PROJECT MANUAL

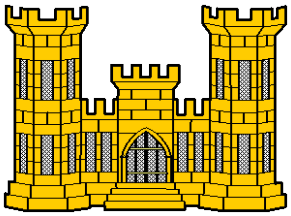
BATHROOMS RENOVATIONS

AT

CAPE MAY NATIONAL GUARD ARMORY

600 Garden State Parkway, Cape May Court House, NJ 08210

LISA J. HOU, D.O.
BRIGADIER GENERAL
NJARNG
THE ADJUTANT GENERAL



STATE OF NEW JERSEY
DEPARTMENT OF MILITARY
AND VETERANS AFFAIRS
101 EGGERTS CROSSING ROAD
LAWRENCEVILLE, NEW JERSEY 08648

PROJECT No: **CM002**
BID DATE: **Sept. 29, 2022**

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PROJECT # CM002

Specifications for this Project are arranged in accordance with the Construction Specification Institute numbering system and format. Section numbering is discontinuous and all numbers not appearing in the Table of Contents are not used for the Project.

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600 GARDEN STATE PARKWAY, CAPE MAY COURT HOUSE, NJ 08210

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BATHROOM RENOVATIONS

At Cape May National Guard Armory
600 Garden State Parkway, Cape May Courthouse, NJ 08210

PROJECT # CM002

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ADVERTISEMENT FOR BIDS

PROJECT: BATHROOMS RENOVATIONS AT CAPE MAY NATIONAL GUARD ARMORY
PROJECT #: CM002
LOCATION: 600 Garden State Parkway, Cape May Court House, NJ 08210

OWNER: STATE OF NEW JERSEY, DEPARTMENT OF MILITARY AND VETERANS AFFAIRS
EST. COST: $1.2M

Sealed bid forms will be received in the New Jersey Department of Military and Veterans Affairs (NJDMAVA), Business Management Bureau, Contract Administration Office, located at 101 Eggert Crossing Road, Lawrenceville, NJ 08648 until **11:00 AM** on **Sept. 29, 2022** and then publicly opened and read aloud. No bid will be accepted thereafter.

*****COVID-19 Restrictions*****

Due to COVID-19 restrictions there will not be an in person bid opening. Please email Bid Proposals no larger than 15MB in PDF format to (bids@dmava.nj.gov) by **11:00 AM** on **Sept. 29, 2022.** Please indicate the Project Number in the Subject Line of the email. Once your proposal has been received via email you will receive an email confirming your bid submission. You will then receive an email with an invitation to a Microsoft TEAMS meeting where all bids will be read aloud later that same day. If you are not bidding and would like to still attend the TEAMS meeting please email your request to bids@dmava.nj.gov.

DMAVA is soliciting bid proposals for the following prime contract. Bidders must be prequalified in the following classification pursuant to N.J.S.A. 52-35-3 by the Department of Treasury, Division of Property Management and Construction (DPMC). Bidders are required to submit a copy of the DPMC prequalified classification with their bid, The following classification is required:

C008 General Construction AND **C009 General Construction/Alterations and Additions**

Current proof must be on file in DPMC and/or submitted to this office not later than TIME SCHEDULE FOR BID OPENING. Failure to do so may result in the disqualification of the bidder.

Bidders are required to submit a copy of proof of registration with the NJSTART program. Information regarding NJSTART may be obtained at the following web site: WWW.NJSTART.GOV

All public works projects in New Jersey require Prevailing Wages. Effective February 18, 1992 Regulation N.J.A.C. 12:60-2.1 and 6.1 of the New Jersey Prevailing Wage Act, N.J.S.A. 34:11-56.25 et. seq. requires that certified payroll records must be submitted to the public body, by all contractors and subcontractors, for each employee on the project within ten (10) days of the payment of wages. The contractor is responsible for paying Official Prevailing Wage in effect on Contract Award Date. To assist in bidding purposes vendors may wish to use un-official Prevailing Wage found at: http://lwd.dol.state.nj.us/labor/wagehour/wagerate/pwr_construction.html

Contract Documents may be obtained by emailing Deborah Soto (Deborah.Soto@dmava.nj.gov) Business Management Bureau's Office for payment instructions. Upon payment of a NON- REFUNDABLE $ 25.00 (company check, or U.S. money order made payable to Treasurer, State of New Jersey) Contract Documents will be emailed. No bidder may withdraw his bid within ninety (90) calendar days after the actual date of the opening thereof.

Each bidder must deposit with his bid, security in an amount and form subject to the conditions provided in the Instructions for Bidders. Successful bidder(s) must provide a 100% Performance Bond and 100% Payment Bond when the project is awarded.

Attention of bidders is particularly called to the requirements as to condition of employment to be observed and minimum wage rates to be paid under the contract.

Bidders are required to comply with the requirements of P.L. 1975, C.127 Affirmative Action Program, and P.L. 1945, C.169 Law Against Discrimination.

A **MANDATORY PRE-BID MEETING** will be held on **Sept. 12, 2022 at 10:00 AM** at The Cape May National Guard Armory, 600 Garden State Parkway, Cape May Court House, New Jersey 08210. Questions related to this advertisement should be directed to the Business Management Bureau at 609-530-7115 between the hours of 8:00 AM to 4:00 PM Monday thru Thursday.

MICHAEL RHODES
Contracting Officer
Department of Military and Veterans Affairs

INSTRUCTION TO BIDDERS

ARTICLES

1. DEFINITIONS - NOTICES

A. The CONTRACT documents consist of the Agreement, Instructions to Bidders, General Conditions and Supplementary Conditions of the CONTRACT, the Drawings and Specifications, Addenda, and Change Orders including all modifications thereof incorporated in the documents before its execution. Whenever the word "CONTRACT" is used herein, it means all of the above documents or such part of them as are clearly indicated.

B. Whenever the word "State" or "Owner" is used herein, it means the State of New Jersey and specifically the New Jersey Department of Military and Veterans Affairs (NJDMAVA).

C. Whenever the word "Contracting Officer" (C.O.) is used herein, it means the individual appointed by the Adjutant General to enter into CONTRACTs as his/her duly authorized representative.

D. Whenever the word "Prime CONTRACTOR", "Single CONTRACTOR" or "CONTRACTOR" is used herein, it means the individual or firm undertaking to do all work contracted for under the CONTRACT.

E. Whenever the word "Architect" or "Engineer" (A/E) is used herein, it means the Architect or Engineer engaged by the Owner and, when applicable by designation, shall be acting as the duly authorized representative of the C.O. to the extent described in "Architect or Engineer Status" in PART IV Article 2. In addition, in Design/Build projects, the Architect/Engineer shall be a representative of the Design/Build venture and acting on behalf of the CONTRACTOR of record.

F. Whenever the word CONSTRUCTION MANAGER is used herein, it means a firm engaged by the state and designated to act as the duly authorized representative of the C.O. to the extent described in the "CONSTRUCTION MANAGER" status in Part IV Article 3.

G. Whenever the word "CONTRACTOR" is used herein, it means an individual or firm undertaking to do all work Contracted for under the CONTRACT. It shall include the understanding that a duly licensed Architectural/Engineering firm is part of the firm or subcontracted to perform the design aspects of the CONTRACT.

H. The term "Federally Funded Contract" applies to CONTRACTS where the National Guard Bureau (NGB) shall be participating by providing the funds. These funds shall be administered by the USP&FO.

I. The term "Subcontractor", as employed here, includes individual or firm having a direct CONTRACT with the CONTRACTOR and it includes one who furnishes labor or material worked or one who merely furnished material not so worked.

J. The entire above are treated throughout the CONTRACT as if each were the singular member and masculine gender.

K. When the term "acceptable" or "approved" is used herein, it means that the material or work shall be acceptable to or approved by the C.O.

L. The term "work" of the CONTRACTOR as used herein includes labor, materials, plant and equipment required to complete the CONTRACT.

M. Written notice shall be deemed to have been duly served if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered or sent by certified or registered mail to the last business address known to them who gives the notice, or delivered in person to said CONTRACTOR or his/her authorized representative on the work.

N. Whenever the words "Contract Limit Lines" are used herein, it refers to the lines shown on the drawings, surrounding the CONTRACT work beyond which no construction work shall be performed unless otherwise noted in the CONTRACT Documents. The CONTRACTOR shall check and verify conditions outside of the CONTRACT limit lines to determine whether or not any conflict exists between elevations or other data shown on the drawings and existing elevations or other data outside of the CONTRACT limit lines.

O. Whenever the words "Construction Site" or "Project" are used herein, it refers to the geographical grounds of the entire Department of Military & Veterans Affairs Property at which the CONTRACT work is performed.

2. QUALIFICATIONS OF BIDDER

A. The State may make such investigations as it deems necessary to determine the ability of the CONTRACTOR to perform the work, and the BIDDER shall furnish to the State all such information and data for this purpose as the State may request. The State reserves the right, in accordance with applicable laws, to reject any bid if the evidence submitted by, or investigation of such, BIDDER fails to satisfy the State that such BIDDER is properly qualified to carry out the obligations of the CONTRACT and to complete the work contemplated therein.

B. BIDDERS, his/her Architects or sub-consultants must be pre-qualified (NOTICE OF CLASSIFICATION) in accordance with New Jersey State laws, rules and Regulations before his/her bid can be accepted and award made.

C. BIDDERS who have been consistently rated as unsatisfactory from previous NJDMAVA projects may be disqualified for this and future projects.

3. AUTHORIZATION TO DO BUSINESS IN THE STATE OF NEW JERSEY

A. If any CORPORATION doing business with the State of New Jersey shall be or become delinquent in the payment of taxes to the State said taxes may be withdrawn from any monies due from the State to such a CORPORATION.

4. LAWS TO BE OBSERVED

A. The CONTRACTOR shall keep fully informed of all Federal, State, and local laws, ordinances, and regulations, and all orders and decrees of bodies or tribunals having any jurisdiction or authority, which in any manner affect those engaged or employed on the Work, or which in any way affect the conduct of Work.

B. The CONTRACTOR shall at all times observe and comply with, and shall cause its agents and employees to observe and comply with, all such laws, ordinances, regulations, orders, and decrees and shall protect and indemnify the State and its representatives against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order, or decree, whether by the CONTRACTOR or the CONTRACTOR'S agents or employees, subcontractors or any suppliers or materialman. If any discrepancy or inconsistency is discovered between the CONTRACT Documents and any such law, ordinance, regulation, order, or decree, the CONTRACTOR shall immediately report the same to the CONTRACTING OFFICER in writing.

5. PERMITS, LAWS AND REGULATIONS

A. Each CONTRACTOR shall obtain and pay for ALL necessary permits from State (i.e., D.C.A, D.E.P., D.O.H., Pinelands Commission, etc.) and Federal (Soil Erosion Conservation District, EPA, etc.) and arrange inspections with these agencies in accordance with the agency's policies. Each CONTRACTOR shall obtain any Federal or State permits which may be required and pay all costs, comply with Federal or State laws, ordinances, and regulations applying to this work provided his/her do not conflict with the CONTRACT Documents. All electrical and applicable mechanical work shall conform to the latest rules of the Underwriter's Laboratory concerned, Board of Fire Underwriters. On new construction and all alteration work, a Final Certificate of Inspection and or Occupancy from the Department of Community Affairs shall be provided at the expense of the CONTRACTOR(S). All plumbing and sewage disposal work shall conform to the regulations of the Uniform Construction Code, Department of Community Affairs and the State Board of Health.

B. Each CONTRACTOR shall be responsible for and save harmless the State from all fines, penalties or loss incurred for, or by reason of, the violation and the local ordinance or regulation or law of the State while the said work is in process of construction.

C. All work shall be conducted in accordance with the State Department of Labor and Industry Construction Safety Code, effective July 1, 1968, as promulgated by the Commission of Labor and Industry under the authority of the Construction Safety Act, P.L. 1962, Chapter 45, and N.J.S.A. 34:5-166 to 34:5-181. Where the Construction Safety Code refers to designation of GENERAL CONTRACTOR for enforcing of compliance with the code, such designation shall be intended to refer to the CONTRACTOR. Particular emphasis is placed upon compliance with all requirements of Articles 3.14 and 3.15 of the code wherein CONTRACTOR shall be responsible for Safety Inspections and Project Protection.

D. All CONTRACTORS shall comply with the Federal Occupational Safety and Health Act of 1970. F.
All CONTRACTORS shall comply with regulations of the DCA Fire Official.

E. All CONTRACTORS and his/her subcontractors shall be certified or licensed by the appropriate agency for the work to be performed. Evidence of such shall be presented when requested by this Department.

6. PREVAILING WAGE ACT

A. Each CONTRACTOR or any Subcontractor shall comply with the State Prevailing Wage Act, Laws of 1963, Chapter 150, and all amendments thereto, and this Act is hereby made a part of every CONTRACT entered into on behalf of the State except those CONTRACTs which are not within the contemplation of the Act.

(1) All workmen employed in the performance of every CONTRACT in excess of $2,500 for any public work to which the Department of Military and Veterans Affairs is a party, shall be paid not less than the prevailing wage rate as designated by the Commission of Labor and Industry or his/her duly authorized deputy or representative.

(2) In the event it is found that any workman, employed by any CONTRACTOR or any Subcontractor covered by any CONTRACT in excess of $2,500 for any public work to which the Department of Military and Veterans Affairs is a party, has been paid a rate of wages less than the prevailing wage required to be paid by such CONTRACT, the C.O. may terminate the CONTRACTOR'S or Subcontractor's right to proceed with the work, or such part of the work as to which there has been a failure to pay required wages and to prosecute the work to completion or otherwise.

The State shall furnish as part of the CONTRACT a copy of the Prevailing Wage Rates, which shall be paid (as designated by the Commission of Labor) to the workman, employed in the performance of the CONTRACT.

(3) Nothing contained in the Prevailing Wage Act shall prohibit the payment of more than the prevailing wage rate to any workman employed on a public work.

a. Each CONTRACTOR and Subcontractor performing public work for the Department of Military and Veterans Affairs are subject to the provisions of the Prevailing Wage Act shall post the prevailing wage rates for each craft and classification involved as determined by the Commissioner, including the effective date of any changes thereof, in prominent and easily accessible places at the site of the work or at such place or places as are used by them to pay workmen his/her wages.

b. The BIDDER'S signature on the PROPOSAL is his/her guarantee that neither his/her nor any subcontractor is currently listed nor on record by the Commissioner as one who has failed to pay the prevailing wages according to the Prevailing Wage Act.

7. FEDERAL DAVIS BACON MINIMUM WAGES

A. The CONTRACTOR shall post at appropriate conspicuous points at the site of the project a schedule showing all determined minimum wage rates for the various classes of laborers and mechanics to be engaged in work on the project under this CONTRACT and all deductions, if any, required by law to be made from unpaid wages actually earned by the laborers and mechanics so engaged.

DAVIS-BACON ACT (40 U.S.C. 276A TO A-7)

B. All mechanics and laborers employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by the Copeland Regulations (29 CFR, Part 3), the full amount due at time of payment computed at wage rates not less than the aggregate of the basic hourly rates and the rates of payments, contributions, or costs for any fringe benefits contained in the wage determination decision of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the CONTRACTOR and such laborers and mechanics. A copy of such wage determination decision shall be kept posted by the CONTRACTOR at the site of the work in a prominent place where the workers can easily see it. The term "mechanics and laborers" shall be deemed to include apprentices and trainees not covered by an approved program as provided by the APPRENTICES AND TRAINEES Clause of the CONTRACT.

C. The CONTRACTOR may discharge his/her obligation under this Clause to workers in any classification for which the wage determination decision contains:

(1) Only a basic hourly rate of pay, by making payment at not less than such basic hourly rate, except as otherwise provided in the Copeland Regulations (29 CFR, Part 3); or

(2) Both a basic hourly rate of pay and fringe benefits payments, by making payment in cash, by irrevocably making contributions pursuant to a fund, plan, or program for, and/or by assuming an enforceable commitment to beat the cost of, bona fide fringe benefits contemplated by the Davis- Bacon Act, or by any combination thereof. Contributions made, or cost assumed, on other than a weekly basis shall be considered as having been constructively made or assumed, during a weekly period to the extent that it applies to such period. Where a fringe benefit is expressed in a wage determination in any manner other than as an hourly rate and the CONTRACTOR pays a cash equivalent or provides an alternative fringe benefit, he shall furnish information with his payrolls showing how he determined that the cost incurred to make the cash payment or to provide the alternative fringe benefit is equal to the cost of the wage determination fringe benefit. In any case where the CONTRACTOR provides a fringe benefit different from any contained in the wage determination, he shall similarly show how he arrived at the hourly rate shown. In the event of disagreement between or among the interested parties as to an equivalent of any fringe benefit, the Contracting Officer shall submit the question, together with his recommendation, to the Secretary of Labor for final determination.

D. The assumption of an enforceable commitment to bear the cost of fringe benefits, or the provision of any fringe benefits not expressly listed in section 1(B) (2) of the Davis-Bacon Act or in the wage determination decision forming a part of the CONTRACT, may be considered as payment of wages only with the approval of the Secretary of Labor may require the CONTRACTOR to set aside assets, in a separate account, to meet his obligations under any unfunded plan or program.

E. The CONTRACTING OFFICER shall require that any class of laborers or mechanics, including apprentices and trainees, which is not listed in the wage determination decision and which is to be employed under the CONTRACT shall be classified or reclassified conforming to the wage determination decision and shall report the action taken to the Secretary of Labor. If the interested parties cannot agree on the proper classification or reclassification of a particular class of laborers and mechanics, including apprentices and trainees, to be used, the CONTRACTING OFFICER shall submit the question, together with his/her recommendation, to the Secretary of Labor for final determination.

F. In the event it is found by the CONTRACTING OFFICER that any laborer or mechanic, including all apprentices and trainees, employed by the CONTRACTOR or any subcontractor directly on the site of the work covered by this CONTRACT has been or is being paid at a rate of wages less than the rate of wages required by paragraph (A) of this Clause, or by the APPRENTICES AND TRAINEES Clause of this CONTRACT, the CONTRACTING OFFICER may (i) by written notice to the Prime CONTRACTOR terminate his right to proceed with the work, or such part of the work as to which there has been a failure to pay said required wages and (ii) prosecute the work to completion by CONTRACT or otherwise, whereupon such CONTRACTOR and his/her sureties shall be liable to the Government for any excess costs occasioned the Government thereby.

G. The CONTRACTING OFFICER'S failure to discharge his/her obligations under this clause may result in withholding of Federal funds which are otherwise authorized for payment to the CONTRACTOR under the terms of this CONTRACT.

H. DISPUTES CONCERNING LABOR STANDARDS

Disputes arising out of the labor standards provisions of this CONTRACT shall be subject to the DISPUTES Clause except to the extent such disputes involved the meaning of classification or wage rates contained in the wage determination decision of the Secretary of Labor or the applicability of the labor provisions of this CONTRACT which questions shall be referred to the Secretary of Labor in accordance with the procedures of the Department of Labor.

8. OBLIGATION OF BIDDER

A. At the time of the opening of bids each BIDDER shall be presumed to have inspected the site, to have read and become thoroughly familiar with the CONTRACT Documents (including all addenda). The failure or omission of any BIDDER to examine any form, instrument, document or site shall in no way relieve any BIDDER from any obligation with respect to his bid.

B. **SITE INVESTIGATION** - The BIDDER acknowledges that they have investigated and satisfied themselves as to the conditions affecting the work, including but restricted to those bearing upon transportation, disposal, handling and storage of materials, availability of labor, water, electric power, roads and uncertainties of weather, river stages, tides or similar physical conditions at the site, the conformation and conditions of the ground, the character of equipment and facilities needed preliminary to and during prosecution of the work. The BIDDER further acknowledges that they have satisfied themselves as to the character, quality and quantity of surface and subsurface materials or obstacles to be encountered. Any failure by the BIDDER to acquaint themselves with the conditions of the site will not relieve them from responsibility for estimating properly the difficulty or cost of successfully performing the work. The State assumes no responsibility for any conclusions or interpretations made by the BIDDER on the basis of the information made available by the State.

9. PROPOSAL

A. Sealed PROPOSALS for the work described shall be received in the Construction Facilities Management Office, Business Management Bureau, Department of Military and Veterans Affairs Building, 101 Eggert Crossing Road, Lawrenceville, New Jersey 08648. Bids must be received on the published date and prior to the time specified for opening bids.

B. PROPOSALS based upon these CONTRACT Documents shall be held as made with full knowledge of conditions and requirements. BIDDERS are expected to visit project site and/or premises prior to time of submitting PROPOSALS for work herein described, and shall thoroughly inspect the conditions under which the CONTRACT is to be executed.

C. PROPOSALS are to be made and submitted on the Bid Form included in the specifications. PROPOSALS shall be submitted via email to (bids@dmava.nj.gov). Please indicate the Project Number in the Subject Line. The maximum file size is 15MB. Please only submit the documents that are required on the Bid Submission Checklist Section 009100-1.

D. Amounts shall be stated in words as well as in figures. In case of a discrepancy, written words shall govern.

E. Each BIDDER must bid on all items of the bid sheets. Failure to bid on any item shall disqualify the BIDDER. Modification of the bid form in any manner shall disqualify the BIDDER.

F. Persons or firms submitting bids shall be engaged in the lines of work called for in these CONTRACT Documents and shall be able to refer to work of a similar character performed by them. Pre-qualification by the State of New Jersey, Department of Treasury, Division of Real Property and Construction Management, is mandatory and evidence of such shall be provided prior to the award of a project.

G. PROPOSALS shall be open for acceptance for ninety (90) calendar days after the bid due date. At times, monies may not be available for all portions of the bids. NJDMAVA reserves the right to delay the notice to proceed and contract execution in such circumstances, and to request the awarded BIDDER to extend the acceptance period. This shall be done in writing at the time of award.

H. Bids not submitted on the appropriate forms and in accordance with the instructions contained herein and in the "Advertisement for Bids" will be rejected when required by, and in accordance with applicable law.

I. Each BIDDER is required to submit an Ownership Disclosure Statement with his bid, pursuant to the requirements of the
N.J.S.A. 52:25-24.2, which shall set forth the names and addresses of all stockholders or holders of an interest of ten percent (10%) or more in the business entity or any of its 10% or greater interest holders.

10. ADDENDA AND INTERPRETATIONS

A. NJDMAVA shall be the sole interpreter of its plans, specifications, and other bid documents.

B. No interpretations of the meaning of the plans, specifications or other pre-bid documents will be made to any BIDDER orally. Any oral interpretation, not documented in writing to all BIDDERS prior to bid opening or referenced in the bid proposal, shall be considered prohibited and, to the extent any such communication does occur it shall not be binding upon the State. (It should be cautioned that NJDMAVA representatives and CONTRACTORs shall avoid this interaction to eliminate the perception of any wrong doing.)

C. Every request for interpretation shall be in writing and addressed to the PROJECT OFFICER on projects under his/her direct control and, to be given consideration, must be received at least fourteen (14) calendar days prior to the date fixed for the opening of bids. Any and all such interpretations and any supplemental instructions will be in the form of written addenda to the specifications, which, if issued, will be mailed by certified mail with return receipt requested, sent via facsimile with written confirmation of delivery, or emailed with written confirmation of email read by bidder, to all prospective BIDDERS (at the respective addresses furnished for such purposes), not later than seven (7) calendar days prior to the date fixed for the opening of bids. Failure of any BIDDER to receive any such addenda or interpretation, which is properly noticed by DMAVA as herein described, shall not relieve such BIDDER from any obligation under his/her bid . All addenda so issued shall become part of the CONTRACT Documents and shall be acknowledged in the proposals.

D. Responsibility of Receipt of Addenda: It shall be the responsibility of the BIDDER to assure himself that his bid is responsive to the Invitation to Bid as modified by any addenda which may have been issued prior to the opening of bids. Information as to addenda may be obtained at any time before the opening of bids by telephone inquiry to the Construction Facilities Management Office, Business Management Bureau, Trenton, New Jersey (609-530-7120).

11. MODIFICATION OF BIDS

Any BIDDER may modify his bid prior to the scheduled closing time for receipt of bids by rescinding the current bid, in writing, and resubmitting a bid in accordance with Article 9, A., PROPOSAL, of this document. In order for rescission to be valid, the original request must be emailed to bids@dmava.nj.gov prior to the closing time for the receipt of bids.

12. APPROVED EQUALS

A. CONTRACTORS shall submit all items, materials, equipment, etc. for APPROVED EQUAL(S) to the CONTRACTING OFFICER fourteen (14) calendar days prior to the bid date.

B. If the items, materials, equipment, etc. are deemed approved equal, an ADDENDA shall be sent to all prospective BIDDERS giving them the opportunity to bid on that product or item.

C. The CONTRACTING OFFICER is the sole determining individual of approved equal items.

D. No items, materials, equipment, etc. shall be submitted or approved as equal after the bid date, nor shall any substitutions be accepted for installation once the bid is awarded and the CONTRACT executed unless circumstances force the substitution through no fault of the CONTRACTOR.

E. No NJDMAVA representative or CONTRACTOR shall authorize an approved equal unless otherwise approved, in writing, by the Contracting Officer.

13. UNIT PRICES REQUIRED

A. When applicable BIDDERS shall list unit prices for both additions and deductions as called for on the Bid Form and in the CONTRACT Documents. The maximum differential between add and deduct unit prices shall not exceed fifteen (15%) percent. Such unit prices may, at the discretion of the CONTRACTING OFFICER, be rejected. If any unit price is not applicable to any BIDDER, he shall write the words "Not Applicable" in the space provided for the unit price.

B. Where unit prices have been established by the State on the Bid Form, BIDDERS agree that such unit price shall prevail. All unit prices appearing on a Bid Form, upon acceptance by the State, shall become a part of the CONTRACT.

