
   1. Josam Company:
   2. Jay R. Smith Manufacturing Company:
   3. Zurn Industries, Inc:
   4. Substitutions: See Section 01600 - Product Requirements.

B. Floor Drains:
   1. Assembly: ASME A112.21.1M.
   2. Body: Lacquered cast iron two piece body with double drainage flange..

2.02 CLEANOUTS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
   2. Josam Company: www.josam.com.
   3. Wade
   4. Zurn Industries, Inc: www.zurn.com.
   5. Watts

B. Cleanouts at Interior Unfinished Accessible Areas : Calked or threaded type.

2.03 HYDRANTS

A. Wall Hydrant Manufacturers:
   1. Watts Model
   2. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
   3. Zurn Industries, Inc: www.zurn.com.
   4. Substitutions: See Section 01600 - Product Requirements.

B. Wall Hydrants W/Box:
   1. Manufacturers:
   2. Josam
   3. Jay R. Smith
   4. Watts Model
   5. Woodford
   6. ASSE 1019; chrome plated lockable recessed box, hose thread spout, lockshield and removable key, and vacuum breaker.

C. Manufacturers:
   1. Josam Model
   2. Jay R. Smith

3. Woodford Model
4. Substitutions: See Section 01600 - Product Requirements.

D. ASSE 1019; chrome plated lockable recessed box, hose thread spout, lockshield and removable key, and vacuum breaker.

2.04 REFRIGERATOR VALVE AND RECESSED BOX

A. Box Manufacturers:
1. IPS Corporation/Water-Tite: www.ipscorp.com.
2. Oatey: www.oatey.com.
3. Substitutions: See Section 01600 - Product Requirements.

B. Valve Manufacturers:
1. IPS Corporation/Water-Tite: www.ipscorp.com.
2. Zurn Industries, Inc: www.zurn.com.
3. Substitutions: See Section 01600 - Product Requirements.

C. Description: Plastic preformed rough-in box with brass valves with wheel handle, slip in finishing cover.

2.05 BACKFLOW PREVENTERS

A. Manufacturers:
1. Ames
2. Watts Regulator Company:
3. Zurn Industries,Inc.:
4. Substitutions: See Section 01600 - Product Requirements.

2.06 REDUCED PRESSURE BACKFLOW PREVENTER:

A. ASSE 1013; bronze body with bronze 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 that opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

2.07 DOUBLE CHECK VALVE ASSEMBLIES

A. Manufacturers:
1. FEBCO
2. Valve Solutions, Inc.
3. Wilkins
4. Watts Regulator Company:
5. Zurn Industries, Inc.:
6. Substitutions: See Section 01600 - Product Requirements.

B. Double Check Valve Assemblies:
1. ASSE 1012; Bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.

2.08 VACUUM BREAKERS

A. Manufacturers:

1. Febco
2. Valve Solutions, Inc.
3. Watts Regulator Company:
4. Wilkins
5. Substitutions: See Section 01600 - Product Requirements.

B. Anti-Siphon Vacuum Breakers:
1. ASSE 1022; Spill resistant anti siphon vacuum breaker with bronze body with corrosion resistant parts.Similar to model 008PCQT series.

2.09 WATER HAMMER ARRESTORS

A. Manufacturers:
1. Jay R. Smith Manufacturing Company:
2. Watts Regulator Company:
3. Zurn Industries, Inc:
4. Wade Model

B. Water Hammer Arrestors:
1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range -100 to 300 degrees F and maximum 250 psi working pressure.

2.10 MIXING VALVES

A. Thermostatic Mixing Valves: (Mixing valves shall mix hot and cold water to supply tempered water to fixture in compliance with ASSE 1070)
1. Manufacturers:
a. Griswold Controls:
b. Armstrong:
c. Leonard Valve Company:
d. Honeywell Water Controls (Sparco):
e. Powers Process Controls: powerscontrols.com
f. Symmons:
g. Substitutions: See Section 01600 - Product Requirements.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

C. Install floor cleanouts at elevation to accommodate finished floor.

D. Install approved portable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs.

E. Pipe relief from backflow preventer to nearest drain.

F. Mixing valve shall be located below each public lavatory. Mixing valves shall mix hot water with cold water to supply tempered water to fixture in compliance with ASSE 1070.

END OF SECTION

SECTION 15182 - HYDRONIC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hydronic system requirements.

B. Heating water piping, above grade.

C. Chilled water piping, above grade.

D. Pipe and pipe fittings for:
   1. Heating water piping system.
   2. Chilled water piping system.
   3. Equipment drains and overflows.

E. Pipe hangers and supports.

F. Unions, flanges, mechanical couplings, and dielectric connections.

G. Valves:
   1. Gate valves.
   2. Globe or angle valves.
   3. Ball valves.
   4. Butterfly valves.
   5. Check valves.

1.02 RELATED REQUIREMENTS

A. Section 09900 - Paints and Coatings.

B. Section 15122 - Piping Expansion Compensation.

C. Section 15075 - Mechanical Identification.

D. Section 15080 - Mechanical Insulation

E. Section 15122 - Piping Expansion Compensation.

F. Section 15073 - Vibration and Seismic Controls for HVAC Piping and Equipment.

G. Section 15183 - Hydronic Specialties.

H. Section 15189 - Chemical Water Treatment: Pipe cleaning.

1.03 REFERENCE STANDARDS

A. ASME (BPV IX) - Boiler and Pressure Vessel Code, Section IX - Welding and Brazing Qualifications; The American Society of Mechanical Engineers; 2010.

B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2012 (ANSI B16.18).

C. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; 2001 (R2010).

D. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; 2010.

E. ASME B31.9 - Building Services Piping; 2011 (ANSI/ASME B31.9).

F. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2001 (R2005).

G. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; The American Society of Mechanical Engineers; 2006.

H. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2008 (ANSI/ASME B31.9).

I. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

J. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2011a.

K. ASTM B32 - Standard Specification for Solder Metal; 2008.

L. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2009.

M. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2005 (Reapproved 2011).

N. AWS A5.8/A5.8M - Specification for Filler Metals for Brazing and Braze Welding; 2011 and errata.

O. AWS A5.8/A5.8M - Specification for Filler Metals for Brazing and Braze Welding; American Welding Society; 2004 and errata.

P. ASTM A 312 – Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipe.

Q. ASTM A 395 – Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings.

R. ASTM A 536 – Standard Specification for Ductile Iron Castings.

S. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2010.

T. MSS SP-58 - Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2009.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Include data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings.

C. Welders Certificate: Include welders certification of compliance with ASME (BPV IX).

D. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

E. Project Record Documents: Record actual locations of valves.

F. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly

views.

G. Operation and Maintenance Manuals: Include in manuals the information listed below. For information on how to prepare and submit manuals see section 1780 (Closeout Submittals).
   1. Recommended spare parts
   2. Spare parts lists
   3. Maintenance instructions, including preventative and corrective maintenance
   4. Shop drawings and product data

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.

B. Welder Qualifications: Certify in accordance with ASME (BPV IX).

1.06 REGULATORY REQUIREMENTS

A. Conform to ASME B31.9 code for installation of piping system.

B. Welding Materials and Procedures: Conform to ASME (BPV IX) and applicable state labor regulations.

C. Provide certificate of compliance from authority having jurisdiction, indicating approval of welders.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.08 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 HYDRONIC SYSTEM REQUIREMENTS

A. Comply with ASME B31.9 and applicable federal, state, and local regulations.

B. Piping: Provide piping, fittings, hangers and supports as required, as indicated, and as follows:
   1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
   2. Use non-conducting dielectric connections whenever jointing dissimilar metals.
   3. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.

C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges or unions to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.

D. Valves: Provide valves where indicated:
   1. Provide drain valves where indicated, and if not indicated provide at least at main shut-off, low points of piping, bases of vertical risers, and at equipment. Use 3/4 inch gate valves with cap; pipe to nearest floor drain.
   2. Isolate equipment using butterfly valves with lug end flanges.
   3. For throttling, bypass, or manual flow control services, use ball valves.
   4. For VAV boxes use ball valves.
   5. For shut-off and to isolate parts of systems or vertical risers, use gate, ball, or butterfly valves.

E. Welding Materials and Procedures: Conform to ASME (BPV IX).

2.02 HEATING WATER PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black, using one of the following joint types:
   1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1 welded.

B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn, using one of the following joint types:
   1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings.
      a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
      b. Braze: AWS A5.8/A5.8M BCuP copper/silver alloy.

2.03 CHILLED WATER PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black; using one of the following joint types:
   1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1 welded.

2.04 EQUIPMENT DRAINS AND OVERFLOWS

A. Steel Pipe: ASTM A53/A53M, Schedule 40 galvanized; using one of the following joint types:
   1. Joints: Threaded.

B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn; using one of the following joint types:
   1. Joints: Solder, lead free, ASTM B 32, HB alloy (95-5 tin-antimony), or tin and silver.

2.05 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

B. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron, adjustable swivel, split ring.

C. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.

D. Hangers for Hot Pipe Sizes 2 to 4 Inches: Carbon steel, adjustable, clevis.

E. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

F. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.

G. Vertical Support: Steel riser clamp.

H. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

I. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

J. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

K. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

L. In grooved installations, use rigid couplings with offsetting angle-pattern bolt pads or with wedge shaped grooves in header piping to permit support and hanging in accordance with ASME B31.9.

2.06 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

A. Unions for Pipe 2 Inches and Under:
   1. Ferrous Piping: 150 psig malleable iron, threaded, or type 304/304L stainless steel, threaded type, with Vic Press 304™ ends.

B. Flanges for Pipe Over 2 Inches:

C. Ferrous Piping: 150 psig forged steel, slip-on.

D. Flange Adapters for Pipe Over 2 Inches:
   1. ASTM A 395 and A 536, ductile iron housings, with pressure responsive synthetic rubber gaskets. (Grade to suit the intended service.) For use with grooved end pipe and fittings and mating to ANSI Class 125/150 flanges.

2.07 GATE VALVES

A. Manufacturers:
   1. Conbraco Industries: www.conbraco.com.
   2. Nibco, Inc: www.nibco.com.
   3. Milwaukee Valve Company: www.milwaukeevalve.com.
   4. Substitutions: See Section 01600 - Product Requirements.

B. Up To and Including 2 Inches:
   1. Bronze body, bronze trim, screwed bonnet, non-rising stem, lockshield stem, inside screw with backseating stem, solid wedge disc, alloy seat rings, solder ends.

C. Over 2 Inches:
   1. Iron body, bronze trim, bolted bonnet, rising stem, handwheel, outside screw and yoke,

solid wedge disc with bronze seat rings, flanged ends.

2.08 GLOBE OR ANGLE VALVES

A. Manufacturers:
   1. Conbraco Industries: www.conbraco.com.
   2. Nibco, Inc: www.nibco.com.
   3. Milwaukee Valve Company: www.milwaukeevalve.com.
   4. Substitutions: See Section 01600 - Product Requirements.

B. Up To and Including 2 Inches:
   1. Bronze body, bronze trim, screwed bonnet, rising stem and handwheel, inside screw with backseating stem, renewable composition disc and bronze seat, solder ends.

C. Over 2 Inches:
   1. Iron body, bronze trim, bolted bonnet, rising stem, handwheel, outside screw and yoke, rotating plug-type disc with renewable seat ring and disc, flanged ends.

2.09 BALL VALVES

A. Manufacturers:
   1. Conbraco Industries: www.conbraco.com.
   2. Nibco, Inc: www.nibco.com.
   3. Milwaukee Valve Company: www.milwaukeevalve.com.
   4. Substitutions: See Section 01600 - Product Requirements.

B. Up To and Including 2 Inches:
   1. Bronze one piece body, chrome plated brass ball, teflon seats and stuffing box ring, lever handle with balancing stops, solder ends with union.

C. Over 2 Inches:
   1. Ductile iron body, chrome plated steel ball, teflon seat and stuffing box seals, lever handle, grooved ends or flanged, rated to 800 psi.
   2. Cast steel body, chrome plated steel ball, teflon seat and stuffing box seals, lever handle, flanged.

2.10 BUTTERFLY VALVES

A. Manufacturers:
   1. Tyco Flow Control: www.tycoflowcontrol.com.
   2. Hammond Valve: www.hammondvalve.com.
   3. Crane Co.: www.cranevalve.com.
   4. Milwaukee Valve Company: www.milwaukeevalve.com.
   5. Substitutions: See Section 01600 - Product Requirements.

B. Body: Cast or ductile iron with resilient replaceable EPDM seat, wafer or lug ends, extended neck.

C. Disc: Construct of aluminum bronze, chrome plated ductile iron, or stainless steel.

D. Body: Cast or ductile iron with resilient replaceable EPDM seat, wafer or lug ends, extended neck.

E. Disc: Aluminum bronze.

F. Operator: 10 position lever handle.

2.11 SWING CHECK VALVES

A. Manufacturers:
1. Hammond Valve: www.hammondvalve.com.
2. Nibco, Inc: www.nibco.com.
3. Milwaukee Valve Company: www.milwaukeevalve.com.
4. Substitutions: See Section 01600 - Product Requirements.

B. Up To and Including 2 Inches:
1. Bronze body, bronze trim, bronze rotating swing disc, with composition disc, solder ends.

C. Over 2 Inches:
1. Iron body, bronze trim, stainless steel, bronze, or bronze faced rotating swing disc, renewable disc and seat, flanged ends.
2. Iron body, bronze trim, bronze or bronze faced rotating swing disc, renewable disc and seat, flanged ends.

PART 3 EXECUTION

3.01 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 couplings, flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

E. After completion, fill, clean, and treat systems. Refer to Section 15189 for additional requirements.

3.02 INSTALLATION

A. All piping must be manufactured in the USA.

B. Install in accordance with manufacturer's instructions.

C. Install heating water piping to ASME B31.9 requirements. Install chilled water piping to ASME B31.5 requirements.

D. Route piping in orderly manner, parallel to building structure, and maintain gradient.

E. Install piping to conserve building space and to avoid interfere with use of space.

F. Group piping whenever practical at common elevations.

G. Sleeve pipe passing through partitions, walls and floors.

H. Slope piping and arrange to drain at low points.

I. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 15122.

J. Painting: Paint chilled water piping according to university specifications. Cotractor shall allow appropriate dry time prior to installing insulation. Contractor shall have USC inpection and approval before installation of insulation or will be required to remove and replace insulation at contractors expense for USC inspection.

K. Inserts:
1. Provide inserts for placement in concrete formwork.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

L. Pipe Hangers and Supports:
1. Install in accordance with ASME B31.9.
2. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
3. Place hangers within 12 inches of each horizontal elbow.
4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
6. Prime coat exposed steel hangers and supports. Refer to Section 09900. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

M. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 15080.

N. Provide access where valves and fittings are not exposed.

O. Use eccentric reducers to maintain top of pipe level.

P. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

Q. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting. Refer to Section 09900.

R. Install valves with stems upright or horizontal, not inverted.

3.03 SCHEDULES

A. Hanger Spacing for Copper Tubing.
1. 1/2 inch and 3/4 inch: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. 1 inch: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. 1-1/2 inch and 2 inch: Maximum span, 8 feet; minimum rod size, 3/8 inch.
4. 2-1/2 inch: Maximum span, 9 feet; minimum rod size, 3/8 inch.
5. 3 inch: Maximum span, 10 feet; minimum rod size, 3/8 inch.

B. Hanger Spacing for Steel Piping.

1. 1/2 inch, 3/4 inch, and 1 inch: Maximum span, 7 feet; minimum rod size, 1/4 inch.
2. 1-1/4 inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.
3. 1-1/2 inches: Maximum span, 9 feet; minimum rod size, 3/8 inch.
4. 2 inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.
5. 2-1/2 inches: Maximum span, 11 feet; minimum rod size, 3/8 inch.
6. 3 inches: Maximum span, 12 feet; minimum rod size, 3/8 inch.
7. 4 inches: Maximum span, 14 feet; minimum rod size, 1/2 inch.

END OF SECTION

SECTION 15183 - HYDRONIC SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air vents.

B. Air separators.

C. Strainers.

D. Suction diffusers.

E. Combination flow controls.

F. Pump suction fittings.

G. Combination fittings.

H. Flow indicators, controls, meters.

I. Relief valves.

1.02 RELATED REQUIREMENTS

A. Section 15182 - Hydronic Piping.

B. Section 15189 - Chemical Water Treatment: Pipe Cleaning.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Operation and Maintenance Manuals: Include in manuals the information listed below. For information on how to prepare and submit manuals see section 1780 (Closeout Submittals).
   1. Recommended spare parts
   2. Spare parts lists
   3. Operating instructions
   4. Maintenance instructions, including preventative and corrective maintenance.
   5. Copies of warranties
   6. Wiring diagrams
   7. Inspection procedures
   8. Shop drawings and product data

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 AIR VENTS

A. Manufacturers:
   1. Armstrong International, Inc: www.armstronginternational.com.
   2. ITT Bell & Gossett: www.bellgossett.com.
   3. Taco, Inc: www.taco-hvac.com.
   4. Substitutions: See Section 01600 - Product Requirements.

B. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.

C. Float Type:
   1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.

D. Washer Type:
   1. Brass with hygroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring loaded ball check valve.

2.02 AIR SEPARATORS

A. Combination Air Separators/Strainers:
   1. Manufacturers:
      a. Armstrong International, Inc: www.armstronginternational.com.
      b. ITT Bell & Gossett: www.bellgossett.com.
      c. Taco, Inc: www.taco-hvac.com.
      d. Substitutions: See Section 01600 - Product Requirements.
   2. Furnish and install, as shown on plans, a centrifugal type air separator. The unit shall have 3" inlet and outlet flanged connections tangential to the vessel shell. The unit shall have the capability to direct accumulated air to the air vent (air elimination system) via an NPT vent connection at top of unit.
   3. A blowdown connection shall be provided to facilitate routine cleaning. Vessel shell diameter to be three times the nominal inlet/outlet pipe diameter, with a minimum vessel volume for sufficient velocity reduction.
   4. The air separator must be designed, constructed and stamped for 125 psig @ 375ºF (862 kPa @ 191ºC) in accordance with Section VIII, Division I of the ASME Boiler and Pressure Vessel Code, and registered with the National Board of Boiler and Pressure Vessel Inspectors. The air separator(s) shall be painted with one shop coat of light gray air dry enamel.
   5.

2.03 STRAINERS

A. Manufacturers:
   1. Armstrong International, Inc: www.armstronginternational.com.
   2. Green Country Filtration: greencountryfiltration.com.

3. WEAMCO: www.weamco.com.
4. Substitutions: See Section 01600 - Product Requirements.

B. Size 2 inch and Under:
1. Screwed brass or iron body for 175 psi working pressure, Y pattern with 1/32 inch stainless steel perforated screen.

C. Size 2-1/2 inch to 4 inch:
1. Provide flanged iron body for 175 psi working pressure, Y pattern with 1/16 inch stainless steel perforated screen.

2.04 SUCTION DIFFUSERS

A. Manufacturers:
1. ITT Bell & Gossett: www.bellgossett.com.
2. Anvil International, Inc: www.anvilintl.com.
3. Substitutions: See Section 01600 - Product Requirements.

B. Fitting: Angle pattern, cast-iron body, threaded for 2 inch and smaller, flanged for 2-1/2 inch and larger, rated for 175 psi working pressure, with inlet vanes, cylinder strainer with 3/16 inch diameter openings, disposable 5/32 inch mesh strainer to fit over cylinder strainer, 20 mesh start up screen, and permanent magnet located in flow stream and removable for cleaning.

C. Accessories: Adjustable foot support, blowdown tapping in bottom, gage tapping in side.

2.05 COMBINATION FLOW CONTROLS

A. Manufacturers:
1. Griswold Controls: www.griswoldcontrols.com
2. ITT Bell & Gossett: www.bellgossett.com.
3. Taco, Inc: www.taco-hvac.com
4. Substitutions: See Section 01600 - Product Requirements.

B. Construction: Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet with blowdown/backflush drain.

C. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi.

D. Control Mechanism: Stainless steel or nickel plated brass piston or regulator cup, operating against stainless steel helical or wave formed spring.

E. Accessories: In-line strainer on inlet and ball valve on outlet.

2.06 RELIEF VALVES

A. Manufacturers:
1. Armstrong International, Inc: www.armstronginternational.com.
2. ITT Bell & Gossett: www.bellgossett.com.
3. Conbraco Industries, Inc: www.conbraco.com.
4. Substitutions: See Section 01600 - Product Requirements.

B. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install specialties in accordance with manufacturer's instructions.

B. Where large air quantities can accumulate, provide enlarged air collection standpipes.

C. Provide manual air vents at system high points and as indicated.

D. Provide air separator on suction side of system circulation pump and connect to expansion tank.

E. Provide valved drain and hose connection on strainer blow down connection.

F. Provide combination pump discharge valve on discharge side of base mounted centrifugal pumps.

G. Support pump fittings with floor mounted pipe and flange supports.

H. Provide relief valves on pressure tanks, low pressure side of reducing valves, heat exchangers, and expansion tanks.

I. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.

3.02 MAINTENANCE

A. See Section 01700 - Execution Requirements, for additional requirements relating to maintenance service.

B. Provide service and maintenance of glycol system for one year from date of Substantial Completion at no extra charge to Owner.

C. Explain corrective actions to Owner's maintenance personnel in person.

END OF SECTION

SECTION 15186 - REFRIGERANT PIPING AND SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping.

B. Refrigerant.

C. Moisture and liquid indicators.

D. Valves.

E. Strainers.

F. Filter-driers.

1.02 RELATED REQUIREMENTS

A. Section 15080 - Mechanical Insulation

B. Section 15738 - Computer Room Air Conditioning Units.

C. Section 15940 - HVAC Sequence of Operation.

1.03 REFERENCE STANDARDS

A. AHRI 750 - Standard for Thermostatic Refrigerant Expansion Valves; Air-Conditioning, Heating, and Refrigeration Institute; 2007.

B. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2010 (ANSI/ASHRAE Std 15).

C. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2001 (R2010).

D. ASME B16.26 - Cast Copper Alloy Fittings For Flared Copper Tubes; The American Society of Mechanical Engineers; 2011.

E. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; The American Society of Mechanical Engineers; 2010.

F. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2011 (ANSI/ASME B31.9).

G. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2008.

H. AWS A5.8/A5.8M - Specification for Filler Metals for Brazing and Braze Welding; American Welding Society; 2011 and errata.

I. MSS SP-58 - Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2009.

1.04 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified ensure system components are

compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

B. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.

C. Valves:
   1. Use service valves on suction and discharge of compressors.

D. Filter-Driers:
   1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Operation and Maintenance Manuals: Include in manuals the information listed below. For information on how to prepare and submit manuals see section 1780 (Closeout Submittals).
   1. Recommended spare parts
   2. Spare parts lists
   3. Operating instructions
   4. Maintenance instructions, including preventative and corrective maintenance.
   5. Copies of warranties
   6. Wiring diagrams
   7. Inspection procedures
   8. Shop drawings and product data

1.06 REGULATORY REQUIREMENTS

A. Conform to ASME B31.9 for installation of piping system.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and specialties in shipping containers with labeling in place.

B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

PART 2 PRODUCTS

2.01 PIPING

A. Copper Tube: ASTM B280, H58 hard drawn or O60 soft annealed.
   1. Fittings: ASME B16.22 wrought copper.
   2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy.

B. Pipe Supports and Anchors:
   1. Provide hangers and supports that comply with MSS SP-58.
      a. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

2. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
3. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
4. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.02 MOISTURE AND LIQUID INDICATORS

A. Manufacturers:

B. Indicators: Single port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 500 psi.

2.03 VALVES

A. Ball Valves:
1. Two piece bolted forged brass body with teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals; for maximum working pressure of 500 psi and maximum temperature of 300 degrees F.

B. Service Valves:
1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends, for maximum pressure of 500 psi.

2.04 STRAINERS

A. Straight Line or Angle Line Type:
1. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass; for maximum working pressure of 430 psi.

2.05 FILTER-DRIERS

A. Performance:
1. Pressure Drop: 2 psi, maximum, when operating at full connected evaporator capacity.
2. Design Working Pressure: 350 psi, minimum.

B. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, activated charcoal, and filtration to 40 microns, with secondary filtration to 20 microns; of construction that will not pass into refrigerant lines.

C. Construction: UL listed.
1. Connections: As specified for applicable pipe type.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and avoid interference with use of space.

D. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.5.
   2. Place hangers within 12 inches of each horizontal elbow.
   3. Provide copper plated hangers and supports for copper piping.

G. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.

H. Provide clearance for installation of insulation and access to valves and fittings.

I. Flood piping system with nitrogen when brazing.

J. Fully charge completed system with refrigerant after testing.

3.03 FIELD QUALITY CONTROL

A. Test refrigeration system in accordance with ASME B31.5.

B. Pressure test system with dry nitrogen to 200 psi. Perform final tests at 27 inches vacuum and 200 psi using halide torch. Test to no leakage.

3.04 SCHEDULES

A. Hanger Spacing for Copper Tubing.
   1. 1/2 inch, 5/8 inch, and 7/8 inch OD: Maximum span, 5 feet; minimum rod size, 1/4 inch.
   2. 1-1/8 inch OD: Maximum span, 6 feet; minimum rod size, 1/4 inch.
   3. 1-3/8 inch OD: Maximum span, 7 feet; minimum rod size, 3/8 inch.
   4. 1-5/8 inch OD: Maximum span, 8 feet; minimum rod size, 3/8 inch.
   5. 2-1/8 inch OD: Maximum span, 8 feet; minimum rod size, 3/8 inch.

END OF SECTION

SECTION 15188 - HVAC PUMPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Base mounted pumps.

1.02 RELATED REQUIREMENTS

A. Section 03300 - Cast-in-Place Concrete.

B. Section 15065 - Motors for Mechanical Equipment.

C. Section 15073 - Vibration and Seismic Controls for HVAC Piping and Equipment.

D. Section 15080 - Mechanical Insulation

E. Section 15182 - Hydronic Piping.

F. Section 15183 - Hydronic Specialties.

G. Section 16155 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2011.

B. UL 778 - Standard for Motor-Operated Water Pumps; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Millwright's Certificate: Certify that base mounted pumps have been aligned.

C. Operation and Maintenance Manuals: Include in manuals the information listed below. For information on how to prepare and submit manuals see section 1780 (Closeout Submittals).
   1. Local representative
   2. Safety instructions
   3. Recommended spare parts
   4. Spare parts lists
   5. Operating instructions
   6. Maintenance instructions, including preventative and corrective maintenance.
   7. Copies of warranties
   8. Wiring diagrams
   9. Inspection procedures
   10. Shop drawings and product data

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture, assembly, and field performance of pumps, with minimum three years of documented experience.

B. Alignment: Base mounted pumps shall be aligned by qualified millwright.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Armstrong Pumps Inc: www.armstrongpumps.com.

B. ITT Bell & Gossett: www.bellgossett.com.

C. Taco.

D. Substitutions: See Section 01600 - Product Requirements.

2.02 HVAC PUMPS - GENERAL

A. Provide pumps that 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.

B. Base Mounted Pumps: Laser aligned by qualified millwright.

C. Products Requiring Electrical Connection: Listed and classified by UL or testing agency acceptable to authority having jurisdiction as suitable for the purpose specified and indicated.

2.03 BASE MOUNTED PUMPS

A. Type: Horizontal shaft, single stage, direct connected, radially or horizontally split casing, for 125 psi maximum working pressure.

B. Casing: Cast iron, with suction and discharge gage ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.

C. Impeller: Bronze, fully enclosed, keyed to shaft.

D. Bearings: Oil lubricated roller or ball bearings.

E. Shaft: Alloy steel with copper, bronze, or stainless steel shaft sleeve.

F. Seal: Mechanical seal, 225 degrees F maximum continuous operating temperature.

G. Seal: Packing gland with minimum four rings graphite impregnated packing and bronze lantern rings, 250 degrees F maximum continuous operating temperature.

H. Drive: Flexible coupling with coupling guard.

I. Baseplate: Cast iron or fabricated steel with integral drain rim.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide access space around pumps for service. Provide no less than minimum space recommended by manufacturer.

C. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For close coupled or base mounted pumps, provide supports under elbows on pump suction and discharge line sizes 4 inches and over. Refer to Section 15073.

D. Provide line sized shut-off valve and strainer on pump suction, and line sized soft seat check valve and balancing valve on pump discharge.

E. Provide air cock and drain connection on horizontal pump casings.

F. Provide drains for bases and seals, piped to and discharging into floor drains.

G. Check, align, and certify alignment of base mounted pumps prior to start-up.

H. Install base mounted pumps on concrete housekeeping base, with anchor bolts, set and level, and grout in place. Refer to Section 03300.

I. Lubricate pumps before start-up.

END OF SECTION

SECTION 15189 - CHEMICAL WATER TREATMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cleaning of piping systems.

B. Chemical feeder equipment.

C. Chemical treatment.

1.02 RELATED REQUIREMENTS

A. Section 15182 - Hydronic Piping.

B. Section 15183 - Hydronic Specialties.

1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.

C. Shop Drawings: Indicate system schematic, equipment locations, and controls schematics, electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions: Indicate placement of equipment in systems, piping configuration, and connection requirements.

E. Certificate: Submit certificate of compliance from authority having jurisdiction indicating approval of chemicals and their proposed disposal.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

G. Operation and Maintenance Manuals: Include in manuals the information listed below. For information on how to prepare and submit manuals see section 1780 (Closeout Submittals).
   1. Local representative
   2. Emergency instructions
   3. Safety instructions
   4. Recommended spare parts
   5. Spare parts lists
   6. Operating instructions
   7. Maintenance instructions, including preventative and corrective maintenance.
   8. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
   9. Copies of warranties
   10. Wiring diagrams
   11. Shop drawings and product data

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience. Company shall have local representatives with water analysis laboratories and full time service

personnel.

1.05 REGULATORY REQUIREMENTS

A. Conform to applicable code for addition of non-potable chemicals to building mechanical systems and to public sewage systems.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. AmSolv/Division of Amrep, Inc: www.amsolv.com.

B. GE Water Technologies: www.gewater.com.

C. Nalco Company: www.nalco.com.

D. Substitutions: See Section 01600 - Product Requirements.

2.02 MATERIALS

A. System Cleaner:
1. Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products; sodium tripoly phosphate and sodium molybdate.
2. Biocide chlorine release agents such as sodium hypochlorite or calcium hypochlorite.

B. Closed System Treatment (Water):
1. Sequestering agent to reduce deposits and adjust pH; polyphosphate.
2. Corrosion inhibitors; boron-nitrite, sodium nitrite and borax, sodium totyltriazole, low molecular weight polymers, phosphonates, sodium molybdate, or sulphites.
3. Conductivity enhancers; phosphates or phosphonates.

2.03 BY-PASS (POT) FEEDER

A. Manufacturers:
1. Neptune Chemical Pump Company: www.neptune1.com.
2. Substitutions: See Section 01600 - Product Requirements.

B. Two quart quick opening cap for working pressure of 175 psi.

PART 3 EXECUTION

3.01 PREPARATION

A. Systems shall be operational, filled, started, and vented prior to cleaning. Use water meter to record capacity in each system.

B. Place terminal control valves in open position during cleaning.

C. Verify that electric power is available and of the correct characteristics.

3.02 CLEANING SEQUENCE

A. Concentration:
1. As recommended by manufacturer.

B. Hot Water Heating Systems:
1. Apply heat while circulating, slowly raising temperature to 160 degrees F and maintain

for 12 hours minimum.
2. Remove heat and circulate to 100 degrees F or less; drain systems as quickly as possible and refill with clean water.
3. Circulate for 6 hours at design temperatures, then drain.
4. Refill with clean water and repeat until system cleaner is removed.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.04 CLOSED SYSTEM TREATMENT

A. Provide one bypass feeder on the hot water heating system. Install isolating and drain valves and necessary piping. Install around balancing valve downstream of circulating pumps unless indicated otherwise.

B. Introduce closed system treatment through bypass feeder when required or indicated by test.

C. Provide 3/4 inch water coupon rack around circulating pumps with space for 4 test specimens.

3.05 CLOSEOUT ACTIVITIES

A. Training: Train Owner's personnel on operation and maintenance of chemical treatment system.
1. Provide minimum of two hours of instruction for two people.
2. Have operation and maintenance data prepared and available for review during training.
3. Conduct training using actual equipment after treated system has been put into full operation.

END OF SECTION

SECTION 15300 - FIRE PROTECTION SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This specification outlines the requirements for a "Total Flood" Clean Agent Fire Suppression System with automatic detection and control. The work described in this specification includes all engineering, labor, materials, equipment and service necessary, and required, to complete and test the suppression system.

1.02 RELATED SECTIONS

A. Drawings and General Provisions of Contract, including the Notice to Bidders, Instructions to Bidders, General Conditions of the Contract, Supplementary General Conditions, and all applicable specification sections of Division 1 - General Requirements shall apply to this section.

B. The requirements of Section 15010 - General Mechanical shall apply to this section.

C. Division 7 - Firestopping, Sealants and Caulking for materials and methods for sealing pipe penetrations through basement walls and fire/smoke barriers.

1.03 APPLICABLE STANDARDS AND PUBLICATIONS

A. The design, equipment, installation, testing and maintenance of the Clean Agent Suppression System shall be in accordance with the applicable requirements set forth in the latest edition of the following codes and standards:
   1. -National Fire Protection Association (NFPA) Standards:
      a. NFPA 2001 Clean Agent Fire Extinguishing Systems
      b. NFPA 70 National Electric Code
      c. NFPA 72 National Fire Alarm Code
   2. Factory Mutual Systems (FM) Publications
      a. Factory Mutual Approval Guide
   3. Underwriters Laboratories, Inc. (UL) Publication
      a. -Fire Protection Equipment Directory with quarterly supplements
   4. National Electrical Manufacturers Association (NEMA) Publication
      a. Enclosures for Industrial Controls and Systems
   5. U.S. Environmental Protection Agency, Protection of Stratospheric Ozone 59 FR 13044 (SNAP)
   6. Requirements of the Authority Having Jurisdiction (AHJ), State and Local codes in force at time of award of contract

B. -The standards listed, as well as all other applicable codes, standards, and good engineering practices, shall be used as “minimum" design standards.

1.04 REQUIREMENTS

A. The Suppression System installation shall be made in accordance with the drawings, specifications, and applicable standards. Should a conflict occur between the drawings and specifications, the specifications shall prevail.

1.05 EXCLUSIONS

A. The work listed below shall be provided by others, or under other sections of this specification:
   1. 120 VAC or 220 VAC power supply to the system control panel
   2. Interlock wiring and conduit for shutdown of HVAC, dampers and/or electric power supplies, relays or shunt trip breakers

1.06 QUALITY ASSURANCE

A. MANUFACTURER
   1. Manufacturer shall provide State Fire Marshal with all technical information as well as installation instructions that apply to their systems and equipment sold, installed, serviced or tested in South Carolina.
   2. The name of the manufacturer shall appear on all major components.
   3. All devices, components, and equipment shall be the products of the same manufacturer, or supplied by the same manufacturer.
   4. All devices, components, and equipment shall be new, standard products of the manufacturer's latest design and suitable to perform the functions intended.
   5. All devices and equipment shall be UL listed and/or FM approved.
   6. Locks for all cabinets shall be keyed alike.

B. INSTALLER
   1. The installing contractor shall possess a valid permit issued by the Office of State Fire Marshal for the State of South Carolina.
   2. The installing contractor shall be trained by the supplier to design, install, test, and maintain fire suppression systems.
   3. When possible, the installing contractor shall employ a NICET certified special hazard designer, Level II or above, who will be responsible for this project.
   4. The installing contractor shall be an experienced firm regularly engaged in the installation of automatic clean agent, or similar, fire suppression systems, in strict accordance with all applicable codes and standards.
   5. The installing contractor must have a minimum of five (5) years experience in the design, installation, and testing, of clean agent, or similar fire suppression systems. A list of systems of a similar nature and scope shall be provided on request.
   6. The installing contractor shall maintain, or have access to, a clean agent recharging station. The installing contractor shall provide proof of his ability to recharge the largest clean agent system within 24 hours after a discharge. Include the amount of bulk agent storage available.
   7. The installing contractor shall be an authorized stocking distributor of the clean agent system equipment so that immediate replacement parts are available from inventory.
   8. The installing contractor shall show proof of emergency service available on a twenty-four-hour-seven-day-a-week basis.

C. SUBMITTALS
   1. The installing contractor shall submit the following design information and drawings for approval prior to starting work on this project:
      a. Field installation layout drawings having a scale of not less than 1/8 in. = 1 ft.- 0 in. or 1:100 detailing the location of all agent storage tanks, nozzles, pipe runs, including pipe sizes and lengths, control panel(s), detectors, manual pull stations, abort stations, audible and visual alarms, etc.

b. Auxiliary details and information such as maintenance panels, door holders, special sealing requirements, and equipment shutdown.
c. Separate layouts, or drawings, shall be provided for each level, (i.e.; room, sub floor, and above ceiling) and for mechanical and electrical work.
d. Electrical layout drawings shall show the location of all devices and include point-to-point conduit runs and a description of the method(s) used for detector mounting.
e. Provide an internal control panel wiring diagram which shall include power supply requirements and field wiring termination points.
f. Separate drawing providing symbol legend and identifying all symbols used.
g. Annunciator wiring schematics and dimensioned display panel illustration shall be provided. (Optional device.)
h. Complete hydraulic flow calculations, from a UL listed computer program, shall be provided for all engineered clean agent systems. Calculation sheet(s) must include the manufacturer's name and UL listing number for verification. The individual sections of pipe and each fitting to be used, as shown on the isometrics, must be identified and included in the calculation. Total agent discharge time must be shown and detailed by zone.
i. Provide calculations for the battery stand-by power supply, taking into consideration the power requirements of all alarms, initiating devices, and auxiliary components under full load conditions.
j. A complete sequence of operation shall be submitted detailing all alarm devices, shutdown functions, remote signaling, damper operation, time delay, and agent discharge for each zone or system.

2. Submit drawings, calculations and system component sheets for approval to the local fire prevention agency, owner's insurance underwriter, and all other authorities having jurisdiction before starting installation. Submit approved plans to the architect/engineer for record.

PART 2 PRODUCTS

2.01 System Description and Operation

A. The system shall provide a minimum design concentration of 4.2% 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.

B. The system shall be complete in all ways. It shall include a mechanical and electrical installation, all detection and control equipment, agent storage containers, 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 Clean Agent suppression system.

C. Provide two (2) 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.

D. The general contractor shall be responsible for sealing and securing the protected spaces

against agent loss and/or leakage during the 10-minute "hold" period.

E. The system(s) shall be actuated by a combination of ionization and photoelectric detectors installed for maximum area coverage of 250 sq. ft. (23.2 m) per detector, in both the room, under floor and above ceiling protected spaces. If the airflow is one air change per minute, photoelectric detectors only shall be installed for maximum area coverage of 125 sq. ft. (11.6 m) per detector. (Ref. NFPA No. 72.)

F. Detectors shall be Cross-Zoned detection requiring two detectors to be in alarm before release.

G. Automatic operation of each protected area shall be as follows:
   1. Actuation of one (1) 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.
   3. After completion of the time-delay sequence, the Clean Agent system shall discharge and the following shall occur:
      a. Illuminate a "SYSTEM FIRED" lamp on the control panel face.
      b. Shutdown of all power to high-voltage equipment.
      c. Energize a visual indicator(s) outside the hazard in which the discharge occurred.
      d. Energize a "System Fired" audible device. (Optional)
   4. 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.

2.02 Material and Equipment

A. GENERAL REQUIREMENTS
   1. The 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.
   2. All devices and equipment shall be U.L. Listed and/or FM approved.
   3. Each system shall have its own supply of clean agent.
   4. The system design can be modular, central storage, or a combination of both design criteria.
   5. Systems shall be designed in accordance with the manufacturer's guidelines.

6. Each supply shall be located within the hazard area, or as near as possible, to reduce the amount of pipe and fittings required to install the system.
7. The clean agent shall be stored in Clean Agent storage tanks. Tanks shall be super-pressurized with dry nitrogen to an operating pressure of 360 psi @ 70 °F (24.8 bar at 21 °C). Tanks shall be of high-strength low alloy steel construction and conforming to NFPA 2001.
8. 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.
9. 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 below 290 psi (20 bar). The pressure gauge shall be color coded to provide an easy, visual indication of container pressure.
10. Tanks shall have a pressure relief provision that automatically operates before the internal nominal pressure exceeds 730 psi (50 bar).
11. Engineered discharge nozzles shall be provided within the manufacturer's guidelines to distribute the clean 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.
12. 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.
    a. All piping shall be reamed, blown clear and swabbed with suitable solvents to remove burrs, mill varnish and cutting oils before assembly.
    b. All pipe threads shall be sealed with Teflon tape pipe sealant applied to the male thread only.

B. AGENT
1. Agent shall not contain any Hydrofluorocarbons (HFC).

C. CONTROL PANEL
1. The control panel shall be an AUTOPULSE releasing panel supplied by ANSUL INCORPORATED or approved equal.
2. The detection control system and its components shall be UL listed and FM approved for use as a local fire alarm system with releasing device service.
3. The control system shall perform all functions necessary to operate the system detection, actuation, and auxiliary functions.
4. -The control system shall include battery standby power to support 24 hours in standby and 5 minutes in alarm.
5. The control system shall be microprocessor based, utilizing a distributed processing concept. A single microprocessor failure shall not impact operation of additional modules in the system.
6. The control system shall be capable of supporting Cross Zoned Detection.
7. The control system shall supply integrated 2.0 amp (minimum) power supply circuitry.

8. Each control system shall contain four (4) initiating circuits:
    a. Each circuit shall be capable of Class A (Style D) or Class B (Style A) operation.
    b. Each circuit shall be capable of operating up to fifteen (15) approved detectors or thirty (30) detectors per system.
    c. Each circuit shall be capable of monitoring contact devices configured for manual release, manual alarm, system abort, trouble input or auxiliary (non-fire) input.
        1) Each control system shall contain release circuits for activation of a fire suppression system(s):
            (a) Each circuit shall be capable of Class B (Style Y) operation.
            (b) Each circuit shall be rated for a minimum of 1.5 amp @ 24 VDC.
9. Each control system shall contain two (2) indicating appliance circuits for annunciation:
    a. Each circuit shall be capable of Class A (Style B) or Class B (Style Y) operation.
    b. Each circuit shall be rated for a minimum of 1.5 amp @ 24 VDC.
10. Each control system shall provide an auxiliary power supply rated for 2 amps @ 24 VDC.
11. Each control system shall provide two (2) SPST relays: one for common alarm and one for common trouble. Four (4) additional programmable relays can be added to each control system by adding a relay module.

D. DETECTORS
1. The detectors shall be spaced and installed in accordance with the manufacturer's specifications and the guidelines of NFPA 72.
2. The ionization detector shall be an Ansul model.
3. The photoelectric detector shall be an Ansul model.

E. MANUAL RELEASE (Electric)
1. The electric manual release shall be a dual action device which provides a means of manually discharging the suppression system when used in conjunction with the detection system.
2. The manual release or manual pull station shall be a dual action device requiring two distinct operations to initiate a system actuation.
3. Manual actuation shall bypass the time delay and abort functions and shall cause all release and shutdown devices to operate in the same manner as if the system had operated automatically.
4. Manual release shall be located at each exit from the protected hazard.

F. ABORT STATION (Optional)
1. The optional abort station shall be the "Dead Man" type and shall be located next to each manual release.
2. The abort station shall be supervised and shall indicate a trouble condition at the control panel, if depressed, and no alarm condition exists.
3. "Locking" or "Keyed" abort stations shall not be permitted.

G. AUDIBLE and VISUAL ALARMS
1. Alarm audible and visual signal devices shall operate from the control panel.
2. The alarm bell, alarm horn, and horn strobe devices shall be an Ansul model.
3. The visual alarm unit shall be an Ansul strobe device.
4. A strobe device shall be placed outside, and above, each exit door from the protected space. Provide an advisory sign at each light location.

H. CAUTION and ADVISORY SIGNS
1. Signs shall be provided to comply with NFPA 2001 and the recommendations of the equipment provider.
   a. Entrance sign: (1) required at each entrance to a protected space.
   b. Manual discharge sign: (1) required at each manual release station.
   c. Flashing light sign: (1) required at each flashing light over each exit from a protected space.

I. SYSTEM and CONTROL WIRING
1. All system wiring shall be furnished and installed by the contractor.
2. All wiring shall be installed in electrical metallic tubing (EMT), or conduit, and must be installed and kept separate from all other building wiring.
3. All system components shall be securely supported independent of the wiring. Runs of conduit and wiring shall be straight, neatly arranged, properly supported, and installed parallel and perpendicular to walls and partitions.
4. The sizes of the conductors shall be those specified by the manufacturer. Color-coded wire shall be used. All wires shall be tagged at all junction points and shall be free from shorts, earth connections (unless so noted on the system drawings), and crosses between conductors. Final terminations between the control panel and the system field wiring shall be made under the direct supervision of a factory-trained representative.
5. All wiring shall be installed by qualified individuals, in a neat and workmanlike manner, to conform to the National Electrical Code, Article 725 and Article 760, except as otherwise permitted for limited energy circuits, as described in NFPA 72. Wiring installation shall meet all local, state, province, and/or country codes.
6. The complete system electrical installation and all auxiliary components shall be connected to earth ground in accordance with the National Electrical Code.

PART 3 EXECUTION

3.01 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 (5) 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.

3.02 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.

3.03 OPERATION and MAINTENANCE

A. Prior to final acceptance, the installing contractor shall provide four (4) 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.

3.04 AS-BUILT DRAWINGS

A. Upon completion of each system, the installing contractor shall provide four (4) copies of system "AS-Built" drawings to the owner. The drawings shall show actual installation details including all equipment locations (ie., 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 (1) copy of reproducible engineering drawings shall be provided reflecting all actual installation details.

3.05 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 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 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 Retro-Tec Corp. 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.

3.06 SYSTEM INSPECTIONS

A. During the one-year warranty period, the installing contractor shall provide two (2) inspections of each system installed under this contract. The first inspection shall be at the six-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.

3.07 WARRANTY

A. All system components furnished and installed under this contract shall be warranted against defects in design, materials and workmanship for the full warranty period which is standard with the manufacturer, but in no case less than one (1) year from the date of system acceptance.

END OF SECTION

SECTION 15410 - PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water closets.

B. Urinals.

C. Lavatories.

D. Sinks.

E. Service sinks.

F. Electric water coolers.

1.02 RELATED REQUIREMENTS

A. Section 07900 - Joint Sealers: Seal fixtures to walls and floors.

B. Section 15145 - Plumbing Piping.

C. Section 15146 - Plumbing Specialties.

D. Section 16155 - Equipment Wiring:

1.03 REFERENCE STANDARDS

A. ASME A112.18.1 - Plumbing Supply Fittings; The American Society of Mechanical Engineers; 2011.

B. ASME A112.19.2 - Vitreous China Plumbing Fixtures and Hydraulic Requirements for Water Closets and Urinals; The American Society of Mechanical Engineers; 2008.

C. ASME A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use); The American Society of Mechanical Engineers; 2008.

D. ASME A112.19.5 - Trim for Water-Closet Bowls, Tanks and Urinals; The American Society of Mechanical Engineers; 2011.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

C. Manufacturer's Instructions: Indicate installation methods and procedures.

D. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

F. Operation and Maintenance Manuals: Include in manuals the information listed below. For information on how to prepare and submit manuals see section 1780 (Closeout Submittals).

G. Recommended spare parts

H. Spare parts lists

I. Operating instructions

J. Maintenance instructions, including preventative and corrective maintenance.

K. Copies of warranties

L. Shop drawings and product data

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.07 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.09 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

PRODUCTS

2.01 MANUFACTURERS

A. Plumbing Fixtures (Water Closets, Urinals, and Lavatories)
   1. American Standard; U.S. Plumbing Products
   2. Crane
   3. Kohler Co.
   4. Eljer Co.

B. Faucets:
   1. American Standard
   2. Kohler Co.
   3. Chicago Faucet
   4. T & S Brass
   5. Just Mfg. Co.
   6. Moen, Inc.
   7. Delta Faucet Co.
   8. Cambridge Brass

C. Supplies and P-traps:
   1. American Standard

2. Kohler Co.
3. Chicago Faucet
4. T & S Brass
5. Cambridge Brass
6. McGuire Manufactuing Co.

D. ADA Trim Insulation
1. McGuire ProWrap
2. Plumberex
3. Tru Boro

E. Flush Valves
1. Delany
2. Sloan Valve Co.
3. Zurn Industries, Inc.

F. Fixture Seats:
1. Bemis
2. Beneke Corp.
3. Forbes-Wright Industries, Inc.: Church Products
4. Olsonite Corp.; Olsonite Seats

G. Stainless Steel Sinks:
1. Elkay Mfg. Co.
2. Just Mfg. Co.
3. Whitehall Manufacturing, Inc.

H. Mop Service Basins
1. Acorn Engineering Company
2. Fiat

2.02 ELECTRIC WATER COOLERS

A. Electric Water Cooler Manufacturers:
1. Helsey Taylor
2. Elkay Manufacturing Company: www.elkay.com.
3. Haws Corporation: www.hawsco.com.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

3.02 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.03 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.04 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.05 CLEANING

A. Clean plumbing fixtures and equipment.

3.06 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Repair or replace damaged products before Date of Substantial Completion.

3.07 SCHEDULES

A. Fixture Heights: Install fixtures to heights above finished floor as indicated.
   1. Water Closet:
      a. Standard: 15 inches to top of bowl rim.
      b. Accessible: 18 inches to top of seat.
   2. Water Closet Flush Valves:
      a. Standard: 11 inches min. above bowl rim.
      b. Recessed: 10 inches min. above bowl rim.
   3. Urinal:
      a. Standard: 22 inches to top of bowl rim.
      b. Accessible: 17 inches to top of bowl rim.
   4. Lavatory:
      a. Standard: 31 inches to top of basin rim.
      b. Accessible: 34 inches to top of basin rim.
   5. Drinking Fountain:
      a. Standard Adult: 40 inches to top of basin rim.
      b. Accessible: 36 inches to top of spout.

B. Fixture Rough-In
   1. Water Closet (Flush Valve Type):
      a. Cold Water: 1 Inch.
      b. Waste: 3 Inch.
      c. Vent: 2 Inch.
   2. Urinal (Flush Valve Type):
      a. Cold Water: 3/4 Inch.
      b. Waste: 2 Inch.
      c. Vent: 1-1/2 Inch.
   3. Lavatory:
      a. Hot Water: 1/2 Inch.
      b. Cold Water: 1/2 Inch.
      c. Waste: 1-1/2 Inch.
      d. Vent: 1-1/4 Inch.
   4. Sink:
      a. Hot Water: 1/2 Inch.
      b. Cold Water: 1/2 Inch.
      c. Waste: 1-1/2 Inch.
      d. Vent: 1-1/4 Inch.

5. Service Sink:
   a. Hot Water: 1/2 Inch.
   b. Cold Water: 1/2 Inch.
   c. Waste: 3 Inch.
   d. Vent: 1-1/2 Inch.
6. Drinking Fountain:
   a. Cold Water: 1/2 Inch.
   b. Waste: 1-1/4 Inch.
   c. Vent: 1-1/4 Inch.

END OF SECTION

SECTION 15720 - AIR HANDLING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Factory fabricated assembly of modular sections consisting of housed centrifugal or plenum fans with belt or direct drives, coils, filters, and other necessary modules to perform one or more of the functions of circulating, cleaning, heating, cooling, humidification, dehumidification, and mixing of air with construction suitable for indoor or outdoor applications.

B. Modular Air Handler

1.02 RELATED REQUIREMENTS

A. Section 15065 - Motors for Mechanical Equipment.

B. Section 15073 - Vibration and Seismic Controls for HVAC Piping and Equipment.

C. Section 15080 - Mechanical Insulation

1.03 REFERENCE STANDARDS

A. ABMA STD 11 - Load Ratings and Fatigue Life for Roller Bearings; American Bearing Manufacturers Association, Inc.; 1990 (Reapproved 2008).

B. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data:
   1. Published Literature: Indicate dimensions, weights, capacities, ratings, gages and finishes of materials, and electrical characteristics and connection requirements.
   2. Filters: Data for filter media, filter performance data, filter assembly, and filter frames.
   3. Fans: Performance and fan curves with specified operating point clearly plotted, power, RPM.
   4. Sound Power Level Data: Fan outlet and casing radiation at rated capacity.
   5. Electrical Requirements: Power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

C. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.

D. Manufacturer's Instructions: Include installation instructions.

E. Maintenance Data: Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01600 - Product Requirements, for additional provisions.

2. Extra Filters: One set for each unit.

G. Operation and Maintenance Manuals: Include in manuals the information listed below. For information on how to prepare and submit manuals see section 1780 (Closeout Submittals).
1. Recommended spare parts
2. Spare parts lists
3. Operating instructions
4. Maintenance instructions, including preventative and corrective maintenance.
5. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
6. Copies of warranties
7. Wiring diagrams
8. Shop drawings and product data

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept products on site in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Inspect for damage.

B. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

C. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.08 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Provide three year manufacturer warranty for air handling units.

PART 2 PRODUCTS

2.01 See Section 01600 for additional requirements.

2.02 Modular Air Handler Manufacturers

A. The Carrier Corporation: www.carrier.com.

B. McQuay: www.mcquay.com

C. York/Johnson Controls: http://www.johnsoncontrols.com

D. Substitutions: See Section 01600 - Product Requirement

2.03 GENERAL DESCRIPTION

A. Configuration: Fabricate as detailed on drawings.

B. Performance: Conform to AHRI 430. See schedules on prints. (NOTE: above does not apply to fan array)

2.04 UNIT CONSTRUCTION

A. Fabricate unit with heavy gauge channel posts and panels secured with mechanical fasteners. All panels, access doors, and ship sections shall be sealed with permanently applied bulb-type gasket. Shipped loose gasketing is not allowed.

B. Panels and access doors shall be constructed as a 2-inch nominal thick; thermal broke double wall assembly, injected with foam insulation with an R-value of not less than R-13.
   1. The inner liner shall be constructed of G90 galvanized steel.
   2. The outer panel shall be constructed of galvanized steel.
   3. The floor plate shall be constructed as specified for the inner liner.
   4. Unit will be furnished with solid inner liners.

C. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, maximum 5 inches of positive or 6 inches of negative static pressure. Deflection shall be measured at the panel midpoint.

D. The casing leakage rate shall not exceed .5 cfm per square foot of cabinet area at 5 inches of positive static pressure or 6 inches of negative static pressure (.0025 m3/s per square meter of cabinet area at 1.24 kPa static pressure).

E. Module to module field assembly shall be accomplished with an overlapping, full perimeter internal splice joint that is sealed with bulb type gasketing on both mating modules to minimize on-site labor and meet indoor air quality standards.

F. Access doors shall be flush mounted to cabinetry, with minimum of two six inch long stainless steel piano-type hinges, latch and full size handle assembly. Access doors shall swing outward for unit sections under negative pressure. Access doors on positive pressure sections, shall have a secondary latch to relieve pressure and prevent injury upon access.

G. A 6-inch (12-inch for AHU-3A and AHU-3B) formed G60 galvanized steel base rail shall be provided by the unit manufacturer for structural rigidity and condensate trapping.. The base rail shall be constructed with 12-gauge nominal for unit sizes 003 - 035 and 10-gauge nominal for unit sizes 040 - 090. The following calculation shall determine the required height of the baserail to allow for adequate drainage. Use the largest pressure to determine base rail height. [(Negative)(Positive) static pressure (in)] (2) + 4” = required baserail height. Should the unit baserail not be factory supplied at this height, the contractor is required to supply a concrete housekeeping pad to make up the difference.

H. Construct drain pans from stainless steel with cross break and double sloping pitch to drain connection. Provide drain pans under cooling coil section. Drain connection centerline shall be a minimum of 3" above the base rail to aid in proper condensate trapping. Drain connections that protrude from the base rail are not acceptable. There must be a full 2" thickness of insulation under drain pan.

2.05 FAN ASSEMBLIES

A. Acceptable fan assembly shall be a single width, single inlet, class II, direct-drive type

plenum fan dynamically balanced as an assembly, as shown in schedule. Maximum fan RPM shall be below first critical fan speed. Fan assemblies shall be dynamically balanced by the manufacturer on all three planes. Provide access to motor and fan assembly through hinged access door.

1. Unit shall have two 9 blade direct drive class II fans. (AHU-1)
2. Manual block-off mounted upstream of fan for isolation of individual fans. (AHU-1)
3. Single source power motor control panel with short circuit protection factory wired from panel to motors in conduit shall be provided. (AHU-1)

B. Fan and motor shall be mounted internally on a steel base. Factory mount motor on slide base that can be slid out the side of the unit if removal is required. Provide access to motor, drive, and bearings through hinged access door. Fan and motor assembly shall be mounted on 2" deflection spring vibration type isolators inside cabinetry.

2.06 BEARINGS, SHAFTS, AND DRIVES

A. Bearings: Basic load rating computed in accordance with AFBMA - ANSI Standards. The bearings shall be provided on the motor with the fan wheel mounted directly on the motor shaft, AMCA arrangement 4.

B. Shafts shall be solid, hot rolled steel, ground and polished, keyed to shaft, and protectively coated with lubricating oil. Hollow shafts are not acceptable.

C. The fan wheel shall be direct coupled to the motor shaft. The wheel width shall be determined by motor speed and fan performance characteristics.

2.07 ELECTRICAL

A. Fan motors shall be manufacturer provided and installed, Open Drip Proof, premium efficiency (meets or exceeds EPAct requirements), 1750 RPM, single speed, 460V / 60HZ / 3P. Complete electrical characteristics for each fan motor shall be as shown in schedule.

B. The air handler(s) shall be ETL listed by Intertek Testing Services, Inc. Units shall conform to bi-national standard ANSI/UL Standard 1995/CSA Standard C22.2 No. 236.

C. Wiring Termination: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclosed terminal lugs in terminal box sized to NFPA 70.

D. Manufacturer shall provide ASHRAE 90.1 Energy Efficiency equation details for individual equipment to assist Building Engineer for calculating system compliance.

E. Installing contractor shall provide GFI receptacle within 25 feet of unit to satisfy National Electrical Code requirements.

F. Air handler manufacturer shall provide, mount and wire variable speed drive with electrical characteristics such as indicated on project schedule and shown on manufacturer's data sheets.

2.08 COOLING AND HEATING COILS

A. Certification: Acceptable water cooling, water heating, steam, and refrigerant coils shall be certified in accordance with AHRI Standard 410 and bear the AHRI label. Coils exceeding the scope of the manufacturer's certification and/or the range of AHRI's standard rating conditions will be considered provided the manufacturer is a current member of the AHRI

Forced Circulation Air-Cooling and Air-Heating Coils certification programs and that the coils have been rated in accordance with AHRI Standard 410. Manufacturer must be ISO 9002 certified.

B. Water cooling coil shall be provided. Provide access to coil(s) for service and cleaning. Enclose coil headers and return bends fully within unit casing. Unit shall be provided with coil connections that extend a minimum of 5" beyond unit casing for ease of installation. Drain and vent connections shall be provided exterior to unit casing. Coil connections must be factory sealed with grommets on interior and exterior panel liners to minimize air leakage and condensation inside panel assembly. If not factory packaged, Contractor must supply all coil connection grommets and sleeves. Coils shall be removable through side and/or top panels of unit without the need to remove and disassemble the entire section from the unit.
   1. Headers shall consist of seamless copper tubing to assure compatibility with primary surface. Headers to have intruded tube holes to provide maximum brazing surface for tube to header joint, strength, and inherent flexibility. Header diameter should vary with fluid flow requirements.
   2. Fins shall have a minimum thickness of 0.0075 inch aluminum plate construction. Fins shall have full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Tubes shall be mechanically expanded into the fins to provide a continuous primary to secondary compression bond over the entire finned length for maximum heat transfer rates. Bare copper tubes shall not be visible between fins.
   3. Coil tubes shall be 5/8 inch OD seamless copper, 0.020 inch nominal tube wall thickness, expanded into fins, brazed at joints. Soldered U-bends shall be provided to minimize the effects of erosion and premature failure having a minimum tube wall thickness of .025 inches.
   4. Coil connections shall be carbon steel, NPT threaded connection. Connection size to be determined by manufacturer based upon the most efficient coil circuiting. Vent and drain fittings shall be furnished on the connections, exterior to the air handler. Vent connections provided at the highest point to assure proper venting. Drain connections shall be provided at the lowest point to insure complete drainage and prevent freeze-up.
   5. Coil casing shall be a formed channel frame of galvanized steel.

C. Water heating coil shall be provided. Provide access to coil(s) for service and cleaning. Enclose coil headers and return bends fully within unit casing. Unit shall be provided with coil connections that extend a minimum of 5" beyond unit casing for ease of installation. Drain and vent connections shall be provided exterior to unit casing. Coil connections must be factory sealed with grommets on interior and exterior panel liners to minimize air leakage and condensation inside panel assembly. If not factory packaged, Contractor must supply all coil connection grommets and sleeves. Coils shall be removable through side and/or top panels of unit without the need to remove and disassemble the entire section from the unit.
   1. Headers shall consist of seamless copper tubing to assure compatibility with primary surface. Headers to have intruded tube holes to provide maximum brazing surface for tube to header joint, strength, and inherent flexibility. Header diameter should vary with fluid flow requirements.
   2. Fins shall have a minimum thickness of 0.0075 inch aluminum plate construction. Fins

shall have full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Tubes shall be mechanically expanded into the fins to provide a continuous primary to secondary compression bond over the entire finned length for maximum heat transfer rates. Bare copper tubes shall not be visible between fins.

3. Coil tubes shall be 5/8 inch OD seamless copper, 0.020 inch nominal tube wall thickness, expanded into fins, brazed at joints. Soldered U-bends shall be provided to minimize the effects of erosion and premature failure having a minimum tube wall thickness of .025 inches.
4. Coil connections shall be carbon steel, threaded connection. Connection size to be determined by manufacturer based upon the most efficient coil circuiting. Vent and drain fittings shall be furnished on the connections, exterior to the air handler. Vent connections provided at the highest point to assure proper venting. Drain connections shall be provided at the lowest point to insure complete drainage and prevent freeze-up.
5. Coil shall be furnished as an uncased galvanized steel track to allow for thermal movement and slide into a pitched track for fluid drainage.

2.09 FILTERS

A. Furnish angled filter in mixing box section with 2-inch pleated MERV 8 filter with microbial resistant Intersept coating. Provide side loading and removal of filters.

B. Filter media shall be UL 900 listed, Class I or Class II.

C. Filter Magnehelic gauge(s) shall be furnished and mounted by equipment manufacturer.

2.10 ADDITIONAL SECTIONS

A. Mixing box section shall be provided with end outside air opening and top return air opening with or without parallel low leak airfoil damper blades. Dampers shall be hollow core galvanized steel airfoil blades, fully gasketed and have continuous vinyl seals between damper blades in a galvanized steel frame. Dampers shall have stainless steel jamb seals along end of dampers. Connecting linkage and ABS plastic end caps shall be provided when return and outside air dampers are each sized for full airflow. Return and outside air dampers of different sizes must be driven separately. Damper Leakage: Leakage rate shall be less than two tenths of one percent leakage at 2 inches static pressure differential. Leakage rate tested in accordance with AMCA Standard 500.

2.11 VARIABLE FREQUENCY DRIVES

A. Provide factory mounted variable frequency drives for AHU-1, 2A, 2B, 3A, 3B.

B. Refer to section 15066

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Bolt sections together with gaskets.

C. Install flexible duct connections between fan inlet and discharge ductwork and air handling unit sections. Ensure that metal bands of connectors are parallel with minimum one inch

flex between ductwork and fan while running.

D. Install assembled unit on vibration isolators. Install isolated fans with resilient mountings and flexible electrical leads. Install restraining snubbers as required. Refer to Section 15073. Adjust snubbers to prevent tension in flexible connectors when fan is operating.

E. Make connections to coils with unions or flanges.

END OF SECTION

SECTION 15738 - COMPUTER ROOM AIR CONDITIONING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air conditioning units.

B. Controls and control panels.

1.02 RELATED REQUIREMENTS

A. Section 16155 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. ASHRAE Std 52.1 - Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 1992.

B. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2007.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide for manufactured products and assemblies. Indicate water, drain, refrigeration, rough-in connections, and electrical characteristics and connection requirements.

C. Shop Drawings: Indicate manufactured products and assemblies. Indicate water, drain, refrigeration, rough-in connections, and electrical characteristics and connection requirements.

D. Manufacturer's Instructions: Indicate assembly, support details, connection requirements, and include start-up instructions.

E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.

F. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01600 - Product Requirements, for additional provisions.
   2. Extra Filters: One set for each individual unit.

H. Operation and Maintenance Manuals: Include in manuals the information listed below. For information on how to prepare and submit manuals see section 1780 (Closeout Submittals).
   1. Local representative
   2. Recommended spare parts
   3. Spare parts lists
   4. Operating instructions
   5. Maintenance instructions, including preventative and corrective maintenance.

6. Copies of warranties
7. Wiring diagrams
8. Shop drawings and product data

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Warranty: Include coverage of refrigeration compressors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Liebert Corporation: www.liebert.com.

B. Substitutions: See Section 01600 - Product Requirements.

2.02 Frame

A. The frame shall be MIG welded, formed sheet metal. It shall be protected against corrosion using the autophoretic coating process. The frame shall be capable of being separated into three parts in the field to accommodate rigging through small spaces.

2.03 Downflow Air Supply

A. The supply air shall exit from the bottom of the unit with the air scrolled towards the front of the unit.

2.04 Downflow Air Return

A. The return air shall enter the unit from the top.

2.05 Exterior Panels

A. The exterior panels shall be insulated with a minimum 1 in. (25mm), 1.5 lb. (0.68 kg) density fiber insulation. The main front panel shall have captive 1/4 turn fasteners.

2.06 Filters, Downflow Unit

A. The filter chamber shall be located within the cabinet, and filters shall be removable from the top of the unit. Filters shall be arranged in a V-bank configuration to minimize air pressure drop.

2.07 Filters, 2" Pre-Filter With 2" Filter

A. Filters shall be 2" ASHRAE 52.2 MERV7 (40% ASHRAE 52.1) pre-filter, with 2" ASHRAE 52.2 MERV11 (60-65% ASHRAE 52.1) efficiency filter.

2.08 Extra Filter Set

A. 2 extra set(s) of filters shall be provided per system.

2.09 Fan section

A. Centrifugal Blower Section
   1. The fans shall be the centrifugal type, double width double inlet and shall be dynamically balanced as a completed assembly. The shaft shall be heavy duty steel with self-aligning, permanently sealed, pillow block bearings with a minimum L3 life of 200,000 hours. The fans shall draw air through the A-frame coil to ensure even air distribution and maximum coil performance. A static regain duct shall be factory-installed to the bottom of the blower.
   2. Motor
      a. The fan motor shall be mounted to an automatic, spring-tensioning base. The motor shall be removable from the front of the cabinet.
   3. Premium Efficiency Motor
      a. The fan motor shall be Open Drip-Proof, Premium efficiency and shall meet NEMA Premium standard.
   4. Drive Package
      a. The motor sheave and fan pulley shall be double-width fixed pitch. Two belts, sized for 200% of the fan motor horsepower shall be provided with the drive package. An auto-tension system shall provide constant tension on the belts. Belts, shaft, blower bearings, sheave and pulley shall be warranted for five years (parts only).

2.10 Humidifier

A. A humidifier shall be factory-installed inside the unit. Bypass air slots shall be included to enable moisture to be absorbed into the air stream. The humidifier shall be removable from the front of the cabinet.

B. Infrared Humidifier
   1. The humidifier shall be of the infrared type consisting of high intensity quartz lamps mounted above and out of the water supply. The humidifier pan shall be stainless steel and arranged to be removable without disconnecting high voltage electrical connections. The complete humidifier section shall be pre-piped, ready for field connection to water supply. The humidifier shall be equipped with an automatic water supply system and shall have an adjustable water-overfeed to prevent mineral precipitation. A high-water detector shall shut down the humidifier to prevent overflowing. A factory-provided air-gap shall prevent backflow of the humidifier supply water.

2.11 Reheat

A. The environmental control unit shall include a factory-installed reheat to control temperature during dehumidification.

B. SCR Electric Reheat
   1. The electric reheat coils shall be low watt density, 304/304 stainless steel fin tubular construction, protected by thermal safety switches, controlled by multiple pulses to achieve tight temperature control. The reheat elements shall be removable from the front of the cabinet.

2.12 Dual Refrigeration System

A. Each unit shall include two (2) independent refrigeration circuits and shall include hot gas

mufflers (semi-hermetic compressors units only), liquid line filter driers, refrigerant sight glass with moisture indicator, externally equalized expansion valves and liquid line solenoid valves. Compressors shall be located outside the airstream and shall be removable and serviceable from the front of the unit.

B. Digital Scroll Compressors
   1. The compressor shall be scroll-type with a variable capacity operation capability. Compressor solenoid valve shall unload the compressor and allow for variable capacity operation. The compressor shall be suction gas cooled motor, vibration isolators, thermal overloads, automatic reset high pressure switch with lockout after three failures, rotalock service valves, pump down low pressure transducer, suction line strainer, and a maximum operating speed of 3500 RPM. Consult factory for 575V availability.

2.13 Evaporator Coil

A. The evaporator coil shall be A-frame design with offset orientation, three rows deep. It shall be constructed of rifled copper tubes and aluminum fins. A stainless steel condensate drain pan shall be provided.

2.14 R-407C Refrigerant

A. The system shall be designed for use with R-407C refrigerant, which meets the EPA clean air act for phase-out of HCFC refrigerants.

2.15 Microprocessor Control With Small Graphic Display

A. The unit controls shall be factory-set for Intelligent Control, which uses “fuzzy logic” and “expert systems” methods. Proportional and Tunable PID shall also be user-selectable options. Internal unit component control shall include the following:
   1. Compressor Short Cycle Control - Prevents compressor short-cycling and needless compressor wear.
   2. System Auto Restart - The auto restart feature shall automatically restart the system after a power failure. Time delay is programmable.
   3. Sequential Load Activation - On initial startup or restart after power failure, each operational load is sequenced with a minimum of one second delay to minimize total inrush current.
   4. Predictive Humidity Control - calculates the moisture content in the room and prevents unnecessary humidification and dehumidification cycles by responding to changes in dew point temperature.
   5. The control processor shall be compatible with all remote monitoring and control devices. Options are available for BMS interface via Modbus, Jbus, BACnet, Profibus and SNMP.
   6. The control processor shall be microprocessor based with a 128x64 dot matrix graphic front monitor display and control keys for user inputs mounted in an ergonomic, aesthetically pleasing housing. The display and housing shall be viewable while the unit panels are open or closed. The controls shall be menu-driven. The display shall be organized into three main sections: User Menus, Service Menus and Advanced Menus. The system shall display user menus for active alarms, event log, graphic data, unit view/status overview (including the monitoring of room conditions, operational status in % of each function, date and time), total run hours, various sensors, display setup

and service contacts. A password shall be required to make system changes within the service menus. Service menus shall include setpoints, standby settings (lead/lag), timers/sleep mode, alarm setup, sensor calibration, maintenance/wellness settings, options setup, system/network setup, auxiliary boards and diagnostics/service mode. A password shall be required to access the advanced menus, which include the factory settings and password menus.

7. The User Menus Shall be Defined as Follows:
8. Active Alarms: Unit memory shall hold the 200 most recent alarms with time and date stamp for each alarm.
9. Event Log: Unit memory shall hold the 400 most recent events with ID number, time and date stamp for each event.
10. Graphic Data View: Eight graphic records shall be available: return air temperature, return air humidity, supply air temperature, outdoor temperature and four custom graphs.
11. Unit View - Status Overview: Simple or Graphical "Unit View" summary displays shall include temperature and humidity values, active functions (and percent of operation) and any alarms of the host unit.
12. Total Run Hours: Menu shall display accumulative component operating hours for major components including compressors, Econ-O-Coil (FC), fan motor, humidifier and reheat.
13. Various Sensors: Menu shall allow setup and display of optional custom sensors. The control shall include four customer-accessible analog inputs for sensors provided by others. The analog inputs shall accept a 4 to 20 mA signal. The user shall be able to change the input to 0 to 5VDC or 0 to 10VDC if desired. The gains for each analog input shall be programmable from the front display. The analog inputs shall be able to be monitored from the front display.
14. Display Setup: Customer shall pre-select the desired grouping of display languages at the time of the order from the following choices:
    a. Group 1: English, French, Italian, Spanish, German
    b. Group 2: English, Russian, Greek
    c. Group 3: English, Japanese, Chinese, Arabic
15. Service Contacts: Menu shall allow display of local service contact name and phone number.
16. The Service Menus Shall be Defined as Follows:
17. Setpoints: Menu shall allow setpoints within the following ranges:
    a. Temperature Setpoint: 65-85ºF (18-29ºC)*
    b. Temperature Sensitivity: +1-10ºF (0.6-5.6ºC)
    c. Humidity Setpoint: 20-80% RH*
    d. Humidity Sensitivity: 1-30% RH
    e. High Temperature Alarm: 35-90ºF (2-32ºC)
    f. Low Temperature Alarm: 35-90ºF (2-32ºC)
    g. High Humidity Alarm: 15-85% RH
    h. Low Humidity Alarm: 15-85% RH
    i. * The microprocessor may be set within these ranges, however, the unit may not be able to control to extreme combinations of temperature and humidity.
18. Standby Settings/Lead-Lag: Menu shall allow planned rotation or emergency rotation of operating and standby units.
19. Timers/Sleep Mode: Menu shall allow various customer settings for turning On/Off

unit.

20. Alarm Setup: Menu shall allow customer settings for alarm notification (audible/local/remote). The following alarms shall be available:
    a. High Temperature
    b. Low Temperature
    c. High Humidity
    d. Low Humidity
    e. Compressor Overload (Optional)
    f. Main Fan Overload (Optional)
    g. Humidifier Problem
    h. High Head Pressure
    i. Change Filter
    j. Fan Failure
    k. Low Suction Pressure
    l. Unit Off
21. Audible Alarm: The audible alarm shall annunciate any alarm that is enabled by the operator.
22. Common Alarm: A programmable common alarm shall be provided to interface user-selected alarms with a remote alarm device.
23. Remote Monitoring: All alarms shall be communicated to the Liebert monitoring system with the following information: date and time of occurrence, unit number and present temperature and humidity.
24. Sensor Calibration: Menu shall allow unit sensors to be calibrated with external sensors.
25. Maintenance/Wellness Settings: Menu shall allow reporting of potential component problems before they occur.
26. Options Setup: Menu shall provide operation settings for the installed components.
27. System/Network Setup: Menu shall allow Unit-to-Unit (U2U) communication and setup for Teamwork modes of operation (up to 32 units).
28. Teamwork Modes of Operation: Saves energy by preventing operation of units in opposite modes multiple units.
29. Auxiliary Boards: Menu shall allow setup of optional expansion boards.
30. Diagnostics/Service Mode: The Liebert iCOM control shall be provided with self-diagnostics to aid in troubleshooting. The microcontroller board shall be diagnosed and reported as pass/not pass. Control inputs shall be indicated as on or off at the front display. Control outputs shall be able to be turned on or off from the front display without using jumpers or a service terminal. Each control output shall be indicated by an LED on a circuit board.
31. Advanced Menus
    a. Factory Settings: Configuration settings shall be factory-set based on the pre-defined component operation.
    b. Change Passwords: Menu shall allow new passwords to be set or changed.

2.16 Miscellaneous Options

A. Locking Disconnect Switch
    1. The manual disconnect switch shall be mounted in the high voltage section of the electrical panel. The switch shall be accessible from the outside of the unit with the door closed and prevent access to the high voltage electrical components until switched

to the "OFF" position.

B. High Temperature Sensor
   1. The firestat shall be factory-installed in the unit and shall be factory-set to 125ºF (52ºC). It shall immediately shut down the environmental control system when activated. The sensor shall be mounted with the sensing element in the return air.

C. Smoke Sensor
   1. The smoke sensor shall immediately shut down the environmental control system and activate the alarm system when activated. The smoke sensor shall be mounted in the electrical panel with the sensing element in the return air compartment. The smoke sensor is not intended to function as or replace any room smoke detection system that may be required by local or national codes. The smoke sensor shall include a supervision contact closure.
   2. Smoke sensor shall also alarm BMS.

D. Condensate Pump, Dual Float
   1. The condensate pump shall have a minimum capacity of 145 GPH (548 l/h) at 20 ft. (58 kPa) head. It shall be complete with integral dual-float switches, pump-and-motor assembly and reservoir. The secondary float shall send a signal to the local alarm and shut down the unit upon high water condition.

2.17 Air-Cooled Systems

A. The indoor evaporator unit shall include refrigerant piping, with a factory holding charge of nitrogen. The hot-gas and liquid lines shall be spun shut and shall include a factory-installed Schrader valve. Field-relief of the Schrader valve shall indicate a leak-free system.

B. Air-Cooled Condenser
   1. The Liebert-manufactured outdoor air-cooled condenser shall be the low profile, multiple direct drive, propeller fan type. The condenser shall be constructed of aluminum and contain a copper tube, aluminum fin coil arranged for (horizontal) (vertical) air discharge.

C. Fan Speed Control
   1. The winter control system for the air-cooled condenser shall be Liebert Fan Speed Control. The variable speed motor shall operate from 0 to 230 volts single phase, 10 to 1050 RPM. It shall be designed with ball bearings, permanent lubrication, internal overload protection, 40°C rise at full speed, 65°C rise at 10 RPM. The control system shall be complete with transducers, thermostats and electrical control circuit, factory prepackaged in the integral condenser control box. The transducer shall automatically sense the highest head pressure of either operating compressor and control the variable speed fan on the air-cooled condenser to properly maintain the head pressure. The Liebert Fan Speed Control system shall provide positive startup and operation in ambient temperatures as low as -20°F (-28.9°C). The air-cooled condenser shall have a 480 volt, 3 ph 60 Hz power supply.

D. Condenser Disconnect Switch
   1. A disconnect switch shall be factory-mounted and wired to the condenser control panel, accessible from the exterior.

2.18 Liqui-tect Sensors

A. Provide solid state water sensors under the raised floor.

B. Alarm BMS when sensor alarms.

2.19 Floor Stand

A. The floor stand shall be constructed of a welded steel frame. The floor stand shall have adjustable legs with vibration isolation pads. The floor stand shall be 12 inches high.

2.20 Return Air Plenum for Downflow Units

A. The air plenum shall be constructed of 20 gauge steel, powder coated to match unit color. The plenum shall be 36" high. A door shall be included in the front of the plenum to enable front filter access. Air shall enter the plenum from the top.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Coordinate installation of computer room air conditioning units with computer room raised floor installer.

C. Coordinate with controls contractor to provide remote monitoring. All alarms should be brought back to the BMS.

D. Coordinate with controls contractor to provide equal run time for each computer room unit. Computer room unit shall be controled by a single common thermostat.

END OF SECTION

SECTION 15762 - TERMINAL HEAT TRANSFER UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fan-coil units.

1.02 RELATED REQUIREMENTS

A. Section 15065 - Motors for Mechanical Equipment.

1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide typical catalog of information including arrangements.

C. Shop Drawings:
1. Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.
2. Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required to actual heat output provided.
3. Indicate mechanical and electrical service locations and requirements.,

D. Manufacturer's Instructions: Indicate installation instructions and recommendations.

E. Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access or valving.

F. Operation and Maintenance Data: Include manufacturers descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

G. Warranty: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

H. Operation and Maintenance Manuals: Include in manuals the information listed below. For information on how to prepare and submit manuals see section 1780 (Closeout Submittals).
1. Recommended spare parts
2. Spare parts lists
3. Operating instructions
4. Maintenance instructions, including preventative and corrective maintenance.
5. Copies of warranties
6. Wiring diagrams
7. Shop drawings and product data

1.04 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Provide one year parts and labor manufacturers warranty for fan-coil unit.

PART 2 PRODUCTS

2.01 FAN-COIL UNITS

A. Manufacturers:
   1. McQuay International: www.mcquay.com.
   2. Johnson Controls
   3. Nailor Industries Inc.
   4. Substitutions: See Section 01600 - Product Requirements.

B. General Construction - All Units
   1. The unit includes a chassis, coil(s), fan wheel(s), fan casing(s), fan board and motor(s). Units also include a noncorrosive, ABS main drain pan, positively sloped in every plane and insulated with closed-cell insulation. All units with factory provided standard piping packages also include a noncorrosive secondary drain pan. Steel parts exposed to moisture are galvanized and if necessary are insulated to prevent condensation. The complete fan assembly, which includes the drain pan and motor is easily removed for service and maintenance. A quick-disconnect motor electrical plug is also provided. The standard chassis construction is 18-gage galvanized steel. The unit is acoustically and thermally insulated with closed-cell insulation.

C. Cabinet
   1. The exposed panels and cabinetry are aesthetically designed and fabricated of heavy gauge steel, available in either 18 or 16 gauge. They have an electrostatically applied, baked-on powder paint finish available in Antique Ivory as standard. Standard finish meets ASTM B117 specifications (salt spray test).