C. All unit prices appearing in a bid proposal, upon acceptance by the State, may be used to evaluate the bids. If the CONTRACTING OFFICER determines that there is a probability of exercising the unit prices in a Change Order, he/she may award a bid on the basis of the bid proposal, while considering the reasonability of the proposed unit prices. Therefore, being lowest bidder on the bid proposal shall not necessarily signify award.

14. BID SECURITY

A. Each PROPOSAL shall be accompanied by a certified check or a bid bond prepared on the form of Bid Bond attached hereto duly executed by the BIDDER as principal made payable to the State of New Jersey.

B. The bond shall equal ten **(10%) percent of the amount of the proposal**, as an evidence of good faith, and to the effect that, if the proposal of the BIDDER is accepted, the BIDDER will enter into the CONTRACT. The bond shall have surety thereon of a surety company approved by the State of New Jersey. If a Bid Bond is submitted, the same shall also provide that the surety shall be bound to issue the final bonds for the faithful performance and payment, in statutory form, if the BIDDER is awarded the CONTRACT.

C. If the BIDDER, whose proposal is accepted, is unable to qualify for the Performance and Payment Bonds or fails to execute a CONTRACT in the time allowed, then such BIDDER and the Surety, in the case a Bid Bond has been submitted, shall be obligated to pay to the State of New Jersey the difference in money between the amount of the bid and the amount which the State legally contracts with another party to perform the work. The State reserves the right to retain any certified check deposited hereunder as reimbursement for the difference as aforesaid and return any balance to the BIDDER upon demand. The BIDDER shall make immediate payment to the State for any deficiency.

D. Nothing contained herein shall be construed as a waiver of any other legal remedies the State may have by reason of default. Certified checks or bonds of unsuccessful BIDDERS will be returned. . Such checks or Bid Bonds will be returned to all except the three lowest BIDDERS, within ten (10) calendar days after the opening of bids. The remaining checks, or Bid Bonds will be returned promptly after the State and the accepted BIDDER have executed the CONTRACT, or, if no award has been made within ninety (90) calendar days after the date of the opening of bids, upon demand of the BIDDER at any time thereafter, so long as he has not been notified of the acceptance of his bid.

E. CONTRACTORS electing to furnish a bid bond must submit the same in the forms as shown in *Section 004313*. Bid Bonds shall be on Statutory Form or in the form attached and supplied by bonding companies authorized to do business in New Jersey.

NOTE: Bid Bonds with the language *Not to Exceed $20,000.00* are unacceptable for New Jersey State Contracting Law, and will be considered a Fatal Flaw for bidding purposes.

15. POWER OF ATTORNEY

Attorneys-in-fact who sign Bid Bonds or contracts must file with each bond a certified and effectively dated copy of his/her Power of Attorney.

16. FORMS – AFFIRMATIVE ACTION

The Affirmative Action Form No. AA-201 must be completed and submitted with all bid proposals. Failure to do so may disqualify the low BIDDER, and the CONTRACTING OFFICER may award the bid to the next responsible BIDDER.

17. FORM OF NON-COLLUSION AFFIDAVIT

State Form of Non-Collusion Affidavit (FORM NJDMAVA 53) must be completed and submitted with all bid proposals. The required number of copies (as outlined in the advertisement) shall be included in the bidding documents. A sample copy appears in the Forms section.

18. UNCOMPLETED CONTRACTS

A. The Certification of Uncompleted Contracts must be completed and submitted with all bid proposals.

B. Failure to include this document with the other bid documents shall result in the bid being disqualified.

C. **Bids shall not** be awarded where the bid proposal of this project added to the total of outstanding uncompleted CONTRACTs exceeds the pre-qualification limits of the CONTRACTOR.

D. Uncompleted Contracts are from both the Public as well as the Private Sector.

19. MCBRIDE PRINCIPALS AND NORTHERN IRELAND ACT OF 1989

.The McBride Principles must be completed and submitted with all bid proposals.

20. PERFORMANCE

A. The State requires that each CONTRACTOR shall perform a minimum of thirty-five (35%) percent of the CONTRACT work by his/her own plant and forces.

B. Plant and work shall not include the administration of the CONTRACT unless it can be shown that the administration process warrants consideration in the thirty-five (35%) percent. The CONTRACTOR shall be responsible for full-time supervision of the project regardless of the thirty-five (35%) rule.

21. AWARD & NOTICE TO PROCEED

A. **The State reserves the right to accept or reject any or all bids in accordance with applicable law**.

B. The award will be officially initiated when the words **"OK TO AWARD"** are annotated on the bid abstract. The CONTRACT shall become effective when signed and dated by the authorized representative of NJDMAVA.

C. CONTRACTOR shall perform his/her work to the satisfaction of the DMAVA Construction Facilities Management Office. CONTRACTORshall complete the work and furnish all material under his/her CONTRACT within the number of stated calendar days from date of **NOTICE TO PROCEED** issued by the CONTRACTING OFFICER.

22. METHOD OF AWARD

A. **Applicable to Federal Funded Projects Only**

1. Bidding procedure involving only base bids for Separate Prime Contract: If the proposal is within the amount of funds available to finance the CONTRACT, then award will be made to the responsible BIDDER submitting the lowest bid for the total combined cost of each branch or divisions of work.

2. Bidding procedures involving a Base Bid and Alternate Deductive Bids: If the Base Bid is within the amount of funds available to finance the construction CONTRACT, then CONTRACT award will be made to that responsible BIDDER submitting the low base bid. If the Base Bid exceeds the amount of funds available to finance the construction CONTRACT, then the State may reject all bids or may award the CONTRACT to that responsible BIDDER submitting the Low Combined Bid, consisting of the Base Bid with such Alternate Deductive Bids as are required to produce a net Bid amount within the availability of funds.

3. Bidding procedure involving a Base Bid and Alternate Additive or unit price Bids: If the Base Bid is within the amount of funds available to finance the construction CONTRACT and the State wishes to accept Alternate Additive Bids, then the CONTRACT will be made to the responsible BIDDER submitting the Low Combined Bid, consisting of the Base Bid plus Alternate Additive Bids. Under this procedure, if the State wishes to make award on only the Base Bid, then CONTRACT award will be made to that responsible BIDDER submitting the Low Base Bid.

4. Bidding Procedure Involving Prime and Single Contract Bidding:

   a. Lowest Prime Contract Bids: If the sum total of the lump sum amount, base bids and alternates, bid by the lowest qualified responsible BIDDERS under separate CONTRACT bidding, as determined under paragraph 1, 2, or 3 is less than the corresponding lump sum amount bid by the lowest responsible BIDDER under single CONTRACT bidding, CONTRACT award will be made to the lowest responsible BIDDER for each of the separate CONTRACTs listed on the Proposal Form.

B. **Applicable to State Funded Projects Only**

The State of New Jersey reserves the right to award a CONTRACT upon basis of lump sum bid for the entire work or upon basis of any base bid or alternates or any combination of base bids or alternates which may best serve the interest of the State.

The BID FORMS method of award shall stipulate what items shall be awarded and how the award shall be determined.

23. PROTESTS

A. BIDDERS who may be aggrieved in connection with the solicitation or award of a CONTRACT or its pre-qualification status or classification status may protest to the CONTRACTING OFFICER.

B. The protest shall be submitted in writing within five (5) calendar days after the date of award. The CONTRACTING OFFICER shall conduct a hearing to settle or resolve protest and if the protest is not resolved by mutual agreement, the CONTRACTING OFFICER shall issue a decision in writing within ten (10) calendar days of the hearing.

C. The CONTRACTING OFFICER shall have final authority for the interpretation of the specifications and a decision under this section shall be deemed a final agency action.

24. SECURITY FOR FAITHFUL PERFORMANCES

A. The CONTRACTOR shall furnish a surety bond or bonds, simultaneously with his/her delivery of the executed CONTRACT, as security for faithful performance of this CONTRACT and for the payment of all persons performing labor on the project under this CONTRACT and furnish materials in connection with this CONTRACT, as specified in the General Conditions included herein. The surety on such bond or bonds shall be a duly authorized surety company satisfactory to the State and authorized to do business in the State of New Jersey.

B. The cost of bonds shall be borne by the representative CONTRACTOR.

25. PROCUREMENT OF STEEL (Applicable to Federal Funded Projects Only)

The BIDDER assures by signing his bid that he will procure steel for use under the CONTRACT at the lowest possible current prices.

26. CONTENTS OF BIDS

Bids can be released to the public pursuant to N.J.A.C. 17:12-1.2(b) and (c), or under the New Jersey Open Public Records Act (OPRA), N.J.S.A. 47:1A-1 et seq., or the common law right to know.

After the opening of sealed Bids all information submitted by a Vendor {Bidder} in response to a Bid Solicitation is considered public information notwithstanding any disclaimers to the contrary submitted by a Vendor {Bidder}. Proprietary and confidential information may be exempt from public disclosure by OPRA and/or the common law. When the Bid Solicitation contains a negotiation component, the Bid will not be subject to public disclosure until a notice of intent to award a Blanket P.O. is announced.

As part of its Bid, a Vendor {Bidder} may designate any data or materials it asserts are exempt from public disclosure under OPRA and/or the common law, explaining the basis for such assertion. Vendor {Bidder} must provide a detailed statement clearly identifying those sections of the Bid that it claims are exempt from production, and the legal and factual basis that supports said exemption(s) as a matter of law. Please include a redacted copy of the Bid indicating the sections identified as confidential. The State will not honor any attempts by a Vendor {Bidder} to designate its entire Bid as proprietary, confidential and/or to claim copyright protection for its entire Bid.

The State reserves the right to make the determination as to what is proprietary or confidential and will advise the Vendor {Bidder} accordingly. Any proprietary and/or confidential information in a Bid will be redacted by the State. Copyright law does not prohibit access to a record which is otherwise available under OPRA.

In the event of any challenge to the Vendor's {Bidder's} assertion of confidentiality with which the State does not concur, the Vendor {Bidder} shall be solely responsible for defending its designation, but in doing so, all costs and expenses associated therewith shall be the responsibility of the Vendor {Bidder}. The State assumes no such responsibility or liability.

A Vendor {Bidder} shall not designate any price lists and/or catalogs submitted as exempt from public disclosure as the same must be accessible to State Using Agencies and Cooperative Purchasing Program participants (if the Bid Solicitation has been extended to these participants) and thus must be made public to allow all eligible purchasing entities access to the pricing information.

In order not to delay consideration of the Bid or the State's response to a request for documents, the State requires that Vendor {Bidder} respond to any request regarding confidentiality markings within the timeframe designated in the State's correspondence regarding confidentiality. If no response is received by the designated date and time, the State will be permitted to release a copy of the Bid with the State making the determination regarding what may be proprietary or confidential.

BID FORM

STATE OF NEW JERSEY
DEPARTMENT OF MILITARY AND VETERANS' AFFAIRS
BUSINESS MANAGEMENT BUREAU
For
BATHROOMS RENOVATIONS
At
THE CAPE MAY NATIONAL GUARD ARMORY
600 Garden State Parkway, Cape May Court House, NJ 08210

(Project # CM002)

Date: 09/29/2022

State of New Jersey
Department of Military and Veterans' Affairs
Business Management Bureau
101 Eggert Crossing Road
Lawrenceville, New Jersey 08648

This Bid Form is to be returned in the self-addressed envelope in accordance with the RFP.

BASE BID: BATHROOMS RENOVATIONS AT CAPE MAY ARMORY

The CONTACTOR shall perform all work listed in this Project Manual and the Terms and Conditions of the CONTRACT described herein for the total sum of:

Written Amount_____

_____($_____)

Additive Bid Item (ABI) #1:

Provide a lump sum price for a complete installation to include labor and materials needed to replace existing sewer pump with new sewer ejector pump into existing lines. Modify control panel to operate new pump.

Written Amount_____

_____($_____)

GC-1 ALLOWANCE: Include $10,000.00 (Ten Thousand) in base bid for unforeseen conditions. Unused allowance amount will be credited to the owner. Allowance is also governed by GENERAL CONDITIONS Article 24. Allowances

UNIT PRICE #1: Isolation Ball Valves - Removal and replacement of isolation valves beyond what is identified on contract drawings.

a. ¾" isolation ball valve $_____ per each Installed.
b. 1" isolation ball valve $_____ per each Installed.
c. 1-1/4" isolation ball valve $_____ per each Installed.
d. 1-1/2" isolation ball valve $_____ per each Installed.
e. 2" isolation ball valve $_____per each Installed.
f. 2-1/2" isolation ball valve $_____per each Installed.
g. 3" isolation ball valve $_____ per each Installed.

UNIT PRICE #2 Thin-Set Porcelain Wall Tile: Unit price shall include material cost, receiving, handling, and installation and Contractor overhead and profit. $_____One (1) square foot of area.

UNIT PRICE #3 Mud-set Porcelain/Mosaic Floor Tile: Unit price shall include material cost, receiving, handling, and installation and Contractor overhead and profit. $_____One (1) square foot of area.

SUBONTRACTORS: The undersigned proposes to subcontract work in conjunction with this bid submitted pursuant to N.J.S.A 52:32-2 to the following named sub-consultants qualified in accordance with N.J.S.A. 53:35-1 et sew:

Plumbing _____

HVAC _____

Electrical _____

Structural _____

Environmental* _____
*Asbestos Abatement, Lead Abatement, Mold Abatement, etc.

NOTE: Award shall be made in accordance with DMAVA guidelines. In the case of Additional Bid Items the lowest responsible bidder for the Base Bid and Additive Bid Items (as needed) in priority order subject to the availability of construction funds and DMAVA guidelines. The amount of construction funding available will be announced at the bid opening subsequent to the bid closing date and time and prior to opening of the submitted bids.

The bidder having examined the project manual with related documents and the sites of the proposed work and being familiar with all of the conditions surrounding the proposed project including the availability of materials and labor, hereby proposed to furnish all labor, materials and supplies, and to complete the work in accordance with the Contract Documents within the time set forth herein, and at the prices stated above. These prices are to cover all expenses incurred in performing the work required under the Contract Documents, of which this proposal is a part.

Bidder hereby agrees to commence work under this contract only after receiving the written "Notice to Proceed" from the Owner and to fully complete the project within the **ONE HUNDRED AND EIGHTY (180) CALENDAR DAYS.** Bidder further agrees to pay as liquidated damages, a sum for each consecutive working day thereafter as provided in the Project Manual.

BID FORMS MUST BE SUBMITTED IN ORIGINAL

Refer to CONTRACT NUMBER and/or ACCOUNT NUMBER IN ALL CORRESPONDENCE.
Bidder acknowledges receipt of the following Minutes and Addenda

Pre-bid Minutes	Date of Minutes
Prebid Mins Received	09/19/2022 via email
Addendum Number	**Date of Addendum**
001	09/21/2022

Upon receipt of written notice of the acceptance of this bid, bidder will execute the formal contract within fourteen (14) calendar days.

Complete and submit with bid package the following forms:

1. Bid Form
2. Bid Bond
3. Disclosure Affidavit
4. Non-Collusion Affidavit
5. Notice of Classification
6. Certificate on Uncompleted Contracts
7. Certification of Non-segregated Facilities
8. Certification MacBride Principals
9. Executive Order No. 117 (2008)
10. PL 2005 Ch. 51 Contractor Certification and Disclosure
11. Disclosure of Investment Activities in Iran
12. Disclosure of Prohibited Activities in Russia or Belarus
13. NJSTART Registration

The State of New Jersey reserves the right to accept or reject any or all bids if it is felt to be in the public interest to do so.

This bid shall be valid for ninety (90) calendar days from date of bid opening.

NOTE: If the bidder is a corporation, indicate State of Incorporation and if a partnership, give full names of partners.

Respectfully submitted:

(Seal – If bid is by a corporation) By

Aliano Brothers General Contractors, Inc.
Name of Firm

Michael Aliano, President
Signature & Title

2560 Industrial Way,

Vineland, NJ 08360
Business Address

(856) 794-9490
Business Phone

BID BOND

BOND NO. _____

KNOWN ALL MEN BY THESE PRESENTS THAT (Insert name and address of CONTRACTOR)

Aliano Brothers General Contractors, Inc.

2560 Industrial Way, Vineland, NJ 08360

as Principal, hereinafter called Principal, and (Insert name and address of Surety)

as Surety, hereinafter called Surety, are held and firmly bound unto the State of New Jersey, Department of Military and Veterans' Affairs, Eggert Crossing Road – CN340, Trenton, New Jersey 08625-0340, as Obligee, hereinafter called Obligee, in the full and just sum of (Insert amount equal to 10% of proposal or proposals)

Dollars ($)

lawful money of the United States, for the payment of which sum, well and truly to be made, of which Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally by this instrument.

WHEREAS, Principal herewith submits proposal dated ,20 ,for (Insert describe the work)

in accordance with proposal contract documents prepared by

which is by reference made a part of this bond the same as though set forth herein, and is hereinafter referred to as the CONTRACT.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the Principal shall be awarded the contract and Principal will, within the time required, enter into the Contract and give a good and sufficient bond to secure the payment and performance of the Contract, then this obligation shall be void and of no effect, otherwise Principal and Surety will pay unto the Obligee the difference in money between the amount of the bid of the Principal and the amount for which the Obligee legal contracts with another party to perform the work if the latter amount be in excess of the former.

Signed, sealed and delivered this 29th day of September 2022 .

ATTEST: Principal

(Seal)

_____
(Principal) Secretary Signature

Phil Aliano, Vice President / Secretary
(Print or Type Name)

_____
(Witness to Principal)

By _____
Principal Signature

Michael Aliano, President
(Print or Type Name)

ATTEST: Surety

(Seal)

_____ **By** _____
(Surety) Secretary Signature Attorney-in-fact Signature

_____ _____
(Print or Type Name) (Print or Type Name)

_____
(Witness as to Surety)

AGREEMENT OF SURETY

In consideration of the sum of One Dollar, lawful money of the United States, the receipt whereof is hereby acknowledged, and for other valuable considerations**, (Insert name and address of Surety)**

hereinafter called the Company, consent and agree that if the contract for **(Insert Description of Contract)**
Project No. CM002 - Bathroom Renovations at Cape May National Guard Armory
for which the preceding proposal is made be awarded to **(Insert name and address of Bidder)**
Aliano Brothers General Contractors, Inc., 2560 Industrial Way, Vineland, New Jersey 08360
hereinafter called the Bidder, the Company will become bound as Surety for its faithful payment and performance and will execute the final bonds required, and if the Bidder shall omit or refuse to execute such contract when notified or awarded then the Company will pay to the State of New Jersey, Department of Military and Veterans' Affairs, herein called the Obligee, the difference between the amount of the Bidder's Bid or proposal, and the lowest amount in excess of said bid, or proposal, for which the Obligee may be able to award contract within a reasonable time.

Signed, sealed and dated this 29th day of September , 20 22 .

(Seal)

_____ **By** _____
(Surety) Secretary Signature Attorney-in-fact Signature

_____ _____
(Print or Type Name) (Print or Type Name)

SECTION 004343

WAGE RATE DETERMINATION

1. **Official Wage Rate Determination:** An official wage rate determination will be provided by the Business Management Bureau to the contractor at time of contract award.

2. **Wage Rate information:** Bidders may obtain wage rate information from the following website: http://lwd.dol.state.nj.us/labor/wagehour/wagerate/pwr_construction.html. Please note the wage rates are unofficial until a wage rate determination is made at time of contract award.

NOTICE OF CLASSIFICATION

TO: State of NJ Department of Military & Veterans Affairs
for the Cape May National Guard Armory
600 Garden State Parkway, CMCH, NJ 08210

Project No. CM002

Aliano Brothers General Contractors, Inc.

$15,000,000.00, C008 - GC, C021 - Demo, C024 - Historical Restoration, C103 - Microbial Remediation

Effective Date: 11/21/2021 Expiration Date: 11/20/2023

AMOUNT	TRADE(S)	EFFECTIVE DATE	EXPIRATION DATE

In accordance with N.J.S.A. 13A:18A-27 et seq. (Department of Education) and N.J.S.A.52:35-1 (Department of Treasury) and any rules and regulations issued pursuant hereto, you are hereby notified of your classification to do State work in the Department(s) as noted above.

Very truly yours.
Bureau of CONTRACTOR Services

enclosures
cc. Records Section

NON-COLLUSION AFFIDAVIT

PROJECT TITLE Bathroom Renovations at the Cape May National Guard Armory

Bid Due Date 09/29/2022

STATE OF NEW JERSEY
as:
COUNTY OF Cumberland

I, Michael Aliano of the City of Millville

in the County of Cumberland and the State of New Jersey

of full age, being sworn according to law on my oath depose and say that:

I am the President of the firm of

Aliano Brothers General Contractors, Inc.

the bidder making the proposal for the above named project, and that I executed the said Proposal with full authority so to do; that said bidder has not, directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with the above named project; and that all statements contained in said Proposal and in this affidavit are true and correct, and made with full knowledge that the State of New Jersey relies upon the truth of the statements in said Proposal and in the statements contained in this affidavit in awarding the CONTRACT for the said project.

Subscribed and sworn to before me this 29th

day of Sepetember, 20 22.

seal

Notary Public of State of New Jersey

My Commission expires:

20

Bidder's Signature and Title

Michael Aliano, President of

Aliano Brothers GC, Inc.

CERTIFICATION OF
NON-SEGREGATED FACILITIES

The bidder or Subcontractor certifies that he does not maintain or provide for his employees any segregated facilities at any of his establishments, and that he does not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The bidder or Subcontractor certifies further that he will not maintain or provide for his employees any segregated facilities at any of his establishments, and that he will not permit his employees to perform their services at any location, under his control where segregated facilities are maintained. The bidder or Subcontractor agrees that a breach of this certification is a violation of the Equal Opportunity Clause in this contract. As used in this certification, the term "segregated facilities" means nay waiting rooms, areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, or national origin, because of habit, local custom or otherwise. The bidder or Subcontractor further agrees that (except where he has obtained identical certifications from proposed Subcontractors for specific time periods) he will obtain identical certifications from proposed Subcontractors prior to the award of Subcontractors exceeding $10,000 which are not exempt from the provisions of Equal Opportunity Clause; that he will retain such certifications in his files; and that he will forward the following notice to such proposed Subcontractors (except where the proposed Subcontractors have submitted identical certification for specific time periods).

NOTICE TO PROSPECTIVE SUBCONTRACTORS OF REQUIREMENTS FOR CERTIFICATIONS OF NONSEGREGATED FACILITIES A Certification of Non-segregated facilities must be submitted prior to the award of a Subcontract exceeding $10,000 which is not exempt from the provisions of the Equal Opportunity Clause. The certification may be submitted either for each Subcontract or for all Subcontracts during a period (i.e. quarterly, semiannually, or annually) (1970 AUG) (Note: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001).

09/29/2022

(Date) *(Signature of Bidder or Subcontractor)*

ALIANO BROTHERS GENERAL CONTRACTORS, INC.

(Type Firm Name)

2560 INDUSTRIAL WAY, VINELAND, NJ 08360

(Type Business Address)

TEL: (856) 794-9490 FAX: (856) 794-9492

DISCLOSURE AFFIDAVIT

DEPARTMENT OF MILITARY AND VETERANS AFFAIRS
101 EGGERT CROSSING ROAD, PO BOX 340,
TRENTON, NEW JERSEY 08625

This form must be completed for ALL CONTRACTS with the State of New Jersey (NJ 52:25-24.2) Bidders

Name: ALIANO BROTHERS GENERAL CONTRACTORS, INC.
Bid (Contract) No.: 22-2389820 Fed Tax I.D. (or S.S.): ALIANO BROTHERS
Address: (Insert full address to include street, city, county, state and zip)
22-2389820

List the names and addresses of all individuals, partnerships, corporations or any other owner having 10% or greater interest in the corporation or partnership named above. If a listed owner is a corporation or partnership than list the name, percentage of ownership, and address of holders of 10% or more interest in that corporation or partnership. If additional space is necessary please list on reverse side. If there are no owners with 10% or greater interest in your company, enter "NONE" below.

Complete affidavit at bottom of form. If this has already been submitted to the Department of Military and Veterans Affairs, use the form for any changes and complete the affidavit.

Name (Type of Print name)	**% OF** Ownership	**ADDRESS** Street, city/twp., county, state, zip
Michael Aliano	50.0%,	1790 Country Bridge Rd., Millville, NJ 08332
(Type President's Name)		
Phil Aliano	50.0%,	767 Stanton Avenue, Franklinville, NJ 08322
(Type Corporate Secretary's Name)		

I certify that:

(✔) List of stockholders has been submitted to NJDMAVA, and it is CURRENT AND CORRECT to the best of my knowledge, with the exceptions above.
( ) The list of stockholders above is CURRENT AND CORRECT to the best of my knowledge.
( ) There are no stockholders holding 10% or greater interest in this corporation or firm to the best of my knowledge.
( ) Firm is sole ownership and not subject to corporate or partnership disclosure requirements.

ATTEST:
Subscribed and sworn to before me this
Day of MICHAEL ALIANO 20 PRES
(Seal)
(Signature of Authorized Representative)

(Notary Public Signature) (Signature of Corporate Secretary) Date
Seal Additional names if required

NAME *(Type or Print Name)*	% OF *Ownership*	ADDRESS *Street, city/twp., county, state, zip*

CERTIFICATION OF UNCOMPLETED CONTRACTS

I certify that the amount of uncompleted work both public and private on the contracts is $_____.

I further certify that the amount of this bid proposal, including all outstanding both public and private incomplete contracts does not exceed my pre-qualification dollar limit.

Respectfully submitted,

By_____

Affix corporate seal here

Aliano Brothers General Contractors, Inc.
Name of Firm

Signature

Michael Aliano, President
Title

2560 Industrial Way
Business Address

Vineland, NJ 08360

Sworn to and subscribed before me this 29th date of 20 september.

(856) 794-9490
Phone

Notary Public of My State of NJ

Commission Expires:

20

CERTIFICATION

MacBride Principles and Northern Ireland Act of 1989.