D. Vertical Cabinet
   1. Discharge air grilles are recessed to resist condensate formation and provided with either a multi-directional discharge air grille or a stamped metal grille. Multi-directional discharge air grilles allow the end-user to change the discharged air to four different directions by rotating in 90° increments. Painted and aesthetically designed metal hinged control access doors are made rigid by channel forming and constructed to be flush with the top panel. Units equipped with the tamperproof option have a key-operated locking access door and tamper-proof access door screws, as well as 16-gauge front and side panels to help prevent nuisance tampering with unit and/or controls. Individual and removable side panels are furnished on both ends of the unit to allow full access to valves, piping, electrical connections and optional secondary drain pan without the need to remove the front. The separate removable front panel allows full access to fans, motors and the main drain pan. When requesting a vertical cabinet it is strongly suggested to provide sub-bases. Subbases are 16-gage steel construction and have an oxford brown/black paint finish. The sub-base depth and width is identical to the unit's dimensions.

E. Coils
   1. All water coils are first leak tested at 400 psig (2760 kPa) then re-tested at 300 psig (690 kPa) after all final piping connections are made, including valve/piping packages. Maximum main coil working pressure is 300 psig (2,069 kPa). Maximum entering water temperature is 200°F (93°C). Tubes and u-bends are 3/8" (10 mm) OD copper. Fins are aluminum and are mechanically bonded to the copper tubes. Coil stubouts are 5/8" (16 mm) OD copper tubing. Piping connections are expanded to accept standard copper tubing 5/8" (16 mm) OD. Water coil fins have full drawn

collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Seamless copper tubes are mechanically expanded into the fins to provide a continuous primary-tosecondary compression bond over the entire finned length for maximum heat transfer rates. Water coils are provided with headers of seamless copper tubing with intruded tube holes to permit expansion and contraction without creating undue stress or strain. Coil casing are constructed of galvanized steel. Coil connections are copper sweat connections with connection size to be determined by manufacturer based upon the most efficient coil circuiting. Vent and drain connections are furnish soldered and installed on the primary coil by the coil connection. An air vent is provided for the secondary heating coil-factory installed when provided with a valve package, shipped loose when valve/piping packages are provided by others. Vent connections are provided at the highest point to ensure proper venting. Drain connections are at the lowest point.

F. Supply Fan
   1. Fan are dynamically balanced, forward curved, double-width centrifugal type constructed of 18 gauge galvanized steel for corrosion resistance. Fan housing construction is formed sheet metal.

G. Motor
   1. Supply fans are provided with permanent split-capacitor motors, high efficiency, with 3 speed tap as minimum and are run-tested in the assembled unit and permanently lubricated. All motors are UL and CSA listed and have integral thermal overload protection with a maximum ambient operating temperature of 104°F. Motors are capable of starting at 80 percent of rated voltage and operating at 90 percent of rated voltage on all speed settings. Motors can operate up to 10 percent overvoltage. Motor wires include a quick-disconnect motor plug for easy removability. Disconnect Switch A unit-mounted disconnect switch is available as a standard option on all units.

H. Filter Section
   1. Filters are 1" (25 mm) throwaway type. They are concealed from sight and easily removable. Other filter types can be provided upon request.

I. Piping Packages
   1. All piping packages are tested at 300 psig and re-tested once integrated and soldered to the coil at 300 psig (690 kPa) The maximum working pressure of the interconnecting piping is 300 psig (2,069 kPa).

J. Piping Packages - Placement and Configurations
   1. Shut off ball valve and strainer on the supply and manual circuit setter (flow control) and shut off ball valve on the return.
   2. The above valve/ping combinations package shall also have the following additional options:
      a. Unions on both supply and return
      b. P/T ports on both supply and return
      c. Strainer with clean-out draining valve

K. Control Valves
   1. Control valve shall be provided by the controls contractor.

L. Other Available Options

1. Tamperproof Locks
   a. Key-operated locking access doors and/or panels help prevent nuisance tampering with unit and/or controls.
2. Leveling Feet
   a. Screw-in bolts and mounting assembly is used to level the unit and is available on all vertical cabinet units. 1 inch adjustment for positive leveling.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install equipment exposed to finished areas after walls and ceiling are finished and painted. Do not damage equipment or finishes.

C. Fan-Coil Units: Install as indicated. Coordinate to assure correct recess size for recessed units.

3.02 CLEANING

A. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.

B. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

END OF SECTION

SECTION 15810 - DUCTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal ductwork.

B. Duct cleaning.

1.02 RELATED REQUIREMENTS

A. Section 15080 - Mechanical Insulation

B. Section 15820 - Duct Accessories.

C. Section 15840 - Air Terminal Units.

D. Section 15850 - Air Outlets and Inlets.

E. Section 15950 - Testing, Adjusting, and Balancing.

1.03 REFERENCE STANDARDS

A. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals; 2009.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2008.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2011.

D. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low Alloy, High-Strength Low-Alloy With Improved Formability, and Ultra-High Strength; 2012a.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2012.

F. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association; 2012.

G. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; Sheet Metal and Air Conditioning Contractors' National Association; 2012, 2nd Edition.

H. SMACNA (DCS) - HVAC Duct Construction Standards; 2005.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for duct materials.

C. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work for 4" pressure class and higher systems.

D. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual.

E. Project Record Documents: Record actual locations of ducts and duct fittings. Record

changes in fitting location and type. Show additional fittings used.

F. Operation and Maintenance Manuals: Include in manuals the information listed below. For information on how to prepare and submit manuals see section 1780 (Closeout Submittals).

G. Shop drawings and product data

1.05 REGULATORY REQUIREMENTS

A. Construct ductwork to NFPA 90A standards.

1.06 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.01 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G90/Z275 coating.

B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
   1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
   2. Surface Burning Characteristics: Flame spread of zero, smoke developed of zero, when tested in accordance with ASTM E84.

C. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

D. Low Pressure Supply: 1 inch w.g. pressure class, galvanized steel.

E. Medium and High Pressure Supply: 5 inch w.g. pressure class, galvanized steel.

F. Return and Relief: 5 inch w.g. pressure class, galvanized steel.

G. General Exhaust: 3 inch w.g. pressure class, galvanized steel.

H. Outside Air Intake: 3 inch w.g. pressure class, galvanized steel.

2.02 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards and as indicated.

B. Transfer Air and Sound Boots: 1/2 inch w.g. pressure class, fibrous glass.

C. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

D. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.

E. T's, bends, and elbows: Construct according to SMACNA (DCS).

F. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

G. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

H. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

I. Clean shop fabricated ductwork of debris, oil and grease. Cover ends of ductwork with temporary closure material and tape. Protect ductwork from entry of dust and debris during shop storage, shipment and temporary storage at the job site.

J. Wipe the inside of all ductwork to remove the debris, oil, grease, etc. Once ductwork is clean, cover with plastic or metal temporary closure material. Seal tight so that no water, moisture or debris can enter the ductwork. Protect ductwork from entry of dust and debris during shop storage, shipment and temporary storage at the job site.

2.03 DUCT MANUFACTURERS

A. Metal-Fab, Inc: www.mtlfab.com.

B. SEMCO Incorporated: www.semcoinc.com.

C. United McGill Corporation: www.unitedmcgill.com.

D. Substitutions: See Section 01600 - Product Requirements.

2.04 MANUFACTURED DUCTWORK AND FITTINGS

A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages,reinforcing, and sealing for operating pressures indicated.

B. Flexible Ducts: Two ply vinyl film supported by helically wound spring steel wire.
   1. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
   2. Pressure Rating: 5 inches WG positive and 1.0 inches WG negative.
   3. Maximum Velocity: 4000 fpm.
   4. Temperature Range: -10 degrees F to 160 degrees F.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA HVAC Duct Construction Standards.

B. Install in accordance with manufacturer's instructions.

C. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

D. Flexible Ducts: Connect to metal ducts with adhesive.

E. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

F. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

G. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

H. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.

I. Use double nuts and lock washers on threaded rod supports.

J. Connect terminal units to supply ducts with one foot maximum length of flexible duct. Do not use flexible duct to change direction.

K. Connect diffusers to low pressure ducts with 5 feet maximum length of flexible duct held in place with strap or clamp.

L. Set plenum doors 6 to 12 inches above floor. Arrange door swings so that fan static pressure holds door in closed position.

M. Leave temporary closures in place until ready for installation. At no time during the installation of the ductwork shall there be any openings that are not protected by temporary closures except for the section that is being installed at that time.

N. Provide temporary closures on the face of all grilles, registers and diffusers.

O. At exterior wall louvers, seal duct to louver frame and install blank-out panels.

P. Seal all joints with sealant.

Q. Perform pressure testing on medium pressure supply ductwork, outside air ductwork main trunks, and exhaust ductwork main trunks.

3.02 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 could be harmed by excessive dirt with temporary filters, or bypass during cleaning.

B. Ductwork Seal Class:
   1. Supply (System with Cooling Coils): Class A.
   2. Return and Relief: Class A.
   3. General Exhaust: Class A.
   4. Outside Air Intake: Class A.

C. Ductwork Leakage Class:
   1. Supply (Medium Pressure): Retangular Metal - 6, Round Metal 3
   2. Supply (Low Pressure): Retangular Metal - 16, Round Metal 8
   3. Return: Retangular Metal - 8, Round Metal 4

4. Outside Air: Retangular Metal - 8, Round Metal 4
5. Exhaust: Retangular Metal - 8, Round Metal 4

END OF SECTION

SECTION 15820 - DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air turning devices/extractors.

B. Backdraft dampers.

C. Duct access doors.

D. Duct test holes.

E. Fire dampers.

F. Flexible duct connections.

G. Volume control dampers.

1.02 RELATED REQUIREMENTS

A. Section 15073 - Vibration and Seismic Controls for HVAC Piping and Equipment.

B. Section 15810 - Ducts.

C. Section 15840 - Air Terminal Units: Pressure regulating damper assemblies.

1.03 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association; 2012.

B. SMACNA (DCS) - HVAC Duct Construction Standards; 2005.

C. UL 33 - Heat Responsive Links for Fire-Protection Service; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

D. UL 555 - Standard for Fire Dampers; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.

C. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers.

D. Manufacturer's Installation Instructions: Provide instructions for fire dampers.

E. Operation and Maintenance Manuals: Include in manuals the information listed below. For information on how to prepare and submit manuals see section 1780 (Closeout Submittals).
   1. Spare parts lists
   2. Operating instructions
   3. Maintenance instructions, including preventative and corrective maintenance.
   4. Copies of warranties
   5. Wiring diagrams

6. Shop drawings and product data

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS

A. Manufacturers:
1. Krueger: www.krueger-hvac.com.
2. PCI Industries, Inc; Pottorff Brand: www.portorff.com.
3. Ruskin Company: www.ruskin.com.
4. Titus: www.titus-hvac.com.
5. Substitutions: See Section 01600 - Product Requirements.

B. Multi-blade device with radius blades attached to pivoting frame and bracket, steel construction, with push-pull operator strap.

2.02 BACKDRAFT DAMPERS

A. Manufacturers:
1. Louvers & Dampers, Inc: www.louvers-dampers.com.
2. Nailor Industries Inc: www.nailor.com.
3. PCI Industries, Inc; Pottorff Brand: www.portorff.com.
4. Ruskin Company: www.ruskin.com.
5. Substitutions: See Section 01600 - Product Requirements.

B. Gravity Backdraft Dampers, Size 18 x 18 inches or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.

2.03 DUCT ACCESS DOORS

A. Manufacturers:
1. Nailor Industries Inc: www.nailor.com.
2. Ruskin Company: www.ruskin.com.
3. SEMCO Incorporated: www.semcoinc.com.
4. Ward Industries by Commercial Products Group of Hart & Cooley, Inc: www.wardind.com.
5. Substitutions: See Section 01600 - Product Requirements.

B. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, install minimum 1 inch thick insulation with sheet metal cover.

C. Access doors with sheet metal screw fasteners are not acceptable.

2.04 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene

plugs, threaded plugs, or threaded or twist-on metal caps.

B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.05 FIRE DAMPERS

A. Manufacturers:
1. Louvers & Dampers, Inc: www.louvers-dampers.com.
2. Nailor Industries Inc: www.nailor.com.
3. PCI Industries, Inc; Pottorff Brand: www.portorff.com.
4. Ruskin Company: www.ruskin.com.
5. Ward Industries by Commercial Products Group of Hart & Cooley, Inc: www.wardind.com.
6. Substitutions: See Section 01600 - Product Requirements.

B. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

C. Ceiling Dampers: Galvanized steel, 22 gage frame and 16 gage flap, two layers 0.125 inch ceramic fiber on top side and one layer on bottom side for round flaps, with locking clip.

D. Horizontal Dampers: Galvanized steel, 22 gage frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.

E. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for closure under air flow conditions. Configure with blades out of air stream except for 1.0 inch pressure class ducts up to 12 inches in height.

F. Multiple Blade Dampers: 16 gage galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.

G. Fusible Links: UL 33, separate at 160 degrees F with adjustable link straps for combination fire/balancing dampers.

2.06 FLEXIBLE DUCT CONNECTIONS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards and as indicated.

B. Flexible Duct Connections: Fabric crimped into metal edging strip.
1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd.
a. Net Fabric Width: Approximately 2 inches wide.
2. Metal: 3 inches wide, 24 gage thick galvanized steel.

C. Leaded Vinyl Sheet: Minimum 0.55 inch thick, 0.87 lbs per sq ft, 10 dB attenuation in 10 to 10,000 Hz range.

2.07 VOLUME CONTROL DAMPERS

A. Manufacturers:
1. Nailor Industries Inc: www.nailor.com.
2. PCI Industries, Inc; Pottorff Brand: www.portorff.com.
3. Ruskin Company: www.ruskin.com.

4. Substitutions: See Section 01600 - Product Requirements.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards and as indicated.

C. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch.
   1. Fabricate for duct sizes up to 6 x 30 inch.

D. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

E. Quadrants:
   1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
   2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
   3. Where rod lengths exceed 30 inches provide regulator at both ends.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards. Refer to Section 15810 for duct construction and pressure class.

B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Provide duct test holes where indicated and required for testing and balancing purposes.

D. Provide fire dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

E. Demonstrate re-setting of fire dampers to Owner's representative.

F. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

G. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment; see Section 15073.

H. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

I. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

J. Provide turning vanes on 90 deg mitered elbows.

END OF SECTION

SECTION 15822 - SOUND ATTENUATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Ductwork Lagging.

1.02 REFERENCE STANDARDS

A. AABC MN-1 - AABC National Standards for Total System Balance; Associated Air Balance Council; 2002.

B. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; Air Movement and Control Association International, Inc.; 2008.

C. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; Air Movement and Control Association International, Inc.; 1990.

D. ASTM E477 - Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers; 2006a.

E. NEBB (STDS) - Procedural Standards for the Measurement and Assessment of Sound and Vibration; National Environmental Balancing Bureau; 2006.

F. SMACNA (DCS) - HVAC Duct Construction Standards; 2005.

1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide catalog information indicating, materials, dimensional data, pressure losses, and acoustical performance.

C. Shop Drawings: Indicate assembly, materials, thicknesses, dimensional data, pressure losses, acoustical performance, layout, and connection details.

D. Design Data: Provide engineering calculations, referenced to specifications and AMCA 301 standards indicating that maximum room sound levels are not exceeded.

E. Test Reports: Indicate dynamic insertion loss and noise generation values of silencers.

F. Manufacturer's Installation Instructions: Indicate installation procedures necessary to maintain integrity of sound isolation.

G. Project Record Documents: Record actual locations of cross-talk silencers.

H. Operation and Maintenance Manuals: Include in manuals the information listed below. For information on how to prepare and submit manuals see section 1780 (Closeout Submittals).
   1. Maintenance instructions, including preventative and corrective maintenance.
   2. Copies of warranties
   3. Shop drawings and product data

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Kinetics Noise Control, Inc.

B. Substitutions: See Section 01600 - Product Requirements.

2.02 DUCTWORK LAGGING

A. The barrier shall be constructed of a 3-mm (0.12") thick mass loaded, limp vinyl sheet bonded to a thin layer of reinforced aluminum foil on one side. The barrier shall have a nominal density of 4.9-kg/m2 (1.0-psf) and shall have a minimum STC rating of 28. The barrier shall exhibit minimum flammability ratings of 0.0-seconds for flame-out and after-glow, and 5-mm (0.2") for char length when tested in accordance with Federal Test Std. No. 191-5903. The barrier shall have a minimum thermal conductivity (K) value of 0.29 and a rated service temperature range of -40°C (-40°F) to 105°C (220°F). When tested for Surface Burning Characteristics per ASTM E84, the barrier will have a Flame Spread Index of no more than 10 and a Smoke Development Index of no more than 40.

B. The decoupling layer shall be a combination of 25-mm (1.0") fiber glass batting, non-woven porous scrim-coated glass cloth, quilted together in a matrix of 100-mm (4.0") diamond stitch pattern which encapsulates the glass fibers.

C. The composite material shall be fabricated to include a nominal 152-mm (6") wide barrier overlap tab extending beyond the quilted fiber glass to facilitate a leak-tight seal around field joints. Nominal barrier width 1372-mm (54"), nominal fiber glass batt decoupler width 1219-mm (48").

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Where indicated, lag ductwork by wrapping with insulation and covering. Apply covering to be air tight. Do not attach covering rigidly to ductwork.

END OF SECTION

SECTION 15835 - POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cabinet exhaust fans.

1.02 RELATED REQUIREMENTS

A. Section 15065 - Motors for Mechanical Equipment.

B. Section 15073 - Vibration and Seismic Controls for HVAC Piping and Equipment.

C. Section 15820 - Duct Accessories: Backdraft dampers.

D. Section 16155 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. AMCA 99 - Standards Handbook; Air Movement and Control Association International, Inc.; 2010.

B. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2005.

C. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating; Air Movement and Control Association International, Inc.; 2007 (ANSI/AMCA 210, same as ANSI/ASHRAE 51).

D. AMCA (DIR) - [Directory of] Products Licensed Under AMCA International Certified Ratings Program; Air Movement and Control Association International, Inc.; http://www.amca.org/certified/search/company.aspx.

E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; Air Movement and Control Association International, Inc.; 2008.

F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; Air Movement and Control Association International, Inc.; 1990.

G. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; National Fire Protection Association; 2011.

H. UL 705 - Power Ventilators; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.

C. Manufacturer's Instructions: Indicate installation instructions.

D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

E. Operation and Maintenance Manuals: Include in manuals the information listed below. For information on how to prepare and submit manuals see section 1780 (Closeout Submittals).
   1. Recommended spare parts
   2. Spare parts lists
   3. Operating instructions
   4. Maintenance instructions, including preventative and corrective maintenance.
   5. Copies of warranties
   6. Wiring diagrams
   7. Shop drawings and product data

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 FIELD CONDITIONS

A. Permanent ventilators may not be used for ventilation during construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acme

B. Greenheck: www.greenheck.com.

C. Loren Cook Company: www.lorencook.com.

D. PennBarry: www.pennbarry.com.

E. Substitutions: See Section 01600 - Product Requirements.

2.02 POWER VENTILATORS - GENERAL

A. Static and Dynamically Balanced: AMCA 204 - Balance Quality and Vibration Levels for Fans.

B. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.

C. Sound Ratings: AMCA 301, tested to AMCA 300, and bearing AMCA Certified Sound Rating Seal.

D. Fabrication: Conform to AMCA 99.

E. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.03 CABINET AND CEILING EXHAUST FANS

A. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.

B. Disconnect Switch: Cord and plug in housing for thermal overload protected motor and wall mounted switch.

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.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Hung Cabinet Fans:
   1. Install fans with resilient mountings and flexible electrical leads. Refer to Section 15073.
   2. Install flexible connections specified in Section 15820 between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

C. Provide sheaves required for final air balance.

D. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.

END OF SECTION

SECTION 15840 - AIR TERMINAL UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Variable volume terminal units.

1.02 RELATED REQUIREMENTS

A. Section 15182 - Hydronic Piping: Connections to heating coils.

B. Section 15183 - Hydronic Specialties: Connections to heating coils.

C. Section 15810 - Ducts.

D. Section 15820 - Duct Accessories.

E. Section 15850 - Air Outlets and Inlets.

F. Section 15928 - Instruments and Control Elements: Thermostats and Actuators.

1.03 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilation Systems; National Fire Protection Association; 2012.

B. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings that indicate air flow, static pressure, and NC designation. Include electrical characteristics and connection requirements.

C. Shop Drawings: Indicate configuration, general assembly, and materials used in fabrication, and electrical characteristics and connection requirements.
   1. Include schedules listing discharge and radiated sound power level for each of second through sixth octave bands at inlet static pressures of 1 to 4 inch wg.

D. Project Record Documents: Record actual locations of units.

E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists. Include directions for resetting constant volume regulators.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

G. Operation and Maintenance Manuals: Include in manuals the information listed below. For information on how to prepare and submit manuals see section 1780 (Closeout Submittals).
   1. Spare parts lists
   2. Operating instructions
   3. Maintenance instructions, including preventative and corrective maintenance.

4. Copies of warranties
5. Wiring diagrams
6. Shop drawings and product data

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Provide one year manufacturer warranty for air terminal units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carrier

B. Johnson Controls

C. McQuay

D. Substitutions: See Section 01600 - Product Requirements.

2.02 SINGLE DUCT VARIABLE VOLUME UNITS

A. Basic Assembly:
1. Casings: Minimum 22 gage galvanized steel.
2. Lining: Minimum 1/2 inch thick neoprene or vinyl coated fibrous glass insulation, 1.5 lb/cu ft density, meeting NFPA 90A requirements and UL 181 erosion requirements. Face lining with mylar film.
3. Plenum Air Inlets: Round stub connections for duct attachment.
4. Plenum Air Outlets: S slip and drive connections.

B. Basic Unit:
1. Configuration: Air volume damper assembly inside unit casing. Locate control components inside protective metal shroud.
2. Volume Damper: Construct of galvanized steel with peripheral gasket and self lubricating bearings; maximum damper leakage: 2 percent of design air flow at 3 inches rated inlet static pressure.
3. Mount damper operator to position damper normally open.

C. Hot Water Heating Coil:
1. Construction: 1/2 inch copper tube mechanically expanded into aluminum plate fins, leak tested under water to 200 psig pressure, factory installed.
2. Capacity: Based on 160 degree F entering water, 140 degree F leaving water and 50 percent total air volume.

D. Velocity Reset Controller and Probe:
1. Pneumatic.
a. Calibration pressure taps for pressure independent control to compensate for varying inlet static pressure.

b. Minimum and maximum limits set at reset device.
c. Maintain air flow to within 5 percent of set point with inlet static pressure variations up to 2 inches.
d. Reset span, adjustable 3 to 8 psi shall remain constant regardless of minimum or maximum setting. Reset start point shall be adjustable from 3-10 psi.

E. DDC controls by the controls contractor. See section 15926. VAV box manufacturer shall receive controllers provided by the controls contractor for factory mounting.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Support units individually from structure. Do not support from adjacent ductwork.

C. Connect to ductwork in accordance with Section 15810.

D. Verify that electric power is available and of the correct characteristics.

END OF SECTION

SECTION 15850 - AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Diffusers.

B. Registers/grilles.

1.02 RELATED REQUIREMENTS

A. Section 09900 - Paints and Coatings: Painting of ducts visible behind outlets and inlets.

1.03 REFERENCE STANDARDS

A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; Air Movement and Control Association International, Inc.; 2012.

B. ARI 890 - Standard for Air Diffusers and Air Diffuser Assemblies; Air-Conditioning and Refrigeration Institute; 2008.

C. ASHRAE Std 70 - Method of Testing for Rating the Performance of Air Outlets and Inlets; American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.; 2006.

D. SMACNA (DCS) - HVAC Duct Construction Standards; 2005.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

C. Project Record Documents: Record actual locations of air outlets and inlets.

D. Operation and Maintenance Manuals: Include in manuals the information listed below. For information on how to prepare and submit manuals see section 1780 (Closeout Submittals).
   1. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
   2. Shop drawings and product data

1.05 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

B. Test and rate louver performance in accordance with AMCA 500-L.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Krueger: www.krueger-hvac.com.

B. Price Industries: www.price-hvac.com.

C. Titus: www.titus-hvac.com.

D. Metal-aire: www.metalaire.com.

E. Substitutions: See Section 01600 - Product Requirements.

2.02 SQUARE PLAQUE CEILING DIFFUSERS

A. Type: Square, stamped, multi-core diffuser to discharge air in 360 degree pattern with sectorizing baffles where indicated.

B. Frame: Inverted T-bar type. In plaster ceilings, provide plaster frame and ceiling frame.

C. Fabrication: Aluminum with baked enamel off-white finish.

2.03 PERFORATED FACE CEILING DIFFUSERS

A. Type: Perforated face with fully adjustable pattern and removable face.

B. Frame: Inverted T-bar type. In plaster ceilings, provide plaster frame and ceiling frame.

C. Fabrication: Steel with aluminum frame and baked enamel off-white finish.

2.04 WALL SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable blades, 3/4 inch minimum depth, 3/4 inch maximum spacing with spring or other device to set blades, vertical face, single deflection.

B. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.

C. Fabrication: Steel with 20 gage minimum frames and 22 gage minimum blades, steel and aluminum with 20 gage minimum frame, or aluminum extrusions, with factory baked enamel finish.

2.05 WALL EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with spring or other device to set blades, vertical face.

B. Frame: 1-1/4 inch margin with countersunk screw mounting.

C. Fabrication: Steel frames and blades, with factory baked enamel finish.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install 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, despite 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. Refer to Section 09900.

END OF SECTION

SECTION 15860 - AIR CLEANING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Disposable, extended area panel filters.

B. Filter frames.

C. Filter gages.

1.02 REFERENCE STANDARDS

A. AHRI 850 - Performance Rating of Commercial and Industrial Air Filter Equipment; Air-Conditioning, Heating, and Refrigeration Institute; 2004.

B. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2007.

C. UL 900 - Standard for Air Filter Units; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on filter media, filter performance data, filter assembly and filter frames, dimensions, motor locations and electrical characteristics and connection requirements.

C. Shop Drawings: Indicate filter assembly and filter frames, dimensions, motor locations, and electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions: Indicate assembly and change-out procedures.

E. Operation and Maintenance Data: Include instructions for operation, changing, and periodic cleaning.

F. Operation and Maintenance Manuals: Include in manuals the information listed below. For information on how to prepare and submit manuals see section 1780 (Closeout Submittals).
   1. Spare parts lists
   2. Shop drawings and product data

PART 2 PRODUCTS

2.01 FILTER MANUFACTURERS

A. American Filtration Inc: www.americanfiltration.com.

B. AAF International/American Air Filter: www.aafintl.com.

C. Camfil Farr Company: www.camfilfarr.com.

D. Substitutions: See Section 01600 - Product Requirements.

2.02 DISPOSABLE, EXTENDED AREA PANEL FILTERS

A. Media: UL 900 Class 1, pleated, lofted, non-woven, reinforced cotton fabric; supported and bonded to welded wire grid by corrugated aluminum separators.
   1. Frame: Non-flammable.
   2. Nominal size: 12 x 24 inches.
   3. Nominal thickness: 2 inches.

B. Minimum Efficiency Reporting Value (MERV): 8, when tested in accordance with ASHRAE 52.2.

2.03 FILTER GAGES

A. Manufacturers:
   1. Dwyer Instruments, Inc: www.dwyer-inst.com.
   2. H.O. Trerice Co: www.trerice.com.
   3. Weiss Instruments: www.weissinstruments.com.
   4. Substitutions: See Section 01600 - Product Requirements.

B. Direct Reading Dial: 3-1/2 inch diameter diaphragm actuated dial in metal case, vent valves, black figures on white background, front recalibration adjustment, range 0-0.5 inch WG, 2 percent of full scale accuracy.

C. Inclined Manometer: One piece molded plastic with epoxy coated aluminum scale, inclined-vertical indicating tube and built-in spirit level, range 0-3 inch WG, 3 percent of full scale accuracy.

D. Accessories: Static pressure tips with integral compression fittings, 1/4 inch aluminum tubing, 2-way or 3-way vent valves.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install air cleaning devices in accordance with manufacturer's instructions.

B. Prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.

C. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with clean set.

D. Provide filter gages on filter banks, installed with separate static pressure tips upstream and downstream of filters.

END OF SECTION

SECTION 15926 - DIGITAL CONTROL EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. System Description

B. Operator Interface

C. Controllers

D. Power Supplies and Line Filtering

E. System Software

F. Controller Software

G. HVAC Control Programs

H. Control equipment.

I. Software.

1.02 RELATED REQUIREMENTS

A. Section 15928 - Instruments and Control Elements.

B. Section 15940 - HVAC Sequence of Operation.

C. Section 16155 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 SYSTEM DESCRIPTION

A. Automatic temperature control field monitoring and control system using field programmable micro-processor based units.

B. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.

C. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for each system component and software module.

C. Shop Drawings:
   1. Indicate trunk cable schematic showing programmable control unit locations, and trunk data conductors.
   2. List connected data points, including connected control unit and input device.
   3. Indicate system graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations.
   4. Show system configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.

5. Indicate description and sequence of operation of operating, user, and application software.

D. Manufacturer's Instructions: Indicate manufacturer's installation instructions for all manufactured components.

E. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.
1. Revise shop drawings to reflect actual installation and operating sequences.
2. Include submittals data in final "Record Documents" form.

F. Operation and Maintenance Data:
1. Include interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.
2. Include keyboard illustrations and step-by-step procedures indexed for each operator function.
3. Include inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

G. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner s name and registered with manufacturer.

H. Operation and Maintenance Manuals: Include in manuals the information listed below. For information on how to prepare and submit manuals see section 1780 (Closeout Submittals).
1. Recommended spare parts
2. Spare parts lists
3. Operating instructions
4. Maintenance instructions, including preventative and corrective maintenance.
5. Wiring diagrams
6. Shop drawings and product data

1.05 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Provide one year manufacturer's warranty for field programmable micro-processor based units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Johnson Controls, Inc: www.johnsoncontrols.com.

B. Substitutions: See Section 01600 - Product Requirements.

2.02 SYSTEM DESCRIPTION

A. Existing campus system is Johnson Controls Metasys system. All new control components must be connected to existing campus control system as part of this project by a Johnson Controls branch office.

B. Controls contractor to provide and prove complete control of equipment by existing campus control system. New controls shall be 100% compatable with existing system.

C. Automatic temperature control field monitoring and control system using field programmable micro-processor based units.

D. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.

E. Include computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.

F. Controls for variable air volume terminals, reheat coils, unit heaters, fan coils, and the like when directly connected to the control units. Individual terminal unit control is specified in Section 15928.

G. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.

H. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

2.03 CONTROLLERS

A. BUILDING CONTROLLERS
1. General:
   a. Manage global strategies by one or more, independent, standalone, microprocessor based controllers.
   b. Provide sufficient memory to support controller's operating system, database, and programming requirements.
   c. Share data between networked controllers.
   d. Controller operating system manages input and output communication signals allowing distributed controllers to share real and virtual object information and allowing for central monitoring and alarms.
   e. Utilize real-time clock for scheduling.
   f. Continuously check processor status and memory circuits for abnormal operation.
   g. Controller to assume predetermined failure mode and generate alarm notification upon detection of abnormal operation.
   h. Communication with other network devices to be based on assigned protocol.
2. Communication:
   a. Controller to reside on a BACnet network using ISO 8802-3 (ETHERNET) Data Link/Physical layer protocol.
   b. Perform routing when connected to a network of custom application and application specific controllers.
   c. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.
3. Anticipated Environmental Ambient Conditions:
   a. Outdoors and/or in Wet Ambient Conditions:
      1) Mount within waterproof enclosures.
      2) Rated for operation at 40 to 150 degrees F.
   b. Conditioned Space:
      1) Mount within dustproof enclosures.

2) Rated for operation at 32 to 120 degrees F.

4. Provisions for Serviceability:
   a. Diagnostic LEDs for power, communication, and processor.
   b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
6. Power and Noise Immunity:
   a. Maintain operation at 90 to 110 percent of nominal voltage rating.
   b. Perform orderly shutdown below 80 percent of nominal voltage.
   c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet.

B. INPUT/OUTPUT INTERFACE
1. Hardwired inputs and outputs tie into the DDC system through building, custom application, or application specific controllers.
2. All Input/Output Points:
   a. Protect controller from damage resulting from any point short-circuiting or grounding and from voltage up to 24 volts of any duration.
   b. Provide universal type for building and custom application controllers where input or output is software designated as either binary or analog type with appropriate properties.
3. Binary Inputs:
   a. Allow monitoring of On/Off signals from remote devices.
   b. Provide wetting current of 12 mA minimum, compatible with commonly available control devices and protected against the effects of contact bounce and noise.
   c. Sense dry contact closure with power provided only by the controller.
4. Pulse Accumulation Input Objects: Conform to all requirements of binary input objects and accept up to 10 pulses per second.
5. Analog Inputs:
   a. Allow for monitoring of low voltage 0 to 10 VDC, 4 to 20 mA current, or resistance signals (thermistor, RTD).
   b. Compatible with and field configurable to commonly available sensing devices.
6. Binary Outputs:
   a. Used for On/Off operation or a pulsed low-voltage signal for pulse width modulation control.
   b. Status lights for building and custom application controllers to be selectable for normally open or normally closed operation.
7. Analog Outputs:
   a. Monitoring signal provides a 0 to 10 VDC or a 4 to 20 mA output signal for end device control.
   b. Drift to not exceed 0.4 percent of range per year.
8. Tri State Outputs:
   a. Coordinate two binary outputs to control three point, floating type, electronic actuators without feedback.
   b. Limit the use of three point, floating devices to the following zone and terminal unit control applications:
      1) VAV terminal units.

2.04 POWER SUPPLIES AND LINE FILTERING

A. UPS:
   1. Provide a UPS at each panel location.

B. Power Supplies:
   1. Provide UL listed control transformers with Class 2 current limiting type or over-current protection in both primary and secondary circuits for Class 2 service as required by the NEC.
   2. Limit connected loads to 80 percent of rated capacity.
   3. Match DC power supply to current output and voltage requirements.
   4. Unit to be full wave rectifier type with output ripple of 5.0 mV maximum peak to peak.
   5. Regulation to be 1 percent combined line and load with 100 microsecond response time for 50 percent load changes.
   6. Provide over-voltage and over-current protection to withstand a 150 percent current overload for 3 seconds minimum without trip-out or failure.
   7. Operational Ambient Conditions: 32 to 120 degrees F.
   8. EM/RF meets FCC Class B and VDE 0871 for Class B and MIL-STD 810 for shock and vibration.
   9. Line voltage units UL recognized and CSA approved.

C. Power Line Filtering:
   1. Provide external or internal transient voltage and surge suppression component for all workstations and controllers.
   2. Minimum surge protection attributes:
      a. Dielectric strength of 1000 volts minimum.
      b. Response time of 10 nanoseconds or less.
      c. Transverse mode noise attenuation of 65 dB or greater.
      d. Common mode noise attenuation of 150 dB or greater at 40 to 100 Hz.

2.05 CONTROL UNITS

A. Units: Modular in design and consisting of processor board with programmable RAM memory, local operator access and display panel, and integral interface equipment.

B. Control Units Functions:
   1. Monitor or control each input/output point.
   2. Completely independent with hardware clock/calendar and software to maintain control independently.
   3. Acquire, process, and transfer information to operator station or other control units on network.
   4. Accept, process, and execute commands from other control unit's or devices or operator stations.
   5. Access both data base and control functions simultaneously.
   6. Record, evaluate, and report changes of state or value that occur among associated points. Continue to perform associated control functions regardless of status of network.
   7. Perform in stand-alone mode:
      a. Start/stop.
      b. Duty cycling.

c. Automatic Temperature Control.
d. Demand control via a sliding window, predictive algorithm.
e. Event initiated control.
f. Calculated point.
g. Scanning and alarm processing.
h. Full direct digital control.
i. Trend logging.
j. Global communications.
k. Maintenance scheduling.

C. Global Communications:
1. Broadcast point data onto network, making that information available to all other system control units.
2. Transmit any or all input/output points onto network for use by other control units and utilize data from other control units.

D. Input/Output Capability:
1. Discrete/digital input (contact status).
2. Discrete/digital output.
3. Analog input.
4. Analog output.
5. Pulse input (5 pulses/second).
6. Pulse output (0-655 seconds in duration with 0.01 second resolution).

E. Monitor, control, or address data points. Mix shall include analog inputs, analog outputs, pulse inputs, pulse outputs and discrete inputs/outputs, as required. Install control unit's with minimum 30 percent spare capacity.

F. Point Scanning: Set scan or execution speed of each point to operator selected time from 1 to 250 seconds.

G. Upload/Download Capability: Download from or upload to operator station. Upload/Download time for entire control unit database maximum 10 seconds on hard wired LAN, or 60 seconds over voice grade phone lines.

H. Test Mode Operation: Place input/output points in test mode to allow testing and developing of control algorithms on line without disrupting field hardware and controlled environment. In test mode:
1. Inhibit scanning and calculation of input points. Issue manual control to input points (set analog or digital input point to operator determined test value) from work station.
2. Control output points but change only data base state or value; leave external field hardware unchanged.
3. Enable control actions on output points but change only data base state or value.

I. Local display: Integral to control unit, containing digital display, and keypad. Display and adjust:
1. Input/output point information and status.
2. Controller set points.
3. Controller tuning constants.
4. High and low limit values.
5. Limit differential.

6. Set/display date and time.
7. Control outputs connected to the network.
8. Automatic control outputs.
9. Perform control unit diagnostic testing.
10. Points in "Test" mode.

2.06 SYSTEM SOFTWARE

A. Operating System:
   1. Concurrent, multi-tasking capability.
      a. Common Software Applications Supported: Microsoft Excel.
   2. System Graphics:
      a. Allow up to 10 graphic screens, simultaneously displayed for comparison and monitoring of system status.
      b. Animation displayed by shifting image files based on object status.
      c. Provide method for operator with password to perform the following:
         1) Move between, change size, and change location of graphic displays.
         2) Modify on-line.
         3) Add, delete, or change dynamic objects consisting of:
            (a) Analog and binary values.
            (b) Dynamic text.
            (c) Static text.
            (d) Animation files.
   3. Standard HVAC Graphics Library:
      a. HVAC Equipment:
         1) Air Handlers.
         2) Terminal HVAC Units.
         3) Fan Coil Units.
      b. Ancillary Equipment:
         1) Fans.
         2) Pumps.
         3) Coils.
         4) Valves.
         5) Dampers.

2.07 CONTROLLER SOFTWARE

A. All applications reside and operate in the system controllers and editing of all applications occurs at the operator workstation.

B. System Security:
   1. User access secured via user passwords and user names.
   2. Passwords restrict user to the objects, applications, and system functions as assigned by the system manager.
   3. User Log On/Log Off attempts are recorded.
   4. Automatic Log Off occurs following the last keystroke after a user defined delay time.

C. Object or Object Group Scheduling:
   1. Weekly Schedules Based on Separate, Daily Schedules:
      a. Include start, stop, optimal stop, and night economizer.

b. 10 events maximum per schedule.
c. Start/stop times adjustable for each group object.

2. Exception Schedules:
   a. Based on any day of the year.
   b. Defined up to one year in advance.
   c. Automatically discarded and replaced with standard schedule for that day of the week upon execution.
3. Holiday or Special Schedules:
   a. Capability to define up to 99 schedules.
   b. Repeated annually.
   c. Length of each period is operator defined.

D. Provide standard application for equipment coordination and grouping based on function and location to be used for scheduling and other applications.

E. Alarms:
1. Binary object is set to alarm based on the operator specified state.
2. Analog object to have high/low alarm limits.
3. All alarming is capable of being automatically and manually disabled.
4. Alarm Reporting:
   a. Operator determines action to be taken for alarm event.
   b. Alarms to be routed to appropriate workstation.
   c. Reporting Options:
      1) Print.
      2) Logged.
      3) Custom messaging.
      4) Graphical displays.
      5) Email.

F. Sequencing: Application software based upon specified sequences of operation in Section 15940.

G. PID Control Characteristics:
1. Direct or reverse action.
2. Anti-windup.
3. Calculated, time-varying, analog value, positions an output or stages a series of outputs.
4. User selectable controlled variable, set-point, and PED gains.

H. Staggered Start Application:
1. Prevents all controlled equipment from simultaneously restarting after power outage.
2. Order of equipment startup is user selectable.

I. Anti-Short Cycling:
1. All binary output objects protected from short-cycling.
2. Allows minimum on-time and off-time to be selected.

J. On-Off Control with Differential:
1. Algorithm allows binary output to be cycled based on a controlled variable and set-point.
2. Algorithm to be direct-acting or reverse-acting incorporating an adjustable differential.

K. Run-Time Totalization:
   1. Totalize run-times for all binary input objects.
   2. Provides operator with capability to assign high run-time alarm.

2.08 HVAC CONTROL PROGRAMS

A. General:
   1. Support Inch-pounds and SI (metric) units of measurement.
   2. Identify each HVAC Control system.

B. Optimal Run Time:
   1. Control start-up and shutdown times of HVAC equipment for both heating and cooling.
   2. Base on occupancy schedules, outside air temperature, seasonal requirements, and interior room mass temperature.
   3. Start-up systems by using outside air temperature, room mass temperatures, and adaptive model prediction for how long building takes to warm up or cool down under different conditions.
   4. Use outside air temperature to determine early shut down with ventilation override.
   5. Analyze multiple building mass sensors to determine seasonal mode and worse case condition for each day.
   6. Operator commands:
      a. Define term schedule
      b. Add/delete fan status point.
      c. Add/delete outside air temperature point.
      d. Add/delete mass temperature point.
      e. Define heating/cooling parameters.
      f. Define mass sensor heating/cooling parameters.
      g. Lock/unlock program.
      h. Request optimal run time control summary.
      i. Request optimal run time mass temperature summary.
      j. Request HVAC point summary.
      k. Request HVAC saving profile summary.
   7. Control Summary:
      a. HVAC Control system begin/end status.
      b. Optimal run time lock/unlock control status.
      c. Heating/cooling mode status.
      d. Optimal run time schedule.
      e. Start/Stop times.
      f. Selected mass temperature point ID.
      g. Optimal run time system normal start times.
      h. Occupancy and vacancy times.
      i. Optimal run time system heating/cooling mode parameters.
   8. Mass temperature summary:
      a. Mass temperature point type and ID.
      b. Desired and current mass temperature values.
      c. Calculated warm-up/cool-down time for each mass temperature.
      d. Heating/cooling season limits.
      e. Break point temperature for cooling mode analysis.
   9. HVAC point summary:

a. Control system identifier and status.
b. Point ID and status.
c. Outside air temperature point ID and status.
d. Mass temperature point ID and point.
e. Calculated optimal start and stop times.
f. Period start.

C. Supply Air Reset:
1. Monitor heating and cooling loads in building spaces, terminal reheat systems, both hot deck and cold deck temperatures on dual duct and multizone systems, single zone unit discharge temperatures.
2. Adjust discharge temperatures to most energy efficient levels satisfying measured load by:
   a. Raising cooling temperatures to highest possible value.
   b. Reducing heating temperatures to lowest possible level.
3. Operator commands:
   a. Add/delete fan status point.
   b. Lock/unlock program.
   c. Request HVAC point summary.
   d. Add/Delete discharge controller point.
   e. Define discharge controller parameters.
   f. Add/delete air flow rate.
   g. Define space load and load parameters.
   h. Request space load summary.
4. Control summary:
   a. HVAC control system status (begin/end).
   b. Supply air reset system status.
   c. Optimal run time system status.
   d. Heating and cooling loop.
   e. High/low limits.
   f. Deadband.
   g. Response timer.
   h. Reset times.
5. Space load summary:
   a. HVAC system status.
   b. Optimal run time status.
   c. Heating/cooling loop status.
   d. Space load point ID.
   e. Current space load point value.
   f. Control heat/cool limited.
   g. Gain factor.
   h. Calculated reset values.
   i. Fan status point ID and status.
   j. Control discharge temperature point ID and status.
   k. Space load point ID and status.
   l. Air flow rate point ID and status.

D. Enthalpy Switchover:

1. Calculate outside and return air enthalpy using measured temperature and relative humidity; determine energy expended and control outside and return air dampers.
2. Operator commands:
   a. Add/delete fan status point.
   b. Add/delete outside air temperature point.
   c. Add/delete discharge controller point.
   d. Define discharge controller parameters.
   e. Add/delete return air temperature point.
   f. Add/delete outside air dew point/humidity point.
   g. Add/delete return air dew point/humidity point.
   h. Add/delete damper switch.
   i. Add/delete minimum outside air.
   j. Add/delete atmospheric pressure.
   k. Add/delete heating override switch.
   l. Add/delete evaporative cooling switch.
   m. Add/delete air flow rate.
   n. Define enthalpy deadband.
   o. Lock/unlock program.
   p. Request control summary.
   q. Request HVAC point summary.
3. Control summary:
   a. HVAC control system begin/end status.
   b. Enthalpy switchover optimal system status.
   c. Optimal return time system status.
   d. Current outside air enthalpy.
   e. Calculated mixed air enthalpy.
   f. Calculated cooling cool enthalpy using outside air.
   g. Calculated cooling cool enthalpy using mixed air.
   h. Calculated enthalpy difference.
   i. Enthalpy switchover deadband.
   j. Status of damper mode switch.

2.09 PROGRAMMING APPLICATION FEATURES

A. Trend Point:

B. Alarm Messages:

C. Weekly Scheduling:

D. Interlocking:

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that conditioned power supply is available to the control units and to the operator work station. Verify that field end devices, wiring, and pneumatic tubing is installed prior to installation proceeding.

3.02 INSTALLATION

A. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.

B. Install software in control units and in operator work station. Implement all features of programs to specified requirements and appropriate to sequence of operation. Refer to Section 15940.

C. Controls contractor to provide 120v AC, 15 amp circuit to each programmable control unit. EXCEPTION: VAV power shall be provided by Div 16 contractor.

D. Provide conduit and electrical wiring in accordance with Section 16155. Electrical material and installation shall be in accordance with appropriate requirements of Division 16.

3.03 MANUFACTURER'S FIELD SERVICES

A. Start and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

B. Provide service engineer to instruct Owner's representative in operation of systems plant and equipment for 1 day period.

3.04 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate complete and operating system to Owner.

END OF SECTION

SECTION 15928 - INSTRUMENTS AND CONTROL ELEMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air supply system.

B. Thermostats.

C. Control valves.

D. Automatic dampers.

E. Damper operators.

F. Airflow Measuring Station

1.02 RELATED REQUIREMENTS

A. Section 15182 - Hydronic Piping: Installation of control valves, flow switches, temperature sensor sockets, gage taps.

B. Section 15820 - Duct Accessories: Installation of automatic dampers.

C. Section 15926 - Digital Control Equipment.

D. Section 15940 - HVAC Sequence of Operation.

E. Section 16140 - Wiring Devices: Elevation of exposed components.

F. Section 16155 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. AMCA 500-D - Laboratory Methods for Testing Dampers for Rating; Air Movement and Control Association International, Inc.; 2012.

B. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2001 (R2010).

C. ASTM B32 - Standard Specification for Solder Metal; 2008.

D. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2009.

E. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2005 (Reapproved 2011).

F. ASTM B819 - Standard Specification for Seamless Copper Tube for Medical Gas Systems; 2000 (Reapproved 2011).

G. ASTM D1693 - Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics; 2012.

H. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilation Systems; National Fire Protection Association; 2012.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.

C. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.

D. Design Data: Provide design data for sizing and selection of compressor.

E. Manufacturer's Instructions: Provide for all manufactured components.

F. Project Record Documents: Record actual locations of control components, including panels, thermostats, and sensors. Accurately record actual location of control components, including panels, thermostats, and sensors.
   1. Revise shop drawings to reflect actual installation and operating sequences.

G. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.

H. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner s name and registered with manufacturer.

I. Operation and Maintenance Manuals: Include in manuals the information listed below. For information on how to prepare and submit manuals see section 1780 (Closeout Submittals).
   1. Recommended spare parts
   2. Spare parts lists
   3. Operating instructions
   4. Maintenance instructions, including preventative and corrective maintenance.
   5. Copies of warranties
   6. Wiring diagrams
   7. Shop drawings and product data

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Johnson Controls

B. Other Acceptable Manufacturers:

C. Substitutions: See Section 01600 - Product Requirements.

2.02 EQUIPMENT - GENERAL

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2.03 AIR SUPPLY

A. Compressor and Receiver:
   1. Duplex belt driven air compressor and tank unit with belt guard, silencers, flexible connections, air filter, automatic and manual drain assemblies, oil and particle filter for minimum 0.5 micron particles, pressure reducing valves, and pressure relief valves.

2. Size each compressor and storage tank to limit compressor starts to maximum 10 per hour and 50 percent running time.
3. Pressure Control: Zinc or aluminum castings, rated for service with elastomeric diaphragm, adjustable electric contacts.
   a. Set to start and stop compressor at 50 and 60 psig.
4. Product:
   a. Substitutions: See Section 01600 - Product Requirements.

B. Pressure Regulators:
1. Zinc or aluminum castings, rated for service with elastomeric diaphragm, balanced construction to automatically prevent pressure build up, and producing flat, reduced pressure curve for system capacity demand.

C. Particle Filters:
1. Zinc or aluminum castings with filtration efficiency at rated air flow of 97 percent, rated for service with threaded connections, quick-disconnect service devices, aluminum bowl or plastic bowl with metal guard equipped with manual drain cock, to separate liquid and solid particles.

D. Combination Filter/Regulators:
1. Zinc or aluminum castings, rated for service with elastomeric diaphragm, balanced construction to automatically prevent pressure build up, and producing flat, reduced pressure curve for system capacity demand; with threaded pipe connections, quick-disconnect service devices, aluminum bowl or plastic bowl with metal guard equipped with manual drain cock to separate liquid and solid particles.

E. Airborne Oil Filter:
1. Rated for service with filtration efficiencies of 99.9 percent for particles of 0.025 micron or larger particles of airborne lubricating oil.

F. Control and Instrumentation Tubing:
1. Copper Tube: ASTM B819 Type K, or ASTM B88 (ASTM B88M) Type K, seamless, H or O temper (drawn or annealed).
   a. Fittings: ASME B16.22, wrought copper.
   b. Joints: Solder, lead free, ASTM B32, HB alloy (95-5 tin-antimony), or tin and silver.
2. Polyethylene Tubing: Black, flame retardant, virgin polyethylene, resistant to environmental stress-cracking when tested in accordance with ASTM D1693.
   a. Fittings: UL labeled, rod or forged brass rated to 200 psig at 100 degrees F.

G. Refrigerated Air Dryer:
1. General Assembly: Self-contained, commercial quality, refrigerated, compressed air dryer complete with heat exchangers, moisture separator, and internal wiring and piping. Provide air inlet and outlet connections connected through manual by-pass valve.
2. Heat Exchangers: Air to refrigerant coils. Provide centrifugal type moisture separator located at discharge of compressed air complete with automatic trap assembly. Provide automatic control system to bypass refrigeration system on low or no load conditions.
3. Refrigeration Unit: Hermetically sealed, operating to maintain dew point of 0 degrees F at 20 psig. House in steel cabinet with access door and panel.

4. Accessories: Air inlet temperature gage, air inlet pressure gage, on/off switch, high temperature light, power on light, refrigerant gage on back, air outlet temperature gage, air outlet pressure gage.

H. Coordination
1. Contractor shall be responsible for coordinating compressor size with the existing conditions and new controls. Compressor shall be sized with adequate capacity to meet sequence of operation for each device. Coordinate power requirements with electrical contractor prior to installation of electrical devices.

2.04 CONTROL VALVES

A. Globe Pattern:
1. Up to 2 inches: Bronze body, bronze trim, rising stem, renewable composition disc, screwed ends with backseating capacity repackable under pressure.
2. Over 2 inches: Iron body, bronze trim, rising stem, plug-type disc, flanged ends, renewable seat and disc.
3. Hydronic Systems:
a. Rate for service pressure of 125 psig at 250 degrees F.
b. Replaceable plugs and seats of stainless steel.
c. Size for 3 psig maximum pressure drop at design flow rate.
d. Two way valves shall have equal percentage characteristics, three way valves linear characteristics. Size two way valve operators to close valves against pump shut off head.

B. Butterfly Pattern:
1. Iron body, bronze disc, resilient replaceable seat for service to 180 degrees F wafer or lug ends, extended neck.
2. Hydronic Systems:
a. Rate for service pressure of 125 psig at 250 degrees F.
b. Size for 1 psig maximum pressure drop at design flow rate.

C. Pneumatic Operators:
1. Provide pneumatic operators on AHU cooling and heating valves, dampers, main chilled water and heating system valves.
2. Rolling diaphragm, spring loaded, piston type with spring range 2 to 5 psig.
3. Valves shall spring return to normal position as indicated on freeze, fire, or temperature protection.
4. Select operator for full shut off at maximum pump differential pressure.

D. Electronic Operators:
1. Provide electronic operators on terminal units and systems not requiring pneumatic operators as listed above.
2. Valves shall spring return to normal position as indicated on freeze, fire, or temperature protection.
3. Select operator for full shut off at maximum pump differential pressure.

2.05 PRESSURE INDEPENDENT CONTROL VALVES

A. Valves shall be configured with one integrated valve body to incorporate an adjustable Cv chamber and separate pressure regulating chamber to maintain a constant differential

pressure across the control surface.

B. Each control valve shall be individually flow tested and factory verified to deviate no more than ±5% through the selected operating pressure range. A calibrated performance tag shall be provided with each valve (optional for ½") that verifies the flow rate in 10° rotation increments up to full rated flow. All testing shall be performed with instruments calibrated to the requirements of ANSI/NCSL Z540-1-1994 with traceability to NIST and/or ISO standards.

C. Control valve rangeability shall be 100:1 minimum.

D. Each control valve shall be subjected to 70 psid and tested to exceed ANSI/FCI 70-2-1998 leakage ratings. Class IV leakage or better is required for control valves 2" nominal size and less. Class III leakage or better is required for control valves larger than 2".

E. Control valve bodies shall be brass, ductile iron, carbon steel or stainless steel. All internal parts shall be brass, bronze, carbon steel, stainless steel or Teflon®. Plastic internal parts are not acceptable.

F. Valve bodies 2" and smaller shall be rated at 300 PSIG working pressure. Valve bodies larger than 2" shall be rated at 150 PSIG minimum working pressure.

G. In all control valves 8" and smaller it shall be possible to modify the valve flow characteristics without removing the valve from the piping system. In all hot water valves it shall be possible to change seals (at recommended 10 year maintenance intervals) without removing the valve from the piping system.

H. Valves 2" and smaller shall have a minimum spring ratio of 5 pounds per inch to ensure stability and tolerance to common system debris. Minimum spring ratio for valves larger than 2" shall be 10 pounds per inch. Spring ratio is defined as operating spring force (lbf) at initial compression divided by the nominal valve size (in).

I. Balancing valves and associated balancing shall not be required where pressure independent modulating control valves are installed.

J. Control valves shall be compatible with modulating actuators from all major manufacturers. Any brand may be used pending approval by the valve manufacturer. Actuators shall modulate all valves up to 10" in nominal size from 0 to 100% design flow while rotating the valve stem a maximum of 90°.
   1. Valve actuators may be specified in the control system specification and shall be factory mounted.
   2. Actuators shall be selected by system close-off requirements. Valves shall be capable of a close-off rating of 200 PSID subject to actuator selection.
   3. For pneumatic actuation the valve manufacturer shall set the end stroke of the actuator at the full design flow listed on the performance tag furnished with each valve.

K. The control valve flow adjustment stem (for valves 8" and less) shall extend out from the control valve and have an indicator that may be used to verify valve position. The control valve shall have tapped mounting holes for mounting the control valve actuator bracket. The actuator shall rotate the valve stem to provide the required flow independent of pressure across the valve. Torque requirements for actuator selection shall be provided by the valve manufacturer.

L. All valves shall have three integral ports factory installed capable of being used to measure pressure or temperature. The first port shall be installed at the inlet to the valve, the second shall be installed between the Cv chamber and the pressure regulating chamber and the third shall be installed at the outlet of the valve. Should the ports not be provided as part of the valve body, they shall be installed in a spool piece and attached to the body.

M. The differential pressure between the first and the third port shall be used in commissioning to verify the minimum differential pressure required for pressure independent operation is available. The differential pressure between the first and second ports shall be used to verify proper valve operation and flow regulation.

N. It shall be possible to verify the flow rate through the control valve using the valve stem position and the differential pressure measurement between the first and second port in the valve. If these valve features are not available, a flow meter shall be installed to verify actual flow rate in operation through the valve.

O. All valves shall be warranted by the manufacturer for no less than 5 years from the date of purchase. The warranty provided by the actuator manufacturer shall apply to actuators.

P. The control valve manufacturer shall provide written guarantee that the heating and cooling coils will meet or exceed maximum delta T performance at all load conditions as projected by ARI certified coil program at time of commissioning. The valve manufacturer will reimburse the full purchase price of the valve(s) if this performance level cannot be met. The actuators provided with the valve(s) shall have a minimum of 100 steps in 90° rotation to assure 100:1 turndown.

2.06 DAMPERS

A. Performance: Test in accordance with AMCA 500-D.

B. Frames: Galvanized steel, welded or riveted with corner reinforcement, minimum 12 gage.

C. Blades: Galvanized steel, maximum blade size 8 inches wide, 48 inches long, minimum 22 gage, attached to minimum 1/2 inch shafts with set screws.

D. Blade Seals: Synthetic elastomeric inflatable mechanically attached, field replaceable.

E. Jamb Seals: Spring stainless steel.

F. Shaft Bearings: Oil impregnated sintered bronze.

G. Linkage Bearings: Oil impregnated sintered bronze.

H. Leakage: Less than one percent based on approach velocity of 2000 ft/min and 4 inches wg.

2.07 DAMPER OPERATORS

A. General: Provide smooth proportional control with sufficient power for air velocities 20 percent greater than maximum design velocity and to provide tight seal against maximum system pressures. Provide spring return for two position control and for fail safe operation.

B. Pneumatic Operators:
   1. Rolling diaphragm piston type with adjustable stops.

C. Pilot Positioners: Starting point adjustable from 2 to 12 psig and operating span adjustable from 5 to 13 psig.

D. Electric Operators:
   1. Spring return, adjustable stroke motor having oil immersed gear train, with auxiliary end switch.

2.08 INPUT/OUTPUT SENSORS

A. Temperature Sensors:
   1. Resistance temperature detectors with resistance tolerance of plus or minus 0.1 percent at 70 degrees F, interchangeability less than plus or minus 0.2 percent, time constant of 13 seconds maximum for fluids and 200 seconds maximum for air.
   2. Measuring current maximum 5 mA with maximum self-heat of 0.031 degrees F/mW in fluids and 0.014 degrees F/mW in air.
   3. Provide 3 lead wires and shield for input bridge circuit.
   4. Use insertion elements in ducts not affected by temperature stratification or smaller than one square meter. Use averaging elements where larger or prone to stratification sensor length 8 feet or 16 feet as required.
   5. Insertion elements for liquids shall be with brass socket with minimum insertion length of 2-1/2 inches.
   6. Outside air sensors: Watertight inlet fitting, shielded from direct rays of sun.

B. Humidity Sensors:
   1. Elements: Accurate within 5 percent full range with linear output.
   2. Duct and Outside Air Sensors: With element guard and mounting plate, range of 0 - 100 percent relative humidity.

C. Static Pressure Sensors:
   1. Unidirectional with ranges not exceeding 150 percent of maximum expected input.
   2. Temperature compensate with typical thermal error or 0.06 percent of full scale in temperature range of 40 to 100 degrees F.
   3. Accuracy: One percent of full scale with repeatability 0.3 percent.
   4. Output: 0 - 5 vdc with power at 12 to 28 vdc.

D. Equipment Operation Sensors:
   1. Status Inputs for Fans: Differential pressure switch with adjustable range of 0 to 5 inches wg.
   2. Status Inputs for Pumps: Differential pressure switch piped across pump with adjustable pressure differential range of 8 to 60 psi.
   3. Status Inputs for Electric Motors: Current sensing relay with current transformers, adjustable and set to 175 percent of rated motor current.

E. Digital to Pneumatic Transducers:
   1. Convert plus or minus 12 vdc pulse width modulation outputs to 0 to 20 psi.

F. Damper Position Indication: Potentiometer mounted in enclosure with adjustable crank arm assembly connected to damper to transmit 0 - 100 percent damper travel.

2.09 THERMOSTATS

A. Electric Low Limit Duct Thermostat:
   1. Snap acting, single pole, single throw, manual reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below setpoint,
   2. Bulb length: Minimum 20 feet.

2.10 TRANSMITTERS

A. Building Static Pressure Transmitter:
   1. One pipe, direct acting, double bell, scale range 0.01 to 6.0 inch wg positive or negative, and sensitivity of 0.0005 inch wg. Transmit electronic signal to receiver with matching scale range.

B. Pressure Transmitters:
   1. One pipe direct acting indicating type for gas, liquid, or steam service, range suitable for system, proportional electronic output.

2.11 AIRFLOW/TEMPERATURE MEASUREMENT STATIONS

A. Airflow/Temperature Measurement - General
   1. The airflow/temperature measurement stations (AFTMS) indicated on the plans shall be capable of monitoring airflow and temperature at each measurement location. Sensors shall use thermal dispersion technology with two thermistor probes at each measurement point. The AFTMS shall be factory tested prior to shipment and not require calibration or adjustment over the life of the equipment when installed in accordance to manufacturer's guidelines. Each sensor probe shall be provided with a UL plenum-rated connecting cable with circular terminal connector. Connecting cable shall be a minimum of 10 feet [3.05m] in length (up to 25 feet [7.62m] optional) for each probe. Sensor probes shall be "plug and play" design and do not have to be matched to a specific transmitter. All sensor calibration data shall be stored in the sensor probe. No additional devices or transducers shall be required to interface with the host controls.
   2. All connectors and interconnects shall have gold plated contacts. Sensors shall be factory-calibrated at least 8 airflow rates and 3 temperatures to NIST-traceable standards for both airflow and temperature. Each sensing point shall independently measure airflow and temperature prior to averaging. Installed accuracy shall be percent of reading listed below, and demonstrated at both maximum and minimum airflow rates for each measurement location.

B. Transmitter and Electronics Enclosure
   1. The transmitter shall be microprocessor-based and capable of processing up to 4 independent sensing points per location. The transmitter shall operate on 24 VAC and be internally fused and protected. Analog output signals shall be field selectable (0-10 VDC or 4-20 mA). When required on the plans, a serial RS-485 interface will be made available with field selectable network protocols (N2 or ModBus RTU). All inputs and outputs shall be fused, protected, and internally isolated from the 24 VAC power supply. The transmitter shall have a digital adjustment for output signal offset/gain. The transmitter shall be capable of being configured to display either I.P. or S.I. units. The transmitter shall be capable of continuously performing sensor and transmitter diagnostics and perform a full system check on power-up. A sensor detection system shall ignore any malfunctioning sensors and set a visual alarm on the transmitter circuit board.
   2. The enclosure shall be aluminum alloy for indoor use and capable of operating over a temperature range of 30° F to 120° F [-1.1° C to 48.9° C] The electronics shall be installed inside and protected from the weather. (specify NEMA4 for outdoor use).

C. Sensor probes shall be constructed of extruded aluminum alloy tube with 303 stainless steel mounting brackets. Probes shall be constructed as insertion, internal, or standoff mounting, depending on the installation requirements.
   1. Probe Performance Requirements
      a. The individual sensor accuracy for airflow shall be at least ±2% of Reading over the sensor probe operating ranges. The installed total accuracy for airflow shall be better than ±3% - 10% of Reading over the sensor probe operating ranges when installed in accordance with manufacturers' guidelines. The installed accuracy for temperature shall be better than ±0.15° F [±0.1° C] over the entire operating range.
   2. Probe Operating Ranges:
      a. Airflow: 0 to 1,500 FPM [0 to 7.62 m/s]
      b. Temperature: -20° F to +160° F [-28.9° C to +71.1° C]
      c. Airflow: 0 to 3,000 FPM [0 to 15.2 m/s]
      d. Temperature: +30° F to +160° F [-1.1° C to +71.1° C]
      e. Relative Humidity: 0 to 99% (non-condensing)

D. Approved Manufacturers and Equipment
   1. EBTRON Gold Series models for duct or plenum probes, fan inlet sensors, and dynamic pressure "bleed flow" sensors, with associated transmitters.
   2. Alternatives submitted in substantial non-conformance with the performance and calibration requirements of this specification will not be considered.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that systems are ready to receive work.

C. Beginning of installation means installer accepts existing conditions.

D. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.

E. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

F. Ensure installation of components is complementary to installation of similar components.

G. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Mount compressor and tank unit on vibration isolation consisting of springs, with minimum 1 inch static deflection and 1 inch clearance to floor. Isolate air supply with wire-braid reinforced rubber hose or polyethylene tubing. Pipe manual and automatic drains to nearest floor drain.

C. Supply instrument air from compressor units through filter, pressure reducing valve,

pressure relief valve, with pressure gages, and shutoff and bypass valves.

D. Install pressure reducing stations consisting of pressure reducing valve, particle filter, valved bypass, pressure gage on inlet and outlet, and pressure relief valve.

E. Locate refrigerated air dryer in discharge air line from tank. Mount dryer on wall on rubber in shear mounts. Install pressure regulator downstream of dryer. Pipe automatic drain to nearest floor drain.

F. Use copper tubing in mechanical rooms, where subject to damage or temperatures in excess of 200 degrees F, where adjacent to heating pipes passing through common sleeve, and where not readily accessible. In mechanical rooms bundled plastic tubing with suitable junction boxes or single plastic tubing with tray or raceway may be used.

G. Solder copper tubing except at instruments or equipment where compression fittings may be used.

H. Conceal tubing. Run exposed only in mechanical rooms, storage rooms and like, in neat manner and properly supported.

I. Mechanically attached tubing to supporting surfaces. Sleeve through concrete surfaces in minimum one inch sleeves, extended 6 inches above floors and one inch below bottom surface of slabs.

J. Purge tubing with dry, oil-free compressed air before connecting control instruments.

K. Provide instrument air tubing with check and hand valves to expansion tanks with Schraeder fittings and hose; refer to Section 15183.

L. Check and verify location of thermostats with plans and room details before installation. Locate 48 inches above floor. Align with lighting switches. Refer to Section 16140.

M. Mount freeze protection thermostats using flanges and element holders.

N. Mount outdoor reset thermostats and outdoor sensors indoors, with sensing elements outdoors with sun shield.

O. Provide separable sockets for liquids and flanges for air bulb elements.

P. Provide valves with position indicators and with pilot positioners where sequenced with other controls.

Q. Provide mixing dampers of opposed blade construction arranged to mix streams. Provide pilot positioners on mixed air damper motors. Provide separate minimum outside air damper section adjacent to return air dampers with separate damper motor.

R. Provide pilot positioners on pneumatic damper operators sequenced with other controls.

S. Install damper motors on outside of duct in warm areas. Do not install motors in locations at outdoor temperatures.

T. Provide conduit and electrical wiring in accordance with Section 16155. Electrical material and installation shall be in accordance with appropriate requirements of Division 16.

END OF SECTION

SECTION 15940 - HVAC SEQUENCE OF OPERATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other sections.

B. Sequence of operation for:
1. Central fan systems.
2. Fan coil units.
3. Heating water zone control.
4. Tertiary chilled water zone control.
5. Terminal air units.
6. Exhaust Fan
7. Computer Room Air Conditioning Unit
8. Unit heaters.

1.02 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Control System Diagrams: Submit graphic schematic of the control system showing each control component and each component controlled, monitored, or enabled.
1. Label with settings, adjustable range of control and limits.
2. Include flow diagrams for each control system, graphically depicting control logic.
3. Include the system and component layout of all equipment that the control system monitors, enables or controls, even if the equipment is primarily controlled by packaged or integral controls.
4. Include draft copies of graphic displays indicating mechanical system components, control system components, and controlled function status and value.
5. Include all monitoring, control and virtual points specified in elsewhere.
6. Include a key to all abbreviations.

C. Points List: Submit list of all control points indicating at least the following for each point.
1. Name of controlled system.
2. Point abbreviation.
3. Point description; such as dry bulb temperature, airflow, etc.
4. Display unit.
5. Control point or setpoint (Yes / No); i.e. a point that controls equipment and can have its setpoint changed.
6. Monitoring point (Yes / No); i.e. a point that does not control or contribute to the control of equipment but is used for operation, maintenance, or performance verification.
7. Intermediate point (Yes / No); i.e. a point whose value is used to make a calculation which then controls equipment, such as space temperatures that are averaged to a virtual point to control reset.
8. Calculated point (Yes / No); i.e. a “virtual” point generated from calculations of other point values.

D. Project Record Documents: Record actual locations of components and setpoints of controls, including changes to sequences made after submission of shop drawings.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CENTRAL STATION AIR HANDLER CONTROLS

A. VAV AIR HANDLING UNIT(s) WITH STATIC PRESSURE OPTIMIZATION
   1. Occupied Cooling Mode
      a. When the AHU is in the Occupied Cooling Mode, the Supply Fan will operate continuously, the Frequency Inverter will modulate to maintain the Duct Static Pressure, and the Cooling Valve, Heating Valve, and Economizer Dampers will modulate in sequence to maintain Discharge Air Temperature.
   2. Unoccupied Mode
      a. When the AHU is in the Unoccupied Mode, the Supply Fan will be OFF, the Frequency Inverter, Outdoor Air Damper, and Cooling Valve will be closed, and the Heating Valve will be closed . The heating valve shall open fully if the outdoor temperature falls below a freeze avoidance temperature setpoint of 40F (adjustable).
   3. Night Setback / Morning Warmup Heating Mode
      a. When the AHU is in the Night Setback / Morning Warm-up Heating Mode, the Supply Fan will operate continuously, the Frequency Inverter will modulate to maintain the Duct Static Pressure, the Outdoor Air Damper and Cooling Valve will be closed, the Return Air Damper will be fully open, and the Heating Valve will modulate to maintain the maximum heating Discharge Air Temperature setpoint. The unit shall signal all VAV Terminal Units to full flow until the Morning Warm-up setpoint is reached and the AHU returns to occupied mode.
   4. Supply Fan Control
      a. The Supply Fan will operate continuously whenever the AHU is in either the Occupied Cooling Mode or the Night Setback / Morning Warm-up Heating Mode. The Supply Fan will be OFF whenever the AHU is in the Unoccupied Mode, the Stop / Auto interlock is open, the Mixed Air Low Limit is tripped, or the Supply Fan Status indicates a failure (after a two minute delay). The Low Limit and the Fan Failure require a manual reset.
   5. Frequency Inverter Control
      a. When the Supply Fan is ON, the Frequency Inverter will slowly ramp (adjustable) up to setpoint and modulate to maintain the proper Duct Static Pressure. The Frequency Inverter will close if the Supply Fan is OFF or the Duct Static Pressure Sensor fails.
   6. Economizer Control
      a. Economizer will be conrolled off Fixed Enthalpy and Fixed Dry Bulb
      b. The DDC controler shall calculate enthalpy and compare the Outside Air Enthalpy and Outside Air Temperature to the economizer enthalpy and temperature setpoints (28 BTU/lbda or 75 degrees F respectively)[setable]. When the outside air exceeds either setpoint the economizer shall be disabled and the Outside Air Damper will return to it's minimum position. A enconomizer shall be disabled when the outside air temperature is below 40 degrees F (setable).

c. The Outdoor Air Damper will be set to its adjustable minimum position if the Economizer function is disabled. If the AHU is in the Morning Warm-up mode, the Supply Fan is OFF or the Mixed Air Temperature Sensor has failed, the Outdoor Air Damper will be closed.
d. When Economizer is enabled the associated motorized relief damper shall be opened. When AHU-2A, 2B, 3A, and 3B are in Economizer mode the relief dampers in the attic shall modulate open to relieve pressure.

7. Heating Valve Control
   a. The Heating Valve will modulate to maintain the Discharge Air Temperature at the Discharge Heating Setpoint. If the AHU is in the Heating mode, the unit will control to the maximum heating Discharge Air Setpoint. The Heating Valve will be closed if the Outdoor Air Damper is open past its minimum position or if the Cooling Valve is open. The Heating Valve will be closed if the Supply Fan is OFF . The heating valve shall open fully if the outdoor temperature falls below a freeze avoidance temperature setpoint of 40F (adjustable).
8. Cooling Valve Control
   a. The Cooling Valve will modulate to maintain the Discharge Air Temperature at the Discharge Cooling Setpoint. If the Economizer function is enabled and the Outdoor Air Damper is not fully opened, the Cooling Valve will be closed. The Cooling Valve will be closed if the AHU is in the Heating mode, the Supply Fan is OFF, or the Discharge Air Sensor has failed.
9. Building Automation System Interface
   a. The Building Automation System (BAS) shall send the AHU a Discharge Air Cooling Setpoint, and a Duct Static Pressure Setpoint. The BAS shall also send Start-up, Occupied, Unoccupied, Morning Warm-up, Heating / Cooling, Economizer enable, Timed Override, Startup, Coastdown, Demand Limit, Duty Cycle, Night Setback, Purge, and Priority Shutdown commands.
   b. If communication with the BAS is lost, the AHU uses its default setpoints and operates in the Occupied Cooling mode. The Economizer function is enabled based on the AHU Outdoor Air Temperature Sensor.
   c. AHU System Level Control
      1) Static Pressure Optimization of Discharge Air Temperature and Static Pressure Setpoints
         (a) The building automation system shall monitor the damper position of all VAV terminal units and determine each VAV AHU's critical zone VAV terminal (CZ), which is the VAV terminal unit that is the widest open.
         (b) When the CZ is more than 95% open, the supply fan discharge static pressure setpoint shall be reset downward by 10% of the previous setpoint at a frequency of 10 minutes until the CZ is more than 97% open or the static pressure setpoint has reset downward to the system minimum setting or the inlet vanes (or Frequency Inverter) are at their minimum setting.
         (c) When the CZ is less than 95% open and the supply fan discharge static pressure setpoint is at the minimum setting, the discharge air temperature setpoint shall be reset upward in increments of 0.5 F at a frequency of 10 minutes and the static pressure setpoint held constant until the CZ is more than 97% open or the discharge air temperature is reset to its maximum setting of 10 F above design setting.

(d) The reverse control sequencing shall occur when the CZ is above 98% open until the discharge air temperature setpoint and the static pressure setpoint are at their design setpoints.
(e) The control bands, setpoint increment values, setpoint decrement values and adjustment frequencies shall be adjusted to maintain maximum static pressure optimization with stable system control and maximum comfort control.

2) VAV Box Reheat Interlock Control
(a) Each VAV box reheat shall be disabled from, or enabled for local control by the VAV box standalone controller.
(b) At a minimum, all boxes being served by an AHU shall be controlled as a group. Provide more groups as designated in the points list, drawings or elsewhere in this specification.
(c) The interlock shall be controlled by comparing the outside air ambient temperature to the interlock setpoint (adjustable). If each AHU controller is individually sensing the outside air ambient temperature serving the unit, then the temperature sensor for that AHU shall be used for the interlock for its group of boxes.
(d) The interlock shall also be controlled by a system operator command and other processes.

3) Supply Air Reset
(a) System shall be capable of resetting the supply air temp by 25% of the difference between the design supply-air temperature and the design room air temperature.

10. The following points will be monitored and alarmed at the AHU controller and the BAS:
a. Supply air temp-Damper output %
b. Mixed air temp-Heat output %
c. Outside air temp-Cool output %
d. Space temp-Fan modulation %
e. Duct static press.-Low limit status
f. Fan status-Heat/cool mode
g. Sensors Norm/Fail status-DDC loop parameters
h. Filter Norm/Dirty-Damper Min. Pos. %
11. The following points will be operator adjustable and/or automatically reset by a BAS program.
a. Heating setpoint-Heat reset setpoint
1) Cooling setpoint-Cool reset setpoint
2) Economizer setpoint-OA changeover
3) Economizer setpoint-Enthalpy changeover
4) Min. Position setpoint-Static press. setpoint
5) Damper open/close-Cool/Heat disable

3.02 FAN COIL UNITS

A. Single temperature unit mounted thermostat set at 75 degrees F maintains constant space temperature by modulating two-way control heating valve.

B. Provide setback based on occupancy schedule.

3.03 HEATING WATER ZONE CONTROL

A. Flow switch in heating pump discharge provides on/off indication.

B. Control heating water supply temperature set at 180 degrees F in accordance with outdoor reset schedule.

C. Control heating water at maximum 180 degrees F at outdoor temperature of -30 degrees F, and minimum 130 degrees F at outdoor temperature of 75 degrees F, with straight line relationship between.

D. Flow switch in heating water circuit on no flow conditions closes valve and indicates alarm.

E. On outside temperatures above 65 degrees F , de-energize heating pumps and suppress alarm. Temperature must be able to be reset remotely.

F. Display:
1. System graphic.
2. System supply temperature.
3. System supply control point adjustment.
4. System return temperature.
5. Pump on/off indication
6. Pump on/off switch.

3.04 TERTIARY CHILLED WATER ZONE CONTROL

A. Flow switch in Chilled water pump discharge provides on/off indication.

B. Control pumps in primary, standby operation.

C. Control tertiary loop based upon return water temperature.

D. As tertiary chilled water return temperature approaches 55° F (setable) modulate return control valve open to allow cold secondary water into building loop.

E. Flow switch in chilled water circuit on no flow conditions indicates alarm.

F. Display:
1. System graphic.
2. System supply temperature.
3. System supply control point adjustment.
4. Building return temperature.
5. Building return control point adjustment
6. System supply flowrate
7. Pump on/off indication
8. Pump on/off switch.

3.05 TERMINAL AIR UNITS

A. Single temperature thermostat set at 72 degrees F maintains constant space temperature by modulating variable volume damper operator. If thermostat is still not satisfied, add heat by modulating control heating valve open.

3.06 EXHAUST FAN

A. All exhaust fans shall be time scheduled to start and stop.

3.07 COMPUTER ROOM AIR CONDITIONING UNIT

A. Interface with unit controls to provide remote monitoring and alarms. All alarms shall be brought back to the BMS. Provide all equipment required for remote monitoring and interfacing with the computer room unit.

B. Coordinate with unit controls to provide equal run time for each computer room unit. Computer room unit shall be controled by a single common thermostat.

3.08 UNIT HEATERS

A. Single temperature electric room thermostat maintains constant space temperature of 68 degrees F by cycling unit fan motor and opening control valve.

END OF SECTION

SECTION 15950 - TESTING, ADJUSTING, AND BALANCING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Testing, adjustment, and balancing of hydronic and refrigerating systems.

C. Measurement of final operating condition of HVAC systems.

D. Sound measurement of equipment operating conditions.

E. Vibration measurement of equipment operating conditions.

1.02 REFERENCE STANDARDS

A. AABC MN-1 - AABC National Standards for Total System Balance; Associated Air Balance Council; 2002.

B. ASHRAE Std 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 1988, with 1997 Errata.

C. NEBB (TAB) - Procedural Standards for Testing Adjusting Balancing of Environmental Systems; National Environmental Balancing Bureau; 2005, Seventh Edition.

D. SMACNA (TAB) - HVAC Systems Testing, Adjusting, and Balancing; Sheet Metal and Air Conditioning Contractors' National Association; 2002.

1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.

C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
   1. Submit to GMK Associates, Inc.
   2. Include certification that the plan developer has reviewed the contract documents, the equipment and systems, and the control system with the GMK Associates and other installers to sufficiently understand the design intent for each system.
   3. Include at least the following in the plan:
      a. Preface: An explanation of the intended use of the control system.
      b. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
      c. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
      d. Identification and types of measurement instruments to be used and their most recent calibration date.
      e. Discussion of what notations and markings will be made on the duct and piping

drawings during the process.
f. Final test report forms to be used.
g. Detailed step-by-step procedures for TAB work for each system and issue, including:
   1) Terminal flow calibration (for each terminal type).
   2) Diffuser proportioning.
   3) Branch/submain proportioning.
   4) Total flow calculations.
   5) Rechecking.
   6) Diversity issues.
h. Expected problems and solutions, etc.
i. Details of how TOTAL flow will be determined; for example:
   1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
   2) Water: Pump curves, circuit setter, flow station, ultrasonic, etc.
j. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and methods to verify this.
k. Confirmation of understanding of the outside air ventilation criteria under all conditions.
l. Procedures for formal deficiency reports, including scope, frequency and distribution.

D. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

E. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
1. Submit under provisions of Section 01400.
2. Revise TAB plan to reflect actual procedures and submit as part of final report.
3. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for GMK Associates and for inclusion in operating and maintenance manuals.
4. 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. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
5. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
6. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
7. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.
8. Include the following on the title page of each report:
   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 GMK Associates.
g. Project Engineer.
h. Project Contractor.
i. Project altitude.
j. Report date.

F. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

PART 3 EXECUTION

2.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
1. AABC MN-1, AABC National Standards for Total System Balance.
2. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.
3. Maintain at least one copy of the standard to be used at project site at all times.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:
1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
2. Certified by one of the following:
a. AABC, Associated Air Balance Council: www.aabchq.com; upon completion submit AABC National Performance Guaranty.
b. NEBB, National Environmental Balancing Bureau: www.nebb.org.