The bidder hereby certifies:

1. Contractor has no business operations in Northern Ireland or

2. Contractor will take lawful steps in good faith to conduct any business operations they have in Northern Ireland in accordance with the MacBride principles of nondiscrimination as set forth in NJSA 52:18A-89.5 and in conformance with the United Kingdoms Fair Employment (Northern Ireland) Act of 1989 and permit compliance with those principles.

ALIANO BROTHERS GENERAL CONTRACTORS, INC.

2560 INDUSTRIAL WAY, VINELAND, NJ 08360

Name and Address of Contractor

Name and Title of Affiant

MICHAEL ALIANO, PRESIDENT

Subscribed and sworn before me this

29TH day of SEPTEMBER, 2022.

Notary Public

DISCLOSURE OF INVESTMENT ACTIVITIES IN IRAN

PART 1: CERTIFICATION
BIDDERS MUST COMPLETE PART 1 BY CHECKING EITHER BOX.
FAILURE TO CHECK ONE OF THE BOXES WILL RENDER THE PROPOSAL NON-RESPONSIVE.

Pursuant to Public Law 2012, c. 25, any person or entity that submits a bid or proposal or otherwise proposes to enter into or renew a contract must complete the certification below to attest, under penalty of perjury, that neither the person or entity, nor any of its parents, subsidiaries, or affiliates, is identified on the Department of Treasury's Chapter 25 fist as a person or entity engaging in investment activities in Iran. The Chapter 25 list is found on the Division's website at http://www.state.nj.us/treasury/purchase/pdf/Chapter25List.pdf. Bidders must review this list prior to completing the below certification. Failure to complete the certification will render a bidder's proposal non-responsive. If the Director finds a person or entity to be in violation of law, s/he shall take action as may be appropriate and provided by law, rule or contract, including but not limited to, imposing sanctions, seeking compliance, recovering damages, declaring the party in default and seeking debarment or suspension of the party

PLEASE CHECK THE APPROPRIATE BOX:

☒ I certify, pursuant to Public Law 2012, c. 25, that neither the bidder listed above nor any of the bidder's parents, subsidiaries, or affiliates is listed on the N.J. Department of the Treasury's list of entities determined to be engaged in prohibited activities in Iran pursuant to P.L. 2012, c.25 ("Chapter 25 List"). I further certify that I am the person listed above, or I am an officer or representative of the entity listed above and am authorized to make this certification on its behalf. I will skip Part 2 and sign and complete the Certification below.

OR

☐ I am unable to certify as above because the bidder and/or one or more of its parents, subsidiaries, or affiliates is listed on the Department's Chapter 25 list. I will provide a detailed, accurate and precise description of the activities in Part 2 below and sign and complete the Certification below. Failure to provide such will result in the proposal being rendered as nonresponsive and appropriate penalties, fines and/or sanctions will be assessed as provided by law.

PART 2: PLEASE PROVIDE FURTHER INFORMATION RELATED TO INVESTMENT ACTIVITIES IN IRAN

You must provide a detailed, accurate and precise description of the activities of the bidding person/entity, or one of its parents, subsidiaries or affiliates, engaging in the investment activities in Iran outlined above by completing the boxes below.

EACH BOX WILL PROMPT YOU TO PROVIDE INFORMATION RELATIVE TO THE ABOVE QUESTIONS. PLEASE PROVIDE THOROUGH ANSWERS TO EACH QUESTION. IF YOU NEED TO MAKE ADDITIONAL ENTRIES, CLICK THE "ADD AN ADDITIONAL ACTIVITIES ENTRY" BUTTON.

Name N/a Relationship to Bidder/Offeror

Description of Activities

Duration of Engagement. Anticipated Cessation Date

Bidder/Offeror Contact Name Contact Phone Number

ADD AN ADDITIONAL ACTIVITIES ENTRY

Certification: I, being duly sworn upon my oath, hereby represent and state that the foregoing information and any attachments thereto to the best of my knowledge are true and complete. I attest that I am authorized to execute this certification on behalf of the above-referenced person or entity. I acknowledge that the State of New Jersey is relying on the information contained herein and thereby acknowledge that I am under a continuing obligation from the date of this certification through the completion of any contracts with the State to notify the State in writing of any changes to the answers of information contained herein. I acknowledge that I am aware that it is a criminal offense to make a false statement or misrepresentation in this certification, and if I do so, I recognize that I am subject to criminal prosecution under the law and that it will also constitute a material breach of my agreement(s) with the State of New Jersey and that the State at its option may declare any contract(s) resulting from this certification void and unenforceable.

Full Name (Print): MICHAEL ALIANO Signature:

Title: PRESIDENT Date: 09/29/2022

CERTIFICATION OF NON-INVOLVEMENT IN PROHIBITED ACTIVITIES IN RUSSIA OR BELARUS PURSUANT TO P.L.2022, c.3

CONTRACT / BID SOLICITATION TITLE BATHROOM RENOVATIONS @ THE CAPE MAY NATIONAL GUARD ARMORY

CONTRACT / BID SOLICITATION No. CM002

CHECK THE APPROPRIATE BOX

☑ I, the undersigned , am authorized by the person or entity seeking to enter into or renew the contract identified above, to certify that the Vendor/Bidder is not engaged in prohibited activities in Russia or Belarus as such term is defined in P.L.2022, c.3,[1] section 1.e, except as permitted by federal law.

I understand that if this statement is willfully false, I may be subject to penalty, as set forth in P.L.2022, c.3, section 1.d.

OR

☐ I, the undersigned am unable to certify above because the person or entity seeking to enter into or renew the contract identified above, or one of its parents, subsidiaries, or affiliates may have engaged in prohibited activities in Russia or Belarus. A detailed, accurate and precise description of the activities is provided below.

Failure to provide such description will result in the Quote being rendered as non-responsive, and the Department/Division will not be permitted to contract with such person or entity, and if a Quote is accepted or contract is entered into without delivery of the certification, appropriate penalties, fines and/or sanctions will be assessed as provided by law.

Description of Prohibited Activity

N/A

Attach Additional Sheets If Necessary.

If you certify that the bidder is engaged in activities prohibited by P.L. 2022, c. 3, the bidder shall have 90 days to cease engaging in any prohibited activities and on or before the 90th day after this certification, shall provide an updated certification. If the bidder does not provide the updated certification or at that time cannot certify on behalf of the entity that it is not engaged in prohibited activities, the State shall not award the business entity any contracts, renew any contracts, and shall be required to terminate any contract(s) the business entity holds with the State that were issued on or after the effective date of P.L. 2022, c. 3.

Signature of Authorized Representative

09/29/2022
Date

MICHAEL ALIANO, PRESIDENT
Print Name and Title of Authorized Representative

ALIANO BROTHERS GENERAL CONTRACTORS, INC.
Vendor Name

[1] Engaged in prohibited activities in Russia or Belarus" means (1) companies in which the Government of Russia or Belarus has any direct equity share; (2) having any business operations commencing after the effective date of this act that involve contracts with or the provision of goods or services to the Government of Russia or Belarus; (3) being headquartered in Russia or having its principal place of business in Russia or Belarus, or (4) supporting, assisting or facilitating the Government of Russia or Belarus in their campaigns to invade the sovereign country of Ukraine, either through in-kind support or for profit.

Executive Order No. 117 (2008)

IMPORTANT NOTICE

NEW "PAY-TO-PLAY" RESTRICTIONS TO TAKE EFFECT NOVEMBER 15, 2008

Governor Jon S. Corzine recently signed Executive Order No. 117, which is designed to enhance New Jersey's efforts to protect the integrity of government contractual decisions and increase the public's confidence in government. The Executive Order builds on the provisions of P.L. 2005, c. 51 ("Chapter 51"), which limits contributions to certain political candidates and committees by for-profit business entities that are, or seek to become, State government vendors.

Executive Order No. 117 extends the provisions of Chapter 51 in two ways:

1. The definition of "business entity" is revised and expanded so that contributions by the following individuals also are considered contributions attributable to the business entity:

- Officers of corporations and professional services corporations, with the term "officer" being defined in the same manner as in the regulations of the Election Law Enforcement Commission regarding vendor disclosure requirements (N.J.A.C. 19:25-26.1), with the exception of officers of non-profit entities;

- Partners of general partnerships, limited partnerships, and limited liability partnerships and members of limited liability companies (LLCs), with the term "partner" being defined in the same manner as in the regulations of the Election Law Enforcement Commission regarding vendor disclosure requirements (N.J.A.C. 19:25-26.1); and

- Spouses, civil union partners, and resident children of officers, partners, LLC members and persons owning or controlling 10% or more of a corporation's stock are included within the new definition, except for contributions by spouses, civil union partners, or resident children to a candidate for whom the contributor is eligible to vote or to a political party committee within whose jurisdiction the contributor resides.

2. Reportable contributions (those over $300.00 in the aggregate) to legislative leadership committees, municipal political party committees, and candidate committees or election funds for Lieutenant Governor are disqualifying contributions in the same manner as reportable contributions to State and county political party committees and candidate committees or election funds for Governor have been disqualifying contributions under Chapter 51.

Executive Order No. 117 applies only to contributions made on or after November 15, 2008, and to contracts executed on or after November 15, 2008.

Updated forms and materials are currently being developed and will be made available on the website as soon as they are available. In the meantime, beginning November 15, 2008, prospective vendors will be required to submit, ***in addition to the currently required Chapter 51 and Chapter 271 forms***, the attached Certification of Compliance with Executive Order No. 117.

Executive Order No. 117 (2008)

Certification on Behalf of A Company, Partnership or Organization and All Individuals Whose Contributions are Attributable to the Entity Pursuant to Executive Order No. 117 (2008)

I hereby certify as follows:

On or after November 15, 2008, neither the below-named entity nor any individual whose contributions are attributable to the entity pursuant to Executive Order No. 117 (2008) has solicited or made any reportable contribution of money or pledge of contribution, including in-kind contributions or company or organization contributions, to the following:

a) Any candidate committee and/or election fund of the Governor;

b) A State political party committee;

c) A legislative leadership committee;

d) A county political party committee; or

e) A municipal political party committee.

I certify as an officer or authorized representative of the Company or Organization identified below that, to the best of my knowledge and belief, the foregoing statements by me are true. I am aware that if any of the statements are willfully false, I am subject to punishment.

Name of Company, Partnership or Organization:

ALIANO BROTHERS GENERAL CONTRACTORS, INC.

Signed: _____ **Title:** PRESIDENT

Print Name: MICHAEL ALIANO **Date:** 09/29/2022

(circle one) (A) The Company, Partnership or Organization is the vendor;

or

(B) the Company, Partnership or Organization is a Principal (more than 10% ownership or control) of the vendor, a Subsidiary controlled by the vendor, or a Political Organization (e.g., PAC) controlled by the vendor.

**Please note that if the person signing this Certification is not signing on behalf of all individuals whose contributions are attributable to the entity pursuant to Executive Order No. 117 (2008), each of those individuals will be required to submit a separate individual Certification.*

Executive Order No. 117 (2008)

Individual Certification of Compliance with Executive Order No. 117 (2008)

I hereby certify as follows:

On or after November 15, 2008, I have not solicited or made any reportable contribution of money or pledge of contribution, including in-kind contributions or company or organization contributions, to the following:

a) Any candidate committee and/or election fund of the Governor;

b) A State political party committee;

c) A legislative leadership committee;

d) A county political party committee; or

e) A municipal political party committee.

I certify that, to the best of my knowledge and belief, the foregoing statements by me are true. I am aware that if any of the statements are willfully false, I am subject to punishment.

Signed: _____

Print Name: MICHAEL ALIANO **Date:** 09/29/2022

Public Law 2005, Chapter 51 **(formerly Executive Order 134)**	**Vendor Certification and Disclosure of Political Contributions (2 Years)**
Vendor: ALIANO BROTHERS GENERAL CONTRACTORS, INC.	**EIN:** 22-2389820 (9 digits)

The vendor should complete the required Certification and Disclosure forms and submit them, together with a completed Ownership Disclosure form, ***to the using agency, department or the Purchase Bureau***. Instructions for completing this form are at http://www.state.nj.us/treasury/purchase/forms.htm#eo134.

Part I: Certification

I hereby certify as follows:

1. On or after October 15, 2004, the below-named person or entity has not solicited or made any contribution of money, pledge of contribution, including in-kind contributions, company or organization contributions, as set forth below that would bar the award of a contract to the vendor, pursuant to the terms of Public Law 2005, Chapter 51 [N.J.S.A. 19:44A-20.13-20.25, superseding Executive Order 134 (2004)].

   a) **Within the preceding 18 months, the below-named person or organization has not made a contribution to**

      (i) Any candidate committee and/or election fund of any candidate for or holder of the public office of Governor; or
      (ii) Any State or county political party committee.

   b) **During the term of office of the current Governor (exclusive of any contributions made prior to October 15, 2004), the below-named person or organization has not made a contribution to**

      (i) Any candidate, committee and/or election fund of the Governor; or
      (ii) Any State or county political party committee nominating such Governor in the election preceding the commencement of said Governor's term.

   c) **Within the 18 months immediately prior to the first day of the term of office of the Governor, (exclusive of any contributions made prior to October 15, 2004), the below-named person or organization has not made a contribution to**

      (i) Any candidate, committee and/or election fund of the Governor; or
      (ii) Any State or county political party committee of the political party nominating the successful gubernatorial candidate in the last gubernatorial election.

2. If the vendor is awarded a contract pursuant to this procurement process, the below-named person or organization will, on a continuing basis, continue to report any contributions it makes during the term of the contract, and any extension(s) thereof.

Part II: Disclosure

Following is the required disclosure of all contributions made from October 15, 2004, through the date of signing of this Certification and Disclosure to: (i) any entity designated and organized as a "political organization" under 26 U.S.C.A. § 527 that is also defined as "continuing political committee" under N.J.S.A. 19:44A-3(n) and N.J.A.C. 19:25-1 or (ii) any candidate committee and/or election fund of any candidate for or current holder of the public office of Governor; and any State or county political party committee. Such an entity is identified in the following chart as a "Committee."

Public Law 2005, Chapter 51
(formerly Executive Order 134)

Vendor Certification and Disclosure of Political Contributions (2 Years)

Vendor: ALIANO BROTHERS GENERAL CONTRACTORS, INC. **EIN:** 22-2389820 (9 digits)

Name and Address of Committee	Date of Contribution	Amount of Contribution	Type of Contribution, i.e., Currency, Check, Loan, In Kind	Donor
Indicate "none" if no contributions were made. Attach additional pages if necessary.				
NONE				

1

Certification on behalf of a COMPANY or organization:

I certify as an officer or authorized representative of the Company or Organization identified below that, to the best of my knowledge and belief, the foregoing statements by me are true. I am aware that if any of the statements are willfully false, I am subject to punishment.
I certify that the firm has not made a contribution that would bar the award of a contract pursuant to Public Law 2005, Chapter 51 [N.J.S.A. 19:44A-20.13-20.25, superseding Executive Order 134 (2004)].
NOTE: This certification will be in effect for two (2) years provided the ownership status does not change or additional contributions are not made. If there are any changes in the ownership of the entity affecting persons or organizations owning more than 10%, or additional contributions are made, a new full set of documents are required to be completed and submitted. By submitting this Certification and Disclosure, the person or entity named herein acknowledges this reporting responsibility and certifies that it will adhere to it.

2

Name of Company or Organization: _____

Signed: _____ **Title:** PRESIDENT

Print Name: MICHAEL ALIANO **Date:** 09/29/2022

(check one) (A) ☑ **The Company or Organization is the vendor, or (B)** ☐ **the Company or Organization is a Principal (more than 10% ownership or control) of the vendor, a Subsidiary controlled by the vendor, or a Political Organization (e.g., PAC) controlled by the vendor.**

Certification by an individual ***– for use by the individual vendor, or as a Principal (more than 10% ownership or control) of the vendor, or as the spouse or child of the vendor:***
I certify that, to the best of my knowledge and belief, the foregoing statements by me are true. I am aware that if any of the statements are willfully false, I am subject to punishment.
NOTE: This certification will be in effect for two (2) years provided the ownership status does not change or additional contributions are not made. If there are any changes in the ownership of the entity affecting persons or organizations owning more than 10%, or additional contributions are made, a new full set of documents are required to be completed and submitted. By submitting this Certification and Disclosure, the person or entity named herein acknowledges this reporting responsibility and certifies that it will adhere to it.

3

Signed: _____

Print Name: MICHAEL ALIANO **Date:** _____

A person may certify BOTH as an officer or authorized representative of the vendor, AND in his or her individual capacity, as a Principal of the vendor.

CONTRACT AND BOND

ARTICLES

1.LEGAL JURISDICTION

A. This CONTRACT shall be construed and governed in accordance with the Constitution and laws of the State of New Jersey. The State in entering into this CONTRACT does not waive its Sovereign Immunity, except as provided in the New Jersey Contractual Liability Act, NJSA 59:13-1 *et seq*.

B. The rights or benefits provided the CONTRACTOR in this CONTRACT which exceed those provided under that Act and the obligations established under this CONTRACT which vary from those under the Act are contractual in nature and shall not be deemed to expand the waiver of Sovereign Immunity as set forth in that Act.

2.RELATIONSHIP OF THE FEDERAL GOVERNMENT (Federal Funded Contracts)

A. This CONTRACT may be funded in part by the Federal Government.

B. The Federal Government is not a party to this CONTRACT. As a condition to receiving and expending Federal funds, there are certain rights of Federal inspection, Federal approval or CONTRACT changes and modifications, and Federal approval of settlements or dispute actions that the Federal Government will exercise prior to authorization of Federal funds. Therefore, no inspection or acceptance, change, modification, settlement, dispute claim payment, or dispute action will be considered binding until the required federal approval is obtained.

C. The Chief, National Guard Bureau or Secretary of the Veterans Administration, or his/her designated representative, is the approval authority. This paragraph does not abrogate any rights conferred on the Federal Government by law or other clause required due to the use of Federal funding.

3.APPROVAL (Federal - National Guard Bureau - Funding)

This CONTRACT and any subsequent terminations, modifications, or change orders (including those resulting from disputes and settlements of disputes) shall be subject to the written approval of the Chief, National Guard Bureau, or his duly authorized representative, and shall not be binding until so approved.

4.CONTRACT EXECUTION

A. The CONTRACTOR shall have fifteen(15) calendar days to fully execute this CONTRACT. The fifteen (15) calendar days shall begin on the day the CONTRACTOR receives the CONTRACT from NJDMAVA.

B. Execution of the CONTRACT shall include appropriate Performance and Payment Bonds, applicable insurance, signed CONTRACTs and all other forms, and signatures and notarization must be received within this time period. Shall the CONTRACTOR fail to execute the CONTRACT within this time frame, the CONTRACTOR shall be deemed in default of the bid bond. The CONTRACTING OFFICER shall then award the CONTRACT to the next lowest BIDDER and exercise any and all rights under the bid bond and the law to retrieve the difference in CONTRACT award.

C. The CONTRACTING OFFICER, in his sole discretion and upon receipt of a written request from the CONTRACTOR no less than three (3) days prior to the expiration of the fifteen (15) day period established herein, may grant an extension of time for CONTRACT execution.

5.PERFORMANCE BOND AND PAYMENT BOND

A. The BIDDER to whom the award is made shall furnish a Performance Bond in an amount at least equal to one hundred percent (100%) of the CONTRACT prices as security for the faithful performance of this CONTRACT and also a Payment Bond in an amount not less than one hundred percent (100%) of the CONTRACT price as security or the payment of all persons performing labor on the project under this CONTRACT and furnishing materials in connection with this CONTRACT.

B. The Performance Bond and the Payment Bond shall be in separate instruments in accordance with local law. Before final acceptance each bond must be approved by the State and/or U.S. Government Agency of Office involved, when applicable, and shall be from a surety company authorized to do business in the State of New Jersey.

C. It is recommended that the Performance Bond and Payment Bond provided herein be used to satisfy the requirements of the State. If a CONTRACTOR chooses to use his/her own bonds, then the language of the bond shall strictly conform to the sample enclosed in these General Conditions. Conditions that modify the intent of the State shall not be accepted.

D. The respective CONTRACTORS shall pay for the cost of bonds.

E. If at any time the State for justifiable cause, shall be or become dissatisfied with any Surety or Sureties then upon the Performance Bond or Payment Bond, the CONTRACTOR shall within five (5) calendar days after notice form the State so to do, substitute an acceptable bond(s) in such form and sum and signed by such other Surety or Sureties as may be satisfactory to the State. The CONTRACTOR shall pay the premiums on such bond. No further payments shall be deemed due nor shall be made to the CONTRACTOR until the new Surety or Sureties shall have furnished such an acceptable bond to the State.

F. Date of Bond must not be prior to date of CONTRACT. Use:
   (1) Correct name of CONTRACTOR
   (2) A Corporation, a Partnership or an Individual as case may be.
   (3) Correct name of Surety.
   (4) If CONTRACTOR is Partnership, all partners shall execute bond.

F. IMPORTANT NOTE: Surety Companies executing bonds on U.S. funded projects must appear on the U.S.Treasury Department's most current list (Circular 570) and be authorized to transact business in the State of New Jersey.

Combined Bonds: Combined performance and payment bonds shall not be accepted. The CONTRACTOR is to provide separate Performance and Payment Bonds with separate bond numbers.

PERFORMANCE BOND

KNOWN ALL MEN BY THESE PRESENTS:
That we, the undersigned_____as principal and_as sureties, are
hereby held and firmly bound unto_____in the penal sum of

_____dollars ($_____) for the payment of which will and truly to be made, we

hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

"Signed this_____day of_____20_____."

"The condition of the above obligation is such that whereas, the above named principal did on the day of

_____20____, enter into a contract with which said contract is made a

part of this the bond the same as though set forth herein":

"Now, if the said Principal shall well and faithfully do and perform the things agreed by Owner to be done and performed according to the terms of said contract, and shall pay all lawful claims of subcontractors, materialmen, laborers, persons, firms or corporations for labor performed or materials, provisions, provender or other supplies or teams, fuels, oils, implements or machinery furnished, used or consumed in the carrying forward, performing or completing of said contract, we agreeing and assenting that this undertaking shall be for the benefit of any subcontractor, materialmen, laborer, person, firm or corporation having a just claim, as well as for the obligee herein; then this obligation shall be void; otherwise the same shall remain in full force and effect; it being expressly understood and agreed that the liability of the surety for any and all claims hereunder shall in no event exceed the penal amount of this obligation as herein stated."

"The said surety hereby stipulates and agrees that no modifications, omission or additions in or to the terms of the said contract or in or to the plans and specifications therefore shall in anywise affect the obligation of said surety on its bond."

Provide, further, that no final settlement between the Owner and the CONTRACTOR shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

This bond is given in compliance with the requirements of the statutes of the State of New Jersey in respect to bonds or Contractors on public works, N.J.S.A. 2A:44-143-147 and amendments thereof.

IN WITNESS WHEREOF, this instrument is executed in six (6) counterparts, each one of which shall be deemed an original, this the_____day of_____20_____.

ATTEST:

_____
Principal

_____ BY _____
(Principal) Secretary

_____
(Address)

(SEAL)

_____
Witness as to Principal

_____
(Address)

_____
Surety

ATTEST:

_____ BY _____
(Surety) Secretary Attorney-in-Fact

_____
(Address)

_____
Witness to Surety

_____
(Address)

The Surety Company shall be one authorized to do business in New Jersey.

PAYMENT BOND

KNOWN ALL MEN BY THESE PRESENTS:

That we, the undersigned_____as principal and_____as sureties, are hereby held and firmly bound unto in the penal sum of

_____

_____dollars ($_____) for the payment of which will and truly to be made, we

Hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

"Signed this_____day of_____20_____."

"The condition of the above obligation is such that whereas, the above named principal did on the day of

_____20____, enter into a contract with which said contract is made a

_____

part of this the bond the same as though set forth herein":

"Now, if the said Principal shall pay all lawful claims of subcontractors, materialman, laborers, persons, forms or other suppliers or teams, fuels, oils, implements or machinery furnished, used or consumed in the carrying forward, performing or completing of said contract, we agreeing and assenting that this undertaking shall be for the benefit of any CONTRACTOR, materialman, laborer, person, firm or corporation having a just claim, as well as for the obligee herein; then this obligation shall be void; otherwise the same shall remain in full force and effect; it being expressly understood and agreed that the liability of the surety for any and all claims hereunder shall in no event exceed the pen amount of this obligation as herein stated."

"The said surety hereby stipulates and agrees that no modifications, omission or additions in or to the terms of the said contract or in or to the plans and specifications therefore shall in anywise affect the obligation of said surety on its bond."

Provide, further, that no final settlement between the Owner and the CONTRACTOR shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

This bond is given in compliance with the requirements of the statutes of the State of New Jersey in respect to bonds or Contractors on public works, Revised Statutes of New Jersey, 1937, Sections 2A:44-143-147 and amendments thereof.

IN WITNESS WHEREOF, this instrument is executed in six (6) counterparts, each one of which shall be deemed an original, this the_____day of_____20____.

ATTEST:

_____
Principal

_____ BY _____
(Principal) Secretary

_____
(Address)

(SEAL)

_____
Witness as to Principal

_____
(Address)

_____
Surety

ATTEST:

_____ BY _____
(Surety) Secretary Attorney-in-Fact

_____
(Address)

_____
Witness to Surety

_____
(Address)

The Surety Company shall be one authorized to do business in New Jersey.

GENERAL CONDITIONS

ARTICLES

1. CONTRACTING OFFICER STATUS (C.O.)

A. The CONTRACTING OFFICER or his/her representative shall have general supervision and direction of the work. He/she are the agents of the State to the extent provided in the CONTRACT documents and all laws and rules and regulations issued thereunder. He/she has the authority to stop the work, whenever such stoppage in his/her opinion may be necessary to insure the proper execution of the CONTRACT. Neither Project Officer nor Inspector, on behalf of the CONTRACTING OFFICER, is authorized to change any provision of the specification without written authorization (Change Order) of the CONTRACTING OFFICER, nor shall the presence or absence of an Inspector relieve the CONTRACTOR from any requirements of the CONTRACT.

B. As the CONTRACTING OFFICER or his/her representative is, in the first instance, the interpreter of the conditions of the CONTRACT and the judge of its performance, he/she shall side neither with the State nor with the CONTRACTOR, but shall use his/her powers under the CONTRACT to enforce its faithful performance by both.

2. ARCHITECT OR ENGINEER STATUS (A/E)

A. NJDMAVA may include Class C services as part of the design CONTRACT. These services may include reviewing shop drawings for compliance to the specifications and interpreting his/her scope of work when clarification is required from the CONTRACTOR.

B. NJDMAVA may hire an A/E to act as a CONSTRUCTION MANAGER on the project. When acting in such a role his/her shall interpret the CONTRACT documents and shall judge the quantity, quality, fitness and acceptability of all parts of the work when acting as an agent for the CONTRACTING OFFICER. He/she shall certify CONTRACTOR'S invoices for work performed and materials delivered to the site, and shall be given access to any part of the work for inspection at all times.

C. The A/E shall not have authority to give approval nor order changes in work which alter the terms or conditions of the CONTRACT, nor which involve additional cost. He/she may, however, make recommendations to the CONTRACTING OFFICER for such changes, whether or not costs are revised, and the CONTRACTING OFFICER may act, at his/her discretion, on the basis of the A/E's recommendations.

D. Under no circumstances shall the A/E have authority to judge or validate an approved equal after the bid date.

3. CONSTRUCTION MANAGER STATUS (CM)

A. NJDMAVA may hire a firm to act as a CONSTRUCTION MANAGER on the project. He/she shall interpret the CONTRACT documents and shall judge the quantity, quality, fitness and acceptability of all parts of the work when acting as an agent for the CONTRACTING OFFICER. He/she shall certify CONTRACTOR'S invoices for work performed and materials delivered to the site, and shall be given access to any part of the work for inspection at all times.

B. The CONSTRUCTION MANAGER shall not have authority to give approval nor order changes in work which alter the terms or conditions of the CONTRACT, nor which involve additional cost. He/she may, however, make recommendations to the CONTRACTING OFFICER for such changes, whether or not costs are revised, and the CONTRACTING OFFICER may act, at his/her discretion, on the basis of the CONSTRUCTION MANAGER Recommendations.

C. The CONSTRUCTION MANAGER shall not have the authority to authorize any approved equals after a bid date.

4. CONTRACTOR STATUS

A. When the term CONTRACTOR is used in these General Conditions or within the CONTRACT documents, it shall also mean a CONTRACTOR. The CONTRACTOR shall be responsible for hiring a license architect to furnish drawings and specifications to fully construct the project as outlined in these documents.

B. NJDMAVA may at any time hire his/her own A/E or CONSTRUCTION MANAGER to oversee the project and inspect the drawings and specifications of the CONTRACTOR. The CONTRACTOR shall be required to meet all applicable federal and state codes, rules, regulations and other guidelines as outlined by the State of New Jersey.

5. INTENTION

A. The drawings and specifications, with the CONTRACT of which he/she form a part, are intended to provide for and comprise everything necessary for the proper and complete finishing of the work in every part notwithstanding that each and every item necessary may not be shown on the drawing or mentioned in the specifications.

B. Contract Drawings and Specifications:

(1). Omissions from the drawings or specifications or the mis-description of details of work which are manifestly necessary to carry out the intent of the drawings and specifications, or which are customarily performed, shall not relieve the CONTRACTOR from performing such omitted or mis-described details of the work but it shall be performed as if fully and correctly set forth and described in the drawings and specifications.

(2) The CONTRACTOR shall check all drawings furnished him immediately upon his/her receipt and shall promptly notify the CONTRACTING OFFICER of any discrepancies. It shall be understood that the CONTRACTOR(S) have reviewed the specifications in his/her entirety along with every page of the drawings for completeness. In the event a conflict should arise where items are omitted from one portion of the drawing but not on another, than the CONTRACTOR(S) shall notify the CONTRACTING OFFICER or his representative immediately. Failure to notify NJDMAVA shall not relieve the CONTRACTOR(S) of his/her responsibility to perform the necessary work or provide the appropriate item at no additional cost to the owner.

(3) Figures marked on drawings shall in general be followed in preference to scale measurements. Large-scale drawings shall in general govern small-scale drawings. The CONTRACTOR shall compare all drawings and verify the figures before laying out the work and will be responsible for any errors which might have been avoided thereby.

C. Determination will be in the form of Addenda to the CONTRACT Document, which will be forwarded to all affected CONTRACTORS.

D. Any provisions in any of the CONTRACT Documents which may be in conflict or inconsistent with any of the paragraphs in these General Conditions shall be void to the extent of such conflict or inconsistency unless the provision is specifically referenced as a supplement or change thereto.

E. Each and every provision of law and clause required by law to be inserted in the CONTRACT shall be deemed to be inserted herein and the CONTRACT shall be read and enforced as though it were included herein, and if through mistake or otherwise any such provision is not inserted, or is not correctly inserted then upon application of either party the CONTRACT shall forthwith be physically amended to make such insertion or correction.

F. **Failure of any CONTRACTOR to thoroughly review all bid documents, drawings and specifications for their thoroughness during the bidding phase, shall not relieve the CONTRACTOR from performing all work at no additional expense to the owner**.

6. DRAWINGS, SPECIFICATIONS, SHOP DRAWINGS, AS-BUILT DRAWINGS

A. Drawings and specifications apply to all parts of this CONTRACT and sub-contracts. The CONTRACTOR shall examine the drawings and specifications for all CONTRACTs on the project, whether bound in one document or separately, shall observe any work indicated or specified pertaining to his work and shall make due allowances to perform or carry out the applicable work.

B. The Architect is to provide one (1) set of DCA approved plans with the Architects raised (embossed) seal and signature on each sheet. This set is to be kept onsite and available for all DCA inspections.

C. Unless otherwise provided in the CONTRACT Documents, the C.O. will furnish to the CONTRACTOR, free of charge, a minimum of one (1) copy of CONTRACT Documents for the execution of the work.

D. The C.O. will furnish, with reasonable promptness, additional instructions, by means of supplemental drawings or otherwise, necessary for the proper execution of the work. All such drawings and instructions shall be consistent with the CONTRACT Documents, true development thereof, and reasonably inferable therefrom. The work shall be executed in conformity therewith and the CONTRACTOR shall do no work without proper drawings and instructions. In giving such additional instructions, the C.O. will have authority to make minor changes in work, not involving extra cost.

E. Any CONTRACTOR so requesting may together with the C.O., jointly prepare a schedule, subject to change from time to time in accordance with the progress of the work, fixing the dates with the various detail and supplemental drawings will be required, and the C.O. will furnish them in accordance with the schedule.

F. All drawings referred to, together with such supplementary details as may be furnished or approved from time to time as the work progresses, are understood as being included and a part of the CONTRACT to which he/she relates. The State may duplicate use, and disclose in any manner and for any purpose shop drawings delivered under this CONTRACT. This clause shall be included in all subcontracts hereunder at any time.

G. On all work of a remodeling nature or installation within present buildings, it will be the responsibility of the CONTRACTOR, by personal inspection, to satisfy themselves as to the correctness of any information given which may affect the quantity, size, and quality of materials required for a satisfactorily completed CONTRACT, whether or not such information is indicated on the drawings or within the specifications.

H. **All work that may be called for in the specifications and not shown on the drawings or shown on the drawings and not called for in the specifications shall be executed and furnished by the CONTRACTORS as if described in both**. Should any incidental work or materials be required but which are nevertheless, necessary for the proper carrying out of the intent therefore, the CONTRACTOR shall understand same to be implied and required and he/she shall perform all such work and furnish all such materials as fully as if it were particularly delineated or described.

I. If there is anything is the specifications or drawings that is unclear or contradictory it is the CONTRACTOR'S responsibility to submit an RFI to the A/E, Construction Manager, and/or C.O. for clarification.

J. The CONTRACTOR shall not at any time after the execution of this CONTRACT, set up any claims whatever based upon insufficient data or incorrectly assumed conditions, nor shall he/she claim any misunderstanding with regard to the nature, conditions or character of the work to be done under the contract.

K. CONTRACT, and he/she shall assume all risks resulting from any changes in conditions which may occur during the progress of the work.

L. No CONTRACTOR shall submit with such promptness as to cause no delay in his/her own work or that of any other Prime CONTRACTOR, a reproducible transparent copy of all shop or setting drawings, details, and schedules required for the work of the various trades; and the A/E, Construction Manager, and/or C.O. will pass upon them with reasonable promptness.

M. The CONTRACTOR shall make any corrections if required by the A/E, Construction Manager, and or C.O. and resubmit a reproducible transparent copy for approval. After final approval of the drawings has been received, the CONTRACTOR shall immediately send the A/E, Construction Manager, and/or C.O. a minimum of six (6) prints of the finally approved drawings, plus the required number of approved prints each to every other interested Prime CONTRACTOR. The A/E or Construction Manager, when applicable, will make proper distribution of all drawings as directed by the C.O.

N. Attached to the CONTRACTOR's initial submission of such drawing or catalog data shall be an itemized schedule listing by dates when all other submissions will be forwarded to the A/E, Construction Manager or the C.O. Any list of drawings prepared by the A/E or Construction Manager is for the C.O.'s convenience only, and shall not be construed as limiting the number of drawings, which the CONTRACTOR shall furnish.

O. If any CONTRACTOR desires to make any deviations or changes from the CONTRACT Documents, he/she shall obtain the consent of the C.O. to such changes in writing (Change Order) before submitting drawings showing such change. He/she shall have checked all drawings submitted by the CONTRACTOR before being submitted. The Project Title and Project Number must appear on all submissions. Drawings and specification references shall also be noted on all submissions. Failure to comply with these instructions will be sufficient reason to return such drawings to the CONTRACTOR without any action being taken.

P. Each CONTRACTOR shall keep, at all times, a copy of all drawings and specifications on the work up to date and in good order, available to the C.O.

Q. All models, drawings, specifications, and copies thereof furnished by the CONTRACTOR. are the property of the State and not to be used in other work, and with the exception of the signed CONTRACT set, are to be returned to the State at the completion of the work. All models are the property of the State.

R. In the event there is no A/E or Construction Manager, all shop drawings will be sent to the CONTRACTING OFFICER.

S. The CONTRACTOR shall keep the CONTRACT Drawings up to date at all times by updating digital files using red-colored markings for the final location of any changes in the work, pipes, traps, conduits, ducts, footings, anchors, etc. The data shall be digitally transferred regularly by the CONTRACTOR.

T. The CONTRACTOR shall submit the digital and hard copies of all CONTRACT Drawings whether altered or not to the A/E or Construction Manager with CONTRACTOR certification as to the accuracy of the information prior to final payment. All as-built drawings shall be entitled "AS-BUILT" above the title block and dated. This information shall be checked, edited, and certified by the A/E, if applicable who shall then transpose such information to the original drawings and certify that such drawings reflect as-built status.

U. Copies of A/E drawings, if desired for this purpose, may be obtained from the State. The CONTRACTOR shall pay for the cost of reproduction.

V. The CONTRACTOR for general construction shall review and approve all shop drawings and submittals prior to submission. After review by the C.O., he/she shall re-distribute the shop drawings and submittals. The CONTRACTOR for general construction is to review all “as-built” drawings and verify their accuracy and assemble into one set of “as-builts” prior to submission to the NJDMAVA.

W. ALL AS-BUILTS ARE TO BE SUBMITTED TO NJDMAVA CLEARLY LABELED AS AS-BUILTS. SUBMISSION TO INCLUDE THE FOLLOWING:
   1. One set of prints
   2. Two (2) CD’s containing electronic copy in pdf format and the AutoCAD file. Auto CAD file to contain the following.
      a. Original Auto CAD file
      b. Plot Style Table (pen assignments)
      c. Special Fonts
      d. Special Symbols
      e. SHX files
      f. External References

7. RESPONSIBILITY FOR WORK; DUTY TO DEFEND AND HOLD HARMLESS

A. The CONTRACTOR shall be responsible for all damages due to his/her operations; to all parts of the work, both temporary and permanent; and to all adjoining property.

B. BECAUSE THE BID SUBMITTED BY THE CONTRACTOR INCLUDES THE COST OF PROVIDING COMPREHENSIVE GENERAL LIABILITY INSURANCE COVERAGE FOR THE STATE AS A NAMED ASSURED AND BECAUSE THE STATE DESIRES TO TRANSFER ALL OF THE RISKS ATTENDING ALL ACTIVITIES IN CONNECTION WITH THIS PROJECT TO THE CONTRACTOR REGARDLESS OF WHICH PARTY, IF ANY, MAY BE AT FAULT, EACH CONTRACTOR SHALL DEFEND, PROTECT AND HOLD THE STATE HARMLESS FROM ALL SUITS, ACTIONS, DAMAGES, AND COSTS OF EVERY NAME AND DESCRIPTION RESULTING FROM THE WORK UNDER THIS CONTRACT OR ACTIVITIES OF ANY KIND AT THE PROJECT SITE OR AT THE LOCATION OF THE CONTRACTOR OR SUPPLIER.

C. The CONTRACTOR shall provide in connection with his/her own work, all safeguards, rails, night-lights, and other means of protection against accidents.

D. The CONTRACTOR shall make, use and provide all proper necessary and sufficient precautions, safeguards and protection against the occurrence or happening of any accident, injuries, damage or hurt to any person or property during the progress of the work.

E. The CONTRACTOR shall, at his/her own expense, protect all finished work liable to damage, and keep the same protected until the project is completed and accepted by the C.O.

F. In order to protect the lives and health of his/her employees under the CONTRACT, the CONTRACTOR shall comply with all pertinent provisions of the "Manual of Accident Prevention in Construction" issued by the Associated General Contractors of America, Inc., and shall maintain an accurate record of all cases of death, occupational disease, the injury requiring medical attention or causing loss of time from work, arising out of and in the course of employment on work under the CONTRACT. The CONTRACTOR alone shall be responsible for the safety, efficiency, and adequacy of his/her plant, appliances, and methods and for any damage or injury which may result from his/her failure or his/her improper construction, maintenance, or operation.

G. In case of emergency, which threatens loss or injury of property and/or safety of life, the CONTRACTOR may be allowed to act without previous instructions from the C.O. in a diligent manner. The CONTRACTOR shall notify the C.O. immediately. Any claim for compensation by the CONTRACTOR due to such extra work shall be documented and promptly submitted to the C.O. for approval. Where the CONTRACTOR has not taken action but has notified the C.O. of any emergency threatening injury to persons or damage to the work or any adjoining property, he/she shall act as instructed or authorized by the C.O. The amount of reimbursement claimed by the CONTRACTOR on account of any emergency action shall be determined in the manner provided in these General Conditions.

8. USE OF PREMISES

A. The CONTRACTOR shall comply with the rules and regulations of the Using Agency.

B. The CONTRACTOR shall confine his/her apparatus, the storage of materials, and the operation of his/her workmen to limits indicated by law, ordinances, permits, CONTRACT limit lines as established, or directions of the C.O. and shall not unreasonably encumber the premises with his/her materials.

C. No CONTRACTOR shall not load or permit any part of the structure to be so loaded with weight that will endanger its safety.

D. The CONTRACTOR shall enforce the C.O.'s instructions regarding signs, advertisements, fire and smoking.

E. WHEN THE PROJECT INVOLVES WORK ON AN EXISTING STRUCTURE, THE STATE'S SMOKE FREE ENVIRONMENT POLICY SHALL BE IN AFFECT. NO CONTRACTOR, SUBCONTRACTOR OR MATERIALMAN SHALL SMOKE ON STATE PROPERTY. WHEN THE WORK INVOLVES THE CONSTRUCTION OF A NEW FACILITY, THEN THE STATE'S SMOKE FREE ENVIRONMENT SHALL BE IN EFFECT WHEN THE BUILDING IS ENCLOSED WITH DOORS AND WINDOWS AND THE HVAC SYSTEM IS OPERATIONAL. AT NO TIME SHALL THERE BE SMOKING IN ANY STRUCTURE WHEN OCCUPIED BY STATE EMPLOYEES OR RESIDENTS.

F. The CONTRACTOR agrees to the use and occupancy of a portion or unit of the project by the State before acceptance by the State, provided the State: No warrantees are in jeopardy and Secures written consent of the CONTRACTOR except in the event, in the opinion of the C.O., the CONTRACTOR is chargeable with unwarranted delay in final completion of punch list items or other Contract requirements and,

(a) Secures endorsement from the insurance carrier and consent of the Surety permitting occupancy of the building or use of the project during the remaining period of construction, or

(b) When the project consists of more than one building and one of the buildings is occupied, secures permanent fire and extended coverage insurance, including a permit to complete construction. Consent of the Surety must also be obtained.

G. The CONTRACTOR shall obtain from the Station Commander or CEO (as appropriate) specific instructions, rules, and regulations regarding conduct of the CONTRACTOR during the construction so that security of the facility and safety of occupants will not be endangered.

9. SUPERINTENDENT - SUPERVISION - LAYING OUT

A. At the site of the work the CONTRACTOR shall employ a Construction Superintendent or Foreman on the work site at all times during progress who shall have full authority to act for the CONTRACTOR. It is understood that such representative shall be acceptable to the C.O. and shall be one who is to be continued in that capacity for the particular job involved unless he ceases to be on the CONTRACTOR'S payroll. Any successor Construction Superintendent or Foreman must be acceptable to the C.O. Should, during the course of the CONTRACT, the C.O. find the superintendent unacceptable as evidence by just cause, than the CONTRACTOR shall remove and replace the superintendent.

B. The various subcontractors shall have competent foremen in charge of his/her respective part of the work at all times. He/she are not to employ on the work any unfit persons or anyone not skilled in the work assigned to them.

C. The CONTRACTOR shall give the work his/her special supervision, lay out his/her own work, do all the necessary leveling and measuring or employ a competent New Jersey licensed engineer or land surveyor satisfactory to the C.O. to do so.

D. If, due to trade agreement, additional standby personnel are required to supervise equipment or temporary services used by other trades, the CONTRACTOR providing such stand-by services shall evaluate requirements and include the cost thereof in his bid.

E. The CONTRACTOR and subcontractors shall rely on his/her own measurements for the performance of his/her work.

F. The CONTRACTOR shall do all field engineering and layout. In addition, he/she shall establish and maintain all benchmarks related to all tasks and the project schedule.

G. The C.P.M schedule shall be working document and maintained in a current status and posted in his/her field office.

H. The CONTRACTOR shall employ a master mechanic at all times.

10. SUBCONTRACTOR COST OR PRICING DATA - PRICE ADJUSTMENTS (1970 JAN)

Insert the following Clause in all CONTRACTs, both formally advertised and negotiated, which exceed $100,000:

A. Paragraphs (B) and (C) of this Clause shall become operative with respect to any modification made pursuant to one or more provisions of this CONTRACT which involves aggregate increases and/or decreases in costs plus applicable profits expected to exceed $100,000. The requirements of this Clause shall be limited to such modifications.

B. The CONTRACTOR shall require subcontractors hereunder to submit cost or pricing data under the following circumstances:

(i) Prior to the award of any subcontract the amount of which is expected to exceed $100,000 when entered into:

(ii) Prior to the pricing of any subcontract modification which involves aggregate increases and/or decreases in costs plus applicable profits expected to exceed $100,000; except where the price is based on adequate price competition, established catalog or market prices of commercial items sold in substantial quantities to the general public or prices set by law or regulation.

C. The CONTRACTOR shall require subcontractors to certify that to the best of his/her knowledge and belief the cost and pricing data submitted under (B) above is accurate, complete, and current as of the date of agreement on the negotiated price of the subcontract change or modification.

D. The CONTRACTOR shall insert the substance of this Clause including this paragraph (D) in each subcontract which exceeds $100,000.

11. FEDERAL FUNDS (APPLICABLE TO FEDERAL FUNDED , NGB, PROJECTS ONLY)

The CONTRACTOR must comply with regulations included in the CONTRACT Documents.

A. Federal Public Law 88-204 as amended, provides that all laborers and mechanics employed on the project shall be paid wages at not less than those prevailing on similar construction in the locality as determined by the Secretary of Labor in accordance with the Davis Bacon Act as amended.

B. In case of conflict between State and U.S. Department of Labor wage rates the higher rate for any given occupation will be the governing rate.

C. CONTRACTORS and Subcontractors are advised that upon acceptance of his/her bids, his/her are obligated under the Davis-Bacon Act to pay not less than the established wage rate. Unless otherwise required by law, wage rates need not be listed for non-manual workers, including executive, supervisory, administrative, and clerical employees.

D. Subject to Federal-State Agreement - This CONTRACT is subject to all terms and conditions in the Master Cooperative Agreement between the United States of America and the State of New Jersey attached hereto and made a part hereof.

12. SUBCONTRACTOR APPROVAL

A. The CONTRACTOR shall within thirty (30) working days after award of the CONTRACT notify the C.O. in writing of the names of Subcontractors proposed for the principal parts of the work and for such other as the C.O. or any that the C.O. may within a reasonable time reject. No CONTRACT shall be entered into with any Subcontractor before his/her name has been approved in writing by the C.O. All subcontractors must be approved by the State, and be DPMC qualified.

B. The CONTRACTOR agrees that he is fully responsible to the State for the acts and omissions of the Subcontractors and of persons either directly or indirectly employed by them as theirs is for the acts and omissions of persons directly employed by him/her.

C. Nothing contained in the CONTRACT Documents shall create any contractual relation between any Subcontractor and the State.

D. The CONTRACTOR agrees to bind every Subcontractor and every Subcontractor agrees to be bonded by the terms of the CONTRACT Documents, as far as applicable to his work.

13. EQUIPMENT - MATERIAL APPROVAL

A. The CONTRACTOR shall submit to the C.O. for approval a list of all manufacturers, materials, and equipment whether specified in the CONTRACT or not; within thirty (30) calendar days after award of CONTRACT. No CONTRACT shall be entered into with any Vendor before his/her name has been approved in writing by the C.O.

B. The CONTRACTOR shall provide the following information:

(1) Identifying Information shall be properly completed.

(2) Note whether the item is included in the specifications and state specification section and paragraph.

(3) If a substitute item is being allowed for the substitution differs from that originally scheduled.

(4) If a credit is allowed for the substitution, the breakdown showing the amount of the credit must be included.

(5) If the State approves the substitute item and the substitute item changes the scope of work under other CONTRACTs or trades from the original specifications, then the CONTRACTOR offering the substitute item shall be responsible for all added such involved by reason of the charge in the work or other trades, including redesign.

(6) The CONTRACTOR, when requesting approval of an out-of-state Subcontractor or material manufacturer or supplier, shall attach a statement to the form to the effect that exhaustive effort was made to use New Jersey firms and/or materials, etc. Preference shall be given to New Jersey manufacturers, firms, etc.

(7) It is further called to the attention of each Prime CONTRACTOR that the approval by the State of a Subcontractor or material supplier does not relieve the CONTRACTOR or the Subcontractor of the responsibility of complying with the drawings and specifications. The approval of a Subcontractor does not imply approval of any material.

C. Where any particular brand or manufacturer is specified, it is to be regarded as a standard. Another brand or make equally as good in the opinion of the C.O. may be acceptable and approved if submitted with these General conditions.

D. After the CONTRACT has been awarded, should the CONTRACTOR desire to use some other material other than that specified, he/she shall first make application to the C.O. in writing, naming the differences in cost in each case, otherwise he/she will be held to what is specified. No changes shall be made without the written consent of the C.O.

E. In the event a CONTRACTOR should propose a substitution for the specified equipment or materials, it shall be his/her responsibility to submit proof of equality, have any tests performed which may be required by the C.O. and pay all costs of such tests.

F. **This section of the specifications shall in no way authorize the use of approved equals**. Submission for approved equals shall be in accordance with Section II Article 12, page 7 of these specifications.

14. REPORTS, RECORDS AND DATA

A. The CONTRACTOR shall submit to the C.O. such schedule of quantities and costs, progress schedules, payrolls, reports, estimates, records, and other data as the State may request concerning work performed or to be performed under this CONTRACT.

B. These shall be submitted in triplicate with state invoices or as requested by the C.O. or his/her duly appointed representative.

C. Any substantial change to the contract drawings, as determined by the C.O. shall be drawn by the CONTRACTOR in the current version of AutoCad (no XREF's) with backup discs provided to NJDMAVA.

15. CONSTRUCTION PROJECT SCHEDULE

A. The CONTRACTOR for the CONTRACT shall be responsible for preparing and furnishing, before the first CONTRACT requisition date (or by the second Quality Review Board meeting, if applicable) a coordinated single project schedule which incorporates project schedules of all prime contractors engaged on the project. (When a DESIGN/BUILD has been awarded, this shall be a schedule including all tasks related to that CONTRACT). The schedule shall be a cost loaded "Primavera" C.P.M. schedule or equal in a form and in sufficient detail satisfactory to the C.O. The schedule shall not only include the multiple tasks and his/her inter-relationships, but shall also clearly delineate the critical path and associated tasks of the project. The schedule shall be updated once each month and be submitted with the payment requisitions. The schedule must be approved by all prime contractors, when applicable, and NJDMAVA or his/her representative.

B. The CONTRACTOR shall submit copies of his/her initial draft of this schedule to all subcontractors. Each subcontractor shall then prepare a project schedule for his/her own work, properly coordinated with the CONTRACTOR'S initial draft, and submit it to the CONTRACTOR for his/her preparation of a final draft of a single coordinated project schedule. The CONTRACTOR shall compare his updated schedule with the C.O.'s and determine what necessary actions shall be taken, when required, to keep the project on schedule IAW the C.O's time frame.

C. C.O. will not process CONTRACT requisitions until final project schedule has been submitted and approved by the State.