E. TAB Supervisor Qualifications: Certified by same organization as TAB agency.

2.02 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. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.

11. Duct system leakage is minimized.
12. Hydronic systems are flushed, filled, and vented.
13. Pumps are rotating correctly.
14. Proper strainer baskets are clean and in place.
15. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

2.03 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.

B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to GMK Associates to facilitate spot checks during testing.

C. Provide additional balancing devices as required.

2.04 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

2.05 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:
1. Running log of events and issues.
2. Discrepancies, deficient or uncompleted work by others.
3. Contract interpretation requests.
4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark on the drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

2.06 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure 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 extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.

M. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

2.07 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect system balance with automatic control valves fully open to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

2.08 SCOPE

A. Test, adjust, and balance the following:
1. HVAC Pumps
2. Air Handling Units
3. Fans
4. Air Terminal Units
5. Air Inlets and Outlets
6. Controls Compressor
7. Fan Coil Units

2.09 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
1. Manufacturer
2. Model/Frame
3. HP/BHP
4. Phase, voltage, amperage; nameplate, actual, no load
5. RPM
6. Service factor
7. Starter size, rating, heater elements
8. Sheave Make/Size/Bore

B. V-Belt Drives:
1. Identification/location
2. Required driven RPM
3. Driven sheave, diameter and RPM
4. Belt, size and quantity
5. Motor sheave diameter and RPM
6. Center to center distance, maximum, minimum, and actual

C. Pumps:
1. Identification/number
2. Manufacturer
3. Size/model
4. Impeller
5. Service
6. Design flow rate, pressure drop, BHP
7. Actual flow rate, pressure drop, BHP
8. Discharge pressure
9. Suction pressure
10. Total operating head pressure
11. Shut off, discharge and suction pressures
12. Shut off, total head pressure

D. Cooling Coils:
   1. Identification/number
   2. Location
   3. Service
   4. Manufacturer
   5. Air flow, design and actual
   6. Entering air DB temperature, design and actual
   7. Entering air WB temperature, design and actual
   8. Leaving air DB temperature, design and actual
   9. Leaving air WB temperature, design and actual
   10. Water flow, design and actual
   11. Water pressure drop, design and actual
   12. Entering water temperature, design and actual
   13. Leaving water temperature, design and actual
   14. Air pressure drop, design and actual

E. Heating Coils:
   1. Identification/number
   2. Location
   3. Service
   4. Manufacturer
   5. Air flow, design and actual
   6. Water flow, design and actual
   7. Water pressure drop, design and actual
   8. Entering water temperature, design and actual
   9. Leaving water temperature, design and actual
   10. Entering air temperature, design and actual
   11. Leaving air temperature, design and actual
   12. Air pressure drop, design and actual

F. Air Moving Equipment:
   1. Location
   2. Manufacturer
   3. Model number
   4. Serial number
   5. Arrangement/Class/Discharge
   6. Air flow, specified and actual
   7. Return air flow, specified and actual
   8. Outside air flow, specified and actual
   9. Supply air temperature
   10. Total static pressure (total external), specified and actual
   11. Inlet pressure
   12. Discharge pressure
   13. Sheave Make/Size/Bore
   14. Number of Belts/Make/Size
   15. Fan RPM

G. Return Air/Outside Air:
   1. Identification/location

2. Design air flow
3. Actual air flow
4. Design return air flow
5. Actual return air flow
6. Design outside air flow
7. Actual outside air flow
8. Return air temperature
9. Outside air temperature
10. Required mixed air temperature
11. Actual mixed air temperature
12. Design outside/return air ratio
13. Actual outside/return air ratio

H. Exhaust Fans:
1. Location
2. Manufacturer
3. Model number
4. Serial number
5. Air flow, specified and actual
6. Total static pressure (total external), specified and actual
7. Inlet pressure
8. Discharge pressure
9. Sheave Make/Size/Bore
10. Number of Belts/Make/Size
11. Fan RPM

I. Duct Traverses:
1. System zone/branch
2. Duct size
3. Area
4. Design velocity
5. Design air flow
6. Test velocity
7. Test air flow
8. Duct static pressure
9. Air temperature
10. Air correction factor

J. Flow Measuring Stations:
1. Identification/number
2. Location
3. Size
4. Manufacturer
5. Model number
6. Serial number
7. Design Flow rate
8. Design pressure drop
9. Actual/final pressure drop
10. Actual/final flow rate

11. Station calibrated setting

K. Terminal Unit Data:
1. Manufacturer
2. Type, constant, variable, single, dual duct
3. Identification/number
4. Location
5. Model number
6. Size
7. Minimum static pressure
8. Minimum design air flow
9. Maximum design air flow
10. Maximum actual air flow
11. Inlet static pressure

L. Air Distribution Tests:
1. Air terminal number
2. Room number/location
3. Terminal type
4. Terminal size
5. Area factor
6. Design velocity
7. Design air flow
8. Test (final) velocity
9. Test (final) air flow
10. Percent of design air flow

END OF SECTION

D I V I S I O N 16

E L E C T R I C A L

Applicable Portions Of The Conditions Of The Contract And Division 1 General Requirements Apply To The Work Of This Division.

SECTION 16010 - GENERAL ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Work included in these specifications and included on the drawings shall include furnishing all labor, materials, supplies, and equipment to perform all work required including cutting, channeling, chasing, excavating and backfilling, demolition (if any) to install a complete and working electrical system(s) in accordance with these sections of the specifications and the accompanying drawings. This shall include all required preparation work, demolition, raceways, coordination, etc. required to install the electrical system.

B. It is recognized that separate subcontracts may be instituted by the General Contractor or the Division 16 Contractor with other contractors and/or suppliers. It is the responsibility of the Division 16 Contractor to completely inform, coordinate and advise those subs as to all of the other requirements, conditions and information associated with providing and installing the total job.

C. The electrical work shall include, but in no way be limited to the following:
   1. Raceways Systems
      a. Power
      b. Lighting
      c. Voice/Data
      d. Fire Alarm Systems
   2. Electrical Distribution System
   3. Lighting Systems
      a. Interior
      b. Exterior
   4. Power Systems
      a. Interior
   5. Wiring Devices
   6. Fire Alarm System
   7. Electrical Demolition
   8. Connection and/or Installation of Devices or Support for Installation of Systems furnished under other divisions of the Project Manual including but not limited too:
      a. Security Access and Control

1.02 RELATED SECTIONS

A. Drawings and specifications including General Conditions, Supplementary Conditions and Division 1 specification sections, apply to work of this and all sections in Division 16. Division 16 General Provisions described in this section apply to all sections of Division 16.

1.03 SUBSTITUTION AND THE "OR EQUAL" CLAUSE

A. See Specification Section 01600. Where a manufacturer and/or model number is noted in a specification, that manufacturer and/or model number shall be the equipment used on the project. Substitutions will be considered and evaluated for all of the specified equipment per the process as outlined in this Specification Section 01600. When an item, piece of equipment, method, etc. is specified or called for on the drawings or in the specifications, it shall establish a standard of quality which shall be used to evaluate all substitutions. It is

not the intent of this specification to limit competition in any way, however; in some evaluations the decision of equality depends to a certain extent personal opinion and preference. In all evaluations, the opinion and decision of the engineer shall be final and binding to all parties.

B. All submittals to request to substitute shall clearly describe the product. Request to substitute shall include catalog descriptive material, engineering data, and also list areas where the requested material exceeds or falls short of the specification for the specified material. If requested, provide samples (To be retained by the Engineer) of the proposed item.

C. Incomplete submittals, or submittals that require the Engineer to spend considerable time researching the item, will not be considered for approval. The burden of proof that an item is equal to the specified item is on the party requesting the substitution. In all evaluations, the opinion and decision of the engineer shall be final and binding to all parties.

D. Request to substitute or obtain approval to substitute for an item or material that has been previously turned down, will not be considered.

E. When approval to substitute an item for the specified item is granted, the approval does not relieve the contractor from compliance with all system functions or equipment characteristics.

F. When a substituted item requires additional work for another contractor or subcontractor to adjust his work to accommodate the substituted item, the contractor who made the substitution shall pay all cost for accommodation of the substituted item.

G. As with any substituted item, it is the responsibility of the contractor making the substitution to make the item fit, function, and act as the specified item. If, in the opinion of the engineer, the substituted item does not comply, function, fit, or perform to the standards of the specified item, the contractor shall remove the substituted item and install the specified item, at no cost to the Owner.

1.04 REFERENCES

A. The Contractor is responsible for obtaining all required permits and complying with the current editions, or the editions referenced in the other individual sections of these specifications, of all applicable National (NEC, IBC, NFPA), State, County, and Municipal codes and regulations. This shall include, but not be limited to, the following:
   1. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.
   2. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association.
   3. NFPA 70 - National Electrical Code; National Fire Protection Association.
   4. NFPA 72 - National Fire Alarm Code;
   5. Federal Occupational Safety and Health Act (OSHA)
   6. NFPA 101 (Life Safety Code);
   7. ANSI/ASME A17.1 (Safety Code for Elevators and Escalators)
   8. Americans with Disabilities Act (ADA).
   9. International Building Code (IBC);
   10. International Fire Code;

B. Unless noted otherwise, the contractor shall comply with the latest edition and update of any and all codes and standards.

C. Compliance with Underwriters Laboratories: All products installed under the contract shall have the Underwriters Laboratories (UL) label where such marking is available. Products which are not UL labeled will not be acceptable if labeled products are available from another approved manufacturer.

D. The above listed requirements are required of the electrical contractor by this contract whether these requirements are shown on the drawings, mentioned in the specifications or not.

E. All work and equipment installed that does not comply with the codes and standards noted above shall be corrected and/or replaced (at engineer's option) at no cost to the Owner.

F. The contractor(s) shall submit all items necessary to obtain all required permits to the appropriate Federal/State/County/City agencies, obtain all required permits, and pay for any and all required fees.

1.05 DEFINITIONS

A. Concealed - Embedded in masonry or installed within other building elements including but not necessarily limited to crawl spaces, spaces above ceilings, in walls, in chases, shafts . It shall also inlcude conduit installed in the ground beneath a floor slab. Not visible.

B. Exposed - Installed in such a manner that it can be seen. All exposed materials shall be installed in a neat manner. If in the engineer's opinion the installed materials are not installed in a neat manner, it shall be removed and reinstalled (at the Contractor's expense) to the satisfaction of the engineer, all at no increase cost to the Owner.

C. Furnish - When used in the Division 16 plans and/or specifications the word "furnish" shall mean to purchase a piece of equipment or material and to have said equipment/material transported to the project site (or other location if so directed). All items to be furnished shall include any and all mounting hardware, support, and accessory required for installation and proper operation. Unless otherwise noted, when a piece of equipment or material is to be furnished by the contractor, it shall also be installed.

D. Provide - When used in the Division 16 plans and/or specifications the word "provide" shall mean to furnish and install complete and ready for use and to put into operation. Include any and all options, accessories, and mounting/installation hardware required for a complete and operating system or element of the electrical system.

E. Install - When used in the Division 16 plans and/or specifications the word "install" shall mean to unload and transport the equipment/material to the installation point of the job site. Any and all mounting hardware (whether specified or called for by name / model number, or not) shall be included. Perform every operation necessary, including any and all final adjustments, etc. required for proper operation.

F. Controlled – When used in the Division 16 plans and/or specifications, the word “controlled” shall mean to govern delivery of operating voltage or power to equipment or systems by means of, but not limited to, feeders, disconnects, breakers, switches, starters, etc..

1.06 COORDINATION OF WORK IN OTHER SECTIONS

A. The Division 16000 contractor is responsible for including any and all work related to the

electrical that is noted in any part of the specifications or any part of the drawings, including Divisions 1, 15 and any other sections.

B. If any piece of equipment is shown on any part of the drawings ("A" (Architectural) drawings, "M" (Mechanical) drawings, "P" (Plumbing) drawings, or "E" (Electrical) drawings), it is the responsibility of the Division 16 Contractor to furnish and install electrical service as required to that equipment. Do a complete review of all contract documents and include electrical service for all such equipment whether or not it is also shown in Electrical documents. Electrical service shall comply with all requirements of the equipment shop drawings and all codes.

C. The Division 16 Contractor will supply power to equipment at the voltage indicated on the Division 16 drawings. The Division 16 Contractor and all other contractors will be held responsible for coordinating the equipment voltages, control equipment, wiring, and locations and type of terminations/connections and/or disconnects required to comply with the National Electrical Code, International Building Code, all local codes, and the equipment manufacturer's requirements. If equipment is furnished to the project at a voltage other than that shown on the Division 16 drawings, the contractor supplying the equipment and all other subcontractors will be held responsible for making any necessary adjustments to correct the conflict, to the satisfaction of the Electrical Engineer.

1.07 INTERPRETATION OF THE DRAWINGS AND SPECIFICATIONS (CONTRACT DOCUMENTS):

A. Refer to the section of the specifications which cover General Conditions, Division 1, and Instructions to bidders. These sections and their requirements are a part of this contract and are binding on this section of the work.

B. Electrical Drawings are diagrammatic in nature except where specific dimensions, or specific details are shown on the electrical, mechanical, or architectural drawings. The Electrical Contractor shall refer to other drawings for exact locations of equipment, building dimensions, architectural details and conditions affecting the electrical work; however, field measurements take precedence over dimensioned drawings. The Electrical Contractor shall provide all labor and materials and all incidental elements; junction and pull boxes, filters, pull wires, connectors, support materials, fuses, disconnect switches, lamps, and labels, to install, connect, start-up and result in a complete and working system in accordance with the drawings and specifications. Unless noted otherwise on the plans or in these specifications, all final connections are the responsibility of the Division 16 Contractor.

C. In order to show the electrical work required under this contract on the drawings, it is necessary to utilize symbols and schematic diagrams/details. These symbols and schematic diagrams/details do not have any dimensional significance nor do they delineate every item required for the intended installations. The work shall be installed in accordance with the intent diagrammatically expressed on the drawings, and in conformity with the dimensions indicated on the final architectural and structural working drawings and on equipment shop drawings. No interpretation shall be made from the limitations of symbols and diagrams that any elements necessary for complete work are excluded.

D. When the details of specific and/or general installation requirements show specific dimensioning and/or positioning requirements of the items to be installed, these dimensions shall be field verified and followed. It is the intent of these details to only establish the

general feasibility of the work required. These details in no way delete, reduce, or substitute the requirement of field coordination for the indicated work.

E. The contractor is responsible for coordinating the installation of all electrical work with the work of other contractors and/or trades. This contractor shall refer to the other drawings (demolition, site, civil, architectural, kitchen, structural, plumbing, mechanical, etc.) to assure that the installed electrical work is installed in a coordinated fashion. Conflicts on installation work due to the lack of proper coordination of this contractor shall result in the work being removed and coordinated and properly reinstalled at no increase cost to the Owner. Report to the Engineer any and all discrepancies that the contractor(s) find in the field between the electrical drawings and the other drawings.

F. The installation of any and all equipment/systems is subject to clarification as indicated in the review comments of the Engineer on the shop drawings. The contractor shall be aware that if the equipment of an approved equal manufacturer is to be installed, the equipment, controls, functions, conduit routing, power requirements, etc. may be different. It is the responsibility of the electrical contractor to coordinate the installation requirements of the equipment to be installed with the electrical plans of the specified equipment/systems. If there are any additional equipment, power service, conduit, conductors, controls, etc. required to install the approved equal equipment, these additional requirements shall be furnished and installed at no additional cost to the Owner.

G. The electrical drawings are such that the electrical service to equipment furnished and installed under other sections of the contract documents (examples, but not limited to: elevators, kitchen equipment, HVAC equipment, water heaters, fans, pumps, motors, etc) is coordinated for the specified equipment only. If the equipment installed under other divisions of the contract documents is not the specified equipment and is an approved equal to the specified equipment, it is possible that the equipment will require different electrical service/interface than that shown on the electrical plans for the specified equipment. In this case, it is the responsibility of the approved equal installing contractor / manufacturer to coordinate the electrical service/interface requirements with the electrical contractor. If the electrical service/interface requirements of the substituted equipment are greater than the specified equipment and result in an increased electrical cost, it is the responsibility of the furnishing/installing contractor to pay the electrical contractor for the increase in electrical cost.

H. Submission of a proposal and ultimate acceptance of an agreement or contract for execution of this section of work will be construed as evidence that the Electrical Contractor and each interested Subcontractor and/or vendor has carefully read and accepts all conditions set forth in each Division under specification Divisions titled "Instructions To Bidders" and Division 1, "General Conditions", in so far as such conditions may affect both the bidding for and execution of this section of work.

1.08 ELECTRICAL SYSTEMS

A. All electrical systems shown on the plans or specified in the specifications shall have equipment furnished and installed so that the system is a complete and functioning system that complies with the intent of the specifications, whether each and every element of each and every system is specified or not. Any and all equipment, options, and system elements necessary for proper operation shall be furnished and installed, whether specifically called

for (specified by name or catalog number) or not.

B. The wiring, connections, and support elements shown on the plans or noted in the specifications is for a complete and workable system(s). Any deviations from the wiring shown due to a particular manufacturer's requirements shall be made at no cost to either the contract or to the Owner. Changes in electrical service to equipment due to substitutions of equipment by any contractors shall be at the cost of that contractor.

1.09 SPECIAL ELECTRICAL REQUIREMENTS

A. Provide all wiring, connectors, fittings, connections, and all accessories for the complete installation of, and final connections to, equipment furnished under other divisions of the specifications and where indicated on the electrical drawings or otherwise specified.

B. The Electrical Contractor shall coordinate with all other contractors the electrical service provided as shown on the electrical plans with respect to voltage, phase, and ampacity. This coordination shall take place before any equipment is ordered and is for the purpose of the contractor providing equipment that requires electrical connection ordering the correct equipment to match the electrical service provided. Any changes in the characteristics of the circuits that serve any electrically operated equipment shall be made at no additional cost to the Owner.

C. Make all final connections to all equipment, provided under the electrical contract and equipment provided under other sections, except where noted on the plans to provide "rough-in only". Where connections are to be made by someone other than the Division 16 contractor, coordinate with the equipment supplier to determine the rough-in requirements. In the case where rough-in is installed now but equipment unknown or is to be installed in the future, install outlet box sized for the conductors installed, install conductors and leave 8" of pigtails for each conductor. Tape all conductors, leave a note in the box as to the panel the circuit is connected, and install a cover plate over the outlet box. In the panel that the circuit terminates, do not connect the circuit to a breaker, tag the circuit with information as to the location of the outlet box, and leave enough pigtail in the panel so that connection can be made to any breaker space in the panel.

D. The Electrical Contractor is hereby alerted that certain features of control, other functions, or systems may be specified in this division by performance, and as such, all elements of wiring or other materials and devices for the complete installation may not be shown on the drawings. The Electrical Contractor shall provide for the final and complete installation of all features called for by drawings or specifications.

E. Note that the Mechanical Division includes furnishing all motors for equipment furnished and installed by Division 15. In addition, unless otherwise shown on the electrical drawings, starters for Division 15 equipment shall also be provided by Division 15. The Division 16 work shall include installing all of the individually mounted, stand alone starters and the power wiring from the electrical system through ALL motor starters to the final connection to the motors. Where motors are served through a Motor Control Center (MCC), motor starters are a part of the motor control center and are furnished and installed through the Electrical Division (Division 16). Where motors are served through a Motor Control Center (MCC), the Division 16 Contractor is responsible for coordinating with the Division 15 Contractor the size, type, horsepower, speed, number of speeds, windings, voltage, and recommended heater size for all motors. From this coordination the Division 16 Contractor

shall furnish and install in the Motor Control Center the starters as required to serve the motors on the project. The only exception for this requirement of the Division 16 scope furnishing and installing starters shall be where the Division 15 equipment has a control panel that includes the starter and/or disconnect. Coordinate with Division 15.

F. Where equipment is prewired, the power wiring shall extend to the power terminals of the pre-wired equipment. Control wiring for the mechanical equipment and temperature control wiring is covered under Division 15 and is not a part of Division 16 unless specifically noted.

G. All safety disconnect switches shall be provided under Division 16 except where the Division 15 equipment is equipped with factory installed disconnects. Where the switch designation calls for the switch to be fused, the electrical contractor shall furnish and install fuses that are sized in accordance to the equipment nameplate of the equipment served.

H. In order to comply with the seismic codes, all recessed light fixtures shall be supported with four (4) hanger wires which shall be tied to the structure.

1.10 DIMENSIONS ON DRAWINGS, IN FIELD, VERIFICATION

A. The contractor shall be responsible for visiting the site in order to become familiar with existing conditions and coordinating the required work as needed. No increase in contract cost will be considered due to the contractor not being aware of existing conditions.

B. Do not scale drawings. Confirm all dimensions in the field. Coordinate all installations with shop drawings and other contractors work. Where discrepancies are found on the contract documents, the contractor shall include in the project cost any and all materials, items and labor required to make any and all changes required to install the work correctly. Where discrepancies are found on the project the contractor shall stop work in that area and contact the engineer.

1.11 SUBMITTALS

A. Unless otherwise noted, Submittals (formerly/also referred to as “shop drawings”) shall be made in accordance with requirements as stated in Division 1. Submittals shall be submitted to the Engineer on all equipment within thirty (30) days of contract award. If submittals are not received within the thirty day time limit the specified equipment shall be used (no exceptions).

B. The Contractor shall not purchase any materials or equipment prior to the receipt of approved submittals from the Engineer. Any commitment to purchase or contract to purchase equipment or materials made between the Contractor and an equipment supplier and/or manufacturer before the receipt of approved submittals from the Engineer shall be at the risk of the Contractor. If submittals are not approved, any restocking charge or cancellation charge by a manufacturer and/or supplier shall be the responsibility of the Contractor and not reflect as an increase cost to the Owner

C. Submittals shall contain all the necessary information required to prove that the equipment will fit and function correctly. Submittals shall be bound together and submitted as a complete package for each section. The Contractor shall review each submittal to confirm that the submittal meets the Contractor's requirements before the submittal is made to the Engineer.

D. For some equipment/systems (examples: fire alarm, nurse call, security, CCTV, cable TV, etc.), the drawings only show the system elements and do not show the interconnection of these elements on a riser diagram. For equipment/systems such as these, the manufacturer shall include with the submittals a wiring/conduit riser diagram for the system.

E. It is not unreasonable to expect a 14 to 21 day (or possibly longer) submittal turnaround from the Engineer. Therefore it is imperative that the Contractor comply with the 30 day requirement outlined in paragraph A. If the project is a "Fast Track" type project, it may be necessary to have submittals reviewed in a very short time period. In such cases, the contractor shall note on the cover sheet of the submittal the date in which submittals must be returned. Every effort will be made to comply with this date, but close coordination between Contractor and Engineer shall be required.

F. The engineer reserves the right to refuse any equipment that in his opinion will not function as well as the specified equipment. The opinion of the engineer shall be final and shall bind all parties. The Engineer has the right to require the contractor to use the specified equipment if the second shop drawing submittal is not approved.

G. Submittal review is only for verifying gbeneral conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Provide equipment and/or devices for which the electrical service requirements matches that shown on the contract documents for the equipment and/or device in question. It is the responsibility of the contractor to submit a separate formal request to change voltages or other aspects of the electrical service for a given piece of equipment or device if a change is desired. It is not incumbent on the engineer to recognize changes in electrical service contained in the shop drawing submittal. The contractor is also responsible for dimensions to be confirmed and correlated at the job site; for information that pertains solely to the fabrication processes or to techniques of construction; and for coordination of the work of all trades.

H. The Contractor shall review the submittals and make note of all dimensions of the equipment and shall make the necessary adjustments in equipment locations as required to install the equipment. THE CONTRACTOR SHALL NOT INSTALL ANY EQUIPMENT OR PROVIDE ELECTRICAL ROUGH-INS BEFORE APPROVED SUBMITTALS ARE RETURNED BY THE ENGINEER AND DIMENSIONS ARE APPROVED.

I. Approval to substitute material, equipment, devices, processes, or any item as an "as/an equal" to the specified item does not relieve the Contractor of the full responsibility to make the substituted material, fit, function or appear as required in the Drawings and Specifications. Contractor shall assume full responsibility for the satisfactory adaptability of a substituted item to those items specified or shown on the drawings.

J. Required submittals are listed with each section of the electrical specifications.

1.12 RECORD DRAWINGS

A. The electrical contractor shall keep a set of construction drawings during the length of the project on which he shall note any and all changes from the original drawings. Of special importance is noting the actual location of all service entrances into the building and where conduit stub outs have been insalled. This record set of drawings shall be updated daily. The drawings shall be neat, orderly and marked in a way to be clearly interpreted. The

record drawings shall be turned over to the Architect to update drawing files for a final set of drawings for the owners record.

B. When the submitted information has been deemed satisfactory and all information has been transferred by the architect to the drawing files, they shall be labeled as "RECORD DRAWINGS" and copies turned over to the owner. Only then will final approval and payment be approved.

C. After the "RECORD DRAWINGS" have been approved by the Engineer, the contractor shall have one set of prints made from the "Record Drawings" and shall wall mount a 4" PVC tube with screw on cap in the main electrical room and place the set of prints in this tube.

1.13 CHANGE ORDERS

A. Change orders will not be issued for relocating electrical equipment or rerouting conduit and wiring. This section of the electrical specifications require that relocating of electrical equipment or rerouting of conduit/wiring be done at no additional cost to the Owner.

B. When change orders are required for electrical work, the unit material and unit labor method shall be used. Unit values for material shall be contractors' net cost from distributor. Unit values for labor hours shall not be greater than those listed in the latest addition of Means mechanical/electrical cost data. Sales tax is to be added to materials and workman's compensation insurance is to be added to labor. Overhead and profit markup is to be added to the materials and labor subtotal per the instructions in Division 1..

C. To calculate a credit for deleted work, the identical method of calculations shall be used for deleted work that is used for new work. No money will be allowed for lost scheduling time or estimation time. The Engineer agrees to expedite change orders as rapidly as possible to avoid construction delay. The contractor may be required to estimate a number of alternatives for change orders in order to arrive at the lowest cost for change orders.

D. There shall be no additional cost for the contractor to estimate multiple alternatives for consideration.

1.14 QUALITY ASSURANCE

A. The contractor performing the electrical work shall employ craftsmen who are thoroughly experienced and trained in the installation of electrical systems and general installation coordination. All work shall be done in the highest level of standards for the trade. Any work installed at a level that is less than the highest level of standards for the trade shall be removed and reinstalled in the manner described above at NO additional cost to the Owner.

B. All equipment shall be installed in compliance with the manufacturer's published installation recommendations and requirements, with any and all required accessories and mounting hardware, and/or as approved by the Engineer. The manufacturer's published installation requirements and recommendations shall become a part of the Owner's Manual (See Paragraph 1.15)

1.15 OPERATING AND MAINTENANCE MANUALS:

A. The Manuals generally include all project submittals updated to reflect actually installed conditions; operating instructions; maintenance schedules; training material; warranty and

bonds; and contact information for sales, warranty and service of equipment. Refer to Division 1 of the specifications for complete requirements.

B. Provide manuals for each product or system.

1.16 DELIVERY, STORAGE, AND PROTECTION

A. Where equipment is purchased by the electrical contractor to be installed in conformance with the contract documents, the contractor shall follow the following procedure as it relates to delivery, storage, and installation:
   1. Coordinate any and all information with any and all contractors who are to do work to accommodate the division 16 equipment/work.
   2. Coordinate delivery of equipment.
   3. Unload the equipment from delivery trucks.
   4. Inspect equipment for damage. Report damage immediately and arrangef ro the equipment to be repaired or replaced. No claims for time extensions or additional work related to the damage will be accepted if not made within ten days of the delivery of the equipment.
   5. Inspect the equipment to assure correct make, model number, voltage, etc.
   6. Provide for safe handling and field storage up to the time of permanent placement in the project.
   7. Provide for any and all field assembly and internal connection as may be necessary for proper operation.
   8. Install in place including any and all required mounting supports, connectors, fittings, connections, and accessories required for complete system operation.

B. Where equipment is purchased by the Owner and is to be installed by the Division 16 contractor, the Division 16 contractor shall follow the following procedure as it relates to delivery, storage, and installation:
   1. Coordinate equipment shop drawings with any and all contractors who are to do work to accommodate the Division 16 equipment /work.
   2. Coordinate delivery of equipment.
   3. Unload the equipment from delivery trucks.
   4. Inspect equipment for damage. Report damage immediately and arrange for the equipment to be repaired or replaced. No claims for time extensions or additional work related to the damage will be accepted if not made within ten days of the delivery of the equipment.
   5. Inspect the equipment to assure correct make, model number, voltage, etc.
   6. Provide for safe handling and field storage up to the time of permanent placement in the project.
   7. Provide for any and all field assembly and internal connection as may be necessary for proper operation.
   8. Install in place including any and all required mounting supports, connectors, fittings, connections, controls, and accessories required for complete system operation.

1.17 MANUFACTURER'S FIELD SERVICES:

A. Provide manufacturers field services where required under the specific sections of the Project Manual using authorized and trained manufactures represtatives of the equipment or systems in question. The field services shall include the following as a minimum:

1. Inspect the installation to verify that the installation meets or exceeds all manufacturer's requirements and recommendations for proper operation.
2. Start/energize the equipment and verify that the equipment/system is operating and functioning as required by these specifications and the manufacturer's requirements.
3. Provide written certificaiton that field services have been performed and that equipment/system is operating and functioning as required by these specifications and the manufacturer's requirements. Submit the certification as part of the closeout documents.

B. Refer to specific sections of the Project Manual and provide all field service requirements listed in addition to these general requirements.

1.18 WARRANTY

A. All work, equipment, and materials shall be new and without defects or blemishes, and guaranteed to be free from defects for a period of one (1) year after the final date of project acceptance as defined by the Architect (NOT THE DATE OF INSTALLATION OR START-UP). All installation and installation materials shall also be guaranteed for the one (1) year period. This shall cover such items as equipment pads, supports, leaks from around equipment installation, etc and is intended to cover everything installed or provided under this division of the contract.

B. Manufactured pieces of equipment shall have their guarantee also backed by the equipment manufacturer.

C. During the guarantee period there shall be no charge to the Owner for items and work done under the guarantee clause (Service calls). This shall apply to replacement equipment, equipment shipping charges, mileage, labor, all taxes, etc.

D. Refer to the other sections of the Project Manual for warranty requirements that may exceed these general requirements and follow those requirements for the equipment, devices, materials or systems in question.

PART 2 PRODUCTS

2.01 GENERAL:

A. All products shall be of new manufacturer (unless the plans and/or other sections of this specification call for existing or other identified products to be used), age of less than one year, and the latest model of a manufacturer. A new product shall not be used if the manufacturer has introduced a product as a replacement. All materials and apparatus for the work shall be furnished, delivered, erected, connected and finished in every detail, and shall be so selected and arranged as to fit into the building spaces in compliance with all code requirements.

B. All equipment that is provided by the contractor, subcontractors, or specialty subcontractor (fire alarm, sound, CCTV, signal system, etc) to be installed at the project site, shall be purchased, installed and maintained by the local (to the project site) authorized, licensed, factory distributor/installer/supplier. The contractor shall include with the submittals, verification in writing from the manufacturer, that the supplier and/or distributor is a factory authorized and licensed by the manufacturer to provide, install, and maintain (throughout the entire length of the warrantee period) the equipment. THERE SHALL BE NO

EXCEPTIONS TO THIS REQUIREMENT.

C. By providing equipment to the project, a manufacturer guarantees to provide replacement parts for the equipment for a period of ten (10) years, even if the item provided goes out of manufacture.

D. Manufacturer's catalog numbers listed are not necessarily complete and are for general identification only. It is the responsibility of the Contractor to provide complete catalog numbers and to provide all accessories for installation as implied by the accompanying description of the equipment, material or device, the demonstrated use on the drawings, and the specifications contained herein. Products provided shall be a standard product which has a history of successful installation and operation for a minimum period of two years. Prototype or custom made equipment is not acceptable unless so specified herein.

E. Manufacturer's instructions shall be obtained by the Contractor and used for the installation of all equipment and devices where such manufacturer's instructions are available.

F. Where a substituted product is used instead of the specified product, the contractor will assume any and all responsibility for the product to fit, function and perform as well as the specified product. The opinion of the engineer will be binding and shall govern all parties as to a substituted product performing as well as the specified product.

G. Completeness: Provide all boxes, off-sets, bends, raceways, devices, raceway supports, installation brackets and supports, flexible connections, wiring connectors, labels and terminals for the complete installation and operation of all products. Each unit of product shall be assembled and installed and all surfaces shall be clean and free of dents, scratches, and abrasions or marred areas.

PART 3 EXECUTION

3.01 GENERAL

A. Before any work is started, the electrical contractor shall coordinate the work of other contractors that will affect the work of the electrical contractor. The electrical contractor shall inspect the work of all other trades to determine if the other work is ready for the electrical contractor to start his work.

B. Any and all electrical installations shall be coordinated with other trades, contractors and the Owner.

C. The contractor shall make himself familiar with existing conditions, site information, etc. so that conflicts are avoided.

D. All work shall be installed per all applicable code, rules, regulations, shop drawings and manufacturer's installation recommendations.

E. The electrical contractor shall be responsible for returning to original, pre-construction condition, any paved areas, sidewalks, planting, walls, and other areas disturbed during electrical installation work.

F. The electrical equipment shall be installed as close as possible to the location as shown on the plans. If during the installation, it is required to install equipment in locations other than the one shown on the plans, the contractor shall make a sketch of the proposed changes, submit it to the Engineer, and after the Engineer has given approval, then proceed with the

installation.

G. Working spaces and clearances shall not be less than the required minimums in the National Electric Code (NEC).

3.02 EXAMINATION

A. The Electrical Contractor is responsible for visiting and examining the site to determine those portions of the site or present buildings affected by this work so as to become familiar with existing conditions and difficulties that will attend the execution of the work, before submitting proposals.

B. Submission of a proposal will be considered as evidence that such examination has been made and later claims for labor, equipment, or materials because of difficulties encountered, which could have been foreseen had such examination been made, will not be recognized.

3.03 ADDITIONS RENOVATIONS AND REMODELING

A. All electrical work shall be coordinated and phased so as to assure electrical service to any other buildings or parts of buildings that require use during construction.

B. All existing electrical system elements shall be protected from damage during any and all additions, renovations, and remodeling.

C. All new electrical equipment and installations shall be installed and connected to existing work or existing electrical system elements in a neat and careful manner. Any existing electrical work or system elements that are disturbed or damaged shall be replaced or repaired to the pre-construction condition at no additional cost to the Owner.

3.04 LOCATIONS OF EQUIPMENT REQUIRING ELECTRICAL SERVICE AND CONNECTIONS:

A. Coordinate the exact installed location of equipment that requires electrical connections that is furnished and installed by other contractors. The electrical drawings try to show the correct location of all of these items, but it is the responsibility of the electrical contractor to coordinate with all other contractors to determine the exact installed location of all equipment furnished and installed by other contractors and wired by the electrical contractor. Such coordination shall include, but not limited to exact location, location of electrical connection, type of connection required, and electrical characteristics.

3.05 OPENINGS, CUTTING AND PATCHING:

A. Contractor shall arrange for openings in the building structure or components to allow for installation of electrical work or transport of electrical equipment as the project progresses.

B. Any cut portion of the building, wall, sidewalk, paved drives, ceiling, floors, roofs, etc., install any raceway or apparatus or transport equipment, shall be restored in a manner such that the end product complies with the specification for that type of work. Where existing work is cut, restore to the original (pre-construction) condition. The electrical contractor shall be responsible for returning to original, pre-construction condition, any of the above noted areas or other areas disturbed during electrical installation work.

C. Structural, load bearing, or supporting device shall not be cut without approval in writing from the Architect.

3.06 EXAMINATION OF EXISTING CONDITIONS:

A. The Electrical Contractor is responsible for visiting and examining the site to determine those portions of the site or present buildings affected by this work so as to become familiar with existing conditions and difficulties that will attend the execution of the work, before submitting proposals.

B. Submission of a proposal will be considered as evidence that such examination has been made and later claims for labor, equipment, or materials because of difficulties encountered, which could have been foreseen had such examination been made, will not be recognized.

3.07 LOCATIONS OF OUTLET BOXES FOR EQUIPMENT AND GENERAL WIRING:

A. All outlets for lighting, power, and equipment, not specifically dimensioned are located diagrammatically on the drawings.

B. Lighting fixtures shall be located in accordance with reflected ceiling plans or tile pattern outlines. If neither is indicated, lighting fixtures shall be symmetrical within the space in which they are located. The Contractor shall be responsible for coordinating with the architectural and mechanical plans and to the shop drawing of the equipment to be installed for the exact location of the outlets required for equipment installation.

C. Lighting fixture and convenience outlets shall be located so that they will be symmetrical with architectural details.

D. Equipment outlets shall be located so as to serve the equipment directly. It is the Contractor's responsibility to coordinate outlet location with equipment so that all outlets are accessible and disconnect switches have clearance for operation.

E. Where outlets are shown to be installed over casework or counters, the Contractor shall be responsible for coordinating the outlet box installation with the architectural details so that the bottom of the box is installed 6" above the counter/casework. Where a back splash is to be installed on the counter/casework, install the bottom of the box 4" above the top of the back splash.

F. If so directed by the Architect / Engineer / Owner, any outlet box may be moved 10 feet in any direction without any additional cost to the Owner.

3.08 EQUIPMENT HOUSEKEEPING PADS:

A. Provide a 4" high concrete pad for floor mounted electrical equipment such as switchboards, motor control centers, transformers, and floor mounted cabinets. Pads shall extend 4" beyond the size of the equipment. Round off all corners. Anchor bolt each corner of the equipment to the pad. Secure the equipment to the pad with locknuts.

3.09 PAINTING:

A. Exposed conduit, ungalvanized troughs, metal frames and support racks and wooden surfaces provided under this section shall be painted. Paint color shall match and be the same paint as the room finish paint unless noted elsewhere on the plans or in the specifications. Clean surfaces completely of all oil, wax, rust and old paint prior to repainting. Paint shall be applied to backup boards before switches, troughs, and devices are installed. Paint shall include a primer and two coats of finished paint. Touch-up scratched, or marred surfaces of lighting fixtures and equipment with paint obtained from

the equipment manufacturer especially for that purpose.

3.10 ELECTRICAL SYSTEM TESTING:

A. At the time of the final inspection, or at such times as parts of the system may be completed, all electrical systems shall be tested for compliance with the specifications. The Contractor shall provide all personnel and equipment; current, voltage and resistance measuring instruments, ladders and lights to assist the Engineer in conducting the tests. Authorized representatives of the manufacturer shall be present to demonstrate compliance with specifications of their specific system.

B. The Contractor shall remove equipment covers as directed for inspection of internal wiring. Accessible ceiling shall be removed as directed for inspection of equipment above the ceilings. After inspection and correction of any problems found, the Contractor shall replace all cover plates, access plates and removable ceiling.

C. The life safety system shall be demonstrated to function in accordance with the specifications. Each device shall be tested for proper operation.

3.11 CLEANING:

A. At completion of the work the Contractor shall clean all exposed elements of the electrical system so that all markings deteriorating the original finish appearance are removed. All lighting fixtures, lenses, and reflectors shall be cleaned inside and out and all lamps shall be left clear of dust, dirt, and grime.

B. The Contractor shall specifically examine the interiors of panelboard cans, equipment cabinets, lighting fixtures, junction boxes, and like components where conduit and wire connections have been made, and all resulting wire ends, insulation cuttings, knock-out plugs, metal filings and any other trash shall be removed so that interiors and exteriors are left free of all debris.

3.12 FIELD QUALITY CONTROL

END OF SECTION

SECTION 16060 - GROUNDING AND BONDING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Ground bars.

E. Ground rod electrodes.

F. Ground access wells.

1.02 RELATED REQUIREMENTS

A. Section 10270 - Access Flooring.

B. Section 16123 - Building Wire and Cable: Additional requirements for conductors for grounding and bonding, including conductor color coding.
   1. Includes oxide inhibiting compound.

C. Section 16075 - Electrical Identification: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. IEEE 81 - Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System; 1983.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

C. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2009.

D. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2007.

E. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Notify GMK Associates of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding

and bonding system components.

C. Shop Drawings:
   1. Indicate proposed arrangement for signal reference grids. Include locations of items to be bonded and methods of connection.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Field quality control test reports.

F. Project Record Documents: Record actual locations of grounding electrode system components and connections.

G. Certificate of Compliance: Indicate approval of installation by authority having jurisdiction.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Installer Qualifications for Signal Reference Grids: Company with minimum five years documented experience with high frequency grounding systems.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.
   1. Examine the existing grounding electrode system and bonding to determine if it meets current standards. Report any deficiencies to the engineer for further consideration.