D. The coordinated progress schedule shall indicate each section of the specifications or work, dates on which various branches of the work will commence, anticipated delivery dates for critical items, approved C.P.M. dates for completion. All shall be predicated upon time of completion specified for the project.

E. After the final schedule has been approved by the C.O., the CONTRACTOR shall prepare and distribute ten (10) copies to the C.O. and two (2) copies to each subcontractor, and two (2) copies to the A/E, if applicable.

F. In the event the C.O. authorizes a new calendar date during the progress of the work, the CONTRACTOR shall furnish a revised schedule immediately with copies as indicated above.

G. The CONTRACTOR shall furnish sufficient labor, construction plant and equipment to insure the prosecution of the work in accordance with the approved Progress Schedule. If, in the opinion of the C.O., or his representative, any subcontractor or the CONTRACTOR falls behind the Project Schedule, the CONTRACTOR shall take such steps as may be necessary to improve his/her progress; and the C.O. may require them to increase the number of shifts, days of work, invest in better construction methods and/or the amount of construction plant and equipment, all without additional cost to the State.

H. Should a CONTRACTOR fail to supply the project schedule prior to the start of the job, then his/her work shall be delayed until it is provided. Any delays incurred will be without additional cost to the State and may incur liquidated damages to the CONTRACTOR.

I. Should a CONTRACTOR fail to supply the progress schedule with the payment requisitions, then payment shall be held until the schedule is received.

16. UNIT SCHEDULE BREAKDOWN

A. The CONTRACTOR shall file, with the C.O., a unit schedule breakdown in sufficient detail and a Project Schedule (C.P.M.), to include the following, which will be used as the basis for determining the amount of payment to be made on a periodic basis for work completed and installed in accordance with CONTRACT documents.

(1). Description of material or equipment and number of units involved.
(2). Lump sum price for labor and lump sum price for equipment and/or material listed. (3.)
Lump sum allowances included in the specification.
(4). The total of items shall equal the lump sum CONTRACT price.

B. The Unit Schedule Breakdown shall be submitted for approval to the C.O. within ten (10) calendar days from date of written Notice To Proceed by the State.

17. PAYMENT

A. The basis for computing monthly progress payments shall be the Project Schedule (CPM) and the Unit Schedule Breakdown.

B. Subject to submission by the CONTRACTOR of written certifications required by them and their Subcontractors, partial payments will be made as work progresses not later than the thirtieth day of each calendar month for work done during the preceding calendar month on estimates certified to by the A/E, or Construction Manager if applicable, and the C.O.

C. In preparing estimates, material delivered to and properly stored on the site and preparatory work done shall be taken into consideration. Estimates for monthly payments must be submitted for the project not later than the thirtieth day of each calendar month. These payments will be based on percentage of completion in comparison to the Project Schedule (CPM). The CONTRACTOR should take diligence to ensure that he/she is on time according to the Schedule and that his/her pay requests correspond to the project completion status.

D. In making such partial payments for work, there will be retained ten (10%) percent of estimated amount until Final Acceptance and completion of all work covered by the CONTRACT. Provided that after eighty (80%) percent of the work has been completed, the CONTRACTOR may request a reduction in retainage to five (5%) percent. This request must be in writing and directed to the C.O. Should the C.O. determine that a reduction is warranted, then he shall direct the Construction Facilities Management Office Account Management Section to make the adjustment in future payment(s). Provided, further, that on completion and acceptance of each separate building, public work, or other division of the CONTRACT, on which the price is stated separately in the CONTRACT, payment may be made in full, including retaining percentages thereon, less authorized deductions.

E. State's Right to Withhold Certain Amounts and Make Application thereof: The CONTRACTOR agrees that he/she will indemnify and save the State harmless from all claims growing out of the lawful demands of Subcontractors, laborers, workmen, mechanics, materialmen, and furnishers of machinery and parts thereof, equipment, power tools, and all supplies, including commissary, incurred in the furtherance of the performance of this CONTRACT. The CONTRACTOR shall, at the State's request, furnish satisfactory evidence that all obligations of the nature herein above designated have been paid, discharged, or waived. If the CONTRACTOR fails so to do, then the State may, after having served written notice on the said CONTRACTOR, either pay unpaid bills, of which the State has written notice, may direct, or withhold from the CONTRACTOR'S unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged whereupon payment to the CONTRACTOR shall be resumed, in accordance with the terms of this CONTRACT, but in no event shall the provisions of this sentence be construed to impose any obligations upon the State to either the CONTRACTOR or his/her Surety. In paying any unpaid bills of the CONTRACTOR, the State shall be deemed the agent of the CONTRACTOR, and any payment so made by the State, shall be considered as a payment made under the CONTRACT by the State to the CONTRACTOR and the State shall not be liable to the CONTRACTOR for any such payment made in good faith.

F. All material and work covered by partial payments made shall thereupon become sole property of the State, but this provision shall not be construed as relieving the CONTRACTOR from sole responsibility for care and protection of materials and work upon which payments have been made or restoration of any damaged work, or as a waiver of right of the State to require fulfillment of all terms of the CONTRACT.

G. The CONTRACTOR shall pay (a) for all transportation and utility services not later than the twentieth day of the calendar month following that in which services are rendered, (b) for all materials, tools, and other expendable equipment to the extent of ninety (90%) percent of the cost thereof, not later than the twentieth day of the calendar month following that in which such material, tools, and equipment are delivered at the site of the project, and the balance of the cost thereof not later than the thirtieth day following the completion of that part of the work in or on which such materials, tools, and equipment are incorporated or used, and to each of his Subcontractors, not later than the fifth day following each payment to the CONTRACTOR, the respectable amounts allowed the CONTRACTOR on account of the work performed by his Subcontractors to the extent of each Subcontractor's interest herein.

H. Upon completion of all CONTRACTs and Final Acceptance of all work required hereunder, the amount due the CONTRACTOR under the CONTRACT shall be paid within thirty (30) calendar days after issuance of Certificate of Final Acceptance of all CONTRACTs by the A/E, if applicable, and approval by the State, after the CONTRACTOR shall have furnished the State with a release in satisfactory form of all claims against the State arising under and by virtue of this CONTRACT, other than such claims, if any, as may be specifically excepted by CONTRACTOR from operation of release; provided, each such exception embraces no more than one claim, the basis and scope of which are clearly defined and amount stated; and, provided further, that the amounts of such excepted claims are not included in voucher for final payment.

I. The acceptance by the CONTRACTOR of final payment shall be and shall operate as a release to the State of all claims and all liability to the CONTRACTOR for all things done or furnished in connection with this work. No payment, however, final or otherwise, shall be made with any intent of releasing the CONTRACTOR or his/her Sureties from any obligations under this CONTRACT or the Performance and Payment Bond.

J. All request for payments under this CONTRACT shall be made on a State of New Jersey Payment Voucher as follows: If Federal/State -original and two (2) copies, if 100% Federal and if 100% State - original and two (2) copies. CONTRACTOR will be provided with forms.

K. Should the Unit Schedule Breakdown reflect the actual work done but not correlate with the time in which it is supposed to be done in accordance with the Progress Schedule, then the C.O. shall withhold a percentage of the payment equal to the percentage of time added. This shall be withheld until such time as the delay is made up.

L. The CONTRACTOR shall not receive final payment until he/she satisfactorily corrects deficiencies cited by the "National Guard Bureau's" or the United States Department Veterans Administration's final inspection, when applicable.

M. The CONTRACTOR'S submittal of a State payment invoice shall include the certified weekly payroll records for the period of the invoice along with the Affirmative Action records required.

18. PAYMENTS WITHHELD

A. The C.O. may withhold or, on account of subsequently discovered evidence, nullify the whole or a part of any certificate for payment to such extent as may be necessary to protect the State from loss on the account of:

(1) Defective work not remedied.

(2) Claims filed, or reasonable evidence indicating probable filing of claims.

(3) Failure of the CONTRACTOR to make payments promptly to Subcontractors or for material or labor.

(4) A reasonable doubt that the CONTRACT can be completed for the balance then unpaid.

(5) Damage to another CONTRACTOR.

(6) Failure to meet the timelines of the approved progress schedule.

(7) Failure to meet the Affirmative Action requirements.

(8) Failure to cleanup in accordance with Section 41.

(9) Failure to make steady progress or,

(10) Failure to make punch list repairs in an agreed upon time frame alteration or repair, as the case may be, and for added administrative and inspection costs to the State on account of the delay; provided, however, that the said liquidated damages provided for herein shall be in addition to other consequential losses or damages that the State may incur by reason of such delay, such as, but not limited to, added costs of the project and the cost of furnishing temporary services, if any. Any such sums for which the CONTRACTOR is liable may be deducted by the State from any monies due or to become due to the CONTRACTOR.

B. When all the above grounds are removed, certificates will at once be issued for amounts withheld because of them.

19. AUDIT BY DEPARTMENT OF MILITARY AND VETERANS AFFAIRS

Insert the following clause in all CONTRACTs (except those entered into by formal advertising which are not expected to exceed $100,000).

A. GENERAL: The Contracting Officer or his/her representatives shall have the audit and inspection rights described in the applicable paragraphs (B), (C) and (D) below.

B. EXAMINATION OF COSTS: If this is a cost reimbursement type, incentive, time and materials, labor hour, or price re-determinable CONTRACT, or any combination thereof, the CONTRACTOR shall maintain, and the C. O. or his/her representatives shall have the right to examine books, records, documents, and other evidence and accounting procedures and practices, sufficient to reflect properly all direct and indirect costs of whatever nature claimed to have been incurred and anticipated to be incurred for the performance of this CONTRACT. Such right of examination shall include inspection at all reasonable times of the CONTRACTOR'S plant, or such parts thereof, as may be engaged in the performance of this CONTRACT.

C. COST OR PRICING DATA: If the CONTRACTOR submitted cost or pricing data in connection with the pricing of this CONTRACT or any change or modification thereto, unless such pricing was based on adequate price competition, established catalog or market prices of commercial items sold in substantial quantities to the general public, or prices set by law or regulation, the C.O. or his/her representatives who are employees of the United States Government shall have the right to examine all books, records, documents and other data of the CONTRACTOR related to the negotiation, pricing or performance of such CONTRACT, change or modification, for the purpose of evaluating the accuracy, completeness and currency of the cost or pricing data submitted. Additionally, in the case of pricing any change or modification exceeding $100,000 to formally advertised CONTRACTs, the Comptroller General of the United States or his/her representatives who are employees of the United States Government shall have such rights. The right of examination shall extend to all documents necessary to permit adequate evaluation of the cost of pricing data submitted, along with the computations and projections used therein.

D. REPORTS: If the CONTRACTOR is required to furnish CONTRACTOR Cost Data Reports (CCDR), CONTRACT Fund Status Reports (CFSR), or Cost Performance Reports (CPR) the C. O. or his/her representatives shall have the right to examine books, records, other documents, and supporting materials, for the purpose of evaluating (i) the effectiveness of the CONTRACTOR'S policies and procedures to produce data compatible with the objective of these reports, and (ii) the data reported.

E. AVAILABILITY: The materials described in (B), (C) and (D) above shall be made available at the office of the CONTRACTOR, at all reasonable times, for inspection, audit, or reproduction, until the expiration of three (3) years from the date of final payment under this CONTRACT or such lesser time specified in Appendix M of the Defense Acquisition Regulation and for such longer period, if and, as is required by applicable statute, or by other clauses of this CONTRACT, or by (1) and (2) below:

(1) If this CONTRACT is completely or partially terminated, the records relating to the work terminated shall be made available for a period of three (3) years from the date of any resulting final settlement.

(2) RECORDS WHICH RELATE TO APPEALS UNDER THE DISPUTES CLAUSE OF THIS CONTRACT, OR LITIGATION, OR THE SETTLEMENT OF CLAIMS ARISING OUT OF THE PERFORMANCE OF THIS CONTRACT, SHALL BE MADE AVAILABLE UNTIL SUCH APPEALS, LITIGATION, OR CLAIMS HAVE BEEN DISPOSED OF. FAILURE OF THE CONTRACTOR OR HIS /HER REPRESENTATIVES TO MAINTAIN AND MAKE AVAILABLE SUCH RECORDS SHALL CONCLUSIVELY BAR THE CONTRACTOR FROM MAKING ANY CLAIM CONCERNING ANY ITEM OR SUBJECT FOR WHICH RECORDS HAVE NOT BEEN MAINTAINED OR MADE AVAILABLE.

F. The CONTRACTOR shall insert a clause containing all the provisions of the above Clause, including this paragraph (F), in all subcontracts exceeding $10,000 hereunder, except altered as necessary for proper identification of the contracting parties and the C.O. under the State prime CONTRACT.

20. MATERIAL - WORKMANSHIP - LABOR

A. All material and work shall conform to the best practice. Only the best of the several kinds of materials shall be used, and the work carefully carried out in strict accordance with the general and detail drawings, under the supervision of the C.O. The Department of Military & Veterans Affairs shall be the sole determiner of "Industry Standards" for projects under its jurisdiction. The C.O. shall have full power at any time to reject such work or materials which does not, in his opinion, conform to the true intent and meaning of the CONTRACT Documents or meet the industry standard.

B. Preference shall be given at all times to materials that are manufactured or produced in the State, where such preference is possible and will best serve the interests of the State.

C. All work when completed in a substantial and workmanlike manner to the satisfaction of the C.O., shall be accepted by him in writing. Unless otherwise specified, all materials used shall be new.

D. The CONTRACTOR shall furnish and pay all necessary transportation, scaffolding, centering, forms, water, labor, tools, light and power, and mechanical appliances, and all other means, materials, and supplies for properly prosecuting his/her work under CONTRACT, unless expressly specified otherwise.

E. The CONTRACTOR shall furnish necessary materials in ample quantities and as frequently as required to avoid delay in the progress of the work, and shall so store them as to prevent interference with other branches of work not under his/her CONTRACT.

F. The CONTRACTOR shall employ qualified and competent craftsmen in his/her respective lines of work. All such employees shall be subject to approval by the C.O. Should the C.O. deem any employee incompetent or negligent or for any cause unfit for his/her duties, the CONTRACTOR shall dismiss them, and he/she shall not again be employed on the work. No CONTRACTOR will be required to employ for any work any person against whom he/she has a reasonable objection.

G. It is understood by CONTRACTOR and Subcontractors engaged in this CONTRACT, that in the employment of both skilled and unskilled labor, preference shall be given to residents of the State of New Jersey and that all such labor shall at all times be satisfactory to the C.O.

H. Any work necessary to be performed after regular working hours, on Saturdays, Sundays, or Legal Holidays, shall be performed without additional expense to the State, including reimbursement to the State for armorer standby or overtime cost.

I. No materials or supplies for the work shall be purchased by the CONTRACTOR or by any Subcontractor subject to any liens, claims, or other encumbrance or other agreement by which an interest is retained by the seller. The CONTRACTOR warrants that his/her have good title to all materials and supplies used by them in the work, free from all liens, claims or encumbrances.

21. DEFECTIVE WORK AND MATERIALS

A. Any materials or work found to be defective, or not in strict conformity with the requirements of the CONTRACT Documents, or defaced or damaged through the negligence of the CONTRACTOR, his/her Subcontractor or employees, or through action of fire or the weather or any causes, shall be removed immediately and new materials or work substituted therefore without delays by the CONTRACTOR involved.

B. No previous inspection or certificate on hand shall be held as an acceptance of defective work or materials or to relieve the CONTRACTOR from the obligation to finish sound materials and to perform good satisfactory work. The C.O. is to be the final judge of the materials and work finished.

C. If the C.O. deems it inexpedient to correct work damaged or not done in accordance with the CONTRACT, the difference in value between such work, and that specified, together with a fair allowance for consequential damage, shall be deducted from the CONTRACT price.

22. INSPECTION OF WORK

A. The C.O. and DCA shall at all times have access to the work whether it is in preparation or in progress, and the CONTRACTOR shall provide proper facilities for such access and for inspection.

B. Should it be considered necessary or advisable by the State, or by the representatives of the Chief, National Guard Bureau or Secretary of the Veterans Administration, at any time before final acceptance of the entire work to make an examination of work already completed, by removing or tearing out same, the CONTRACTOR shall on request promptly furnish all necessary facilities, labor and material. If such work is found to be defective or nonconforming in any material respect due to the fault of the CONTRACTOR or his/her subcontractors, he/she shall defray all the expenses of such examination and reconstruction. If, however, such work is found to meet the requirements of the CONTRACT, an equitable adjustment shall be made in the CONTRACT price to compensate the CONTRACTOR for the additional services involved in such examination and reconstruction; and if completion of the work has been delayed thereby, he/she shall, in addition, be granted a suitable extension or time. Federal funding support of the cost for examination and replacement of satisfactorily completed work that requires removal or that is damaged due to inspection requirements is subject to prior approval by the Chief, National Guard Bureau or Secretary of the Veterans Administration or his/her duly authorized representatives.

C. All materials and equipment used in the construction of the project shall be adequately tested according to standards of the trade, or as required by the State, all at the expense of the CONTRACTOR, except as otherwise provided herein.

D. On Federally funded projects, the authorized representative and agents of the Federal Department or Agency shall be permitted to inspect all work, materials, payrolls, records of personnel, invoices of materials, and other relevant data and records.

E. Before a certificate of substantial completion can be issued, the General Construction CONTRACTOR shall arrange for an inspection of the project by DCA, where and when applicable, with regard to all life safety systems including but not limited to: Fire alarm systems, sprinkler systems; provisions for panic egress; emergency lighting; and so forth. The General Construction CONTRACTOR shall coordinate the inspection with all of the other Prime Contractors of the project so that the life safety inspection shall be inclusive of all systems.

F. Inspection:

(1) Except as otherwise provided in subparagraph (3) hereof, all material and workmanship (if not otherwise designated by the specifications) shall be subject to inspection, examination, and testing by representatives of the C.O. at any and all times during manufacture and/or construction (and at any and all places where such manufacture and/or construction are carried on). The State shall have the right to reject defective material and workmanship or require its correction. Rejected workmanship shall be satisfactorily replaced with proper material without charge therefor, and the CONTRACTOR shall promptly segregate and remove the rejected material from the premises. If the CONTRACTOR fails to proceed at once with the replacement of rejected material and/or the correction of defective workmanship, the State may, by CONTRACT or otherwise, replace such material and/or correct such workmanship and charge the cost thereof to the CONTRACTOR, or the State may terminate the right of the CONTRACTOR to proceed as provided in this CONTRACT, the CONTRACTOR and Surety being liable for any damage to the same extent as provided in said Articles for terminations thereunder.

(2) The CONTRACTOR shall furnish promptly, without additional charge, all reasonable facilities, labor, and materials necessary for the safe and convenient inspections and tests that may be required by the C. O. or the State. All inspections and tests by the State shall be performed in such manner as not unnecessarily to delay work. Special, full size, and performance tests shall be as described in the specifications. The CONTRACTOR shall be charged with any additional cost of inspection when material and workmanship is not ready at the time inspection is requested by the CONTRACTOR.

(3) Inspection of material and finished articles to be incorporated in the work at the site may be made by C.O. or his/her representative and by the Department of Community Affairs at the place of production, manufacture, or shipment, whenever the quantity justifies it, unless otherwise stated in the specifications; and such inspection and acceptance shall be in writing, and unless otherwise stated in the specifications, shall be final, except as regards latent defects, departures from specific requirements of the CONTRACT and the specifications and drawings made a part thereof, damage or loss in transit, fraud, or such gross mistakes as amount to fraud. Subject to the requirement contained in the preceding sentence, the inspection of material and workmanship for final acceptance as a whole or in part, shall be made at the site. Nothing contained in this paragraph (3) shall in any way restrict the State's rights under any warranty or guarantee.

23. CHANGE ORDERS (ADDITIONS - DEDUCTIONS - DEVIATIONS)

A. The C.O. at his/her discretion, may at any time during the progress of the work authorize additions, deductions or deviations from the work described in the CONTRACT Documents as herein below set forth; and the CONTRACT shall not be vitiated, or the Surety released thereby.

B. Federal funding support for any change or extra is subject to prior approval by the Chief, National Guard Bureau, or Secretary of the Veterans Administration or his/her duly authorized representative.

C. Additions, deductions, deviations may be authorized as follows at the C.O.'s option;

(1) On the basis of unit price specified.

(2) On a lump sum basis.

(3) On a time and material basis.

(4) Standby time or overtime.

D. The value of any change in the CONTRACT under C-1, 2, 3, 4 shall be determined as follows:

a. On the basis of unit prices specified.

When a Change Order is authorized on the basis of a unit price included in the CONTRACT or subsequently agreed upon the unit price only is used to determine the cost of the work.

b. On a lump sum basis.

When a Change Order is authorized on a lump sum basis, the lump sum price submitted by the CONTRACTOR must include a breakdown for labor, material, insurance, profit, overhead and bond.

c. On a time and material basis.

When a Change Order is authorized on a time and material basis, the payment for such work is to be performed by a CONTRACTOR, shall include the cost for labor and materials to which may be added ten (10%) percent for overhead, Five (5%) percent for profit and one (1%) percent for bond. Where such work is to be performed by a Subcontractor of the CONTRACTOR, then, and in that event, the CONTRACTOR may add an additional ten (10%) percent only of the cost of labor and materials to be paid to them for his/her overhead. Payment for work done on a time and material basis shall be limited to the maximum (upset) price established.

d. Standby time or overtime.

When a Change Order is authorized for standby time, overhead and profit is to be limited to ten (10%) percent of the net labor cost to cover the CONTRACTOR'S overhead, profit, and bond. The limit of ten (10%) percent shall apply whether or not a Subcontractor is involved. Any claim for standby time will be rejected unless documented by the time sheets signed by the C.O.

E. When a Change Order is authorized for overtime and the work to be performed is a contractual obligation the State will pay for only the premium portion of the labor cost plus ten (10%) percent for overhead and profit, and one (1%) percent for bond.

F. All Change Orders shall be subject to audit by the C.O.

G. CONTRACTORS are not authorized to add separate administrative, internal engineering or other similar cost since the overhead allowed shall be determined to be sufficient to cover these administrative costs.

H. Should a CONTRACTOR request a Change Order or imply there could be one, he/she shall be required to submit a formal request to the C. O. within ten (10) days of identifying such request. This request shall include an itemized breakdown of the work involved and related cost. Should the CONTRACTOR fail to provide this documentation, then the C. O. shall not review this issue at any time in the future.

I. In order to avoid delays to the progress of the work, the C.O. at his/her discretion, may authorize any CONTRACTOR, in writing, to proceed and the CONTRACTOR shall so proceed with such addition, deduction, or deviation prior to the issuance of a formal Change Order. CONTRACTORS shall submit his/her proposals for any change in the work within twenty (20) calendar days from the date of authorization to proceed with the work. Should the C.O. and the CONTRACTOR not agree on costs of a change order, then the CONTRACTOR shall proceed with such work as not to delay the project. This shall not waive his/her rights to any claims under the provisions of this CONTRACT and shall not delay the C.O. from making a good faith effort to resolve the dispute.

J. All such work shall be executed under the conditions of the original CONTRACT, except that any claims for extension of time caused thereby shall be adjusted at the time of ordering such change. Except as provided herein before and except in an emergency endangering life or property, no change shall be made unless in pursuance of a written order; and no claim for an addition to the CONTRACT sum shall be valid unless so ordered. Should the CONTRACTOR perform extra work without first obtaining an order from the C.O., such action may be construed by the State as a waiver of any and all claims to extra payment therefore.

K. When work is deleted, the Prime CONTRACTOR shall submit a credit based upon an estimate which includes a bill of material and a breakdown of labor costs to which shall be added one (1%) percent for bond. When credits are involved, documented cancellation and/or restocking charges may be included.

L. When work is added and deleted on the same Change Order, resulting in net additional costs, the CONTRACTOR shall first prepare a bill-of-material and labor breakdown showing separate net costs of the added and deleted work. He shall then subtract the net cost of the selected work from the net cost of the added work and escalate the DIFFERENCE by adding ten (10%) percent for overhead, five (5%) percent for profit (both based on base amount) and one (1%) percent for bond.

M. When similar materials are to be added and deleted on the same Change Order, the difference in material quantities shall be determined before pricing and escalation. Labor costs in the same trade shall be handled in the same manner, the difference in labor hours shall be determined before pricing and escalation.

N. When work is added and deleted on the same Change Order, resulting in net credit, the CONTRACTOR shall first determine the net cost of the deleted materials, labor, and equipment comprising the credit. They shall next determine the total cost of the added material, labor and equipment rental, including escalation. The total cost of the added work shall then be subtracted from the net cost of the deleted work and the resulting difference shall become the amount of the credit Change Order.

O. When work is added by a CONTRACTOR in which a Subcontractor is used, the Subcontractor shall submit an estimate to the CONTRACTOR on <u>their own stationery</u> with supporting documentation which includes a bill of material and a breakdown of labor costs to which may be added ten (10%) percent for overhead and five (5%) percent for profit. The CONTRACTOR will be allowed to add ten (10%) percent and one (1%) percent for bond to the estimate of the Subcontractor.

P. When work is deleted by a CONTRACTOR in which a Subcontractor is used the Subcontractor shall submit to the CONTRACTOR a credit based upon an estimate on his own stationery with supporting documentation which includes a bill of material and a breakdown of labor costs. When credits are involved, documented cancellation and/or restocking charges may be included. The CONTRACTOR shall add one (1%) percent for bond to the estimate of the Subcontractor.

Q. The State reserves the right to accept or reject any combination of add or deduct alternates. Under no circumstances does the sequential order of add or deduct alternates imply he/she will be awarded in such order.

R. No Change Order shall be approved if funding is not available from the State or Federal Government. CONTRACTORS proceeding with work that is not approved under DMAVA's Change Order process shall do so at his/her sole risk without any implied cost to the State.