B. Do not use products for applications other than as permitted by NFPA 70 and product listing.

C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

E. Grounding System Resistance:
   1. Achieve specified grounding system resistance under normally dry conditions unless

otherwise approved by GMK Associates. Precipitation within the previous 48 hours does not constitute normally dry conditions.

2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested according to IEEE 81 using "point-to-point" methods.

F. Grounding Electrode System:
1. Provide connection to required and supplemental grounding electrodes to form grounding electrode system. For this project, confirm that required components to meet current standards exist in the current grounding system.
2. Metal Underground Water Pipe(s):
3. Metal Building or Structure Frame:
4. Ground Rod Electrode(s):

G. Separately Derived System Grounding:
1. Provide grounding electrode conductor to connect derived system grounded conductor to nearest effectively grounded metal building frame. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.
2. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.
3. Where common grounding electrode conductor ground riser is used for tap connections to multiple separately derived systems, provide bonding jumper to connect the metal building frame and metal water piping in the area served by the derived system to the common grounding electrode conductor.
4. Outdoor Source: Where the source of the separately derived system is located outside the building or structure supplied, provide connection to grounding electrode at source in accordance with NFPA 70.
5. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.
6. Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.

H. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit

equipment grounding conductor and to outlet box with bonding jumper.

5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
   a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
   b. Metal gas piping.
   c. Metal process piping.
8. Provide bonding for interior metal air ducts.
9. Provide bonding for metal building frame where not used as a grounding electrode.
10. Provide bonding for metal siding not effectively bonded through attachment to metal building frame.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
   1. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.
   2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in addition to requirements of Section 16123:
   1. Use insulated copper conductors unless otherwise indicated.
      a. Exceptions:
         1) Use bare copper conductors where installed underground in direct contact with earth.
         2) Use bare copper conductors where directly encased in concrete (not in raceway).
   2. Factory Pre-fabricated Bonding Jumpers: Furnished with factory-installed ferrules; size braided cables to provide equivalent gauge of specified conductors.

C. Connectors for Grounding and Bonding:
   1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
   2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
   3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as shown on the drawings.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Install products in accordance with manufacturer's instructions.

B. Install grounding and bonding system components in a neat and workmanlike manner in accordance with NECA 1.

C. Make grounding and bonding connections using specified connectors.
1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

D. Identify grounding and bonding system components in accordance with Section 16075.

E. Ground interior lighting fixtures with grounding conductor to rigid metal raceways serving them. Flexible metal conduit shall have a ground wire installed with the power conductors.

F. Where connections are made to motors or equipment with flexible metal conduit, grounding conductor shall be stranded copper conductor within the conduit, bonded to the equipment and to the rigid metal raceway system..

G. At each convenience outlet, install a grounding clip attached to the outlet box and leave a sufficient length of #12 wire with green colored insulation to connect to the grounding terminal of the receptacle. Grounding clip shall be equal to Steel City Type G.

3.03 ADDIITIONAL COMMUNICATION SYSTEMS GROUNDING:

A. Television Distribution System - Provide one No. 6 AWG THW in ½ inch conduit to nearest point on grounding electrode system.

B. Public Address System - Provide one No. 6 AWG THW in ½ inch conduit to nearest point on grounding electrode system.

3.04 FIELD QUALITY CONTROL

A. Provide field inspection in accordance with Section 01400. Inspect grounding and bonding system conductors and connections for tightness and proper installation

B. Inspect and test in accordance with NETA STD ATS except Section 4.

C. Perform inspections and tests listed in NETA STD ATS, Section 7.13.

D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

E. Investigate and correct deficiencies where measured ground resistances do not comply with

specified requirements.

F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION

SECTION 16070 - HANGERS AND SUPPORTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

A. Section 03300 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 16131 - Conduit: Additional support and attachment requirements for conduits.

C. Section 16138 - Boxes: Additional support and attachment requirements for boxes.

D. Section 16510 - Interior Luminaires: Additional support and attachment requirements for interior luminaires.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2012.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2011.

D. MFMA-4 - Metal Framing Standards Publication; Metal Framing Manufacturers Association; 2004.

E. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2009.

F. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements; 2006

G. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2010

H. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

I. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.

4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
5. Notify GMK Associates of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03300.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with applicable building code.

1.07 RECORD DRAWINGS

A. Comply with the applicable instructions in Section 16010.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
2. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose, where applicable.
3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of 2. Include consideration for vibration, equipment operation, and shock loads where applicable.
4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM

A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
   1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
   2. Conduit Clamps: Bolted type unless otherwise indicated.
   3. Manufacturers:
      a. Cooper Crouse-Hinds, a division of Cooper Industries: www.cooperindustries.com.
      b. Erico International Corporation: www.erico.com.
      c. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
      d. Thomas & Betts Corporation: www.tnb.com.
      e. Substitutions: See Section 01600 - Product Requirements.

C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
   1. Manufacturers:
      a. Cooper Crouse-Hinds, a division of Cooper Industries: www.cooperindustries.com.
      b. Erico International Corporation: www.erico.com.
      c. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
      d. Thomas & Betts Corporation: www.tnb.com.
      e. Substitutions: See Section 01600 - Product Requirements.

D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
   1. Comply with MFMA-4.
   2. Channel Material:
      a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
      b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
   3. Minimum Channel Thickness: 12 gauge.
   4. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.
   5. Manufacturers:
      a. Cooper B-Line, a division of Cooper Industries: www.cooperindustries.com.
      b. Thomas & Betts Corporation: www.tnb.com.
      c. Unistrut, a brand of Atkore International Inc: www.unistrut.com.
      d. Substitutions: See Section 01600 - Product Requirements.
      e. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.

E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
   1. Minimum Size, Unless Otherwise Indicated or Required:
      a. Equipment Supports: 1/2 inch diameter.
      b. Single Conduit up to 1 inch (27mm) trade size: 1/4 inch diameter.
      c. Single Conduit larger than 1 inch (27mm) trade size: 3/8 inch diameter.
      d. Trapeze Support for Multiple Conduits: 3/8 inch diameter.
      e. Outlet Boxes: 1/4 inch diameter.

f. Luminaires: 1/4 inch diameter.

F. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types for the specified applications.
2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
4. Hollow Masonry: Use toggle bolts.
5. Hollow Stud Walls: Use toggle bolts.
6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
7. Sheet Metal: Use sheet metal screws.
8. Wood: Use wood screws.
9. Plastic and lead anchors are not permitted.
10. Powder-actuated fasteners are permitted only as follows:
a. Where approved by GMK Associates.
b. Use only threaded studs; do not use pins.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install support and attachment components in a neat and workmanlike manner in accordance with NECA 1.

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Unless specifically indicated or approved by GMK Associates, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by GMK Associates, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Equipment Support and Attachment:
1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies

on its own weight for support.

H. Conduit Support and Attachment: Also comply with Section 16131.

I. Box Support and Attachment: Also comply with Section 16138.

J. Interior Luminaire Support and Attachment: Also comply with Section 16510.

K. Secure fasteners according to manufacturer's recommended torque settings.

L. Remove temporary supports.

M. Identify independent electrical component support wires above accessible ceilings (only where specifically indicated or permitted) with color distinguishable from ceiling support wires in accordance with NFPA 70.

3.03 FIELD QUALITY CONTROL

A. See Section 01400 - Quality Requirements, for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 16075 - ELECTRICAL IDENTIFICATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Warning signs and labels.

E. Field-painted identification of conduit.

1.02 RELATED REQUIREMENTS

A. Section 09900 - Paints and Coatings.

B. Section 16123 - Building Wire and Cable: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

C. Section 16140 - Wiring Devices: Device and wallplate finishes; factory pre-marked wallplates.

1.03 REFERENCE STANDARDS

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2007.

B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2007.

C. ASTM D 709 - Standard Specification for Laminated Thermosetting Materials; 2001 (Reapproved 2007).

D. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008; Including All Applicable Amendments and Supplements.

E. NFPA 70E - Standard for Electrical Safety in the Workplace; 2012.

F. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements for submittals procedures.

B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.06 EXTRA MATERIALS

A. See Section 01600 - Product Requirements for additional requirements.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

A. Existing Work: Unless specifically excluded, identify existing elements to remain that are not already identified in accordance with specified requirements.

B. Identification for Equipment:
   1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
      a. Switchboards:
         1) Identify ampere rating.
         2) Identify voltage and phase.
         3) Identify power source and circuit number. Include location when not within sight of equipment.
         4) Use identification nameplate to identify main overcurrent protective device.
         5) Use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.
      b. Motor Control Centers:
         1) Identify ampere rating.
         2) Identify voltage and phase.
         3) Identify power source and circuit number. Include location when not within sight of equipment.
         4) Use identification nameplate to identify main overcurrent protective device.
         5) Use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.
      c. Panelboards:
         1) Identify ampere rating.
         2) Identify voltage and phase.
         3) Identify power source and circuit number. Include location when not within sight of equipment.
         4) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
         5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
         6) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.
      d. Transformers:
         1) Identify kVA rating.
         2) Identify voltage and phase for primary and secondary.
         3) Identify power source and circuit number. Include location when not within sight of equipment.
         4) Identify load(s) served. Include location when not within sight of equipment.
      e. Enclosed switches, circuit breakers, and motor controllers:
         1) Identify voltage and phase.
         2) Identify power source and circuit number. Include location when not within sight of equipment.
         3) Identify load(s) served. Include location when not within sight of equipment.
      f. Transfer Switches:

1) Identify voltage and phase.
2) Identify power source and circuit number for both normal power source and standby power source. Include location when not within sight of equipment.
3) Identify load(s) served. Include location when not within sight of equipment.

2. Service Equipment:
   a. Use identification nameplate to identify each service disconnecting means.
3. Emergency System Equipment:
   a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
   b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.
4. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
5. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".

C. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 16123.
2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
3. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
   a. At each source and load connection.
   b. Within boxes when more than one circuit is present.
   c. Within equipment enclosures when conductors and cables enter or leave the enclosure.

D. Identification for Raceways:
1. Use voltage markers or color-coded bands to identify systems other than normal power system for accessible conduits at maximum intervals of 20 feet.
   a. Color-Coded Bands: Use field-painting to mark bands 3 inches wide.
      1) Color Code:
         (a) Emergency Power System: Dark Red.
         (b) Fire Alarm System: Red.
      2) Field-Painting: Comply with Section 09900.
      3) Vinyl Color Coding Electrical Tape: Comply with Section 16123.
2. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify circuits enclosed for accessible conduits at wall penetrations, at floor penetrations, at roof penetrations, and at equipment terminations when source is not within sight.
3. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.

E. Identification for Boxes:
1. Use voltage markers or color coded boxes to identify systems other than normal power system.

a. Color-Coded Boxes: Field-painted in accordance with Section 09900 per the same color code used for raceways.

2. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.

F. Identification for Devices:
1. Wiring Device and Wallplate Finishes: Comply with Section 16140.
2. Factory Pre-Marked Wallplates: Comply with Section 16140.
3. Use identification label to identify fire alarm system devices.
a. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.
4. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.
5. Use identification label or engraved wallplate to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
1. Manufacturers:
a. Brimar Industries, Inc: www.brimar.com.
b. Kolbi Pipe Marker Co: www.kolbipipemarkers.com.
c. Seton Identification Products: www.seton.com.
d. Substitutions: See Section 01600 - Product Requirements.
2. Materials:
a. Indoor Clean, Dry Locations: Use plastic nameplates.
3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
a. Exception: Provide minimum thickness of 1/8 inch when any dimension is greater than 4 inches.
4. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:
1. Manufacturers:
a. Brady Corporation: www.bradyid.com.
b. Brother International Corporation: www.brother-usa.com.
c. Panduit Corp: www.panduit.com.
d. Substitutions: See Section 01600 - Product Requirements.
2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:
1. Minimum Size: 1 inch by 2.5 inches.
2. Legend:
a. System designation where applicable:

1) Emergency Power System: Identify with text "EMERGENCY".
2) Fire Alarm System: Identify with text "FIRE ALARM".

b. Equipment designation or other approved description.
c. Other information as indicated.

3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height:
   a. System Designation: 1 inch.
   b. Equipment Designation: 1/2 inch.
   c. Other Information: 1/4 inch.
5. Color:
   a. Normal Power System: White text on black background.
   b. Emergency Power System: White text on red background.
   c. Fire Alarm System: White text on red background.

D. Format for General Information and Operating Instructions:
1. Minimum Size: 1 inch by 2.5 inches.
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/4 inch.
5. Color: Black text on white background unless otherwise indicated.

E. Format for Receptacle Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Power source and circuit number or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: White text on black background.

F. Format for Control Device Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Load controlled or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

G. Format for Fire Alarm Device Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Designation indicated and device zone or address.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: White text on red background.

H. Colors: Submit to owner for approval and modify where instructed.
1. Black - Normal Power Equipment
2. Red - Emergency Power Equipment
3. Bright Red - Fire Alarm.

2.03 WIRE AND CABLE MARKERS

A. Manufacturers:

1. Brady Corporation: www.bradyid.com.
2. HellermannTyton: www.hellermanntyton.com.
3. Panduit Corp: www.panduit.com.
4. _____.
5. Substitutions: See Section 01600 - Product Requirements.

B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

D. Legend: Power source and circuit number or other designation indicated.

E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

F. Minimum Text Height: 1/8 inch.

G. Color: Black text on white background unless otherwise indicated.

H. Locations: Each conductor at panelboard gutters, pull boxes, outlet boxes, and junction boxes each load connection.

2.04 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:
1. Materials:
2. Minimum Size: 7 by 10 inches unless otherwise indicated.

C. Warning Labels:
1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester, or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
3. Minimum Size: 2 by 4 inches unless otherwise indicated.

D. Description: 6 inch wide plastic tape, detectable type colored yellow with suitable warning legend describing buried electrical lines.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

B. Degrease and clean surfaces to receive nameplates and labels.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
   1. Surface-Mounted Equipment: Enclosure front.
   2. Flush-Mounted Equipment: Enclosure front.
   3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
   4. Elevated Equipment: Legible from the floor or working platform.
   5. Branch Devices: Adjacent to device.
   6. Interior Components: Legible from the point of access.
   7. Conduits: Legible from the floor.
   8. Boxes: Outside face of cover.
   9. Conductors and Cables: Legible from the point of access.
   10. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing, or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Secure rigid signs using stainless steel screws.

G. Mark all handwritten text, where permitted, to be neat and legible.

END OF SECTION

SECTION 16097 - ELECTRICAL DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical demolition.

1.02 RELATED REQUIREMENTS

A. Section 01700 - Execution Requirements: Additional requirements for alterations work.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.01 EXAMINATION

A. All demolition work shall be preformed with due care and diligence so as to prevent the unnecessary destruction and/or damage to sytems that shall remain in operation at the conclusion of the project. Determine the exact location of all existing equipment, devices and wiring before commencing work.

B. Preserve all portions of the existing electrical systems which shall remain.

C. Verify field measurements and circuiting arrangements are as shown on Drawings.

D. Verify that abandoned wiring and equipment serve only abandoned facilities.

E. Demolition drawings are based on casual field observation and existing record documents. Equipment and circuits have been shown in an approximate way and have not been independently verified by the owner or engineer. Determine all work necessary to renovate, alter, change and repair existing sytems based on the actual field conditions.

F. Conduit and wiring are not shown on the demolition plan but shall be considered fully a part of the work.

G. Existing conduit and wiring may be re-used where they are of the type specified, meet the requirements for the new work as defined by the Contract Documents and remain in good condition.

H. Existing circuitry without a seperate grounding conductor shall not be re-used.

I. Report discrepancies to GMK Associates before disturbing existing installation.

J. Beginning of demolition means installer accepts existing conditions and agrees to be fully responsible for any and all damages caused by a failure to exactly locate and preserve any and all existing portions of the electrical system.

3.02 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings to be removed.

B. Coordinate utility service outages with utility company.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Remove, relocate, and extend existing installations to accommodate new construction. Maintain the continuity of service and grounding to the existing circuits and other system elements contained within the area of constuction that serve other areas of the facility and conceal them above ceilings and other building elements in the new construction.

B. Remove abandoned wiring to source of supply or to the point on a shared circuit from where the equipment of device is served.

C. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

D. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

E. Remove and re-install or protect in place all existing equipment and devices shown to remain on or in walls, ceilings and floors which are exposed to demolition and construction activities and which may be damaged by dust, dirt, debris and painting. Where new walls are extended extend boxes and wiring to accomodate new finish.

F. Replace existing devices shown to remain in operation and and their associated coverplates which have been damaged.

G. Disconnect and remove abandoned panelboards and distribution equipment.

H. Coordinate disconnect and remove electrical devices and equipment serving utilization equipment that has been removed. Examing the demolition plans of all trades provide electrical demolition services for equipment and devices being removed.

I. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

J. Provide all cutting and patching to repair any damage caused by construction activities including adjacent construction and finishes damaged during demolition and extension work.

K. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

L. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.04 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment that remain or that are to be reused.

B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide newly revised typed panelboard directories for existing panelboards to reflect new circuit

conditions as a result of construction and demolition.

C. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts and broken electrical parts.

D. All equipment, devices and materials removed during demolition work and not indicated to be reused or turned over to the owner, shall become the responsibility of the Contractor for disposal.

END OF SECTION

SECTION 16123 - BUILDING WIRE AND CABLE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single conductor building wire.

B. Wiring connectors.

C. Electrical tape.

D. Heat shrink tubing.

E. Wire pulling lubricant.

1.02 RELATED REQUIREMENTS

A. Section 07840 - Firestopping.

B. Section 16060 - Grounding and Bonding: Additional requirements for grounding conductors and grounding connectors.

C. Section 16075 - Electrical Identification: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2001 (Reapproved 2007).

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2011.

C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010.

D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2009).

E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2010.

F. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2008.

G. FS A-A-59544 - Cable and Wire, Electrical (Power, Fixed Installation); Federal Specification; Revision A, 2008.

H. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

I. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; National Electrical Manufacturers Association; 2009 (ANSI/NEMA WC 70/ICEA S-95-658).

J. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2009.

K. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

M. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

N. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

O. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

P. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.

Q. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
3. Notify GMK Associates of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures and Section 16010.

B. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify GMK Associates and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

C. Nonmetallic-sheathed cable is not permitted.

D. Underground feeder and branch-circuit cable is not permitted.

E. Service entrance cable is not permitted.

F. Armored cable is not permitted.

G. Metal-clad cable is not permitted.

H. Use stranded conductors for control circuits.

I. Use conductor not smaller than 16 AWG for control circuits.

J. Conductor sizes are based on copper unless indicated as aluminum or "AL".

2.02 CONDUCTOR AND CABLE MANUFACTURERS

A. Cerro Wire LLC: www.cerrowire.com.

B. Encore Wire Corporation: www.encorewire.com.

C. Industrial Wire & Cable, Inc: www.iewc.com.

D. Southwire Company: www.southwire.com.

E. Substitutions: See Section 01600 - Product Requirements.

2.03 ALL CONDUCTORS AND CABLES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose indicated.

C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D. Comply with NEMA WC 70.

E. Comply with FS A-A-59544 where applicable.

F. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

G. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

H. Conductors for Grounding and Bonding: Also comply with Section 16060.

I. Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only

where specifically permitted): Plenum rated, listed and labeled as suitable for use in return air plenums.

J. Conductor Material:
   1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
   2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
   3. Tinned Copper Conductors: Comply with ASTM B33.

K. Minimum Conductor Size:
   1. Branch Circuits: 12 AWG.
      a. Exceptions:
         1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
         2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
         3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.
   2. Control Circuits: 14 AWG.

L. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

M. Conductor Color Coding:
   1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
   2. Color Coding Method: Integrally colored insulation.
      a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
   3. Color Code:
      a. 480Y/277 V, 3 Phase, 4 Wire System:
         1) Phase A: Brown.
         2) Phase B: Orange.
         3) Phase C: Yellow.
         4) Neutral/Grounded: Gray.
      b. 208Y/120 V, 3 Phase, 4 Wire System:
         1) Phase A: Black.
         2) Phase B: Red.
         3) Phase C: Blue.
         4) Neutral/Grounded: White.
      c. 240/120 V High-Leg Delta, 3 Phase, 4 Wire System:
         1) Phase A: Black.
         2) Phase B (High-Leg): Orange.
         3) Phase C: Blue.
         4) Neutral/Grounded: White.
      d. 240/120 V, 1 Phase, 3 Wire System:
         1) Phase A: Black.
         2) Phase B: Red.
         3) Neutral/Grounded: White.
      e. Equipment Ground, All Systems: Green.

f. Isolated Ground, All Systems: Green with yellow stripe.
g. Travelers for 3-Way and 4-Way Switching: Pink.
h. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.
i. For control circuits, comply with manufacturer's recommended color code.

2.04 SINGLE CONDUCTOR BUILDING WIRE

A. Description: Single conductor insulated wire.

B. Conductor Stranding:
1. Feeders and Branch Circuits: Stranded.

C. Insulation Voltage Rating: 600 V.

D. Insulation:
1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2.

2.05 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Connectors for Grounding and Bonding: Comply with Section 16060.

C. Wiring Connectors for Splices and Taps:
1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.

D. Wiring Connectors for Terminations:
1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
5. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
6. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
7. Conductors for Control Circuits: Use crimped terminals for all connections.

E. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
1. Manufacturers:

a. 3M: www.3m.com.
b. Ideal Industries, Inc: www.idealindustries.com.
c. NSI Industries LLC: www.nsiindustries.com.

F. Push-in Wire Connectors: Rated 600 V, 221 degrees F.
1. Manufacturers:
a. Ideal Industries, Inc: www.idealindustries.com.
b. NSI Industries LLC: www.nsiindustries.com.
c. Wago Corporation: www.wago.us.

G. Mechanical Connectors: Provide bolted type or set-screw type.
1. Manufacturers:
a. Burndy: www.burndy.com.
b. Ilsco: www.ilsco.com.
c. Thomas & Betts Corporation: www.tnb.com.

H. Compression Connectors: Provide circumferential type or hex type crimp configuration.
1. Manufacturers:
a. Burndy: www.burndy.com.
b. Ilsco: www.ilsco.com.
c. Thomas & Betts Corporation: www.tnb.com.

I. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.
1. Manufacturers:
a. Burndy: www.burndy.com.
b. Ilsco: www.ilsco.com.
c. Thomas & Betts Corporation: www.tnb.com.

2.06 WIRING ACCESSORIES

A. Electrical Tape:
1. Manufacturers:
a. 3M: www.3m.com.
b. Plymouth Rubber Europa: www.plymouthrubber.com.
c. Substitutions: See Section 01600 - Product Requirements.
2. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
3. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
4. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.
5. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176 degrees F.
6. Varnished Cambric Electrical Tape: Cotton cambric fabric tape, with or without

adhesive, oil-primed and coated with high-grade insulating varnish; minimum thickness of 7 mil; suitable for continuous temperature environment up to 221 degrees F.

7. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.
   1. Manufacturers:
      a. 3M: www.3m.com.
      b. Burndy: www.burndy.com.
      c. Thomas & Betts Corporation: www.tnb.com.

C. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that raceway installation is complete and supported.

E. Verify that field measurements are as shown on the drawings.

F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

A. Circuiting Requirements:
   1. Unless dimensioned, circuit routing indicated is diagrammatic.
   2. When circuit destination is indicated and routing is not shown, determine exact routing required.
   3. Arrange circuiting to minimize splices.
   4. Include circuit lengths required to install connected devices within 10 ft of location shown.
   5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
   6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
   7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are shown as separate, combining them together in a single raceway is permitted, under the following conditions:
      a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.

b. Increase size of conductors as required to account for ampacity derating.
c. Size raceways, boxes, etc. to accommodate conductors.

8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
9. Provide oversized neutral/grounded conductors where indicated and as specified below.
   a. Provide 200 percent rated neutral for feeders fed from K-rated transformers.
   b. Provide 200 percent rated neutral for feeders serving panelboards with 200 percent rated neutral bus.

B. Install products in accordance with manufacturer's instructions.

C. Install conductors and cable in a neat and workmanlike manner in accordance with NECA 1.

D. Installation in Raceway:
   1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
   2. Pull all conductors and cables together into raceway at same time.
   3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
   4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

E. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

F. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
   1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
   2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.

G. Terminate cables using suitable fittings.

H. Install conductors with a minimum of 12 inches of slack at each outlet.

I. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.

J. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

K. Make wiring connections using specified wiring connectors.
   1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
   2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.

3. Do not remove conductor strands to facilitate insertion into connector.
4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

L. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
   1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
      a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
      b. For taped connections likely to require re-entering, including motor leads, first apply varnished cambric electrical tape, followed by adequate amount of rubber splicing electrical tape, followed by outer covering of vinyl insulating electrical tape.
   2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
      a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
      b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.
   3. Wet Locations: Use heat shrink tubing.

M. Insulate ends of spare conductors using vinyl insulating electrical tape.

N. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

O. Identify conductors and cables in accordance with Section 16075.

P. Color Code Legend: Provide identification label identifying color code for ungrounded conductors at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.

Q. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07840.

R. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

S. Where a circuit home run or a feeder is shown on the plans without any conductor or raceway identification, it shall be a minimum of 2 # 12, 1 # 12 Ground, ½" Conduit unless additional information is available as follows:
   1. Where an overcurrent device is shown for the circuit in panelboards or otherwise noted,

size the conductor and raceway to match the overcurrent device rating. If the feeder or homerun is shown connected to a transformer, electric motor, mechanical equipment or other equipment for which load information is available on the plans or in the project manual, provide conductors and raceways sized to the load capacity of the equipment. Verify final sizes with the Engineeer in such cases.

T. Support cables or flexible metal conduits above accessible ceiling, using spring metal clips or metal cable ties to support cables from structure or ceiling suspension system. Do not rest cable on ceiling panels. Provide brdile rings or drive rings.

U. Support cables or flexible metal conduits used for final connections to lighting, equipment or devicesd above accessible ceilings to building structural elements, steel channel trapeze hangers, or other manufactured hangers or support systems fastened to or hung from the building structure. It is permissable to use the ceiling wire or separate support wire installed for the purpose to support the final six feet of cable connected to light fixtures. Do not lay cables on ceiling tiles or on duct work, piping or other system elements.

V. Use a power distribution block as manufactured by Ilsco (sized for the size and number of conductors, and splice type) for splices and taps, 6 AWG and larger. Power distribution block shall be installed in a junction box, sized per NEC.

3.04 FIELD QUALITY CONTROL

A. Perform inspection, testing, and adjusting in accordance with Section 01400.

B. Inspect wire and cable for physical damage and proper connection.

C. Torque test conductor connections and terminations to manufacturer's recommended values.

D. Perform continuity test on all power and equipment branch circuit conductors. Verify proper phasing connections.

E. Feeder 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 AWG wire or larger, between conductors and between conductor and the grounding conductor.
3. After all fixtures, 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 this neutral bar. He shall then test each one separately to the panel until source of the low reading is found. The contractor shall correct troubles, reconnect, and retest until at least 250,000 ohms from the neutral bar to the grounded panel can be achieved with only the neutral feeder disconnected.
4. Document test by tabulating the readings with time of day, date, temperature and all pertinent test information. Submit documenation to the engieer prior to the final inpsection and as a prerequesite for final acceptance of the project.
5. At final inspection, the contractor shall furnish a megger and show the engineers and State Construction Office representatives that the panels comply with the above.

F. Inspect and test in accordance with NETA STD ATS, except Section 4.

G. Perform inspections and tests listed in NETA STD ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.

H. Correct deficiencies and replace damaged or defective conductors and cables.

I. Perform inspections and tests listed in NETA STD ATS, Section 7.3.2.

END OF SECTION

SECTION 16131 - CONDUIT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).

B. Flexible metal conduit (FMC).

C. Liquidtight flexible metal conduit (LFMC).

D. Electrical metallic tubing (EMT).

E. Rigid polyvinyl chloride (PVC) conduit.

F. Conduit fittings.

1.02 RELATED REQUIREMENTS

A. Section 07840 - Firestopping.

B. Section 16123 - Building Wire and Cable.

C. Section 16060 - Grounding and Bonding.

D. Section 16070 - Hangers and Supports.

E. Section 16075 - Electrical Identification.

F. Section 16138 - Boxes.

G. Section 16075 - Electrical Identification: Identification products and requirements.

1.03 FIRE ALARM SYSTEM RACEWAYS

A. Wiring is not shown on the plans for the fire alarm system but shall be considered typical for the system around which the design is based. Provide raceways to fully accomodate system wiring, devices and equipment based on floor plan layouts and specifications. Open cabling is not permitted for fire alarm systems unless approved by the engineer.

1.04 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2005.

B. ANSI C80.3 - American National Standard for Steel Electrical Metallic Tubing (EMT); 2005.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

D. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); National Electrical Contractors Association; 2006.

E. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); National Electrical Contractors Association; 2003.

F. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association; 2012

(ANSI/NEMA FB 1).

G. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; National Electrical Manufacturers Association; 2003.

H. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; National Electrical Manufacturers Association; 2004.

I. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

K. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

L. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.

M. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

N. UL 651 - Schedule 40 and 80 Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

O. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Unless otherwise noted on the drawings or specified elsewhere in Division 16, route all conductors in conduit. The electrical plans indicate the general location of circuiting, electrical devices, and/or outlet boxes. If approved by the Engineer, conduit runs may be modified at the time of construction to adapt to the construction conditions, but in no case shall a circuit be combined with another circuit or modified without approval.
   2. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   3. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   4. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
   5. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
   6. Notify GMK Associates of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.06 SUBMITTALS

A. See Section 01300 - Administrative Requirements for submittals procedures.

B. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2 inch (53 mm) trade size and larger.

1.07 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

B. Accept conduit on site. Inspect for damage.

C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

D. Protect PVC conduit from sunlight.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use EMT or GRS as applicable to the conditions.

C. Underground:
1. Under Slab on Grade: Use galvanized steel rigid metal conduit or rigid PVC conduit.
2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit or rigid PVC conduit.
3. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit or rigid PVC conduit.
4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.
5. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows for bends.
6. Where steel conduit is installed in direct contact with earth where soil has a resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape to provide supplementary corrosion protection or use PVC-coated galvanized steel rigid metal conduit.
7. Where steel conduit emerges from concrete into soil, use corrosion protection tape to provide supplementary corrosion protection for a minimum of 4 inches on either side of where conduit emerges or use PVC-coated galvanized steel rigid metal conduit.

D. Embedded Within Concrete:
1. Within Slab on Grade (within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit, PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
2. Within Slab Above Ground: Not permitted.
3. Within Concrete Walls Above Ground: Use galvanized steel rigid metal conduit, PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid

metal conduit where emerging from concrete.

5. Where electrical metallic tubing (EMT) emerges from concrete into salt air, use corrosion protection tape to provide supplementary corrosion protection for a minimum of 4 inches on either side of where conduit emerges.

E. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).

F. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).

G. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).

H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit.

I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).

J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit.
   1. Locations subject to physical damage include, but are not limited to:
      a. Where exposed below 8 feet, except within electrical and communication rooms or closets.
      b. Where exposed below 20 feet in warehouse areas.

K. Exposed, Exterior: Use galvanized steel rigid metal conduit or PVC-coated galvanized steel rigid metal conduit.

L. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit.

M. Corrosive Locations Above Ground: Use PVC-coated galvanized steel rigid metal conduit or aluminum rigid metal conduit.
   1. Corrosive locations include, but are not limited to:
      a. Cooling towers.

N. Hazardous (Classified) Locations: Use galvanized steel rigid metal conduit or PVC-coated galvanized steel rigid metal conduit.

O. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.
   1. Maximum Length: 6 feet.

P. Connections to Vibrating Equipment:
   1. Dry Locations: Use flexible metal conduit.
   2. Damp, Wet, or Corrosive Locations (Incudes all kitchens): Use liquidtight flexible metal conduit.
   3. Maximum Length: 6 feet unless otherwise indicated.
   4. Vibrating equipment includes, but is not limited to:
      a. Transformers.
      b. Motors.

Q. Fished in Existing Walls, Where Necessary: Use flexible metal conduit.

2.02 CONDUIT REQUIREMENTS

A. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling a mandrel through them.

B. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

C. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.

D. Minimum Conduit Size, Unless Otherwise Indicated:
1. Branch Circuits: 1/2 inch (16 mm) trade size.
2. Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.
3. Control Circuits: 1/2 inch (16 mm) trade size.
4. Flexible Connections to Luminaires: 3/8 inch (12 mm) trade size.
5. Underground, Interior: 3/4 inch (21 mm) trade size.
6. Underground, Exterior: 1 inch (27 mm) trade size.
7. The outside diameter of any conduit buried in concrete shall not exceed 1/3 the thickness of the structural slab, wall or beam in which it is placed. Locate conduit in the middle of the member.

E. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

B. Fittings:
1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or malleable iron.
a. Do not use die cast zinc fittings.
3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 FLEXIBLE METAL CONDUIT (FMC)

A. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.

B. Fittings:
1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or malleable iron.
a. Do not use die cast zinc fittings.

C. Description: Interlocked steel construction.

2.05 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.
      a. Do not use die cast zinc fittings.

C. Description: Interlocked steel construction with PVC jacket.

D. Fittings: NEMA FB 1.
   1. Fittings shall be of the type that uses a threaded grounding cone, a steel, nylon or plastic compression ring, insulated throat, and a gland for tightening. Fittings shall be made of steel, have insulated throats and have a male thread and locknut or male bushing with a ring seal. Each connector shall provide a low resistance ground connection between the flexible conduit and the outlet box, conduit or other equipment to which it is connected.

2.06 ELECTRICAL METALLIC TUBING (EMT)

A. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel.
      a. Do not use die cast zinc fittings.
   3. Connectors and Couplings: Use compression (gland) or set-screw type.
      a. Do not use indenter type connectors and couplings.
   4. Damp or Wet Locations (where permitted): Use fittings listed for use in wet locations.
   5. Embedded Within Concrete (where permitted): Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are not acceptable.

C. EMT connectors shall be made tight to boxes and cabinets using insulated throat steel fittings specifically designed for use with EMT conduit. Use insulating insert at all joints to prevent any abrasion of wires during installation.

2.07 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

B. Fittings:
   1. Manufacturer: Same as manufacturer of conduit to be connected.
   2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

C. Description: NEMA TC 2; Schedule 40 PVC.

D. Fittings and Conduit Bodies: NEMA TC 3.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on drawings.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

D. Verify routing and termination locations of conduit prior to rough-in.

3.02 PLANNING

A. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

B. Most conduit is shown on the plans as concealed above grade. However it may be necessary or convenient to route some of these conduits either partially or entirely underground because of wall construction, open ceiling areas, other types of building construction or for other practical considerations. Plan conduit routing early in construction to allow for the conditions. Consult with the engineer about changes in conduit routing.

C. For open ceiling areas in finished areas examine building sections, structural drawings, elevations and other details to determine how to route conduit to be partially concealed or less obtrusive. Route conduit in channels, corners, tops of beams and other elements to present a neat and less visible appearance. Extend counduit underground to natural building chases (walls, column wraps, air duct chases) that will conceal conduit when possible even if conduit runs will be longer. Consult with the engineer about possible voltage drop concerns when conduit runs will exceed reasonable or specified distances.

D. Keep up with building construction so that access to areas where conduit should be installed in not blocked.

3.03 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install conduit in a neat and workmanlike manner in accordance with NECA 1.

C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

D. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

E. Conduit Routing:
   1. Unless dimensioned, conduit routing indicated is diagrammatic.
   2. When conduit destination is indicated and routing is not shown, determine exact routing required.
   3. Conceal all conduits unless specifically indicated to be exposed.
   4. Conduits in the following areas may be exposed, unless otherwise indicated:
      a. Electrical rooms.
      b. Mechanical equipment rooms.
      c. Within joists in areas with no ceiling.
   5. Unless otherwise approved, do not route conduits exposed:
      a. Across floors.
      b. Across roofs.
      c. Across top of parapet walls.

   d. Across building exterior surfaces.
6. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
7. Arrange conduit to maintain adequate headroom, clearances, and access.
8. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
9. Route conduits above water and drain piping where possible.
10. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
11. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
12. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
    a. Heaters.
    b. Hot water piping.
    c. Flues.
    d. Steam piping.
13. Group parallel conduits in the same area together on a common rack.
14. Construct racks using steel channel and provide 25% spare space for future conduits.

F. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 and Section 16070 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
3. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers and split hangers.
4. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
5. Use conduit strap to support single surface-mounted conduit.
    a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
6. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
7. Use conduit clamp to support single conduit from beam clamp or threaded rod.
8. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
9. Use non-penetrating rooftop supports to support conduits routed across rooftops (only where approved).
10. Use of spring steel conduit clips for support of conduits is permitted only as follows:
    a. Support of electrical metallic tubing (EMT) up to 1 inch (27 mm) trade size concealed above accessible ceilings and within hollow stud walls.
11. Use of wire for support of conduits is not permitted.
12. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with the most stringent requirements.

13. Although it is intended that conduit not be attached to ceiling support wires, drops to light fixtures and other ceilling mounted devices remote from the building structure may be acceptable. Endeavor to install the conduit for trhe main circuit run on or supported to walls, ceiling joists and made supports near the points where drops are to be made. Confer with engineer where any doubt exists.

G. Connections and Terminations:
   1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
   2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
   3. Use suitable adapters where required to transition from one type of conduit to another.
   4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
   5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
   6. Where spare conduits stub up through concrete floors and are not terminated in a box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
   7. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
   8. Secure joints and connections to provide maximum mechanical strength and electrical continuity.
   9. When stub outs from wall or floor mounted outlet boxes are shown, noted or specified as part of an empty raceway system for sound, data, fire alarm and other low-voltage systems for which cable will be installed open in ceiling spaces, plenums, chases and other building elements it shall be understood that access for cable to the outlets, equipment cabinets and devices of the system must be provided through areas of inaccessible ceilings. Provide conduits between accessible ceiling areas or extend outlet box stubouts through inaccessible areas to a point where cable can be installed.

H. Penetrations:
   1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
   2. Make penetrations perpendicular to surfaces unless otherwise indicated.
   3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
   4. Conceal bends for conduit risers emerging above ground.
   5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
   6. Provide suitable modular seal where conduits penetrate exterior wall below grade.
   7. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
      a. For exterior non-membrane openings, furnish and install cast iron pipe sleeves for conduits passing through non-membrane waterproofed exterior walls, footings, roofs or beams. Sleeves through exterior walls below grade shall have continuously welded center flange buried in construction. Make conduit watertight in sleeve with oakum packing and caulked lead joints on both sides of

wall.

b. For interior membrane openings, furnish and install cast iron sleeves passing through interior membrane water proofed floors with integral flashing flange and clamping ring. Adjust sleeves to floor construction with galvanized steel or wrought iron pipe nipples top and bottom, extending two inches above finished floor. Clamp sleeves to flashing with clamping device.

c. For exterior membrane openings, furnish and install cast iron sleeves passing through exterior membrane waterproofed walls, floors and roof with integral flashing flange and clamping ring, modified for the required thickness. Make conduit watertight in sleeve with oakum packing and caulked lead joint.

8. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
9. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07840.

I. Underground Installation:
1. Provide trenching and backfillingNone-N/A.
2. Minimum Cover, Unless Otherwise Indicated or Required:
   a. Underground, Exterior: 24 inches.
   b. Under Slab on Grade: 12 inches to bottom of slab.
   c. Install conduit with minimum grade of 4 inches per 100 feet.
   d. Terminate conduit in end bell at manhole entries.
3. Provide underground warning tape in accordance with Section 16075 along entire conduit length for service entrance where not concrete-encased.

J. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):
1. Maximum Conduit Size: 1 inch (27 mm) unless otherwise approved.
2. Install conduits within middle one third of slab thickness.
3. Secure conduits to prevent floating or movement during pouring of concrete.

K. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete in accordance with Section 03300 with minimum concrete cover of 3 inches on all sides unless otherwise indicated.
1. Stagger conduit joints in concrete encasement 6 inches minimum vertically.
2. Use suitable separators and chairs installed not greater than 4 feet on centers. Band conduit together with suitable banding devices. Securely anchor conduit to prevent movement during concrete placement.
3. Provide No. 4 steel reinforcing bars 6 inches on center in top of bank under paved areas.

L. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where conduits are subject to earth movement by settlement or frost.

M. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not

limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.
2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

N. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.

O. Provide grounding and bonding in accordance with Section 16060.

P. Identify conduits in accordance with Section 16075.

Q. If obstructions are encountered which prevent installation of the pull wire and/or conductors, the blocked section of raceway shall be removed and replaced. Any cutting or patching involved in such replacement will be included as a part of the electrical scope of work and included in the contract.

3.04 FIELD QUALITY CONTROL

A. See Section 01400 - Quality Requirements, for additional requirements.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective conduits.