S. When Change Orders are identified, NJDMAVA shall have ten (10) calendar days to review and process Change Orders.

24. ALLOWANCES

A. The CONTRACTOR shall include in his proposal the cash allowances stated in the CONTRACT Documents.

B. The CONTRACTOR shall purchase the "Allowed Materials" as directed by the C.O. on the basis of the lowest and best bid of at least three (3) competitive bids. If the actual price purchasing of the "Allowed Materials" is more or less than the "Cash Allowance", the CONTRACT price shall be adjusted accordingly. The adjustment in CONTRACT price shall be made on the basis on the purchase price without additional charges for overhead, profit, insurance, or any other incidental expenses.

C. The cost installation of the "Allowed Materials" shall be included in the applicable sections of the CONTRACT specifications covering this work.

25. TIME OF COMPLETION - DELAY - LIQUIDATED DAMAGES

A. In the event of the failure of the CONTRACTOR to complete the said work within the time stated in his/her proposal, the CONTRACTOR shall be liable to the State in the sum of one hundred ($100.00) dollars per day, or the sum equal to 1/20th of one percent of the total consideration provided for under this Contract, per day, or for the sum of total costs incurred by NJDMAVA to maintain staffing of the project beyond its completion date, whichever is greater for each and every day that the paid work shall be and remain incomplete, which said sum shall be treated as liquidated damages and not a penalty, for the loss to the State of the use of the premises in a completed state of construction, alteration or repair, as the case may be, and for added administrative and inspection costs to the State on account of the delay; provided, however, that the said liquidated damages provided for herein shall be in addition to other consequential losses or damages that the State may incur by reason of such delay, such as, but not limited to, added costs of the project and the cost of furnishing temporary services, if any. Any such sums for which the CONTRACTOR is liable may be deducted by the State from any monies due or to become due to the CONTRACTOR.

B. It is hereby understood and mutually agreed, by and between the CONTRACTOR and the State, that the date of beginning and the time for completion as specified in the CONTRACT of the work to be done hereunder are ESSENTIAL CONDITIONS of this CONTRACT; and it is further mutually understood and agreed that the work embraced in this CONTRACT shall be commenced on a date to be specified in the "Notice to Proceed."

C. The CONTRACTOR agrees that said work shall be prosecuted regularly, diligently, and uninterruptedly at such rate of progress as will insure full completion thereof within the time specified. It is expressly understood and agreed, by and between the CONTRACTOR and the State that the time for the completion of the work herein is a reasonable time for the completion of the same, taking into consideration the average climatic range and usual industrial conditions prevailing in this locality.

D. If the said CONTRACTOR shall neglect, fail, or refuse to complete the work within the time herein specified, or any proper extension thereof granted by the C.O., then the CONTRACTOR does hereby agree, as a part consideration for the awarding of this CONTRACT, to pay to the State the amount specified in paragraph A above, not as a penalty but as liquidated damages for such breach of CONTRACT as hereinafter set forth, for each and every calendar day that the CONTRACTOR shall be in default after the time stipulated in the CONTRACT for completing the work.

E. The Said amount is fixed and agreed upon by and between the CONTRACTOR and the State because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the State would in such event sustain, and said amount is agreed to be the amount of damages which the State would sustain and said amount shall be retained from time to time by the State from current periodical estimates.

F. It is further agreed that time is of the essence of each and every portion of the CONTRACT and of the specifications wherein a definite and certain length of time is fixed for the performance of any act whatsoever, and where under the CONTRACT and additional time is allowed for the completion of any work, the new time limit fixed by such extension should be of the essence of this CONTRACT PROVIDED that the CONTRACTOR shall not be charged with liquidated damages, or any excess cost when the Owner determines that the CONTRACTOR is without fault and the CONTRACTOR'S reasons for the time extension are acceptable to the owner; provided further, that the CONTRACTOR shall not be charged with liquidated damages of any excess cost when the delay in the completion of the work is due:

(1) To any preference, priority, or allocation order duly issued by the Government.
(2) To unforeseeable cause beyond the control and without the fault or negligence of the CONTRACTOR, including, but not restricted to, acts of God, or of the public enemy, acts of the State, acts of another CONTRACTOR in the performance of a CONTRACT with the State which acts are contrary to the terms of such CONTRACT, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and severe weather; and
(3) To any delays of Subcontractors or suppliers occasioned by any of the causes specified in subsections (1) and (2) of this article:

G. Provided, further, that the CONTRACTOR shall, within ten (10) days from the beginning of such delay, unless the C.O. shall grant a further period of time prior to the date of final settlement of the CONTRACT, notify the State, in writing of the causes of the delay and any costs involved. The C.O. shall first ascertain the facts and extent of the delay and notify the CONTRACTOR within ten (10) working days that good cause has been shown to warrant the granting of such extension or deny the delay.

I. Should the State be prevented or enjoined from proceeding with work either before or after the start of construction by reason of any litigation or other reason beyond the control of the State to include delays caused by other state of federal agencies, the CONTRACTOR shall not be entitled to make or assert claim for damage by reason of said delay; but time for completion of the work will be extended to such reasonable time as State may determine will compensate for time lost by such delay with such determination to be set forth in writing.

26. CONSTRUCTION SIGN

A. The CONTRACTOR shall construct and install a construction sign as indicated on the drawings or as provided after the project is started. Lettering shall be as shown on the drawings and shall include the names of the subcontractors engaged on the project, and, if applicable, such State personnel as directed. The sign shall be securely installed to remain rigid and plumb, shall be maintained in good condition throughout the construction period, and shall be removed when directed by the A/E.

B. The construction sign shall indicate, when applicable, that the Federal Government is participating in the development of the project.

27. TEMPORARY DRIVES AND WALKS

A. The CONTRACTOR for general construction shall provide, maintain and remove, when no longer required, all temporary driveways, parking areas and walkways that may be necessary to allow access to all parts of the structure and for handling of materials and equipment. The CONTRACTOR shall maintain temporary access to parts of the structure and for handling of materials and equipment and keep temporary access and parking facilities clean and provide dust control by means of application of water or road oil as required.

B. Should the CONTRACTOR for the General Construction Contract elect to place any materials that will be incorporated into the permanent driveways, parking areas or walks, he/she shall not do so without having prepared the subgrade as may be elsewhere required by the specifications nor will he be relieved from any responsibility for providing additional materials or of reworking the subgrade, if required to make the improvements conform fully with the specifications.

C. The CONTRACTOR for the General Construction Contract shall obtain permission in writing from NJDMAVA before using any existing driveways or parking areas for construction purposes. He/she shall maintain such driveways and areas in good condition during the construction period, and at completion of the project, shall leave them in same condition as at the start of the work.

28. TEMPORARY BUILDINGS AND SANITARY FACILITIES

A. Owner will provide a meeting facility within the existing building for Preconstruction Meeting, Progress Meetings and Special Meetings. The CONTRACTOR shall coordinate time and dates of meetings with Owner's representative and schedule meetings and room locations in advance.

B. Contractor will be permitted to locate storage container(s) on the Base. Contractor shall coordinate locations for containers with Owner's project representative. Container's located on site shall be locked whenever the CONTRACTOR is not on premises.

C. Owner will allow CONTRACTOR to use power from the existing building. Owner will pay for power consumed by the CONTRACTOR. CONTRACTOR shall coordinate locations for access to power with Owner's representative.

D. Owner will allow CONTRACTOR to utilize potable water from the existing building. Note: Where CONTRACTOR shuts off water, accommodation will be made to provide alternate water for continued uninterrupted occupation by Owner during construction operations.

E. CONTRACTOR'S personnel shall not use the restroom facilities within the existing building. CONTRACTOR shall provide temporary restroom facilities for the use of its personnel. Locate temporary restroom facilities in location approved by Owner's Representative. The CONTRACTOR, from the commencement of the job, shall provide sufficient and sanitary toilet room facilities for the use of all persons at work. These are to be kept in sanitary conditions and at the completion of the job are to be cleaned out and removed. Sanitary facilities shall conform with the Board of Health, State and local requirements. Contractor shall have the portable facilities maintained and cleaned on a weekly basis.

F. In that temporary office facilities will not be required; the CONTRACTOR will not be required to have temporary telephone or fax service at the site. CONTRACTOR'S on-site Superintendent shall provide a cell phone number to Architect and Owner and shall be required to maintain this cell phone in operating order at all times while work is in progress on the site. CONTRACTOR shall provide the Architect and Owner with a fax number for the CONTRACTOR'S home office and CONTRACTOR'S home office shall develop procedures for prompt delivery of fax messages to the on-site Superintendent. CONTRACTOR shall provide e-mail addresses for key project personnel including the Project Manager and the On-Site Superintendent.

G. CONTRACTOR is hereby advised that the building will be occupied and in use during the construction period. However; the CONTRACTOR shall be required to provide barricades around the construction work area where barricades are required for site safety. Site safety and access control shall be the responsibility of the CONTRACTOR. CONTRACTOR shall work with the Owner's representatives to coordinate safety requirements and access control during the construction period. Coordinate access keying for the affected doors with the Owner.

H. CONTRACTOR is advised that parking at the site is permitted in accordance with local policies. CONTRACTOR shall coordinate worker parking with the Owner's representative. Owner takes no responsibility for illegal parking by the CONTRACTOR'S personnel.

29. TEMPORARY ENCLOSURES, GLASS BREAKAGE AND CLEANING (IF REQUIRED)

A. Whenever necessary, in order to maintain proper temperatures for the prosecution of the work, or for the protection thereof, the General CONTRACTOR shall furnish and maintain temporary enclosures for all openings in exterior walls that are not enclosed with finishing materials. Window sash may be installed and glazed. Temporary wood doors shall be provided at door openings.

B. The General CONTRACTOR shall be responsible for all breakage of glass after same has been installed, no matter by whom or what caused, and shall replace all broken, scratched or otherwise damaged glass before the completion and acceptance of the work.

C. The General CONTRACTOR shall wash all glass on both sides at completion, or when directed, removing all paint spots, stains, plaster, etc.

D. The General CONTRACTOR shall provide and maintain necessary temporary dustproof partitions around areas of work in any existing building.

E. Chemical fire extinguishers shall be provided by the CONTRACTOR for general construction and meet all O.S.H.A. requirements.

30. HOISTING

The CONTRACTOR shall be responsible for hoisting and distributing his/her own material and equipment throughout the project.

31. FIRE PROTECTION

A. The CONTRACTOR shall perform his/her work on or about the premises in a careful manner with full consideration to fire protection as required by the State DCA Fire Official, National Fire Protection Association Code, U.C.C. Codes, and The National Board of Fire Underwriters having jurisdiction. Fire resistant materials shall be used for temporary enclosures.

B. Chemical extinguishers approved by the C.O. shall be provided by the CONTRACTOR during the progress of the work where and as required by the State Fire Marshall, the Local Fire Department, and the National Board of fire Underwriters, except in storage sheds, warehouses, CONTRACTOR'S Offices, workmen's temporary. Chemical extinguisher shall also meet all O.S.H.A. requirements.

C. The CONTRACTOR shall maintain an active program of fire prevention to keep workman fire conscious during the entire life of the CONTRACT. He/she shall designate one member of his/her organization to execute and coordinate fire control measures of his/her own organization, that of all Subcontracting under his/her jurisdiction and that of all other subcontractors at the site. He/she shall report to the C.O. any lack of cooperation or refusal to participate on the part of the CONTRACTOR or Subcontractor with regard to the fire prevention program.

D. Each Subcontractor shall cooperate with the CONTRACTOR in carrying out the above program.

E. The CONTRACTOR shall be responsible for periodic cleaning up of the building and premises to eliminate fire hazards, and he/she shall remove all of his/her refuse from the project site. Should a dispute arise relative to responsibility, the decision of the C.O. shall be final and binding. If a CONTRACTOR fails to remove debris from the site within three (3) working days after he/she has been given written notice to do so by the C.O., the C.O. will have the debris removed by others and the cost backcharged to the CONTRACTOR(s) responsible.

F. Storage of flammable material will not be permitted in the new structure or existing buildings unless written permission is obtained from the C.O. Storage of all such materials shall be the interested CONTRACTOR'S responsibility.

G. On-site open burning of rubbish, garbage, trade waste, leaves or plant life is strictly prohibited in accordance with New Jersey Air Pollution Control Code, effective October 11, 1971, as promulgated by New Jersey Department of Environmental Protection.

32. PROTECTION - PUMPING - WEATHER CONDITIONS

A. The CONTRACTOR shall protect all trees, shrubs, lawns and all landscape work from damage and shall provide such guards and covering as necessary. All damaged items shall be repaired or replaced at the CONTRACTOR'S expense to the satisfaction of the C.O. Special precaution shall be taken to protect the floors from damage at all times.

B. It shall be the responsibility of the CONTRACTOR at all times to protect the building excavations, trenches up to 10 feet from the building and the building from water damage, including damage by rainwater, ground water, backing up of drains, downspouts or sewers. The CONTRACTOR shall construct and maintain all necessary drainage and do all pumping required to keep the structure free from water and shall perform any pumping necessary for the full and proper execution of the construction work and protection of the building including all equipment installed therein.

C. Beyond a point ten feet from the building, it shall be the responsibility of the CONTRACTOR installing underground pipes, conduits, cables, or heat transmission lines to protect the trenches by shoring or other methods and perform all pumping required to dispose of the surface and subsurface water to permit the satisfactory performance of the work. The CONTRACTOR shall provide his/her own pumping equipment of adequate capacity and shall be responsible for all fuel, cost of operators and supervision.

D. The CONTRACTOR shall remove all snow and ice as may be required for the proper protection and prosecution of his/her CONTRACT and to provide access to the building for the other subcontractors.

E. In the event of temporary suspension of work, or during inclement weather, or whenever the C.O. shall direct, the CONTRACTOR shall cause his/her subcontractors to protect carefully his/her work and materials against damage from the weather. If, in the opinion of the C.O., any work or materials shall have been damaged by reason of failure on the part of the CONTRACTOR or any of his/her Subcontractors so to protect his/her work, such materials shall be removed and replaced at the expense of the CONTRACTOR.

F. Unless otherwise shown in the CONTRACT documents, the CONTRACTOR shall provide minimum protection of the construction area by means of enclosure by four foot high snow fence.

EXCAVATION, TRENCHING AND BACKFILL (ALL TRADES):

(1) The CONTRACTOR shall do all excavation of earth that may be required for the installation of his/her work. The CONTRACTOR and subcontractors shall also do all the necessary backfilling, rough grading, removal of surplus earth of other materials, repaving or replacing of hard surfaced areas which he disturbs. Remove all water that may accumulate in any excavation necessary for this work and furnish sheet piling where required. They shall re-sod or reseed grass area he disturbs.

(2) The CONTRACTOR and/or his/her subcontractors shall be fully responsible for any accident that may occur to any person or property during the hours of the work and shall fully defend, protect and hold the owner harmless from all claims.

(3) The CONTRACTOR and/or his/her subcontractors shall furnish all plant, labor, equipment, appliances, and materials and perform all operations in connection with the excavation, trenching and backfilling for all piping requiring trenching as indicated on the drawings and which is installed under this specification.

(4) Where streets, roads or any other property other than that of the owner must be disturbed it shall be the responsibility of this CONTRACTOR to make all necessary arrangements, obtain all permits and pay required fees.

(5) EXCAVATION: The CONTRACTOR and their subcontractors shall perform all excavation of every description and of whatever substances encountered, to the proper depth as required for his work or as otherwise specified. During excavation, materials suitable for backfilling shall be piled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and prevent slides or cave- ins. All excavated materials not required or suitable for backfill shall be removed and wasted as indicated on the drawings or as directed by the C.O. Such grading shall be done as may be necessary to prevent surface water from flowing into trenches or other excavation and any water accumulating therein shall be removed by pumping or other approved methods. Such sheeting and shoring shall be done as may be necessary for the protection of the work and for the safety of personnel. Unless otherwise indicated, excavation shall be by open-cut except that short section of a trench may be tunneled; if, in the opinion of the C.O., the pipe can be safely and properly installed and backfill can be properly tamped in such section. Earth excavation shall comprise all materials not classified as rock excavation, and shall include clay, silt, sand, muck, gravel, hard pan, loose shale, loose stone in masses and boulders measuring less than that defined as rock.

(6) TRENCH EXCAVATION: Trenches shall be of necessary width for the proper laying of the pipe, and the banks shall be accurately graded and machine tamped to provide uniform bearing and support for each section of the pipe on undisturbed soil at every point along its entire length, except for the portions of the pipe sections where it is necessary to excavate the bell holes and for the proper sealing of pipe joints. Bell holes and depression for joints shall be dug after the trench bottom has been graded, and in order that the pipe rest upon a prepared bottom for as nearly its full length as practicable, bell holes and depressions shall be only such length, depth, and width as required for properly making the particular type of joint. Except where rock is encountered care shall be taken not to excavate below the depth indicated. Over depths in the rock excavation and unauthorized over-depths shall be backfilled with loose, granular, moist earth, and thoroughly machine tamped. Whenever wet or otherwise unstable soil that is incapable of properly supporting the pipe, as determined by the Contracting Officer, is encountered in the bottom of the trench, such soil shall be removed to the depth required and the trench backfilled to the proper grade with crushed stone, coarse sand, fine gravel, or other suitable material.

(7) PROTECTION OF EXISTING UTILITIES: Existing utilities shall be protected from damage during the excavation and backfilling of trenches and, if damaged, shall be repaired by the CONTRACTOR at his/her expense.

(8) BACKFILLING: The trenches shall not be backfilled until all required pressure tests are performed and until the piping installed conforms to the requirements specified in the various sections of the specifications. The trenches shall be carefully backfilled with clay, sand and gravel, soft shale, or other approved materials, free from large clogs of earth or stones, deposited in six inch (6") layers and thoroughly and carefully tamped until the pipe has a cover of not less than one foot (1') for water and gas piping and two feet (2") for sanitary and storm sewers and all others. Where piping is specially coated for protection against corrosion, care shall be taken not to damage the coating. The remainder of the backfill materials shall then be laid into the trench in one foot (1') layers and tamped. Setting the backfill with water will be permitted and will be a requirement when so directed by the C.O. Any trenches improperly backfilled, or where settlement occurs, shall be reopened to the depth with the surface restored to the required grade and compaction, mounded over, and smoothed off. Open trenches across roadways, or other areas to be paved shall be backfilled in six inch (6") layers, and each layer shall be moistened and compacted to a density at least equal to that of the surrounding earth filled trench with adjoining earth to provide the required bearing value, so the paving of the area can proceed immediately after backfilling is completed. Along all the mounding over the trenches left in a uniform and neat condition to the satisfaction of the C.O.

(9) TESTS FOR DISPLACEMENT OF SEWERS: Storm and sanitary sewers will be checked by the C.O. to determine whether any displacement of the pipe has occurred after the trench has been backfilled to two feet (2') above the pipe and tamped as specified. The tests will be as follows: A light will be flashed between manholes or between sections of pipe by means of flashlight to determine if the interior of the pipe line shows poor alignment, displaced pipe, or other defects. The CONTRACTOR at his expense shall remedy the defects designated by the C.O.

33. SAMPLES

The CONTRACTOR shall furnish for approval all samples as directed. The work shall be in accordance with approved samples. Such samples shall be submitted promptly to the C.O. at the beginning of the work, so as to give the C.O. ample time to examine them. Any list of samples prepared by the CONTRACTOR is for the C.O.'s convenience only, and shall not be construed as limiting the number of samples which the CONTRACTOR shall furnish.

34. TESTING OF EQUIPMENT

A. When mechanical, electrical and/or other equipment is installed, it shall be the responsibility of the CONTRACTOR to operate it for a satisfactory period of time as required by the C.O. for proper testing of the equipment and instructing the State's operating personnel.

B. Fuel, power and any other items and/or services required for proper testing of equipment and for the period of instructing personnel shall be provided at the expense of the CONTRACTOR.

C. Tests shall be conducted in the presence of the State inspector. Test results shall be submitted and approved by the C.O. prior to acceptance of the installation.

D. All subcontractors installing any equipment shall thoroughly train the State's operating personnel in the operation, adjustment, and maintenance of all equipment.

E. DMAVA shall require witnessing of all certification and/or testing of major pieces of equipment. Notice of such testing shall be given to DMAVA five (5) days in advance of all tests.

35. CONCRETE AND OTHER STRUCTURAL TESTING

A. Concrete testing shall be performed by a testing company selected by the CONTRACTOR, approved by the C.O., and paid for by the CONTRACTOR. The testing laboratory will perform the following work:

(1) Design mixes for controlled concrete.

(2) Take and test cylinders of concrete as poured. Four (4) test specimens will be made for each 50 cubic yards of concrete placed or not less than four (4) cylinders for each day's pour.

(3) Plant inspection at batching plant.

(4) Field inspection of all concrete when being poured.

(5) Make slump tests in the field in accordance with ATSM requirements. (6)

Submit reports to the State and the Engineer.

B. A testing company selected by the CONTRACTOR, approved by the C.O. and paid for by the CONTRACTOR shall perform other structural testing and inspection, when determined as necessary by the C.O.

C. Each CONTRACTOR shall cooperate fully with the testing company and supply materials for testing as required.

D. Required testing shall include, but not be limited to, soils, concrete, steel and fireproofing.

36. OPENING-CHANNELS-CUTTING-ETC.

A. The CONTRACTOR shall be responsible for furnishing and setting of sleeves, built-in items, anchors, inserts, etc. for his/her work. The CONTRACTOR shall build these items into the construction.

B. The CONTRACTOR shall build recesses, channels, chases, openings and flues and leave holes where shown on drawings or where directed for steam, water or other piping, electrical conduits, switch boxes, panelboards, flues and ducts, or any other feature of the heating and ventilation work. All subcontractors requiring such recesses, channels, chases, openings, etc. shall furnish to the CONTRACTOR through the Project Manager complete detail drawings for all chases and openings required in connection with the work. Such information shall be furnished in complete form and in ample time to allow the construction work proceed without interruption or delay. At least three (3) copies of such drawings shall be furnished to the C.O.

C. The CONTRACTOR shall close, build in and finish around or over all openings, chases, channels, pockets, etc. after installation has been completed.

D. In the event that any CONTRACTOR fails to furnish the information as above required in time, said CONTRACTOR shall at his/her own expense do all cutting, rebuilding and finishing and shall employ the CONTRACTOR for such work.

E. Positive instructions in writing shall be obtained from the C.O. before cutting or boring any floor beams, floor constructions or supporting members.

37. CUTTING-PATCHING-DIGGING

A. The CONTRACTOR shall do all cutting, fitting or adjusting of his/her work that may be required to make its several parts come together properly, and fit it to receive or be received by work of other subcontractors shown upon, or reasonably implied by the CONTRACT documents for the completed structure and he/she shall make good after them, as the C.O. may direct.

B. Any cost caused by defective work or failure to coordinate shall be borne by the CONTRACTOR responsible thereof.

C. The CONTRACTOR shall not endanger the work of others by cutting, digging or otherwise altering the work of any other CONTRACTOR save with the consent of the C.O.

D. The General CONTRACTOR shall have the final responsibility for the following: clean-up of premises and patching of all work. If the cleanup is not accomplished within twenty-four (24) hours of written notice from C.O. or General CONTRACTOR, DMAVA shall have the option to withhold final payment in accordance with Article 18 (PAYMENT WITHHELD) of this document.

38. JOB MEETING

A. The CONTRACTOR and any subcontractors, material man or vendor whose presence is necessary, shall attend job meetings when called by the A/E, the Construction Manager or the C.O. for the purpose of discussing the execution of the work, unless excused in writing by the A/E, the Construction Manager or the C.O.

B. Meetings will be held at least once every week at the time and place designated by the C.O. All decisions, instructions and interpretations given by the C.O. at these meetings shall be binding and conclusive on the CONTRACTOR. The proceedings of these meetings will be recorded by the C.O. or his representative; and each CONTRACTOR will be furnished a reasonable number of copies for his use and for distribution to the various subcontractors, materialmen and vendors involved.

C. The CONTRACTOR for general construction shall attend the Quality Review Board meetings which when applicable, shall be held a minimum of once a month.

39. PHOTOGRAPHS

A. With each monthly application for payment, until the exterior of the building is completed, the General CONTRACTOR shall submit progress photographs of the building in duplicate, giving two (2) views of each building as selected by the A/E, or the Construction Manager and/or C.O., taken from the same points each month.

B. The photographs shall be digital, in color, and the photographs shall bear the date of the exposure, the name of the project, the CONTRACTOR and the CO.

C. The photographs are to be submitted monthly at the project meetings. The photographic record shall include but not be limited to:
   (1) All new structures on site.
   (2) All site work.
   (3) Landscaping.
   (4) All representative interior space.
   (5) Work that shall be enclosed.

40. WORK FURNISHED BY OTHER

A. The State may, and reserves the rights to, enter upon the premises at any and all times during the progress of the work, or cause others to do so, for the purpose of installing any apparatus or carrying on any construction not included in this specification. The CONTRACTOR shall not commit or permit any act which will interfere with the performance of work by the CONTRACTOR or by State employees.

B. The CONTRACTOR shall examine all work or materials not included in his/her CONTRACT, the installation of which will affect the work in his/her CONTRACT, and should the same be imperfect, incorrect or insecure, he/she shall notify the C.O. immediately in order that the same may be rectified.

41. USE OF PREMISES AND REMOVAL OF DEBRIS

A. Each CONTRACTOR expressly undertakes at his/her own expense:

(1) To take every precaution against injuries to persons or damage to property.

(2) To store his apparatus, materials, supplies, and equipment in such orderly fashion at the site of the work as will not unduly interfere with the progress of his/her work or the work of any other person.

(3) To place upon the work or any part thereof only such loads as are consistent with the safety of that portion of the work.

(4) To clean up frequently all refuse, rubbish, scrap materials, and debris caused by his/her operations, to the end that at all times the work shall present a neat, orderly and workmanlike appearance.