3.05 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.06 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

B. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 1-1/2 inch size.

C. Where rigid steel conduit does not terminate in a box or other device, and stubs up, install an insulated metallic bushing.

D. Where called for on the plans, or if required by code, to provide a positive bonding and grounding of conduit to the enclosure or box, or for bonding and grounding of multiple or single rigid metal conduits, the conduit end shall be equipped with an insulated metallic grounding and bonding bushing.

E. Where called for on the plans, or if required by code, to provide a grounding bonding jumper inside or outside of a raceway or an enclosure, use a grounding and bonding adapter locknut. Where the installation calls for the bonding jumper to be installed inside the conduit, use an insulated grounding and bonding bushing.

F. Nylon pull cord shall be rated for minimum 200 pounds of pull force.

END OF SECTION

SECTION 16138 - BOXES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

1.02 RELATED REQUIREMENTS

A. Section 07840 - Firestopping.

B. Section 16060 - Grounding and Bonding.

C. Section 16070 - Hangers and Supports.

D. Section 16131 - Conduit:
   1. Conduit bodies and other fittings.
   2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.

E. Section 16075 - Electrical Identification: Identification products and requirements.

F. Section 16140 - Wiring Devices:
   1. Wall plates.
   2. Additional requirements for locating boxes for wiring devices.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; National Electrical Contractors Association; 2010.

C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association; 2012 (ANSI/NEMA FB 1).

D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; National Electrical Manufacturers Association; 2008 (Revised 2010) (ANSI/NEMA OS 1).

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 2008.

F. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

I. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify GMK Associates of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01600 - Product Requirements, for additional provisions.
2. Keys for Lockable Enclosures: Two of each different key.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 BOXES

A. General Requirements:
1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
3. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.
4. Where box size is not indicated, size to comply with NFPA 70 but not less than

applicable minimum size requirements specified.

5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
   1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
   2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
   3. Use cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit is used.
   4. Use nonmetallic boxes where exposed rigid PVC conduit is used.
   5. Use suitable concrete type boxes where flush-mounted in concrete.
   6. Use suitable masonry type boxes where flush-mounted in masonry walls.
   7. Use raised covers suitable for the type of wall construction and device configuration where required.
   8. Use shallow boxes where required by the type of wall construction.
   9. Do not use "through-wall" boxes designed for access from both sides of wall.
   10. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
   11. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
   12. Nonmetallic Boxes: Comply with NEMA OS 2, and list and label as complying with UL 514C.
   13. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
   14. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes.
   15. Minimum Box Size, Unless Otherwise Indicated:
      a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
      b. Communications Systems Outlets: 4 inch square by 2-1/8 inch (100 by 54 mm) trade size.
      c. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.
   16. Wall Plates: Comply with Section 16140.
   17. Manufacturers:
      a. Cooper Crouse-Hinds, a division of Cooper Industries: www.cooperindustries.com.
      b. Hubbell Incorporated; Bell Products: www.hubbell-bell.com.
      c. Hubbell Incorporated; RACO Products: www.hubbell-raco.com.
      d. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
      e. Thomas & Betts Corporation: www.tnb.com.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
   1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or

UL 508A.

2. NEMA 250 Environment Type, Unless Otherwise Indicated:
   a. Indoor Clean, Dry Locations: Type 1, painted steel.
   b. Outdoor Locations: Type 3R, painted steel.
3. Junction and Pull Boxes Larger Than 100 cubic inches:
   a. Provide hinged-cover enclosures unless otherwise indicated.
   b. Boxes 6 square feet and Larger: Provide sectionalized screw-cover or hinged-cover enclosures.
4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
   a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
   b. Back Panels: Painted steel, removable.
5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
6. Manufacturers:
   a. Cooper B-Line, a division of Cooper Industries: www.cooperindustries.com.
   b. Hoffman, a brand of Pentair Technical Products: www.hoffmanonline.com.
   c. Hubbell Incorporated; Wiegmann Products: www.hubbell-wiegmann.com.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on drawings.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide separate boxes for emergency power and normal power systems.

E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

H. Box Locations:
   1. Locate boxes to be accessible. Provide access panels in accordance with Section 08310 as required where approved by the Architect.
   2. Unless dimensioned, box locations indicated are approximate.
   3. Locate boxes as required for devices installed under other sections or by others.
      a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 16140.

4. Locate boxes so that wall plates do not span different building finishes.
5. Locate boxes so that wall plates do not cross masonry joints.
6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
9. Fire-Resistance-Rated Walls: Install flush-mounted boxes such that the required fire-resistance will not be reduced.
    a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
    b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.
10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 16131.
11. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
    a. Concealed above accessible suspended ceilings.
    b. Within joists in areas with no ceiling.
    c. Electrical rooms.
    d. Mechanical equipment rooms.
    e. In other unfinished utility spaces.

I. Box Supports:
1. Secure and support boxes in accordance with NFPA 70 and Section 16070 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
4. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.

J. Install boxes plumb and level.

K. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete,

tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

L. Install boxes as required to preserve insulation integrity.

M. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

N. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07840.

O. Close unused box openings.

P. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

Q. Provide grounding and bonding in accordance with Section 16060.

R. Identify boxes in accordance with Section 16075.

S. Junctions and pull boxes are not generally shown on the plans. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NFPA 70.

T. Coordinate installation of outlet boxes for equipment connected under Section 16155.

U. Set wall mounted boxes at elevations to accommodate mounting heights indicated.

V. Electrical boxes are shown on Drawings in approximate locations unless dimensioned.
   1. Adjust box locations up to 10 feet if required to accommodate intended purpose. Review the Contract Documents, especially Architectural Elevations and millwork shop drawings to determine appropriate locations for boxes.

W. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

X. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

Y. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07840.

Z. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.

AA. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.

AB. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

AC. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

AD. Secure flush mounting box to interior wall and partition studs.

AE. Use stamped steel bridges to fasten flush mounting outlet box between studs.

AF. Use adjustable steel channel fasteners for hung ceiling outlet box.

AG. Do not fasten boxes to ceiling support wires.

AH. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches of box.

AI. Use 4" square outlet box with plaster ring for single device outlets.

AJ. Install plugs, and other inserts to cover all unused conduit openings.

3.03 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.04 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

SECTION 16140 - WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall switches.

B. Receptacles.

C. Wall plates.

1.02 RELATED REQUIREMENTS

A. Section 16060 - Grounding and Bonding.

B. Section 16138 - Boxes.

C. Section 16075 - Electrical Identification: Identification products and requirements.

D. Section 16145 - Lighting Control Devices: Devices for automatic control of lighting, including occupancy sensors, in-wall time switches, and in-wall interval timers.

E. Section 16155 - Equipment Wiring: Cords and plugs for equipment.

1.03 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; Federal Specification; Revision G, 2001.

B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification); Federal Specification; Revision F, 1999.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; National Electrical Contractors Association; 2010.

E. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association; 1999 (R 2005).

F. NEMA WD 5 - Specific-Purpose Wiring Devices.

G. NEMA WD 6 - Wiring Device -- Dimensional Requirements; National Electrical Manufacturers Association; 2002 (R2008).

H. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

J. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

K. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

L. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

M. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
   3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
   4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
   5. Notify GMK Associates of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. Sequencing:
   1. Do not install wiring devices until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures and Section 16010 - General Electrical Requirements.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
   1. Surge Protection Receptacles: Include surge current rating, voltage protection rating (VPR) for all protection modes, and diagnostics information.

C. Certificates for Surge Protection Receptacles: Manufacturer's documentation of listing for compliance with UL 1449.

D. Field Quality Control Test Reports.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Operation and Maintenance Data:
   1. GFI Receptacles: Include information on status indicators and testing procedures and intervals.
   2. Surge Protection Receptacles: Include information on status indicators.

G. Project Record Documents: Record actual installed locations of wiring devices.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01600 - Product Requirements, for additional provisions.
   2. Extra Surge Protection Receptacles: Two of each type.
   3. Extra Wall Plates: Two of each style, size, and finish.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution

requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hubbell Incorporated: www.hubbell-wiring.com.

B. Leviton Manufacturing Company, Inc: www.leviton.com.

C. Lutron Electronics Company, Inc: www.lutron.com.

D. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us

E. Cooper Wiring Devices: www.cooperwiringdevices.com.

F. GE Industrial: www.geindustrial.com.

G. Substitutions: See Section 01600 - Product Requirements.

H. Source Limitations: Where possible, for each type of wiring device furnish products produced by a single manufacturer and obtained from a single supplier.

2.02 APPLICATIONS

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C. Provide weather resistant GFI receptacles with specified weatherproof covers for all receptacles installed outdoors or in damp or wet locations.

D. Provide GFI protection for all receptacles installed within 6 feet of sinks.

E. Provide GFI protection for all receptacles installed in kitchens.

F. Provide GFI protection for all receptacles serving electric drinking fountains.

G. Unless noted otherwise, do not use combination switch/receptacle devices.

2.03 ALL WIRING DEVICES

A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

B. Finishes:
   1. All Wiring Devices: Ivory with ivory nylon wall plate unless otherwise indicated.
   2. Wiring Devices Installed in Finished Spaces: Ivory with ivory nylon wall plate unless otherwise indicated.
   3. Wiring Devices Installed in Unfinished Spaces: Gray with galvanized steel wall plate unless otherwise indicated.

4. Wiring Devices Installed in Wet or Damp Locations: Ivory with specified weatherproof cover unless otherwise indicated.
5. Surge Protection Receptacles: Blue.
6. Wiring Devices Connected to Emergency Power: Red with red nylon wall plate.

2.04 WALL SWITCHES

A. All Wall Switches: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

B. Standard Wall Switches: Commercial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.
   1. Products:

C. Lighted Wall Switches: Commercial specification grade, 20 A, 120/277 V with illuminated standard toggle type switch actuator and maintained contacts; illuminated with load off; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

D. Pilot Light Wall Switches: Commercial specification grade, 20 A, 120/277 V with red illuminated standard toggle type switch actuator and maintained contacts; illuminated with load on; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.05 RECEPTACLES

A. All Receptacles: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring and screw activated terminals for back wiring with separate ground terminal screw.
   2. NEMA configurations specified are according to NEMA WD 6.
   3. Hospital Grade Receptacles: Listed as complying with UL 498 Supplement SD, with green dot hospital grade mark on device face.

B. Convenience Receptacles:
   1. Standard Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
   2. Self grounding devices without an accompanying ground screw terminal is prohibited.
   3. Weather Resistant Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R,, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
   4. Tamper Resistant Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R,, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
   5. Tamper Resistant and Weather Resistant Convenience Receptacles: Commercial

specification grade, 20A, 125V, NEMA 5-20R,, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

C. GFI Receptacles:
   1. All GFI Receptacles: Provide with feed-through protection, light to indicate ground fault tripped condition and loss of protection, and list as complying with UL 943, class A.
      a. Provide test and reset buttons of same color as device.
   2. Standard GFI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R.
   3. Weather Resistant GFI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.
   4. Tamper Resistant GFI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type.
   5. Tamper Resistant and Weather Resistant GFI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.

D. Surge Protection Receptacles:
   1. All Surge Protection Receptacles: Listed and labeled as complying with UL 1449, Type 2 or 3.
      a. Energy Dissipation: Not less than 240 J per mode.
      b. Protected Modes: L-N, L-G, N-G.
      c. UL 1449 Voltage Protection Rating (VPR): Not more than 700 V for L-N, L-G modes and 1200 V for N-G mode.
      d. Diagnostics:
         1) Visual Notification: Provide indicator light to report functional status of surge protection.
         2) Audible Notification: Provide switchable audible alarm to report that surge protection is not functional.
      e. Average 7:1 reduction of RFI and EMI noise from 500 Khz to 30 Mhz. Isolated ground type when indicated.
   2. Standard Surge Protection Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R.

2.06 WALL PLATES

A. All Wall Plates: Comply with UL 514D.
   1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
   2. Size: Standard; Use jumbo size for brick or block construction.
   3. Screws: Metal with slotted heads finished to match wall plate finish.
   4. Color: Verify and obtain approval at submittal review.

B. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.

C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

D. Brass Wall Plates: Brushed satin finish, factory-coated to inhibit oxidation.

E. Aluminum Wall Plates: Smooth satin finish, clear anodized, factory-coated to inhibit oxidation.

F. Chrome Wall Plates: Smooth finish, chrome plated steel.

G. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.

H. Premarked Wall Plates: Factory labeled as indicated; hot stamped for nylon wall plates and engraved for metal wall plates.

I. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum base plate fastened with corrosion resistant screws, with a hinged, heavy duty, clear, polycarbonate cover with corrosion-resistant pins and hinges; listed as suitable for use in wet locations while in use with attachment plugs connected. Minimum 3.25" depth to allow use of most standard straight connected cord ends.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 16138 as required for installation of wiring devices provided under this section.
   1. Mounting Heights: Unless otherwise indicated, as follows:
      a. Wall Switches: 48 inches above finished floor.
      b. Wall Dimmers: 48 inches above finished floor.
      c. Fan Speed Controllers: 48 inches above finished floor.
      d. Receptacles: 18 inches above finished floor or 6 inches above counter.
   2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.

3. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
4. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify GMK Associates to obtain direction prior to proceeding with work.
5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. Provide GFI receptacles with integral GFI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

I. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.

J. Install wiring devices plumb and level with mounting yoke held rigidly in place.

K. Install wall switches with OFF position down.

L. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

M. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

N. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

O. Identify wiring devices in accordance with Section 16075.

P. Install protective rings on active flush cover service fittings.

Q. Corridor receptacle shall be hospital grade.

R. Quadraplex outlets shall be two outlets installed in a common outlet box with a common wall plate.

3.04 FIELD QUALITY CONTROL

A. Perform field inspection, testing, and adjusting in accordance with Section 01400.

B. Inspect each wiring device for damage and defects.

C. Operate each wall switch with circuit energized to verify proper operation.

D. Test each receptacle to verify operation and proper polarity.

E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

F. Inspect each surge protection receptacle to verify surge protection is active.

G. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust presets for wall dimmers according to manufacturer's instructions as directed by GMK Associates.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 16145 - LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Occupancy sensors.

B. In-wall time switches.

1.02 RELATED REQUIREMENTS

A. Section 16060 - Grounding and Bonding.

B. Section 16138 - Boxes.

C. Section 16075 - Electrical Identification: Identification products and requirements.

D. Section 16140 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, fan speed controllers, and wall plates.

E. Section 16510 - Interior Luminaires.

F. Section 16520 - Exterior Luminaires.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; National Electrical Contractors Association; 2010.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2008.

D. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Fluorescent Ballasts; National Electrical Manufacturers Association; 2011.

E. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.

G. UL 917 - Clock-Operated Switches; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
   3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
   4. Coordinate the placement of photo sensors for daylighting controls with windows, skylights, door swings and luminaires to achieve optimum operation. Coordinate

placement, especisally in open ceiling construction with ductwork, piping, equipment, structural beams or other potential obstructions to light level measurement installed under other sections or by others.

5. Essentially the design for the sensor placement, sensor type, sensor location, sensor aiming and quantity is the responsibility of the manufacturer and the manufacturers licensed representatives and technicians. The plans simply will show rooms or areas that require sensor switching and the general type of control.
6. Sensors used as an integral part of a lighting control system shall be equipped and designed to fully integrate with the system and control lighting as prescribed. Provide all interfaces necessary for the lighting control system to be in use.
7. Notify GMK Associates of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. Sequencing:
   1. Do not install lighting control devices until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
   1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.

C. Bill of Materials - Provide a single list of all products and associated accessories provided as part of this work.

D. Shop Drawings:
   1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.

E. Samples:
   1. Occupancy Sensors: One for each type and color specified.
   2. In-Wall Time Switches: One for each type and color specified.

F. Field Quality Control Reports.

G. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

H. Operation and Maintenance Data: Include detailed information on device programming and setup.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01600 - Product Requirements, for additional provisions.

J. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for all occupancy sensors.

C. Provide five year manufacturer warranty for utility grade locking receptacle-mounted outdoor photo controls.

D. Provide two year manufacturer warranty for all daylighting controls.

PART 2 PRODUCTS

2.01 ALL LIGHTING CONTROL DEVICES

A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

C. Products for Switching of Electronic Fluorescent Ballasts: Tested and rated to be suitable for peak inrush currents specified in NEMA 410.

D. Source Limitations: To ensure compatibility and limit the complexity for maintainence and servicing, obtain sensors and other devices specified herein from a single source to the greatest extent possible. Failure to take this into consideration will result in replacing submitted products with those selected by the reviewing authority at additional cost.

2.02 OCCUPANCY SENSORS

A. Manufacturers:
   1. Hubbell Building Automation, Inc: www.hubbellautomation.com
   2. Lutron Electronics Company, Inc: www.lutron.com.
   3. Sensor Switch Inc: www.sensorswitch.com.
   4. WattStopper: www.wattstopper.com.
   5. Substitutions: See Section 01600 - Product Requirements.
   6. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

B. All Occupancy Sensors:
   1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
   2. Sensor Technology:
      a. Passive Infrared (PIR) Occupancy Sensors: Designed to detect occupancy by sensing movement of thermal energy between zones.
      b. Ultrasonic Occupancy Sensors: Designed to detect occupancy by sensing frequency shifts in emitted and reflected inaudible sound waves.
      c. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
      d. Passive Infrared/Acoustic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and audible sound sensing technologies.
   3. Sensing technology shall be designed so that no radiation is emitted that inteferes with certain types of hearing aids or electronic devices like white board readers.
   4. In high humidity or cold evironments, the sensors must be conformably coated and rated for condensing humidity and -40 degree Fahrenheit operation.
   5. Sensor switches shall have optional features available for photocell/daylight override, vandal resistant lenses and no switch.
   6. All models shall have reduce turn on to adjust for problematic areas with unforeseen reflective surfaces.
   7. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
   8. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
   9. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
   10. Passive Infrared Lens Field of View: Field customizable by addition of factory masking material, adjustment of integral blinders, or similar means to block motion detection in selected areas.
   11. Turn-Off Delay: Field adjustable, up to a maximum time delay setting of not less than 15 minutes and not more than 30 minutes.
   12. Sensitivity: Field adjustable from 0-100%.
   13. Adaptive Technology: Field selectable; capable of self-adjusting sensitivity and time delay according to conditions.
   14. Integral Photocell: For field selectable and adjustable inhibition of automatic turn-on of load when ambient lighting is above the selected level.
   15. Compatibility: Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
   16. Load Rating for Line Voltage Occupancy Sensors: As required to control the load indicated on the drawings.
   17. Isolated Relay for Low Voltage Occupancy Sensors: SPDT dry contacts, ratings as required for interface with system indicated.

C. Wall Switch Occupancy Sensors:
   1. All Wall Switch Occupancy Sensors:
      a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
      b. Unless otherwise indicated or required to control the load indicated on the drawings, provide line voltage units with self-contained relay.
      c. Where indicated, provide two-circuit units for control of two separate lighting loads, with separate manual controls and separately programmable operation for each load.
      d. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
      e. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
      f. Provide selectable audible alert to notify occupant of impending load turn-off.
      g. Finish: Match finishes specified for wiring devices in Section 16140, unless otherwise indicated.
      h. Provide vandal resistant lenses for passive infrared (PIR) and dual technology wall switch occupancy sensors where indicated.
   2. Passive Infrared (PIR) Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.
   3. Ultrasonic Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 400 square feet.
   4. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.

D. Ceiling Mounted Occupancy Sensors:
   1. All Ceiling Mounted Occupancy Sensors:
      a. Description: Low profile occupancy sensors designed for ceiling installation.
      b. Unless otherwise indicated or required to control the load indicated on the drawings, provide low voltage units, for use with separate compatible accessory power packs.
      c. Provide field selectable setting for disabling LED motion detector visual indicator.
      d. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
      e. Finish: White unless otherwise indicated.
   2. Passive Infrared (PIR) Ceiling Mounted Occupancy Sensors:
      a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
      b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
   3. Ultrasonic Ceiling Mounted Occupancy Sensors:
      a. Standard Range Sensors: Capable of detecting motion within an area of 500 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
      b. Medium Range Sensors: Capable of detecting motion within an area of 1,000 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
      c. Extended Range Sensors: Capable of detecting motion within an area of 2,000

square feet at a mounting height of 9 feet.

4. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
   a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
   b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
5. Passive Infrared/Acoustic Dual Technology Ceiling Mounted Occupancy Sensors:
   a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
   b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 9 feet.

E. Directional Occupancy Sensors:
1. All Directional Occupancy Sensors: Designed for wall or ceiling mounting, with integral swivel for field adjustment of motion detection coverage.
   a. Unless otherwise indicated or required to control the load indicated on the drawings, provide low voltage units, for use with separate compatible accessory power packs.
   b. Provide field selectable setting for disabling LED motion detector visual indicator.
2. Passive Infrared (PIR) Directional Occupancy Sensors:
   a. Standard Range Sensors: Capable of detecting motion within a distance of 40 feet at a mounting height of 10 feet.
   b. Long Range Sensors: Capable of detecting motion within a distance of 80 feet at a mounting height of 10 feet.
   c. High Bay Sensors: Capable of detecting motion within a distance of 50 feet at a mounting height of 30 feet.
3. Passive Infrared/Ultrasonic Dual Technology Directional Occupancy Sensors: Capable of detecting motion within a distance of 40 feet at a mounting height of 10 feet.

F. Power Packs for Low Voltage Occupancy Sensors:
1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.
2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on the drawings.
3. Where exposed wiring is not allowed by code or other construction guidelines, install the power pack in an enclosure and run interconnecting wiring to devices in conduit.
4. Power packs must be available for multiple circuit control by use of power packs designed for multiple circuits and shall also be capable of operating slave packs.
5. Input Supply Voltage: Dual rated for 120/277 V ac.
6. Load Rating: As required to control the load indicated on the drawings.

G. Accessories:
1. Provide heavy duty coated steel wire protective guards compatible with specified occupancy sensors where indicated.

2.03 IN-WALL TIME SWITCHES

A. Manufacturers:
1. Source Limitations: Furnish products produced by a single manufacturer and obtained

from a single supplier.

B. Digital Electronic In-Wall Time Switches:
   1. Description: Factory-assembled solid state programmable controller with LCD display, suitable for mounting in standard wall box, and listed and labeled as complying with UL 916 or UL 917.
   2. Program Capability:
      a. 7-Day Time Switches: Capable of different schedule for each day of the week.
      b. Astronomic Time Switches: Capable of different schedule for each day of the week and field-configurable astronomic feature to automatically adjust for seasonal changes in sunrise and sunset times.
   3. Schedule Capacity: Not less than 40 programmable on/off operations.
   4. Provide automatic daylight savings time compensation.
   5. Provide power outage backup to retain programming and maintain clock.
   6. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
   7. Switch Configuration: Suitable for use in either SPST or 3-way application.
   8. Contact Ratings: As required to control the load indicated on the drawings.

2.04 OUTDOOR PHOTO CONTROLS

A. Manufacturers:
   1. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

B. Stem-Mounted Outdoor Photo Controls:
   1. Description: Direct-wired photo control unit with threaded conduit mounting stem and field-adjustable swivel base, listed and labeled as complying with UL 773A.
   2. Housing: Weatherproof, impact resistant polycarbonate.
   3. Photo Sensor: Cadmium sulfide.
   4. Provide external sliding shield for field adjustment of light level activation.
   5. Light Level Activation: 1 to 5 footcandles turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
   6. Voltage: As required to control the load indicated on the drawings.
   7. Failure Mode: Fails to the on position.
   8. Load Rating: As required to control the load indicated on the drawings.
   9. Provide accessory wall-mounting bracket where indicated or as required to complete installation.

C. Locking Receptacle-Mounted Outdoor Photo Controls
   1. Description: Plug-in locking type photo control unit complying with ANSI C136.10 for mounting on a compatible receptacle, listed and labeled as complying with UL 773.
   2. Housing: Weatherproof, impact resistant UV stabilized polypropylene, color to be selected.
   3. Photo Sensor: Cadmium sulfide.
   4. Light Level Activation: 1 to 3 footcandles turn-on and 1.5 to 1 turn-off to turn-on ratio with instant turn-on and delayed turn-off.
   5. Voltage: As required to control the load indicated on the drawings.
   6. Failure Mode: Fails to the on position.
   7. Load Rating: As required to control the load indicated on the drawings.

8. Surge Protection: 160 joule metal oxide varistor.
9. Provide the following accessories where indicated or as required to complete installation:
   a. Receptacle: Complying with ANSI C136.10.
   b. Mounting Bracket.
   c. Shorting Cap: Suitable for replacing locking photo control to complete circuit.

D. Button Type Outdoor Photo Controls
1. Description: Direct-wired photo control unit complying with ANSI C136.24 with weatherproof gasketed wall plate where required or indicated, listed and labeled as complying with UL 773A.
2. Housing: Weather resistant polycarbonate.
3. Photo Sensor: Cadmium sulfide.
4. Light Level Activation: 1 to 3 footcandles turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
5. Voltage: As required to control the load indicated on the drawings.
6. Failure Mode: Fails to the on position.
7. Load Rating: As required to control the load indicated on the drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.

F. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 16138 as required for installation of lighting control devices provided under this section.

1. Mounting Heights: Unless otherwise indicated, as follows:
   a. Wall Switch Occupancy Sensors: 48 inches above finished floor.
   b. In-Wall Time Switches: 48 inches above finished floor.
   c. In-Wall Interval Timers: 48 inches above finished floor.
2. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.
3. Locate wall switch occupancy sensors on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify GMK Associates to obtain direction prior to proceeding with work.

C. Install lighting control devices in accordance with manufacturer's instructions.

D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

E. Install lighting control devices plumb and level, and held securely in place.

F. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 16140.

G. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

H. Install identification label for wall switch occupancy sensors, in-wall time switches, in-wall interval timers, and accessory manual wall switches in accordance with Section 16075 indicating load served where indicated, when controlling loads that are not visible from the control location, or when multiple control devices are installed at one location.

I. Occupancy Sensor Locations:
   1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for complete coverage of respective room or area based on manufacturer's recommendations for installed devices.
   2. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.

J. Outdoor Photo Control Locations:
   1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east, west, or down.
   2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by the photo control itself.

K. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into the photo control.

L. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near the sensor location.

M. Where indicated, install separate compatible wall switches for manual control interface with lighting control devices or associated power packs.

N. Unless otherwise indicated, install switches on load side of power packs so that switch does not turn off power pack.

O. Where indicated or required, provide cabinet or enclosure in accordance with Section 16138 for mounting of lighting control device system components.

3.04 FIELD QUALITY CONTROL

A. See Section 01400 - Quality Requirements, for additional requirements.

B. Inspect each lighting control device for damage and defects.

C. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.

D. Test time switches to verify proper operation.

E. Test outdoor photo controls to verify proper operation, including time delays where applicable.

F. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by GMK Associates.

C. Adjust position of directional occupancy sensors and outdoor motion sensors to achieve optimal coverage as required.

D. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.

E. Adjust time switch settings to achieve desired operation schedule as indicated or as directed by GMK Associates. Record settings in written report to be included with submittals.

F. Adjust external sliding shields on outdoor photo controls under optimum lighting conditions to achieve desired turn-on and turn-off activation as indicated or as directed by GMK Associates.

G. Where requested by the owner the manufacturers field technician and the electrical contractor shall schedule a follow up field trip for additional adjustments and training within a year of completion of construction. This shall be considered part of the installation contract for this project with no service charges incurred by the owner or his agents.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

A. See Section 01780 - Closeout Submittals, for closeout submittals.

B. See Section 01820 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of lighting control devices to GMK Associates, and correct deficiencies or make adjustments as directed.

D. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Instructor: Qualified contractor familiar with the project and with sufficient knowledge of the installed lighting control devices.
   4. Location: At project site.

END OF SECTION

SECTION 16155 - EQUIPMENT WIRING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical connections to equipment.

1.02 RELATED REQUIREMENTS

A. Section 16131 - Conduit.

B. Section 16123 - Building Wire and Cable.

C. Section 16138 - Boxes.

D. Section 16140 - Wiring Devices.

E. Section 16412 - Enclosed Switches.

1.03 REFERENCE STANDARDS

A. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association; 1999 (R 2005).

B. NEMA WD 6 - Wiring Devices - Dimensional Requirements; National Electrical Manufacturers Association; 2002 (R2008).

C. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
   2. Determine connection locations and requirements.

B. Sequencing:
   1. Install rough-in of electrical connections before installation of equipment is required.
   2. Make electrical connections before required start-up of equipment.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
   1. Colors: Conform to NEMA WD 1.

2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

B. Disconnect Switches: As specified in Section 16412 and in individual equipment sections.

C. Wiring Devices: As specified in Section 16140.

D. Flexible Conduit: As specified in Section 16131.

E. Wire and Cable: As specified in Section 16123.

F. Boxes: As specified in Section 16138.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.

E. Provide cord and cap where field-supplied attachment plug is required.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

END OF SECTION

SECTION 16215 - ELECTRICAL SENSING AND MEASUREMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Instrument transformers.

B. Meters and meter switches and relays.

1.02 REFERENCE STANDARDS

A. ANSI C12.1 - American National Standard Code for Electricity Metering; 2008.

B. ANSI C39.1 - American National Standard Requirements for Electrical Analog Indicating Instruments; 1981 (R1992).

C. IEC 60051-1 - Direct Acting Indicating Analogue Electrical Measuring Instruments and Their Accessories - Part 1: Definitions and General Requirements Common To All Parts;; 1997.

D. IEC 60051-2 - Direct Acting Indicating Analogue Electrical Measuring Instruments and Their Accessories - Part 2: Special Requirements for Ammeters and Voltmeters; 1984.

E. IEEE C12.1 - American National Standard Code for Electricity Metering; Institute of Electrical and Electronic Engineers; 1988.

F. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; Institute of Electrical and Electronic Engineers; 2008.

G. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide electrical ratings, adjustment ranges, enclosure type, outline dimensions, mounting dimensions, and terminal connection information.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

1.04 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.

C. Products: Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Eaton; Power Xpert 4000 Series: www.eaton.com

B. Substitutions: See Section 01600 - Product Requirements.

2.02 MICROPROCESSOR-BASED METERING EQUIPMENT

A. Manufacturers:
   1. Eaton; Power Xpert 4000 series: www.eaton.com.
   2. Substitutions: See Section 01600 - Product Requirements.

B. Where indicated on the drawings, provide a microprocessor based line of Power Quality complete Meters, designated PX-M. PX-M consists of a Power Quality Meter Base(s) designated PX-B along with an integrally mounted Power Quality Meter Display designated PX-D or combination of PX-Bs and remotely located PX-Ds as indicated on the drawings. The PX-M, PX-B, and PX-D shall be equal to Eaton type Power Xpert Meter (PXM) Series 4000, 6000, or 8000 having the features and functions as shown on the drawings and herein specified. PX-B shall be NEMA 1 rated and PX-D shall be NEMA 12 rated.Analog Ammeters: IEC 60051-1 and IEC 60051-2; direct-reading, full range, indicating ammeter with 4.5 inch square recessed case and 250 degree scale, white dial with black figures and pointer, 5 ampere, 60 Hertz movement, 1 percent accuracy.

C. Complete PX-M, combination PX-B and/or PX-D shall be have the following minimum listings and/or certifications:
   1. Safety: UL 61010-1, EN 610101.
   2. Accuracy: ANSI C12.20 Class 0.2, IEC/EN60687 0.2 for revenue meters.
   3. EMC: FCC Part 15 Subpart B Class A immunity.
   4. IEC Standards: 50081-2, 61000-3, 61000-4, and 61326.

D. Meter shall be supplied suitable for standard 120/240 Vac or 110/250 Vdc inputs as required or indicated on the drawings.Analog Voltmeters: IEC 60051-1 and IEC 60051-2; direct-reading, full range, indicating voltmeter with 4.5 inch square recessed case and 250 degree scale, white dial with black figures and pointer, 120 volt, 60 Hertz movement, 1 percent accuracy.

E. Current inputs for each channel shall be from standard instrument current transformers.
   1. The analog current input shall be converted to 4096 samples per cycle with a delta-sigma converter digitally filtered down to 512 samples per cycle for anti-aliasing.
   2. Meter burden shall be less than 10 milliohms.
   3. Overload withstand capability shall be a minimum of 500A for 1 second, non-repeating.
   4. Input range capability shall be 0.005 to 20 amperes.

F. Voltage inputs for each channel shall allow for connection into circuits with the following parameters:
   1. Input range of 600V L-L, 347V L-N direct connected.
   2. PT primary input of 120 volts to 500,000 volts.
   3. Nominal full-scale value of 700 volts rms.
   4. Input impedance of 2 mega ohms.
   5. The analog voltage input shall be converted to 4096 samples per cycle by means of a delta sigma converter and digitally filtered down to 512 samples per cycle for anti-phasing.

G. The PX-Metering series shall be capable of monitoring, displaying, and communicating the below true rms minimum information where applicable with the accuracy as indicated of read or calculated values based on 3 to 300% full scale. The PX-Metering series shall be suitable for installation in single phase, two or three wire systems or in three phase, three or four wire systems
   1. AC current (amperes) in A, B and C phase, 3-phase average, Neutral (N) and Ground (G). A total of five (5) current inputs shall be provided. Accuracy of all current inputs shall be 0.05% reading, +/- 0.01% of full scale. Provide neutral and ground current transformers. The 5 ampere current inputs shall withstand 40 amperes continuous and 300 amperes for 1 second. Current transformer ratios shall be selectable.
   2. AC voltage (volts) for A-B, B-C and C-A, phase average, A-N, B-N and C-N, average phase to N, and N to G. Accuracy of all voltage inputs shall be +/- 0.1% reading, +/-0.05% maximum of full scale. Capable of metering up to 600 volt without external Potential Transformers (PTs) and up to 500 kV with appropriate PTs.
   3. Auxiliary AC voltage (volts) for A2-B2, B2-C2, and C2-A2, phase average. Accuracy of all voltage inputs shall be +/- 0.1% reading, +/-0.05% maximum of full scale. Capable of metering up to 600 volt without external Potential Transformers (PTs) and up to 500 kV with appropriate PTs.
   4. Real Power (Watts), Reactive Power (vars), Apparent Power (VA), for each phase and system. Accuracy +/- 0.10% reading and +/- 0.0025% full scale. Forward/Reverse indication shall be provided.
   5. Accumulated, Incremental and conditional measurement for Real Energy (WH), Reactive Energy (VARH), Apparent Energy (VAH) for each phase and system. Accuracy +/- 0.10% reading and +/- 0.0025% full scale. Forward/Reverse and Net difference indication shall be provided.
   6. Frequency (Hz) Accuracy +/- 0.01 hertz.
   7. Demand values including present, running average, last complete interval and peak for System Current (Amperes). Demand values including present, running average, last complete interval, peak and coincident with peak kVA and kW demand for System Real Power (Watts), System Reactive Power (vars), and System Apparent Power (VA).
   8. Power Factor for both Displacement only 60-cycle fundamental Watts to VA and Apparent total Watts to total vars including harmonics for A, B and C phase and 3 phase average. Accuracy +/- 0.10% at unity PF and +/-0.30% at 0.5 PF.
   9. Current percent Total Harmonic Distortion (THD) in A, B and C phase and N.
   10. Voltage percent THD in A-B, B-C and C-A phase, A-N, B-N and C-N.
   11. K-Factor (sum of the squares of harmonic currents times the square of their harmonic numbers).
   12. Transformer Derating Factor (1.414 divided by the Crest Factor).
   13. Crest Factor (ratio of peak current to rms current).
   14. (PXM 6000/8000 only)CBEMA (ITIC) curve data
   15. (PXM 6000/8000 only)Flicker data
   16. Nines (9's) availability data.
   17. Power Quality Index

H. The PX series shall provide the following sampling capabilities:
   1. A/D technology, sampling at 4096 samples per cycle.
   2. Over-sampling and quantizing filtering to eliminate false signal noise.
   3. (PXM 6000/8000 only)ITIC representation of power events.

4. (PXM 8000 only)DV/dt triggers for sub-cycle oscillatory transients.
5. (PXM 8000 only)Six (6) MHz/ one (1) MHz capture of impulsive transients.
6. Waveform recorded at *(512 standard samples-PXM 4000/6000) (100,000 high rate samples-PXM 8000) per cycle.
7. (PXM 8000 only)Three-phase voltage and neutral-to-ground fast transient capture.
8. (PXM 8000 only)Absolute threshold and dV/dt triggering.

I. The PX series shall provide the following advanced analysis features:
   1. Calculation of harmonic magnitudes and phase angle for each phase voltage and current through the 85th harmonic.
   2. Waveforms shall be available in non-volatile memory and retrievable via file transfer protocol (ftp) in COMTRADE file format over the Internet network.
   3. Historical Trending: Historical trend logging for graphical viewing from the Local PX-D display or from an embedded WEB server. The graphical views of historical data shall support both pan and zoom functions. All standard metering parameters shall be logged as part of the standard meter functionality including minimum, maximum and average for each metered parameter. The minimum and maximum readings shall be based on 200ms calculations. The averages shall be calculated over the user selected time interval period. Minimum storage capacity for standard trend plots shall be as follows:
      a. Five-minute intervals for 48 hours (2 days).
      b. Fifteen-minute intervals for 192 hours (8 days)
      c. One-hour intervals for 28 days
      d. Eight-hour intervals for 56 weeks
      e. One-week intervals for 44 months
      f. Data storage available in *(2GB-PXM 4000 only), (4GB-PXM 6000 only), or (8GB-PXM 8000 only).

J. Time of Use Monitoring: Time of use monitoring shall include:
   1. Four rate periods for time of use revenue metering.
   2. Total rate independent of time of use.
   3. Up to 4 rate schedules (weekdays and weekends).

K. Energy Profile: Energy profile data shall include recording of real and reactive energy forward, reverse, net and absolute sum as well as apparent energy (KVAH). Up to eight (8) status inputs shall be configurable as energy accumulators for counting KYZ pulse inputs. These readings shall be stored over a configurable interval from 1 to 60 minutes as well as in daily and weekly totals. Storage capacity shall be as follows:
   1. Sixty-two (62) days of fifteen (15) minute interval energy and pulse interval data. (Fixed interval capacity shall equal 5,952 intervals configurable from 1 to 60 minutes).
   2. Three hundred and seventy-two (372) days of 1 day accumulated energy and pulse interval data.
   3. Two Hundred and eight (208) weeks of one (1) week accumulated energy and pulse interval data.

L. Event Triggers: The PX-M shall have a quantity of five (5) types of configurable event triggers consisting of 1) Out of limits, 2) Demand overload, 3) ITIC, 4) Sub-Cycle disturbance and 5) Fast Transient. These triggers shall permit pickup, reset and pickup delay to be user configurable. When a trigger occurs, actions shall include Performance

monitoring (Nines (9s) analysis, Capturing Waveform, Capture all metered parameters, and ability to send by email and/or activate a relay output. The meter graphic display PX-D shall flash an LED to annunciate the alarm condition and an audible alarm shall be available. The following trigger options shall be included:

1. Out of limits - one hundred and five (105) triggers.
2. Demand overload - Ten (10) triggers.
3. Sub-cycle disturbance - dV/dt and absolute.
4. (PXM 6000/8000 only)ITIC curve display sag or swell voltage events - Eight (8) triggers.
5. (PXM 8000 only)Fast transient - dV/dt and absolute per phase.

M. Event Logging: The PX-M or embedded WEB Server shall allow the user to view a list of triggered events along with any captured parameters, event details, and triggered waveforms. In addition, a separate event log shall include logging of activities including acknowledged triggers, new minimum and maximum events, and systems operations, such as resets. The size of each event log shall be virtually unlimited based only on the memory option selected.

N. (PXM 6000/8000 only)ITIC Analysis Plot: The PX-D or embedded WEB Server shall include a graphic display of the Information Technology Industry Council (ITIC) plot with counts of disturbances and transients that have occurred. The ITIC plot shall organize events into eight (8) distinct disturbance zones corresponding to the severity of the event and a ninth (9th) zone for transients. A pass/fail count shall be displayed to indicate how many events are outside the ITIC limits. Operator clicking of any counter in the ITIC WEB page shall link the user to the event view and display all triggered events in the selected zone making it easy to view disturbance waveforms associated with the ITIC plot.

O. Sag/Swell and Waveform recording: Sixty (60) cycles of waveform shall be recorded at 512 samples per cycle including 30 cycles of pre and post event data. The embedded WEB server shall be capable of supporting viewing of all triggered waveforms one channel at a time and shall include the ability to zoom and to scroll horizontally using a slider bar. Waveforms shall be stored in non-volatile flash memory using industry standard COMTRADE format. Waveforms shall have the capability to be automatically sent out as COMTRADE attachments to an email following an event, or shall be retrievable from a ftp directory structure from the meter's memory.