(5) To remove all surplus material, false work, temporary structures, including foundations thereof, plant of any description, and debris of every nature resulting from his operations, and to put the site in a neat, orderly condition before final payment.

(6) In case of dispute, the State may remove the rubbish and charge the cost to the several CONTRACTORS as the C.O. shall be determined to be just.

(7) All materials of any kind or character belonging to the CONTRACTOR which shall remain upon the premises where the work is being performed after the expiration of sixty (60) calendar days from the date of certificate of final acceptance issued by the State of the CONTRACTOR shall become absolutely the property of the State, subject to be used and disposed of by the State as the State may deem proper.

(8) The CONTRACTOR shall provide dumpsters for use by all subcontractors. The CONTRACTOR shall place his/her debris in the dumpster(s).

(9) If medical waste or hazardous materials are discovered, then the CONTRACTOR shall notify the C.O. immediately. The subcontractors' responsibility for removal of this debris is not eliminated because it is classified as hazardous.

B. The CONTRACTOR shall have the final responsibility for clean-up and/or patching of all work and the removal of debris. Should he/she fail to clean up or patch any portion of the site, then the C.O. will proceed to make the necessary repairs and clean up the area and charge the CONTRACTOR for the amount of work performed.

42. FEDERAL EXCISE TAXES AND STATE SALES TAX

A. Under Chapter 32 of the Internal Revenue Code an exemption covering this exemption is on file with the Director of Purchase and Property and is Number A- 257217. Excise taxes are not to be included in the proposal.

B. CONTRACTORS are exempt from sales tax on State work.

43. PATENTS

A. The CONTRACTOR shall hold and save the State and its officers, agents, servants, and employees harmless from liability of any nature or kind, including cost and expenses for, or on account of, any patented or unpatented invention, process, article, or appliance manufactured or used in the performance of the CONTRACT, including its use by the State, unless otherwise specifically stipulated in the CONTRACT Documents.

B. License or Royalty Fees: License and/or Royalty Fees for the use of a process, which is authorized by the State, must be reasonable. Payment of such fees shall be made directly to the holder of the patent and his/her authorized licensee by the State. Such payments shall not be made through the CONTRACTOR.

C. If the CONTRACTOR uses any design, device or materials covered by letters, patent or copyright, he/she shall provide for such use by suitable agreement with the State of such patented or copyrighted design, device or material. It is mutually agreed and understood that, without exception, the CONTRACT prices shall include all royalties, or costs arising from the use of such design, device or materials, in any way involved in the work. The CONTRACTOR and/or his/her Sureties shall indemnify and save harmless the owner of the project from any and all claims for infringement by reason of the use of such patented or copyrighted design, device or materials or any trademark or copyright in connection with work agreed to be performed under this CONTRACT, and shall indemnify the State for any cost, expense or damage which it may be obliged to pay by reason of such infringement at any time during the prosecution of the work or after completion of the work.

44. SUBSURFACE CONDITIONS FOUND DIFFERENT

A. Should the CONTRACTOR encounter subsurface and/or latent conditions at the site materially differing form those shown on the plans or indicated in the specifications, he/she shall immediately give written notice to the C.O. of such conditions before he/she are disturbed.

B. The C.O. will thereupon promptly investigate the conditions, and if he/she find that they materially differ from those shown on the plans or indicated in the specifications, he/she will at once make such changes in the plans and/or specifications as he/she may find necessary. Any increase or decrease of cost resulting from such changes may, in the sole discretion of the C.O., be adjusted in the manner provided in Articles 24 and 25 of the General Conditions.

45. UNCLASSIFIED EXCAVATION

A. All excavation work under all CONTRACT's shall be considered unclassified excavation. Unclassified excavation shall consist of the removal of earth, rock, abandoned utilities, foundations and all other materials encountered of whatever nature.

B. When explosives are used, work shall be executed by experienced powdermen who are licensed, or otherwise authorized to use explosives. Explosives shall be stored, handled and used in accordance with

C. L ocal regulations and the "Manual of Accident Prevention in Construction" of the Associated General Contractors of America, Inc. Any damage to foundations or other work caused by the use of explosives shall be corrected at the CONTRACTOR's expense.

46. SOIL BORINGS

Where data pertaining to test pits, test borings, or any like information orally, by drawings or in writing, are given, he/she are for general information only and shall not relieve the CONTRACTOR, bidding on this work, from the responsibility for making such investigations as may be necessary to insure that his/her bid is based on actual conditions.

47. PAY LIMITS FOR ADDITIONS OR DEDUCTIONS

A. The method of measurement and establishment of pay limits for additions or deductions for excavation shall be as follows:

(1) BASEMENT EXCAVATIONS: Pay limit for excavation shall be in accordance with cross sections limited by vertical parallel planes extending twenty-four inches (24") outside of foundation walls shown on CONTRACT drawings, and horizontal plane along bottom of basement concrete slab or footing.

(2) ALL PIPELINES AND UNCASED UTILITIES: Pay limit for trench excavation shall be limited to width of thirty-six inches (36") or the largest diameter of pipe barrel plus twenty-four inches (24"), whichever is greatest, and depth at bottom of pipe barrel. When rock is encountered, CONTRACTOR shall excavate to six inches (6") below bottom of pipe barrel. A compacted granular fill bed for the pipe shall be provided by CONTRACTOR. No additional payment will be made for this additional six inches (6") of granular fill.

(3) ENCASED ELECTRICAL CONDUIT, STEAM TRANSMISSION LINES, UNFORMED FOUNDATION FOOTINGS: Width and depth of trench shall be limited to same width and elevations of structure shown on CONTRACT drawings.

(4) Where unsuitable foundation material is encountered, the CONTRACTOR shall excavate to elevations as directed by the C.O. Unit prices for additional excavation and replacement with approved compacted granular fill, stated in the proposal form, shall be used as a basis for additional payment by the State.

48. QUANTITIES OF ESTIMATE

A. Wherever the estimated quantities of work to be done and materials to be furnished under the CONTRACT are shown in any of the documents including the proposal, his/her are given for use in comparing bids and the right is especially reserved except as herein otherwise specifically limited, to increase or decrease as may be deemed reasonably necessary or desirable by the State to complete the work contemplated by this CONTRACT, and such increase or decrease shall in no way vitiate this CONTRACT, nor shall any such increase or decrease give cause for claims or liability for damages.

49. LANDS AND RIGHTS-OF-WAY

Prior to the start of construction, the State shall obtain all lands and rights-of-way necessary for the carrying out and completion of work to be performed under this CONTRACT.

50. CUT OVERS

All cutovers of existing mechanical services shall be done at a time convenient to the C.O. so as not to interfere with facility operations (water line cut-line by wet tap will be permissible during regular working hours).

51. INFRASTRUCTURE INVESTMENT AND JOBS ACT ("IIJA)

AGREEMENT: In accordance with the Pub. L. No. 117-58, which includes the Build America, Buy America Act ("the Act"). Pub. L. No. 117-58, §§ 70901-52. The Act strengthens Made in America Laws and will bolster America's industrial base, protect national security, and support high-paying jobs. The Act requires that the head of each Federal agency shall ensure that "none of the funds made available for a Federal financial assistance program for infrastructure may be obligated for a project unless all of the iron, steel, manufactured products, and construction materials used in the project are produced in the United States."

A. The CONTRACTOR agrees that only domestic construction material will be used (by the CONTRACTOR, subcontractors, materialmen, and suppliers) in the performance of this CONTRACT, except for nondomestic construction material listed in the "Nondomestic Construction Materials" Clause, if any, of this CONTRACT.

B. DOMESTIC CONSTRUCTION MATERIAL: "Construction material" means any article, material, or supply brought to the construction site for incorporation in the building or work. An unmanufactured construction material is a "domestic construction material" if it has been mined or produced in the United States. A manufactured construction material is a "domestic construction material" if it has been manufactured in the United States and if the cost of its components which have been mined, produced, or manufactured in the United States exceeds 50% of the cost of all its components. "Component" means any article, material, or supply directly incorporated in a construction material.

C. DOMESTIC COMPONENT: A component shall be considered to have been "mined, produced, or manufactured in the United States" (regardless of its source in fact) if the article, material, or supply in which it is incorporated was manufactured in the United States and the component is of a class or kind determined by the Government to be not mined, produced, or manufactured in the United States in sufficient and reasonably available commercial quantities and of a satisfactory quality.

52. WATCHMEN

A. The CONTRACTOR may provide watchmen service throughout the period of construction to adequately protect the work, stored materials and temporary structures located on the premises. Additionally, watchmen shall be used to prevent unauthorized persons from entering upon the construction site.

B. Watchman may be employed to cover a twenty-four hour, seven day per week schedule. It may be necessary to employ more than one watchman because of the size of the facility or project. The watchman must use a designated roving patrol as established by the General CONTRACTOR. He/she shall maintain a log of his/her activities and unusual events.

C. It shall be the responsibility of all primes to provide the watchman with a list of names of individuals who shall be working overtime and weekends prior to said time.

D. The watchman shall be provided a Standard Operating Procedures Manual as prepared by the General CONTRACTOR and at a minimum the SOP shall include:

(1) Emergency telephone numbers for Police, Fire and ambulance
(2) CONTRACTOR emergency telephone numbers
(3) NJDMAVA emergency personnel and telephone numbers
(4) Procedures indicating action to be taken upon the discovery of theft.

E. Employment of a Watchman shall commence on the first day that equipment and material are stored on site.

F. The CONTRACTOR and their subcontractors shall adequately secure and protect his own tools, equipment, materials and supplies.

THE FOLLOWING ARTICLES, 53 to 64 INCLUSIVE, ARE APPLICABLE TO FEDERALLY FUNDED PROJECTS ONLY.

53. INTEREST OF MEMBER OF OR DELEGATE TO CONGRESS

No member of or Delegate to Congress shall be admitted to any share or part of this CONTRACT or to any benefit that may arise therefrom, but this provision shall not be construed to extend to this CONTRACT if made with a corporation for its general benefit.

54. OTHER PROHIBITED INTERESTS

A. No official of the Owner who is authorized in such capacity and on behalf of the Owner to negotiate, make, accept or approve, or to take part in negotiating, making, accepting, or approving any architectural, engineering, inspection of construction, or material supply CONTRACT or any Subcontract in connection with the construction of the project, shall become directly or indirectly interested personally in this CONTRACT or in any part thereof.

B. No officer, employee, architect, attorney, engineer, or inspector of or for the State who is authorized in such capacity and on behalf of the State to exercise any legislative, executive, supervisory, or other similar function in connection with the construction of the project, shall become directly or indirectly interested personally in this CONTRACT or in any part thereof, any material supply CONTRACT, subcontract, insurance CONTRACT, or other CONTRACT pertaining to the project.

55. WITHHOLDING OF FUNDS (1977 DEC)

A. The C. O. may withhold or cause to be withheld from the State prime CONTRACTOR so much of the accrued payments or advances as may be considered necessary (i) to pay laborers and mechanics, including apprentices, trainees, watchmen, and guards, employed by the CONTRACTOR or any subcontractor on the work the full amount of wages required by the CONTRACT, and (ii) to satisfy any liability of the CONTRACTOR and any subcontractor for liquidated damages under paragraph (B) of the Clause entitled CONTRACT WORK HOURS AND SAFETY STANDARDS ACT OVERTIME COMPENSATION.

B. If the CONTRACTOR or any subcontractor fails to pay any laborer, mechanic, apprentice, trainee, watchman, or guard employed or working on the site of the work, all or part of the wages required by the CONTRACT, the C.O. may, after written notice to the State prime CONTRACTOR, take such action as may be necessary to cause suspension of any further payments of advances until such violations have ceased.

56. PAYROLLS AND BASIC RECORDS (1977 DEC)

A. The CONTRACTOR shall maintain payrolls and basic records relating thereto during the course of the work and shall preserve them for a period of three (3) years thereafter for all laborers and mechanics, including apprentices, trainees, watchmen, and guards, working at the site of the work. Such records shall contain the name and address of each such employee, his/her correct classification, rate of pay (including rates of contributions for, or costs assumed to provide, fringe benefits), daily and weekly number of hours worked, deductions made and actual wages paid. (NOTE: Watchmen and guards are reflected on payroll records for Contract Work Hours and Safety Standards Act purposes only.) Whenever the CONTRACTOR has obtained approval from the Secretary of Labor as provided in paragraph (C) of the Clause entitled DAVIS-BACON ACT, he shall maintain records which show the commitment, its approval, written

B. Communication of the plan or program to the laborers or mechanics affected, and the costs anticipated or incurred under the plan or program.

C. The CONTRACTOR shall submit weekly a copy of all payrolls to the CO.. The State prime CONTRACTOR shall be responsible for the submission of copies of payrolls of all subcontractors. The copy shall be accompanied by a statement signed by the CONTRACTOR indicating that the payrolls are correct and complete, that the wage rates contained therein are not less than those determined by the Secretary of Labor, and that the classifications set forth for each laborer or mechanic, including apprentices and trainees, conform with the work he performed. Weekly submission of the "Statement of Compliance" required under this CONTRACT and the Copeland Regulations of the Secretary of Labor (29 CFR, Part 3) shall satisfy the requirement for submission of the above statement. The CONTRACTOR shall submit also a copy of any approval by the Secretary of Labor with respect to fringe benefits which is required by paragraph (C) of the Clause entitled DAVIS-BACON ACT.

D. The CONTRACTOR shall make the records required under this Clause available for inspection by authorized representatives of the C.O. and the Department of Labor, and shall permit such representatives to interview employees during working hours on the job.

57. APPRENTICES AND TRAINEES (1977 DEC)

A. Apprentices will be permitted to work at less than the predetermined rate for the work he/she performed when he/she are employed and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State apprenticeship agency recognized by the Bureau, or if a person is employed in his first ninety (90) days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State apprenticeship agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen in any craft classification employed on this CONTRACT shall not be greater than the ratio permitted to the CONTRACTOR as to his/her entire work force under the registered program. Any employee listed on a payroll at an apprentice wage rate, who is not a trainee as defined in paragraph (B) of this Clause or is not registered or otherwise employed as stated above, shall be paid the wage rate determined by the Secretary of Labor for the classification of work he actually performed. The CONTRACTOR or subcontractor shall furnish to the Contracting Officer written evidence of the registration of his program and apprentices as well as the appropriate ratios and wage rates (expressed in percentages of the journeyman hourly rates), for the area of construction prior to using apprentices on the CONTRACT work. The wage rate paid apprentices shall be not less than the appropriate percentage of the journeyman's rate contained in the applicable wage determination.

B. Trainees will be permitted to work at less than the predetermined rate for the work performed when his/her are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification, by the U.S. Department of Labor, Employment and Training Administration, Bureau of Apprenticeship and Training. The ratio of trainees to the journeyman on this CONTRACT shall not be greater than permitted under the plan approved by the Bureau of Apprenticeship and Training. Every trainee must be paid at not less than the rate specified in the approved program for his level of progress. Any employee listed on the payroll at a trainee rate who is not registered and not participating in a training plan approved by the Bureau of Apprenticeship and Training shall be paid not less than the wage rate determined by the Secretary of Labor for the classification of work he actually performed. The CONTRACTOR or subcontractor shall furnish the C.O. written evidence of the certification of his program, the registration of the trainee, and the ratios and wage rates prescribed in that program. In the event the Bureau of Apprenticeship and Training withdraws the approval of a training program, the CONTRACTOR shall no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

C. The utilization of apprentices, trainees, and journeymen under this Clause shall be in conformity with the equal employment opportunity requirements of this CONTRACT.

58. COPELAND ("ANTI-KICKBACK") ACT-NONREBATE OF WAGES

The regulations of the Secretary of Labor applicable to contractors and subcontractors (29 CFR, Part 3) made pursuant to the Copeland Act, as amended (40 U.S.C. 276c) and to side in the enforcement of the Anti-Kickback Act (18 U.S.C. 874) are made a part of this CONTRACT by reference. The CONTRACTOR will comply with these regulations and any amendments or modifications thereof and the prime CONTRACTOR will be responsible for the submission of affidavits required of subcontractors thereunder; the foregoing shall apply except as the Secretary of Labor may specifically provide for reasonable limitations, variations, tolerances and exemptions.

59. CONTRACT TERMINATION: DEBARMENT

A. A breach of Articles 67 through 78 as well as a breach of any other material provisions of this contract may be grounds for termination of the CONTRACT and for debarment as provided in 29 CFR. 5.6.

B. Title 29 of Code of Federal Regulations, part 5.6 as printed in the Federal Register of January 4, 1964 may be obtained from General Services Administration, Washington, D.C.

60. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT-OVERTIME COMPENSATION (40 U.S.C. 327-333) (1977 DEC)

A. This Contract is subject to the Contract Work Hours and Safety Standards Act and to the applicable rules, regulations, and interpretations of the Secretary of Labor.

B. The CONTRACTOR shall not require or permit any laborer or mechanic, including apprentices, trainees, watchmen, and guards in any workweek in which he is employed on any work site under this CONTRACT to work in excess of eight (8) hours in any calendar day or in excess of forty (40) hours in such workweek on work subject to the provisions of the CONTRACT Work Hours and Safety Standards Act unless such laborer or mechanic, including apprentices, trainees, watchmen, and guards, receives compensation at a rate not less than one and one-half times his basic rate or pay for all such hours worked in excess of eight (8) hours in any calendar day or in excess of forty (40) hours in such workweek, whichever is the greater number of overtime hours. The "basic rate of pay," as used in this Clause, shall be the amount paid per hour, exclusive of the CONTRACTOR'S contribution or cost for fringe benefits and any cash payment made in lieu of providing fringe benefits, or the basic hourly rate contained in the wage determination, whichever is greater.

C. In the event of any violation of the provisions of paragraph (A), the CONTRACTOR shall be liable to any affected employee for any amount due, and to the United States for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including an apprentice, trainee, watchman, or guard, employed in violation of the provisions of paragraph (A) in the sum of $10 for each calendar day on which such employee was required or permitted to be employed on such work in excess of eight (8) hours or in excess of the standard workweek of forty (40) hours without payment of the overtime wages required by paragraph (A).

61. CONVICT LABOR

In connection with the performance of work under this CONTRACT, the CONTRACTOR agrees not to employ any person undergoing sentence of imprisonment, as provided by Public Law 89-176, September 10, 1965 (18 USC 4082 (c) (2) and Executive Order 11755, December 29, 1973.

62. CONTRACTOR WILL COMPLY WITH THE NEW JERSEY STATUTES AND ALL RULES AND REGULATIONS ISSUED THEREUNDER PROHIBITING DISCRIMINATION IN EMPLOYMENT.

EQUAL OPPORTUNITY (FEDERALLY ASSISTED CONSTRUCTION) (1972 AUG)

NONDISCRIMINATION IN EMPLOYMENT - In connection with the performance of work under this CONTRACT, the CONTRACTOR agrees not to discriminate against any employee or applicant for employment because of sex, race, creed, color, or national origin; and further agrees to insert the foregoing provision in all subcontracts hereunder except subcontracts for standard commercial supplies or for raw materials.

EQUAL OPPORTUNITY FEDERALLY ASSISTED CONSTRUCTION (1978 SEP)- If, during any twelve (12) month period (including the 12 months preceding the award of this CONTRACT), the CONTRACTOR has been or is awarded Federal contracts or federally assisted contracts and/or subcontracts which have an aggregate value in excess of $10,000, the CONTRACTOR shall comply with (1) through (7) below. Upon request, the CONTRACTOR shall provide information necessary to determine the applicability of this Clause.

The CONTRACTOR hereby agrees that it will incorporate or cause to be incorporated into any CONTRACT for construction work, or modification thereof, as defined in the Regulations of the Secretary or Labor at 42 CFR Chapter 60, which is paid for in whole or in part with funds obtained from the Federal Government or borrowed on the credit of the Federal Government pursuant to a grant, CONTRACT, loan, insurance, or guarantee, or undertaken pursuant to any Federal program involving such grant, CONTRACT, loan, insurance, or guarantee, the following Equal Opportunity Clauses:

During the performance of this CONTRACT, the CONTRACTOR agrees as follows:

(1) The CONTRACTOR will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The CONTRACTOR will take affirmative action to ensure that applicants are employed, and that employees are treated equally during employment, without regard to his/her race, color, religion, sex, or national origin. Such action shall include but not be limited to the following: Employment, upgrading, demotion or transfer, recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The CONTRACTOR agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

(2) The CONTRACTOR will, in all solicitations or advertisements for employees place by or on behalf of the CONTRACTOR, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(3) The CONTRACTOR will send to each labor union or representative of workers with which he has a collective bargaining agreement or other Contract or understanding, a notice to be provided advising the said labor union or worker's representatives of the CONTRACTOR'S commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The CONTRACTOR will comply with all provisions of Executive Order 11375 of October 13, 1967, and by rules, regulations, and relevant orders of the Secretary of Labor.

(5) The CONTRACTOR will furnish all information and reports required by Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and relevant orders.

(6) In the event of the CONTRACTOR'S noncompliance with the nondiscrimination clauses of this CONTRACT or with any of the said rules, regulations, or, this CONTRACT may be canceled, terminated, or suspended in whole or part and the CONTRACTOR declared ineligible for further Government CONTRACTs or Federally assisted construction CONTRACTs in accordance with Executive Order 11246 of September 25, 1965 as amended by Executive Order 11375 of October 1967, and such sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(a) The CONTRACTOR will include the portion of the sentence immediately preceding Paragraph (1) and the provisions of Paragraphs (1) through (7) in every subcontract or purchase order unless exempt by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, so that such provisions will be binding upon each Subcontractor or vendor. The CONTRACTOR will take such action with respect to and subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance: Provided, however, that in the event a CONTRACTOR becomes involved in, or is threatened with, litigation with a Subcontractor or vendor as a result of such direction by the administering agency, may direct as a means of enforcing such provisions, including sanctions for noncompliance: Provided, however, that in the event a CONTRACTOR becomes involved in, or is threatened with, litigation with a Subcontractor or vendor as a result of such direction by the administering agency, may direct as a means of enforcing such provisions, including sanctions for noncompliance: Provided, however, that in the event a CONTRACTOR becomes involved in, or is threatened with, litigation with a Subcontractor or vendor as a result of such direction by the administering agency, the CONTRACTOR may request the United States to enter into such litigation to protect the interests of the United States. The applicant further agrees that it will be bound by the above Equal Opportunity clause with respect to its own employment practices when it participates in Federally assisted construction work: Provided that if the applicant so participating is a State or local government, the above Equal Opportunity clause is not applicable to any agency, instrumentality or subdivision of such government which does not participate in work on or under the CONTRACT. The applicant agrees that it will assist and cooperate actively with the administering agency and the Secretary of Labor in obtaining the compliance of CONTRACTORS and Subcontractors with the Equal Opportunity clause and the rules, regulations, and relevant orders of the Secretary of Labor, that will furnish the administering agency and the Secretary of Labor such information as his/her may require for the supervision of such compliance, and that it will otherwise assist the administering agency in the discharge of the agency's primary responsibility for securing compliance. The applicant further agrees that it will refrain from entering into any CONTRACT or CONTRACT modification subject to Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967. With a CONTRACTOR debarred from, or who has not demonstrated eligibility for, Government contracts and Federally assisted construction CONTRACTs pursuant to the Executive Order and will carry out such sanctions and penalties for violation of the Equal Opportunity clause as may be imposed upon CONTRACTORS and Subcontractors by the administering agency or the Secretary of Labor pursuant to Part II, Subpart D of the Executive Order. In addition, the applicant agrees that if it fails or refuses to comply with these undertakings, the administering agency may take any (CONTRACT, loan, insurance, guarantee): refrain from extending any further assistance to the applicant under the program with respect to which the failure or refusal occurred until satisfactory assurance of future compliance has been received from such applicant; and refer the case to the Department of Justice for appropriate legal proceedings.

Diane B. Allen Equal Pay Act

Pursuant to N.J.S.A. 34:11-56.14(b), any employer, regardless of the location of the employer, who enters into a contract with a public body to perform any public work for the public body shall provide to the Commissioner of the New Jersey Department of Labor and Workforce Development, through certified payroll records required pursuant to P.L. 1963, c. 150 (N.J.S.A. 34:11-56.25 et seq.), information regarding the gender, race, job title, occupational category, and rate of total compensation of every employee of the employer employed in the State in connection with the contract. The employer shall provide the commissioner, throughout the duration of the contract or contracts, with an update to the information whenever payroll records are required to be submitted pursuant to P.L. 1963, c. 150 (N.J.S.A. 34:11-56.25 et seq.).

Information regarding the Diane B. Allen Equal Pay Act and its requirements may be obtained from the New Jersey Department of Labor and Workforce Development (LWD) web site at: https://nj.gov/labor/equalpay/equalpay.html.

LWD forms may be obtained from the online web site at: https://nj.gov/labor/forms_pdfs/equalpayact/MW-562withoutfein.pdf.

63. GRATUITIES

A. The State may, by written notice to the CONTRACTOR, terminate the right of the CONTRACTOR to proceed under this CONTRACT if it is found, after notice and hearing, by the Secretary or Governor or the Duly authorized representative of either, that gratuities (in the form of entertainment, gifts, or otherwise) were offered or given by the CONTRACTOR, or any agent or representative of the CONTRACTOR, to any officer or employee of the State with a view toward securing a CONTRACT or securing favorable treatment with respect to the awarding or amending, or the making of any determinations with respect to the performance, of such CONTRACT: Provided, that the existence of the facts upon which the Secretary or Governor or the duly authorized representative of either makes such findings shall be in issue and may be reviewed in any competent court.

B. In the event this CONTRACT is terminated as provided in paragraph (A) hereof, the State shall be entitled (1) to pursue the same remedies against the CONTRACTOR as it could pursue in the event of a breach of the CONTRACT by the CONTRACTOR, and (2) as a penalty in addition to any other damages to which it may be entitled by law, to exemplary damages in an amount (as determined by the Secretary or Governor or the duly authorized representative of either) which shall be not less than three (3) nor more than ten (10) times the costs incurred by the CONTRACTOR in providing any such gratuities to any such officer or employee.