P. Minimum and Maximum values for the following parameters:

1. Voltage L-L and L-N
2. Current per phase
3. Apparent Power Factor and Displacement Power Factor
4. Real, Reactive, and Apparent total Power
5. THD voltage L-L and L-N
6. THD Current per phase
7. Frequency

Q. The PX-M and PX-B shall have $(provisions for) a digital Input/Output (I/O) card which shall include:

1. Eight (8) digital inputs - self sourced 24 Vdc. These shall be interrupt driven, allowing for 1ms accuracy of digital events time stamps when utilizing local NTP server. Inputs shall be configurable for demand synch, and pulse counting. Inputs selected for pulse

counting shall be scalable. Interval by interval pulse recordings shall be maintained in the PX-M/PX-B profile memory and shall be capable of being displayed graphically.

2. Three (3) relay outputs - 5A maximum form C continuous, 380Vac maximum, 125Vdc maximum. Outputs shall be suitable for KYX or alarm annunciation. Relay outputs shall have the following minimum ratings:
   a. Make: 30A, 30 Vdc, 120-240 Vac.
   b. Break: 5A, 30 Vdc, 120-240 Vac.
   c. Resistive load: 0.5A, 125Vdc; 0.25A, 250 Vdc.
   d. Mechanical Operations: 1,000,000 no-load and100,000 under rated voltage and current.
   e. Output Relay when event triggered shall be capable of operating in timed, normal or latched mode.
   f. Two (2) solid state outputs - 80 mA maximum continuous, 30 Vdc maximum.

R. The PX-M and/or PX-B shall be provided with multiple communications ports and protocols, including the following capability:
   1. RS-485 remote display port
   2. RS-485 Modbus RTU
   3. RJ-45 10/100 baseT Local Ethernet Configuration Port for local WEB server connection
   4. HTML web pages
   5. File transfer protocol (ftp)
   6. RJ-45 Selectable 100FX or 10/100Base-T Ethernet network port
   7. RS-232
   8. RS-485 Modbus RTU selectable master/slave port
   9. Modbus TCP
   10. SMTP(Simple Mail Transfer Protocol) for email support
   11. SNMP(Simple Network Management Protocol) MIB support
   12. Ethernet TCP/IP
   13. NTP(Network Time Protocol) support

S. The PX-D graphical display shall utilize a simple “twist and click” navigation control dial to easily navigate the menus, select links to related pages, ad to drill down into increasing levels of further details. A “back” key shall be provided for easy navigation to higher level screens. The graphical display shall have the following features:
   1. Backlight LCD remote graphics display with 320 x 240 pixels.
   2. Capable of being mounted to the Meter base unit or remote mounting of display up to 2000 ft away with capability of displaying up to 16 base units or complete Meters.
   3. A set of screens including real time data, trend lots, waveform views and ITIC plot.
   4. Allow basic device setup and password protected resets.
   5. An audible alarm to annunciate alarm conditions.

T. The WEB server shall provide the user with remote WEB access to all the metered, trend and waveform information. The WEB server shall include real time monitored information in both numeric and graphical visual formats.

U. A reset button shall be provided on the PX-M and PX-B to be able to reset communications to factory defaults. Reset capabilities shall be provided in conjunction with various lockable dip switch settings

V. The meter shall be capable of providing the graphically display of the following Main Meter

Menu Screens:

1. Meter Screen providing:
   a. Volts: L-L and L-N, and average
   b. Frequency
   c. Current and average phase A, B, and C, N & G
2. Power Screen providing:
   a. Energy
   b. Demand
   c. Power Factor
3. Quality Screen providing:
   a. Total Harmonic Distortion (THD) of volts and current
   b. $(PXM 6000/8000 only)Flicker
   c. Percent Nines (9s) reliability
4. Events screen providing:
   a. Latest events
   b. Enabled Triggers
   c. Historical Events
   d. Calendar view of Events
   e. Events Timeline screen
5. Set-up screen providing:
   a. View set-up
   b. Edit set-up
   c. Login
   d. Logout
   e. A tool bar for screen selection which is always present and viewable shall be provided along the bottom of the graphical display. Selection of one of the main screens shall be by turning the navigation knob and highlighting the desired screen. Once selected, pressing the knob shall make the selection.

W. Meter shall be mounted in an external NEMA 1 enclosure which shall be mounted to the existing Motor Control Center which is the main service entrance equipment.

X. Include any and all reqired accessories such as CT's and wiring to operate this meter.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

END OF SECTION

SECTION 16412 - ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed safety switches.

B. Fusible switches.

C. Nonfusible switches.

D. Enclosures

1.02 RELATED REQUIREMENTS

A. Section 16060 - Grounding and Bonding.

B. Section 16070 - Hangers and Supports.

C. Section 16075 - Electrical Identification: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2008.

C. NEMA FU 1 - Low Voltage Cartridge Fuses; National Electrical Manufacturers Association; 2002 (R2007).

D. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association; 2001 (R2006).

E. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2009.

F. FS W-S-865 - Switch, Box, (Enclosed), Surface-Mounted.

G. NEC 695 - Fire Pumps

H. NFPA 20 - Standard for the Installation of Centrifugal Fire Pumps.

I. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

J. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

K. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

L. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. All equipment to be installed by any contractor that requires electrical connection, that has an electric motor, or is classified by codes as requiring disconnecting means, shall

have a disconnect switch or code approved disconnecting means furnished and installed by the Division 16 Contractor, whether a disconnect is shown on the plans or not.

2. If the equipment being served is equipped with a code approved factory installed disconnecting means, then the requirement for the Division 16 Contractor to provide a disconnecting means shall be deleted. Coordinate with the equipment provider to determine if the equipment is being provided with a code approved, factory installed disconnecting means.
3. The Division 16 Contractor shall coordinate the disconnect required and shall furnish and install the disconnect.
4. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
5. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
6. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
7. Notify GMK Associates of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements and Section 16010 - General Electrical Requirements, for submittal procedures.

B. Product Data: Provide switch ratings and enclosure dimensions. Ratings shall include but not necessarily be limited to voltage, number of poles, voltage, amperage, horsepower and short-circuit.

C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include dimensioned plan and elevation views of enclosed switches and adjacent equipment with all required clearances indicated.
   2. Include wiring diagrams showing all factory and field connections.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

E. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and

traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature between -22 degrees F and 104 degrees F during and after installation of enclosed switches.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Eaton Corporation; Cutler-Hammer Products: www.eaton.com.

B. General Electric Company: www.geindustrial.com.

C. Schneider Electric; Square D Products: www.schneider-electric.us.

D. Substitutions: See Section 01600 - Product Requirements.

E. Source Limitations: Furnish enclosed switches and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break, enclosed safety switches complying with NEMA KS 1, type HD (heavy duty), and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.

B. Provide products listed and labeled by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature: Between -22 degrees F and 104 degrees F.

D. Horsepower Rating: Suitable for connected load.

E. Voltage Rating: Suitable for circuit voltage.

F. Short Circuit Current Rating:
   1. Minimum Ratings:
      a. Switches Protected by Class H Fuses: 10,000 rms symmetrical amperes.
      b. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.
      c. Double Throw Switches Protected by Class R, Class J, or Class T Fuses: 100,000 rms symmetrical amperes.

G. Provide with switch blade contact position that is visible when the cover is open.

H. Fuse Clips for Fusible Switches: As required to accept fuses indicated.

I. Conductor Terminations: Suitable for use with the conductors to be installed.

J. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

K. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

L. Enclosures: Comply with NEMA KS 1 and NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
      b. Outdoor Locations: Type 3R.
   2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.

M. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

N. Heavy Duty Switches:
   1. Conductor Terminations:
      a. Provide mechanical lugs unless otherwise indicated.
      b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   2. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.
      a. Provide means for locking handle in the ON position where indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed safety switches.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install enclosed switches in accordance with manufacturer's instructions.

B. Install enclosed switches securely, in a neat and workmanlike manner in accordance with NECA 1.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required supports in accordance with Section 16070.

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 16060.

H. Provide fuses complying with Section 16491 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

I. Identify enclosed switches in accordance with Section 16075.

J. coordinate with the supplier of each piece of equipment that requires a disconnect switch to determine the exact rating and type of the switch and the rating and type of fuses (if required or called for).

K. Install disconnect switches as near as possible to the spot where indicated on Drawings. Contractor shall field determine the construction conditions and locate the switch in the best possible location.

L. Install fuses in fusible disconnect switches.

3.03 FIELD QUALITY CONTROL

A. Perform field inspection in accordance with Section 01400.

B. Inspect and test in accordance with NETA STD ATS, except Section 4.

C. Perform inspections and tests listed in NETA STD ATS, Section 7.5.1.1.

D. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 16443 - PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

C. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

A. Section 16060 - Grounding and Bonding.

B. Section 16070 - Hangers and Supports.

C. Section 16075 - Electrical Identification: Identification products and requirements.

D. Section 16491 - Fuses: Fuses for fusible switches and spare fuse cabinets.

1.03 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; Federal Specification; Revision D, 2006.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

C. NECA 407 - Standard for Installing and Maintaining Panelboards; National Electrical Contractors Association; 2009.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2008.

E. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC; National Electrical Manufacturers Association; 2000 (R2005).

F. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association; 2001 (R2006).

G. NEMA PB 1 - Panelboards; National Electrical Manufacturers Association; 2011.

H. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; National Electrical Manufacturers Association; 2007.

I. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2009.

J. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008, ; Including All Applicable Amendments and Supplements.

K. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

L. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

M. UL 67 - Panelboards; Current Edition, Including All Revisions.

N. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures and Section 16010 - General Electrical Requirements.

B. Shop Drawings: Indicate outline and support point dimensions, voltage, phases, main bus ampacity, bus material, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes and characteristics, circuit numbering and special features and options. Present the information in the form of schedules and lists for each panelboard in question.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

E. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01600 - Product Requirements, for additional provisions.
2. Panelboard Keys: Two of each different key.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.06 MAINTENANCE MATERIALS

A. See Section 01600 - Product Requirements, for additional provisions.

B. Furnish two of each panelboard key.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Eaton Corporation; Cutler-Hammer Products: www.eaton.com.

B. General Electric Company: www.geindustrial.com.

C. Schneider Electric; Square D Products: www.schneider-electric.us.

D. Substitutions: See Section 01600 - Product Requirements.

2.02 ALL PANELBOARDS

A. Provide products listed and labeled by Underwriters Laboratories Inc. as suitable for the purpose indicated.

B. Unless otherwise indicated, provide products suitable for continuous operation under the

following service conditions:
1. Altitude: Less than 6,600 feet.
2. Ambient Temperature:
   a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

C. Short Circuit Current Rating:

D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

F. Bussing: Sized in accordance with UL 67 temperature rise requirements.
1. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

G. Conductor Terminations: Suitable for use with the conductors to be installed.

H. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
2. Boxes: Galvanized steel unless otherwise indicated.
   a. Provide wiring gutters sized to accommodate the conductors to be installed.
3. Fronts:
   a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
   b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
4. Lockable Doors: All locks keyed alike unless otherwise indicated.

I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

2.03 POWER DISTRIBUTION PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
1. Phase and Neutral Bus Material: Copper.
2. Ground Bus Material: Copper.

D. Circuit Breakers:
1. Provide bolt-on type or plug-in type secured with locking mechanical restraints.

E. Enclosures:
1. Provide surface-mounted enclosures unless otherwise indicated.

2. Substitutions: See Section 01600 - Product Requirements and Section 16010 - General Electrical Requirements.

F. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard.

G. Minimum integrated short circuit rating: As indicated.

H. Main Circuit Breakers: Molded case type with integral thermal and instantaneous magnetic trip in each pole, bolt-on type; UL listed. Mains shall be individually mounted. No branch main circuit breaker allowed.

I. Solid-State Molded Case Circuit Breakers: With electronic sensing, timing and tripping circuits for adjustable current settings; UL listed. Provide for all main circuit breakers 400 amp and larger and where mains exceed 600 amps for all branch circuit breakers 400 amp and larger:

J. Branch Molded Case Circuit Breakers: With integral thermal and instantaneous magnetic trip in each pole, bolt-on type; UL listed. For air conditioning equipment branch circuits provide circuit breakers UL listed as Type HACR.

K. Circuit Breaker Accessories: Trip units and auxiliary switches as indicated.

L. Enclosure: NEMA PB 1, Type 1 cabinet box.

M. Cabinet Front: Surface type, fastened with hinge and latch, hinged door with flush lock, metal directory frame, finished in manufacturer's standard gray enamel.

N. Circuit Arrangement: Arrange circuit breakers in the panelboard identical to that shown in the construction documents.

2.04 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
2. Phase and Neutral Bus Material: Copper.
3. Ground Bus Material: Copper.

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Enclosures:
1. Provide surface-mounted or flush-mounted enclosures as indicated.
2. Provide clear plastic circuit directory holder mounted on inside of door.

F. Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit

panelboard.

G. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard; provide insulated ground bus where scheduled.

H. Minimum Integrated Short Circuit Rating: As indicated.

I. Main Circuit Breakers: Molded case type with integral thermal and instantaneous magnetic trip in each pole, bolt-on type; UL listed. Mains shall be individually mounted; No branch main circuit breakers.

J. Branch molded Case Circuit Breakers: Thermal magnetic trip circuit breakers, bolt-on type, with common trip handle for all poles; UL listed.
   1. Type SWD for lighting circuits.
   2. Type HACR for air conditioning equipment circuits.
   3. Class A ground fault interrupter circuit breakers where scheduled.
   4. Do not use tandem circuit breakers.

K. Enclosure: NEMA PB 1, Type 1.

L. Cabinet Box: 6 inches deep, 20 inches wide for 240 volt and less panelboards, 20 inches wide for 480 volt panelboards.

M. Cabinet Front: Flush cabinet front with concealed trim clamps, concealed hinge, metal directory frame, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.

N. Circuit Arrangement: Arrange circuit breakers in the panelboard identical to that shown in the construction documents.

2.05 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:
   1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
   2. Interrupting Capacity:
      a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
      b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
   3. Conductor Terminations:
      a. Lug Material: Copper, suitable for terminating copper conductors only.
   4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
   5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install panelboards securely, in a neat and workmanlike manner in accordance with NECA 1 (general workmanship), NECA 407 (panelboards), and NEMA PB 1.1.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required supports in accordance with Section 16070.

E. Install panelboards plumb.

F. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

G. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.

H. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

I. Provide grounding and bonding in accordance with Section 16060.

J. Install all field-installed branch devices, components, and accessories.

K. Install panelboards in accordance with NEMA PB 1.1 and NECA 1.

L. Install panelboards plumb. Install recessed panelboards flush with wall finishes.

M. Height: 6 feet to top of panelboard; install panelboards taller than 6 feet with bottom no more than 4 inches above floor.

N. Provide filler plates to cover unused spaces in panelboards.

O. Provide computer-generated circuit directory for each lighting and appliance panelboard, and each power distribution panelboard provided with a door, clearly and specifically indicating the loads served. Identify spares and spaces. In addition confirm and identify all existing circuits and include the descriptions as part of the new directory.

P. The typed directory shall include the room number location of the load served. (EXAMPLE: 36 - Lights:204,206.....14 - Receptacles:RM 115.....6 - Electric Unit Heater:173) Room numbers shall be the room numbers as on the room door, not the space numbers as shown on the plans.

Q. Provide identification nameplate for each power distribution panelboard branch device in accordance with Section 16075, clearly and specifically indicating the loads served.

R. Provide engraved plastic nameplates under the provisions of Section 16075.

S. Provide arc flash warning labels in accordance with NFPA 70.

T. Provide spare conduits out of each recessed panelboard to an accessible location above ceiling. Identify each as SPARE.
   1. Minimum spare conduits: 5 empty 1 inch.

U. Ground and bond panelboard enclosure according to Section 16060.

V. Examine riser diagrams, homeruns and schedules carefully and provide circuit breakers for all branch circuits and feeders shown originating from any panelboard. Whether listed in a

schedule for a panelboard or not, provide a circuit breaker for such circuits in the panelboard sized according to the branch circuit or feeder size shown on a riser or otherwise noted. Any information that can be reasonably used to size a circuit breaker such as transformer or motor sizes shall be considered legitimate information for sizing circuit breakers where more specific information is not available. Note these circuits on the shop drawings to be verifed by the Engineer.

3.02 FIELD QUALITY CONTROL

A. Perform inspection, testing, and adjusting in accordance with Section 01400.

B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

C. Perform field inspection and testing in accordance with Section 01400.

D. Inspect and test in accordance with NETA STD ATS, except Section 4.

E. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA STD ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 200 amperes. Tests listed as optional are not required.

F. Correct deficiencies and replace damaged or defective panelboards or associated components.

G. Perform inspections and tests listed in NETA STD ATS, Section 7.5 for switches, Section 7.6 for circuit breakers.

3.03 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

END OF SECTION

SECTION 16491 - FUSES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fuses.

1.02 RELATED REQUIREMENTS

A. Section 16075 - Electrical Identification: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. NEMA FU 1 - Low Voltage Cartridge Fuses; National Electrical Manufacturers Association; 2002 (R2007).

B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008, Including All Applicable Amendments and Supplements.

C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01600 - Product Requirements, for additional provisions.
   2. Extra Fuses: Three set(s) of three for each type and size installed.
   3. Fuse Pullers: One set(s) compatible with each type and size installed.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Cooper Bussmann, a division of Cooper Industries: www.cooperindustries.com.

B. Mersen (formerly Ferraz Shawmut): ferrazshawmut.mersen.com.

C. Littelfuse, Inc: www.littelfuse.com.

2.02 FUSES

A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose indicated.

B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.

C. Provide fuses of the same type, rating, and manufacturer within the same switch.

D. Comply with UL 248-1.

E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.

F. Voltage Rating: Suitable for circuit voltage.

G. Power Load Feeder Switches: Class RK1 (time delay).

H. Motor Load Feeder Switches: Class RK1 (time delay).

I. Lighting Load Feeder Switches Larger than 600 amperes: Class L time delay.

J. Other Feeder Switches Larger than 600 amperes: L time delay.

K. General Purpose Branch Circuits: Class RK1 (time delay).

L. Motor Branch Circuits: Class L time delay.

PART 3 EXECUTION

3.01 INSTALLATION

A. Do not install fuses until circuits are ready to be energized.

B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

END OF SECTION

SECTION 16510 - INTERIOR LUMINAIRES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires.

B. Exit signs.

C. Ballasts.

D. Fluorescent emergency power supply units.

E. Lamps.

F. Luminaire accessories.

1.02 RELATED REQUIREMENTS

A. Section 16138 - Boxes.

B. Section 16075 - Electrical Identification: Identification products and requirements.

C. Section 16145 - Lighting Control Devices: Automatic controls for lighting including occupancy sensors, outdoor motion sensors, time switches, outdoor photo controls, and daylighting controls.

D. Section 16140 - Wiring Devices: Manual wall switches and wall dimmers.

1.03 REFERENCE STANDARDS

A. ANSI C78.379 - American National Standard for Electric Lamps -- Reflector Lamps -- Classification of Beam Patterns; 2006.

B. ANSI C82.1 - American National Standard for Lamp Ballast - Line Frequency Fluorescent Lamp Ballast; 2004.

C. ANSI C82.11 - American National Standard for Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts - Supplements; 2011.

D. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (R2008).

E. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).

F. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

G. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; National Electrical Contractors Association; 2006.

H. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; National Electrical Contractors Association; 2006.

I. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Fluorescent Ballasts; National Electrical Manufacturers Association; 2011.

J. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; National Electrical Manufacturers Association; 2006.

K. NEMA WD 6 - Wiring Devices - Dimensional Requirements; National Electrical Manufacturers Association; 2002 (R2008).

L. FS W-F-414 - Fixture, Lighting.

M. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

N. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures; National Fire Protection Association; 2012.

O. UL 935 - Fluorescent-Lamp Ballasts; Current Edition, Including All Revisions.

P. UL 1598 - Luminaires; Current Edition, Including All Revisions.

Q. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations. Do not rely on catalog numbers for such information.
   2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
   3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
   4. If only one fixture shown on the plans in a room or within a group of fixtures is labeled the remainder of the fixtures in the room or within the group shall be considered to be the same except where obvious to the contrary.
   5. Notify GMK Associates of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
   2. Provide photometric calculations where luminaires are proposed for substitution upon request.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories,

and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.

1. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IESNA LM-63 standard format upon request.
2. Ballasts: Include wiring diagrams and list of compatible lamp configurations.
3. Lamps: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.
4. Fluorescent Emergency Power Supply Unit: Include list of compatible lamp configurations and associated lumen output.
5. Air Handling Luminaires: Include air handling performance data.

D. Certificates for Dimming Ballasts: Manufacturer's documentation of compatibility with dimming controls to be installed.

E. Additional information required on submitted data sheet:
1. Fixture Type
2. Catalog Number
3. Color photograph or isometric drawings
4. Plan and elevation views
5. Ballast Type
6. Lamp Type
7. Coefficients of Utilization
8. Candle power distribution charts
9. Zonal Lumen Summary charts
10. Options selected
11. Description of fixture construction

In addition to a paper copy of the data or specification sheet provide on a CD-ROM a PDF of the technical specification sheet and the product brochure for each light fixture.

F. Special Accessories or Modifications: Identify special modifications or accessories that may not apply to all fixtures of the type specified to meet dimming, control, fire rating and other indicated conditions or applications on the drawings. These conditions or applications are not generally identified on the light fixtures schedule and are not characterized by a special fixture type designation. Provide separate marked up cut sheets and designations or other wise schedule or note the exceptions for the fixtures in question.

G. Custom Light Fixtures: Submit 1/2 scale drawings with all details fully delineated.

H. Light Fixture Systems: For lighting systems such as continuous cove or strip lights, recessed perimeter systems, and linear suspended systems provide complete layout drawings and installation details. Describe the system completely and show elevations, sections and other details required to completely delineate the product and installation.

I. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

J. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

K. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01600 - Product Requirements, for additional provisions.
   2. Extra Lenses and Louvers: Two percent of total quantity installed for each type, but not less than two of each type.
   3. Extra Lamps: Ten percent of total quantity installed for each type, but not less than two of each type.
   4. Extra Ballasts: Two percent of total quantity installed for each type, but not less than two of each type.

L. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Provide two year manufacturer warranty for all linear fluorescent ballasts.

C. Provide five year pro-rata warranty for batteries for emergency lighting units.

D. Provide ten year pro-rata warranty for batteries for self-powered exit signs.

E. Provide three year full warranty for fluorescent emergency power supply units.

F. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Light Fixtures:
   1. As scheduled on the drawings.

B. Lamps:
   1. General Electric
   2. Osram Sylvania

3. Phillips Lighting
4. Venture

C. Ballasts:
1. Advance Transformer Co.
2. Magnetec, Inc.
3. Valmont Electric

D. Fluorescent Emergency Ballast:
1. Bodine
2. Radiant Illumination, Inc.
3. Lithonia
4. Iota

E. Dimming Fluorescent Ballasts:
1. Lutron
   a. Eco-10 Series
   b. EcoSystems Series
   c. Hi-lume Series

F. Substitutions: See Section 01600 - Product Requirements.

2.02 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

B. Catalog numbers are for general identification of fixtures only. It is the responsibility of the Contractor to provide complete catalog numbers and to provide all accessories for installation as implied by the accompanying description of the fixture, the demonstrated use on the drawings, and the specifications contained herein.

2.03 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

D. Provide products complying with Federal Energy Management Program (FEMP) requirements.

E. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

F. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

G. The voltages of all light fixtures shall be determined by the circuit to which each light fixture is connected. Refer to the circuiting requirements shown on the drawings, in particular the lighting plans and panelboard schedules, to determine the voltage required. While in most cases light fixtures require only one voltage, there are cases where a light

fixture must be provided in mulitiple voltages. It is the responsibility of the Contractor to determine where this occurs and provide fixtures in the voltages required.

H. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

I. Sheet Metal:
1. Shall be formed to prevent warping and sagging. Housing, trim and lens frame shall be true straight (unless intentionally curved), and parallel to each other as designed. Prepainted metal is not acceptable.
2. Wireways and fittings shall be free of burrs and sharp edges and shall accommodate internal and branch circuit wiring without damage to the wiring.
3. When installed any exposed fixture housing surface, trim frame, door frame and lens frame shall be free of light leaks; lens doors shall close in a light tight manner.
4. Hinged door closure frames shall operate smoothly without binding when the fixture is in the installed position, and latches shall function easily by finger action without the use of tools.

J. Lamp Sockets:
1. Fluorescent sockets shall be the biting edge type or phosphorous-bronze with silver flash contact surface type and shall conform to the applicable requirements of UL 542 and ANSI C-81. Lamp holders for bi-pin lamps, with the exception of those for "U" type lamps, shall be of the telescoping compression type, or of the single slot entry type requiring a one-quarter turn of the lamp after insertion.
2. Incandescent: Shall have porcelain enclosures and conform to the applicable requirements of UL 496.

K. Metal Components:
1. The manufacturer shall apply his standard finish (unless otherwise specified) over a corrision resistant primer, after cleaning to free the metal surfaces of rust, grease, dirt and other deposits. Fixture finish shall be free of stains or evidence of rusting, blistering, or flaking.
2. Fixture shall be painted after fabrication. Pre-painted metal is not acceptable.
3. Interior light reflecting finishes shall be white with not less than 85 percent reflectances except where otherwise shown on the drawings.
4. Exterior finishes shall be as shown on the drawings.

L. Louvers and Light Transmitting Panels: Fluorescent fixtures and with louvers or light transmitting panels shall have hinges, latches and safety catches to facilitate safe, convenient cleaning and relamping. Vapor tight fixtures shall have pressure clamping devices in lieu of the latches.

M. Recessed Luminaires:
1. Ceiling Compatibility: Comply with NEMA LE 4.
2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
3. Recessed incandescent and High Intensity Discharge (HID) light fixtures, including those installed in grid ceiling systems, shall be provided with integral thermal protection. Incandescent light fixtures shall comply with Article 430.130 of NFPA-70. Thermal protection for HID light fixtures shall be integral with the ballast.

4. Recessed incandescent, compact fluorescent or HID light fixtures installed in other than "lay-in" grid type ceilings shall be prewired type with an UL wiring junction box accessible through the fixture aperture. Where such light fixtures utilize a ballast, the ballast shall be removable through the fixture aperture.
5. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.
6. Air-Handling Recessed Fluorescent Luminaires: Suitable for air supply/return, heat removal, or combination as indicated.
    a. Luminaires for Air Supply/Return: Provide air control blades where indicated.
    b. Luminaires for Heat Removal: Provide heat removal dampers where indicated.

N. Damp Location Luminaires: Light fixtures installed in wet or damp locations shall be UL listed and appropriately labeled for such use.

O. Fluorescent Luminaires:
1. Provide ballast disconnecting means complying with NFPA 70 where required.
2. Fluorescent Luminaires Controlled by Occupancy Sensors: Provide programmed start ballasts.
3. Fluorescent Luminaires Controlled by Dual-Level Switching: Provide with two ballasts.
    a. Luminaires with Two Lamps: Each ballast controls one lamp.
    b. Luminaires with Three Lamps: One ballast controls two outer lamps and one ballast controls inner lamp.
    c. Luminaires with Four Lamps: One ballast controls two outer lamps and one ballast controls two inner lamps.

P. LED Luminaires: Listed and labeled as complying with UL 8750.

Q. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

2.04 EXIT SIGNS

A. All Exit Signs: Internally illuminated with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
1. Number of Faces: Single or double as indicated or as required for the installed location.
2. Directional Arrows: As indicated or as required for the installed location.

B. Self-Powered Exit Signs:
1. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
2. Battery: Sealed maintenance-free nickel cadmium unless otherwise indicated.
3. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
4. Provide low-voltage disconnect to prevent battery damage from deep discharge.
5. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

C. Accessories:
   1. Provide compatible accessory high impact polycarbonate vandal shields where indicated.
   2. Provide compatible accessory wire guards where indicated.

D. Exit Signs: Exit sign fixture suitable for use as emergency lighting unit.
   1. Provide fixtures complying with NFPA 101.
   2. Lamps: LED.
   3. Mounting: As indicated.

2.05 BALLASTS

A. Manufacturers:
   1. Manufacturer Limitations: Where possible, for each type of luminaire provide ballasts produced by a single manufacturer.
   2. Where a specific manufacturer or model is indicated elsewhere in the luminaire schedule or on the drawings, substitutions are not permitted unless explicitly indicated.

B. All Ballasts:
   1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
   2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
   3. Ballasts shall be accessible for servicing without removing or dismantling the fixtures. Each fluorescent ballast serving lamps 30 watts and larger shall be bolted to the fixture body or housing with four studs or captive screws.
   4. Ballasts shall be equipped with color coded QUICK-CONNECT horizontal wiretap connectors on each end of the ballast housing for ease of installation. Ballasts shall be serviceable while the fixture is in its normally installed position, and shall not be mounted to removable reflectors or wireway covers unless so specified.

C. Fluorescent Ballasts:
   1. All Fluorescent Ballasts: Unless otherwise indicated, provide high frequency electronic ballasts complying with ANSI C82.11 and listed and labeled as complying with UL 935.
      a. Input Voltage: Suitable for operation at voltage of connected source, with variation tolerance of plus or minus 10 percent.
      b. Total Harmonic Distortion: Not greater than 20 percent.
      c. Power Factor: Not less than 0.95.
      d. Ballast Factor: Normal ballast factor between 0.85 and 1.15, unless otherwise indicated.
      e. Thermal Protection: Listed and labeled as UL Class P, with automatic reset for integral thermal protectors.
      f. Sound Rating: Class A, suitable for average ambient noise level of 20 to 24 decibels.
      g. Lamp Compatibility: Specifically designed for use with the specified lamp, with no visible flicker.
      h. Lamp Operating Frequency: Greater than 20 kHz, except as specified below.
         1) Do not operate lamp(s) within the frequencies from 30 kHz through 40 kHz in order to avoid interference with infrared devices.
      i. Lamp Current Crest Factor: Not greater than 1.7.

j. Lamp Wiring Method:
   1) Instant Start Ballasts: Parallel wired. (All fixtures except where not available or compatible with installation requirements.)
   2) Rapid Start Ballasts: Series wired.
   3) Programmed Start Ballasts: Provide parallel or series/parallel wired where available; otherwise series wired is acceptable.

k. Provide automatic restart capability to restart replaced lamp(s) without requiring resetting of power.

l. Provide end of lamp life automatic shut down circuitry for T5 and smaller diameter lamp ballasts.

m. Surge Tolerance: Capable of withstanding characteristic surges according to IEEE C62.41.2, location category A.

n. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of CFR, Title 47, Part 18, for Class A, non-consumer application.

o. Provide high efficiency T8 lamp ballasts certified as NEMA premium.

p. Provide lamp striation reduction circuitry.

q. Ballast Marking: Include wiring diagrams with lamp connections.

2. Non-Dimming Fluorescent Ballasts:
   a. Lamp Starting Method:
      1) T8 Lamp Ballasts: Instant start unless otherwise indicated.
      2) T5 Lamp Ballasts: Programmed start unless otherwise indicated.
      3) Compact Fluorescent Lamp Ballasts: Programmed start unless otherwise indicated.
   b. Lamp Starting Temperature: Capable of starting standard lamp(s) at a minimum of 0 degrees F, and energy saving lamp(s) at a minimum of 60 degrees F unless otherwise indicated.

2.06 LAMPS

A. Manufacturers:
   1. Manufacturer Limitations: Where possible, provide lamps produced by a single manufacturer.

B. All Lamps:
   1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
   2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
   3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
   4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the GMK Associates to be inconsistent in perceived color temperature.

C. Incandescent Lamps: Wattage and bulb type as indicated, with base type as required for lighting fixture; 130 V rated.
   1. Reflector Type Incandescent Lamps: Beam pattern as indicated.
   2. Non-Reflector Type Incandescent Lamps: Inside frosted lamp finish unless otherwise

indicated.

D. Compact Fluorescent Lamps: Wattage and bulb type as indicated, with base type as required for luminaire.
   1. Low Mercury Content: Provide lamps that pass the EPA Toxicity Characteristic Leaching Procedure (TCLP) test for characteristic hazardous waste.
   2. Correlated Color Temperature (CCT): 3,500 K unless otherwise indicated.
   3. Color Rendering Index (CRI): Not less than 80.
   4. Average Rated Life: Not less than 10,000 hours for an operating cycle of three hours per start.

E. Linear Fluorescent Lamps: Wattage and bulb type as indicated, with base type as required for luminaire.
   1. Low Mercury Content: Provide lamps that pass the EPA Toxicity Characteristic Leaching Procedure (TCLP) test for characteristic hazardous waste.
   2. T8 Linear Fluorescent Lamps:
      a. Correlated Color Temperature (CCT): 3,500 K unless otherwise indicated.
      b. Color Rendering Index (CRI): Not less than 80.
      c. Average Rated Life: Not less than 20,000 hours for an operating cycle of three hours per start.
   3. T5 Linear Fluorescent Lamps:
      a. Correlated Color Temperature (CCT): 3,500 K unless otherwise indicated.
      b. Color Rendering Index (CRI): Not less than 80.
      c. Average Rated Life: Not less than 20,000 hours for an operating cycle of three hours per start.

2.07 LIGHT TRANSMITTING PLASTICS

A. Shall be 100 percent virgin acrylic plastic or water white, annealed, crystal glass.

B. Shall have not less than 1/8-inch of average thickness. The average thickness shall be determined by adding the maximum thickness to the minimum unpenetrated thickness and dividing the sum by 2.

C. Unless otherwise specified lenses and diffusers shall be retained firmly in a metal frame by clips or clamping ring in such a manner as to allow expansion and contraction of the lens without distortion or cracking.

2.08 AIR HANDLING AND HEAT REMOVAL FLUORESCENT FIXTURES

A. Shall conform to the requirements in this section for other types of fluorescent fixtures and to the detail drawings.

B. Air return shall be from both sides of the fixture through the lamp chamber into the ceiling plenum. If only one end of the fixture is used for entering return air, the opposite end shall be used to return air into the plenum. If both ends of the fixture are used for entering return air, air shall be exhausted into the ceiling plenum at the center of the fixture. Return air volume shall be adjustable by means of movable exhaust slot covers on the ends of the fixture operable from the room side of the fixture. Fixture shall be designed to remove a minimum of 45 cfm of return air through the side slots with a maximum pressure drop of 0.03 inch water gage.

2.09 LUMINAIRES IN FIRE RATED ASSEMBLIES

A. Provide a fire rated cover or enclosure for light fixtures shown installed in fire rated assemblies, especially fire rated ceilings, that match the rating of the assembly and manitains the integrity of the assembly's fire rating. Coordinate with Contractor to install covers or enclosures. As an alternative, a fire rated fixture matching the specified fixture may be submitted for consideration.

2.10 ACCESSORIES

A. Stems for Suspended Luminaires: Steel tubingNone-N/A, factory finished to match luminaire or field-painted as directed.

B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.

C. Provide accessory plaster frames.

D. Tube Guards for Linear Fluorescent Lamps: Provide clear virgin polycarbonate sleeves with endcaps where indicated.

E. Substitutions: See Section 01600 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 16138 as required for installation of luminaires provided under this section.

B. Install products according to manufacturer's instructions.

C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 1 (general workmanship), NECA 500 (commercial lighting), and NECA 502 (industrial lighting).

D. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

E. Suspended Ceiling Mounted Luminaires:
   1. Do not use ceiling tiles to bear weight of luminaires.
   2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
   3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members, or to building structure.
   4. Secure pendant-mounted luminaires to building structure.
   5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
   6. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

F. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.
   2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.

G. Suspended Luminaires:
   1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
   2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
   3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet in length, with no more than 4 feet between supports.
   4. Install canopies tight to mounting surface.
   5. Unless otherwise indicated, support pendants from swivel hangers. Provide pendant length to susped the light fixtures at the indicated height.

H. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

I. Additional Support Requirements:
   1. Anchoring: Anchor light fixtures to channels of the ceiling construction, to the structural slab or to structural members within a partition, or above a suspended ceiling.
   2. Supports or anchors shall maintain the fixture positions after cleaning and relamping.
   3. Support the lighting fixtures without causing the ceiling or partition to deflect.
   4. All light fixtures shall be attached to suspended ceiling grid systems at two opposing ends using screws and/or clips approved for the seismic rating of the ceiling. Follow state and local codes that may requires fixtures to be screwed to the ceiling supports instead of using clips.
   5. Fixtures weighing less than 10 pounds shall be directly supported with a minimum of one #12 gage hanger wire to the structure above. This wire may be slack.
   6. Fixtures weighing between 11 to 55 pounds shall be directly supported with a minimum of two #12 gage hanger wires connected from the fixture housing to the structure above. Connect the hangers at diagonal opposite corners of the light fixtures. These wires may be slack.
   7. Where fixtures weigh over 56 pounds they shall be independently supported from the building structure by approved hangers. Two-way angular bracing of hangers shall be provided to preven lateral motion.
   8. Pendant hung fixtures must be independently supported form the structure above

without using the ceiling grid system for direct support.

9. Where ceiling cross runners are installed for support of lighting fixtures, they must have a carrying capacity equal to that of the main ceiling runners and be rigidly secured to the main runners.
10. Surface mounted lighting fixtures:
    a. Fixtures shall be bolted against the ceiling independent of the outlet box at four points spaced near the corners of each unit. The bolts (or stud-clips) shall be minimum 1/4-20- secured to main ceiling runners and/or secured to cross runners. Non-turning studs may be attached to the main ceiling runners and cross runners with special non-friction clip devices designed for the purpose, provided they bolt through the runner, or are also secured to the building structure by 12 gage safety hangers. Studs or bolts securing fixtures weighing in excess of 56 pounds shall be supported directly from the building structure.
    b. Where ceiling cross runners are installed for support of lighting fixtures they must have a carrying capacity equal to that of the main ceiling runners and be rigidly secured to the main runners.
    c. Fixtures less than 15 pounds in weight and occupying less than two square feet of ceiling area may, (when designed for the purpose) be supported directly from the outlet box when all the following conditions are met.
        1) Screws attaching the fixture to the outlet box pass through round holes (not key-hole slots) in the fixture body.
        2) The outlet box is attached to a main ceiling runner (or cross runner) with approved hardware.
        3) The outlet box is supported vertically from the building structure.
    d. Fixtures mounted in open construction shall be secured directly to the building structure with approved bolting and clamping devices.
11. Outlet boxes for support of lighting fixtures where permitted) shall be secured directly to the building structure with approved devices or supported vertically in a hung ceiling from the building structure with a nine gage wire hanger, and secured by approved device to a main ceiling runner or cross runner to prevent any horizontal movement relative to the ceiling.
12. HID Luminaires: Use hangers rated 500 pounds minimum or provide safety chain between ballast and structure. Provide safety chain between reflector and ballast.

J. Install accessories furnished with each luminaire.

K. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within fixture; use flexible conduit.

L. Connect luminaires and exit signs to branch circuit outlets provided under Section 16138 using flexible conduit.

M. Bond products and metal accessories to branch circuit equipment grounding conductor.

N. Air Handling Luminaires: Interface with air handling accessories furnished and installed under Section 15840.

O. Fluorescent Luminaires Controlled by Dual-Level Switching: Connect such that each switch controls the same corresponding lamps in each luminaire.

P. Exit Signs:

1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
2. Install lock-on device on branch circuit breaker serving units.

Q. Remote Ballasts: Install in accessible location as indicated or as required to complete installation, using conductors per manufacturer's recommendations not exceeding manufacturer's recommended maximum conductor length to luminaire.

R. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

A. See Section 01400 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Mask the trims and bottoms of all lighting fixtures if necessary to protect the fixture during construction.

D. Operate each luminaire after installation and connection to verify proper operation.

E. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.

F. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by GMK Associates.

3.05 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by GMK Associates. Secure locking fittings in place.

B. Air-Handling Luminaires with Air Control Blades or Heat Removal Dampers: Adjust as indicated or as required for proper airflow as directed by GMK Associates.

C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by GMK Associates or authority having jurisdiction.

3.06 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

B. Clean electrical parts to remove conductive and deleterious materials. This shall include but not necessarily be limited to fixture bottoms, trims, lenses, baffles, reflector cones and lamps.

C. Remove dirt and debris from enclosures.

D. Clean photometric control surfaces as recommended by manufacturer.

E. Clean finishes and touch up damage.

3.07 CLOSEOUT ACTIVITIES

A. See Section 01780 - Closeout Submittals, for closeout submittals.

B. See Section 01820 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of luminaires to GMK Associates, and correct deficiencies or make adjustments as directed.

D. Just prior to Substantial Completion, replace all lamps that have failed.

3.08 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

3.09 ATTACHMENTS

A. Luminaire schedule.

END OF SECTION