C. The rights and remedies of the State provided in this Clause shall not be exclusive and are in addition to any other rights and remedies provided by law or under this CONTRACT.

64. AMERICAN WITH DISABILITIES ACT

EQUAL OPPORTUNITY FOR INDIVIDUALS WITH DISABILITIES

The CONTRACTOR and the State do hereby agree that the provisions of Title II of the Americans With Disabilities Act of 1990 (the "Act") (42 U.S.C. S12101 et seq.), which prohibits discrimination on the basis of disability by public entities in all services, programs, and activities provided or made available by public entities, and the rules and regulations promulgated pursuant thereunto, are made a part of this CONTRACT. In providing any aid, benefit, or service on behalf of the STATE pursuant to this CONTRACT, the CONTRACTOR agrees that the performance shall be in strict compliance with the Act. In the event that the CONTRACTOR, its agents, servants, employees, or subcontractors violate or are alleged to have violated the Act during the performance of this CONTRACT, the CONTRACTOR shall defend the STATE in any action or administrative proceeding commenced pursuant to this Act. The CONTRACTOR shall indemnify, protect, and save harmless the STATE, its agents, servants, and employees from and against any and all suits, claims, losses, demands, or damages of whatever kind or nature arising out of or claimed to arise out of the alleged violation. The CONTRACTOR shall, at his/hers its own expense, appear, defend, and pay any and all charges for legal services and any and all

costs and other expenses arising from such action or administrative proceeding or incurred in connection therewith. In any and all complaints brought pursuant to the STATE'S grievance procedure, the CONTRACTOR agrees to abide by any decision of the STATE, which is rendered pursuant to, said grievance procedure. If any action or administrative proceeding results in an award of damages against the STATE or if the STATE incurs any expense to cure a violation of the ADA which has been brought pursuant to its grievance procedure, the CONTRACTOR shall satisfy and discharge the same at its own expense.

The STATE shall, as soon as practicable after a claim has been made against it, give written notice thereof to the CONTRACTOR along with full and complete particulars of the claim. If any action or administrative proceeding is brought against the STATE or any of its agents, servants and employees, the STATE shall expeditiously forward or have forwarded to the CONTRACTOR every demand, complaint, notice, summons, pleading or other process received by the STATE or its representatives.

It is expressly agreed and understood that any approval by the STATE of the services provided by the CONTRACTOR pursuant to this CONTRACT will not relieve the CONTRACTOR of the obligation to comply with the Act and to defend, indemnify, protect, and save harmless the STATE pursuant to this paragraph.

It is further agreed and understood that the STATE assumes no obligation to indemnify or save harmless the CONTRACTOR, its agents, servants, employees and subcontractors from any claim which may arise out of his/her performance of this Agreement. Furthermore, the CONTRACTOR expressly understands and agrees that the provisions of this indemnification clause shall in no way limit the CONTRACTOR'S obligations assigned in this Agreement, nor shall he/she be construed to relieve the CONTRACTOR from any liability, nor preclude the STATE from taking any other actions available to it under any other provisions of this Agreement or otherwise at law.

65. ADDITIONAL GENERAL MECHANICAL CONDITIONS FOR PLUMBING, HEATING AND VENTILATING, AND ELECTRICAL WORK

A. GENERAL:

(1) All trades shall perform work in accordance with the requirements of local codes and in accordance with any authority having jurisdiction.

(2) Where the words "furnish", "provide", or "install" are mentioned in these specifications, either singularly or in combination, they are to be interpreted to mean "furnish and install" unless specifically noted otherwise.

(3) These words are further to be interpreted to by prefixed to all materials, equipment and apparatus hereinafter mentioned in these specifications, shown on the drawings either in abbreviated or in schedule form.

(4) Where the work "CONTRACTOR" is mentioned in this article of the specifications or on the drawings, it shall mean the particular Mechanical or Electrical CONTRACTOR under that section, unless specifically noted otherwise.

(5) Where the term "mechanical trades", "mechanical CONTRACTOR" are used, he/she shall refer to the Plumbing, Heating and Ventilating and Electrical Contractors.

. DEFINITIONS:

(1) "Furnish" or "Provide": to furnish, erect, install, and connect up complete and ready for regular operation particular work referred to, unless specifically indicated or specified otherwise.

(2) "Work": Labor, materials, equipment, apparatus, controls, accessories, and other items customarily furnished for proper and complete installation of work.

(3) "Piping": Pipe, fittings, flanges, valves, controls, hangers, traps, drains, insulation, and items

necessary or required in connection with or relating to such piping.

(4) "Wiring": Conduit, fittings, wire, junction and outlet boxes, switches, cutouts, and receptacles, and items necessary or required in connection with or relating to such wiring.

(5) "Concealed": Embedded in masonry or other construction, installed behind wall furring, within double partitions or hung ceiling, in trenches, in crawl spaces, below floor or below grade.

(6) "Exposed": Not installed underground or "Concealed" as defined above. (7)

"Indicated" or "Shown": As indicated or shown on drawing.

(7) "Noted": As indicated on drawings and/or specified.

C. EXAMINATION OF THE BUILDING SITE:

(1) The CONTRACTORS shall visit the building site before submitting his/her proposals to fully acquaint themselves with all existed and limiting conditions.

(2) Any existing or limiting conditions discovered on the site visit and found to be in direct conflict with the intent of the drawings and specifications must be called to the CONTRACTING OFFICER'S attention for immediate adjustment.

(3) The CONTRACTORS shall assume full responsibility for the cost of additional work arising out of his/her failure to examine the building site.

D. PERMITS AND FEES

(1) The CONTRACTORS shall make application and obtain approval of all work shown on the drawings and specifications of his/her trades, from all authorities having jurisdiction.

(2) The CONTRACTOR shall secure all permits, licenses, and pay all charges or fees necessary and incidental to the due and lawful prosecution of their work, including those of the local water, gas and electric companies.

(3) The CONTRACTORS shall note that "BOCA", New Jersey Uniform Construction Code, New Jersey Department of Environmental Protection and the Department of Community Affairs rules and regulations of all authorities shall govern and take precedence over the drawings and specifications, except where drawings and specification require materials and workmanship of higher quality than required by the rules and regulations, the CONTRACT Drawings and Specifications shall apply.

(4) If any existing work remaining in place or any new work must be corrected to meet provisions of rules and regulations, such correction must be made by the CONTRACTORS at no increase of the CONTRACT sum.

(5) The CONTRACTORS shall give all requisites or notices required relating to his/her work to the CONTRACTING OFFICER.

(6) Upon completion of his/her work, but before final acceptance of the work by the owner, the CONTRACTORS shall submit to the C. O. all necessary certificates of approval.

E. MATERIAL AND EQUIPMENT SCHEDULE:

(1) Within ten (10) calendar days after award of the CONTRACT and before commencement of purchase or installation of any material or equipment, a complete schedule of the materials and equipment proposed for installation shall be prepared by the contractors and submitted to the C.O. for approval. Any scheduled materials, fixtures and equipment not conforming to the specification or drawings may be rejected.

(2) No consideration will be given to partial lists submitted from time to time.

(3) The CONTRACTOR shall assume full responsibility for rejections, delays, corrections and additional costs resulting from his failure to obtain advance approval of his material and equipment schedule.

(4) All mechanical and electrical equipment shall bear the seal of approval of the National Board of Fire Underwriters, the National Electrical Code and State of New Jersey codes. F.

MATERIAL AND EQUIPMENT SUBSTITUTIONS

(1) Materials and equipment as identified on the drawings and/or in these specifications by the manufacturers or specific trade names shall be furnished as identified, except where permission for substitution (as per the Approved Equal Article) is obtained from the C.O.

(2) Substitutions of material and equipment other than identified on the drawings, in these specifications, or approved under the Approved Equal Article may be made by this CONTRACTOR at the discretion of the C.O. These will only be requested and approved under certain circumstances, e.g., item is no longer manufactured, manufacturer is no longer in business, conflict with what is specified and what actually can be bought, etc. The CONTRACTOR shall then submit for substitution under the following procedure

a. Make written request to the C.O. stating reason for substitutions.

b. Support request with duplicate copies of complete description, capacities, dimensions, weights of proposed product.

c. State any CONTRACT credit to owner for acceptance of such substitution.

(3) Substitute material or equipment will be accepted with the CO's written approval only.

(4) The CONTRACTORS shall bear the entire responsibility and all additional costs involved for any redesign required, architecturally, structurally or mechanically to suit any equipment which he may offer as a substitute for approval and installations.

G. MANUFACTURER'S SERVICE:

The CONTRACTORS shall provide, if required, at the appropriate time or as directed by the C.O., the services of a competent factory trained engineer of the particular manufacturer of the equipment or item involved to inspect, adjust and place in proper operating condition any and all such item of manufacturer. No additional compensation will be allowed the CONTRACTORS for such services.

H. OPERATING INSTRUCTIONS:

(1). The CONTRACTORS shall provide for each item of equipment or apparatus furnished under this CONTRACT, a triplicate set of printed instructions obtained from the manufacturer covering the proper operation, care, lubrication, cleaning, servicing, adjusting, etc., of the items involved, together with special safety instructions.

(2) The CONTRACTOR or individual primes shall pay particular attention in instructing the owner's representative(s), who will operate the plant, in all such details required to operate all pieces of equipment. The instruction shall include identifying the proper preventive maintenance programs.

I. CHARTS AND DIAGRAMS:

(1) CONTRACTOR shall install where directed charts and diagrams, framed and glass-covered of approved size, giving the number, location and function of each valve, identifications of each pipe line, and an electrical single line diagram.

(2) Included in the above are to be:

a. Two (2) valve charts and piping diagrams for each trade.

b. Temperature and other control diagrams shall be mounted in each equipment room for the equipment located therein.

c. Diagram of all feeders showing the wiring connections from incoming service to main distribution switchgear, light and power panels and motor controllers.

J. SLEEVE AND HANGER DRAWINGS:

(1) The CONTRACTORS shall prepare sleeve and hanger drawings showing types, sizes and locations of all sleeves and hangers, required for his work.

(2) The CONTRACTORS shall submit to the CO four (4) copies of his/her sleeve and hanger drawings for record only.

(3) Two (2) copies of sleeve and hanger drawings shall be furnished to the General CONTRACTOR.

K. MOVING OF EQUIPMENT:

The CONTRACTOR shall investigate each space into and through which equipment must be moved. Equipment shall be shipped from manufacturer in sections of size suitable for moving through restricted spaces.

L. ACCESSIBILITY:

All work shall be installed so that all parts required are readily accessible for inspection, operation maintenance and repair. Minor deviations from the drawings may be made to accomplish this, but changes of magnitude shall not be made without prior written approval from the C.O.

M. EQUIPMENT BASES:

(1) CONTRACTOR shall submit for approval of the C.O., detail drawings of all equipment foundations and shall furnish all templates for his foundations.

(3) Each CONTRACTOR shall construct the required forms from drawings and will supply and pour the concrete. It is the duty of this CONTRACTOR to place any templates and anchor bolts and to supervise the construction of these foundations. Each CONTRACTOR will refer to the General Specification for types and mixes of concrete.

N. ACCESS DOORS:

(1) The CONTRACTOR shall provide Access doors in masonry walls whose work required the access. All trades are to furnish doors of same manufacture. Type to be approved by the C.O.

(2) Furnish access doors to the General CONTRACTOR for installation under another section of the specifications. Access doors are not required in areas having removable section-hung ceiling.

(3) Frame and door shall finish flush with finished surface. Fabricate doors from No. 14 gauge sheet steel; frames No. 16 gauge sheet steel, and equipped with concealed hinges, permitting at least 175 degrees opening, and two (2) concealed screw driver operated cam locks.

(4) Fabricate access doors of minimum 14 gauge steel with rounded corners for installation in tile and

masonry walls with maximum of 3/4 inch wide trim and masonry anchors.

(5) Minimum door size: 12 X 12 inch at easily accessible valves and cleanouts: 18 X 18 inch where partial body access in required; 24 X 24 inch where entire body access in necessary.

(6) Group together concealed boxes, controls, valves, dampers, and other mechanical and electrical equipment requiring access for operation, maintenance and repair, to reduce number of access doors required.

(7) Where electric motors or heaters are installed in hung ceilings, provide disconnect switch in hung ceiling within reach form access door.

O. ELIMINATION OF NOISE AND VIBRATION:

(1) All equipment and accessories shall operate without objectionable noise and vibration.

(2) Should operation of any one or more of the systems produce noise or vibration which is, in the opinion of the C.O., objectionable, the CONTRACTOR shall, at his/her own expense, make changes in equipment and do all work necessary to eliminate the objectionable noise or vibration.

P. CLEANING:

All apparatus, accessories and piping, after installation, shall be thoroughly cleaned of all dirt, grease and foreign matter, and left in a condition satisfactory to the C.O. for delivery to the owner for his operation.

Q. PAINTING

(1) Except for shop coasts and finish coasts, as may be herein specified, all painting will be done by others. (2)

All concealed supports and ironwork not otherwise protected against corrosion shall be given two (2) coats of bituminous base paint.

(3) The CONTRACTORS shall, however, thoroughly clean all his/her work and leave same in a neat and workmanlike condition for the application of paint.

R. ELECTRIC WIRING:

(1) The Electrical CONTRACTOR shall be required to bring a service outlet and wiring within 2'-0" of each piece of equipment installed by other trades and CONTRACTs.

(2) All electric work including labor and materials, from these outlets to place equipment into complete operation shall be done under the CONTRACT furnishing and installing the equipment.

S. MOTORS:

(1) Unless otherwise indicated on the drawings or herein specified, electric motors 1/2 horsepower and larger shall be 3 phase motor. Electric motors less than 1/2 horsepower shall be 120 volts, single phase.

(2) All motors shall be of special design for quiet operation and voltage specified, guaranteed to operate continuously at full load with a temperature rise in any part not exceeding 40 degrees C. or for two (2) hours at 25% overload, with a temperature rise not exceeding 55 degrees C. All temperatures shall be measured by a thermometer based on a room temperature of 25 degrees C. The motors shall be capable of carrying 50% overload for short periods without injurious heating.

(3) Fractional horsepower motors shall be of the sealed pre-lubricated ball bearing type. Larger size motors

shall have ball bearings with pressure grease fittings and drain parts, unless otherwise indicated.

(4) All motors shall be approved by the Underwriters' Laboratories Inc., for the service and location intended. In general, motors shall be open drip- proof type in dry nonhazardous location, and weather-protected Type II here exposed to dampness or weather. Motors, located here exposed to dampness or weather, shall be provided with watertight connection boxes.

(5) All motors shall conform to the design, construction and performance requirements of Standard C-50 for "Rotating Electrical Machinery" of the American Standards Association, and shall comply with the regulation of the National Electrical Code.

(6) Direct connected motors shall be provided with acceptable type couplings, and the motors must be dowelled into the base plates at least at two (2) points. Motors connected to belt-driven apparatus shall be provided with slotted slide base with take-up screws.

(7) All motors for pumps, compressors, air conditioning drives, and similar type applications where moisture or dust is present shall be provided with vacuum-impregnated epoxy encapsulation of the windings.

(8) Motors shall be capable of withstanding momentary overloads of 50% without injurious heating. His/her shall operate without excessive heating, flashing or sparking under any conditions within the required capacity of load and speed. All motors shall operate quietly, and shall be replaced if, in the Contracting Officer's opinion, it does not operate quietly.

(9) All motors shall be equipped with ball bearings unless specified otherwise in other sections of these specifications.

(10) Motors for single-phase operation shall be of the capacitor type and those for three-phase operation shall be polyphase motors of the squirrel cage induction or wound rotor inductor type.

(11) Direct connected fan motors shall have speeds as indicated on the plans or specifications. V-Belt connected motors shall have a maximum synchronous speed of 1800 rpm.

(12) Motors requiring high starting torque are to be wound to suit such requirements and are to be high starting torque, low starting current type.

(13) Fans, blowers, centrifugal pumps, and similar application shall be NEMA design B motors.

(14) Reciprocating pumps, compressor, air conditioning drives, and conveyors shall be NEMA design C motors.

(15) Motors shall be as manufactured by G.E., Westinghouse, U.S. Motors, Electro-Dynamic or Reliance.

T. MOTORS CONTROLLERS AND STARTERS:

(1) Unless otherwise herein specified, the CONTRACTOR will provide all motor controllers and starters providing said motor. Motor controllers and starters shall be as manufactured by General Electric, Westinghouse or Allen Bradley.

(2) Motor controllers and starters shall be of a type suitable for use in connection with each motor to be controlled. All starters shall have pilot light and shall be "hand-off automatic" type.

(3) Controllers shall be of the fully enclosed type, floor or wall mounted except where mounted in a Motor Control Center. Each enclosure shall be furnished with a schematic-wiring diagram pasted inside the door.

(4) All controllers shall have thermal overload protection in three phases for three-phase motors, and in the phase leg for single-phase motors.

(5) All magnetic controllers must provide low voltage protection for the motors.

(6) All component parts of each controller (switches or breakers, starters, resistors, etc.) shall be in one (1) ventilated enclosure.

(7) Controllers shall be of the combination type with fused or non-fused safety type disconnect switched as required by the local electrical code.

(8) Across-the-line magnetic type starters shall be used for all motors except where reduced voltage type starters are indicated on plans or specifications.

(9) Reduced voltage starters shall be of the auto-transformer type unless otherwise indicated on the drawings.

(10) Each three-phase motor controller shall be provided with control transformer.

(11) Starters for single-phase motors shall be manual across-the-line type with thermal overload protection except where remote push buttons are called for, in which case magnetic type starter shall be used.

(12) Remote controls shall be of the four (4) wire type with "Start" and "Stop" push button, and pilot light to indicate "on" and "off" operation of motors. When motors are remotely controlled, additional push button stations with the pilot lights shall be installed integrally in the controller door.

(13) The CONTRACTORS shall deliver to the electrical CONTRACTOR all necessary wiring diagrams and instructions for power connections and wiring to his equipment.

(14) Except where equipment is factory mounted and wired, the CONTRACTORS shall deliver the motor controllers and starters to be provided under his/her CONTRACT to the electrical CONTRACTOR at the job site, who will mount same and provide all power and control wiring.

U. VALVE TAGS:

Each valve on main or branch line of piping shall have 1-1/2" diameter brass tag with black filled engraved numbers and letters. Tag shall be affixed to valve by means of a brass "S" hook. Tags on different services shall be identifiable by a letter and number designation.

V. PIPE SLEEVES:

(1) The individual Mechanical CONTRACTOR shall furnish and set all sleeves used to accommodate pipes or conduits passing through walls, floors and partitions. Unless otherwise specified, sleeves shall be standard weight steelpipe.

(2) Sleeves shall be of sufficient size to pass conduit, pipe or with insulation so as not to present any undue friction with one inch (1") minimum clearance.

(3) Sleeves in exterior walls shall be either galvanized steel or cast iron with an intermediate flange. Sleeves shall finish flush with walls. Spaces between pipe or conduit and sleeve or insulation and sleeve shall be packed with oakum and caulked with lead or plastic compound.

(4) Sleeves for concealed pipes in chases shall terminate flush with floor. Sleeves for pipes exposed to view shall project one inch (1") above finished floor. Sleeves passing through wall shall terminate flush with wall surface. Sleeves in equipment spaces shall project two inches (2") above finished floor.

(5) Sleeves shall be set before concrete is cured and before masonry construction is finished. Any subsequent cutting and repair of construction because of failure to set sleeves in time shall be done at CONTRACTOR'S expense.

(6) Sleeves passing through waterproofed floors or walls shall be enclosed with caulking type plate. Plate shall be split type, complete with floor gasket and flanged ends for bolting halves together. The bell end of the plate shall be tightly packed with oakum.

(7) Pipes and conduit passing through roof decks shall be installed with a base-flashing fitting.

W. ESCUTCHEONS:

Escutcheons shall be provided at all exposed finished surfaces pierced by sleeves. It shall fit around insulation or around pipe if uninsulated and shall extend against the finished surface of wall, floor, or ceiling so that embedded sleeve is completely concealed. Escutcheons shall be solid nickel-plated cast iron with set screws and attached to projecting sleeves or pipes and not to pipe covering.

X. FLASHING:

CONTRACTOR shall provide all cap flashing for the trade involved, unless otherwise specified. Base flashing will be provided under another division of these specifications.

Y. BUTTONS AND TABS:

Furnish buttons or tabs, as approved, to indicate location of mechanical and electrical equipment in removable type ceilings.

AA. SUPPORTS FROM OVERHEAD CONSTRUCTION:

Where overhead construction does not permit fastening of supports for equipment, furnish additional framing, subject to approval by C.O.

BB. REAMING:

The ends of all pipes shall be fully reamed or filed out to the full size of the bore before being made up with the fittings.

CC. CONNECTION OF EQUIPMENT FURNISHED BY OTHERS:

(1) All equipment noted on the drawings as furnished by the owner or by other trades will be rigged in place, set and installed under separate CONTRACTs or under other sections of this specification. All wiring and piping technically and internally or integrally a part of the equipment will be previously executed, or executed under separate CONTRACTs, unless otherwise specifically shown and/or specified in these drawings and specifications.

(2) The mechanical and electrical trades shall make all necessary supply, inlet and outlet connections to equipment furnished by the owners or installed under separate CONTRACT as called for on the drawings and as required.

(3) CONTRACT drawings only indicate the services to various pieces of owner's equipment. The mechanical and electrical trades shall make all connections to such equipment as required. The CONTRACTOR will furnish all power and control wiring to such equipment.

DD. AS-BUILT DRAWINGS:

The CONTRACTOR shall keep on the job site, one (1) set of drawings upon which, any changes in the work, which may arise due to field conditions or other causes, shall be recorded. These drawings shall be kept in good condition and shall be turned over to the C.O. upon completion of the work. Final payment will be withheld until such drawings are turned over to the C.O.

EE. UNDERWRITERS' LABORATORIES CERTIFICATION:

All mechanical and electrical equipment shall bear the UL label of approval where such inspection service is furnished for the particular type of equipment.

FF. FINAL TESTS:

(1) Before an application for final acceptance of the work will be considered, all tests deemed necessary to show proper execution to the work shall have been performed and completed in the presence of the C.O. Scheduling of all testing procedures shall be arranged to suit the convenience of the C.O.

(2) Where electricity-utilizing equipment, supplied by other trades, is energized, controlled or otherwise made operative by electric work wiring systems, the testing which will prove the proper functional performance of such wiring systems shall be conducted specifically by the trade responsible for the mechanical equipment. The electrical work shall, however, include cooperation in such testing and the making available to any necessary electrical testing equipment.

(3) Testing to show the proper functioning of lighting fixtures and lamps, supplied by other trades or any other parties, shall be completely included in the electrical work.

(4) Any defects or deficiencies discovered in any of the electrical work shall be corrected in an approved manner without additional cost.

GG. DEMOLITION:

(1) The CONTRACTOR shall disconnect, remove and cap all existing outside and underground utilities which are abandoned as a result of this CONTRACT, as shown on drawings or specified within specification. All transformers and meters shall be the property of the owners.

(2) Electrical - Disconnect and store on the job site overhead wiring, transformers and conduit as indicated on drawings. Trench disconnects and removes underground electric wires and conduit as indicated on drawings and backfill in accordance with specifications.

(3) Plumbing - All abandoned underground piping (except clay) shall be trenched, removed and backfilled. All underground clay pipe may be trenched, crushed and backfilled. See Trench and Backfilling in specifications.

66. ELECTRIC WELDING EQUIPMENT, TERRAZZO GRINDERS, PIPE THREADING EQUIPMENT, FLOOR SANDERS

A. The CONTRACTOR shall provide at locations acceptable to subcontractors involved two (2) outlets - 208, 220, 230, volts 60 cycle - three phase (single phase if 3-phase not available) 7-1/2 H.P. maximum capacity for each of the Prime Contractors using the referenced equipment. Should any subcontractor desire additional outlets or service of this type beyond the specified two (2) outlets or service of a greater capacity or of different characteristics or for any other power equipment, he/she shall arrange with the CONTRACTOR for the installation and pay all costs involved.

B. The CONTRACTOR who is obligation to employ standby personnel by trade agreement to which he/she are a party shall determine and include all such costs thereof in his/her bid proposal.

C. Any conflict arising between the prime contractors with regard to financial obligations for standby personnel or standby supervisory employees when the maximum number of units are provided, shall be resolved between the parties involved in direct proportion to the number of units on the site by the respective contractors.

D. No CONTRACTOR shall at any time set up claim for an extra relating to costs of standby maintenance or standby supervision for electric motor driven equipment. The State under no condition will entertain or consider an extra in this regard.

E. The provisions required hereunder are in addition to the provisions required under Light and Power.

67. APPROVAL

Any sum or sums allowed to the CONTRACTOR under the provisions of this CONTRACT or under the State arbitration proceedings or under other State procedure shall be paid subject to the approval of the CONTRACTING OFFICER, Chief, National Guard Bureau or agent of the Veterans Administration as part of the cost of the work herein contracted for and shall be deemed to be within the contemplation of this CONTRACT.

68. COOPERATION - THREE DAY'S NOTICE, ETC.

A. The CONTRACTOR shall cooperate with each other and secure the effective cooperation of the different craftsmen employed on the work, so that no portion of the work is delayed or slighted because of the failure of any workmen in any part to do his duty. Should it at any time appear that this is happening, then the CONTRACTOR shall immediately discharge the delinquents and employ others to finish the work.

B. All subcontractors shall coordinate his/her work with adjacent work and with other trades so as to accelerate general progress of the work and assure correctness.

C. Each CONTRACTOR shall lay out and install his/her work at such time or times and in such manner as to facilitate general progress of project.

D. It is agreed that in event of any dispute arising as to possible or alleged interference among various CONTRACTORS which may retard progress of work, same will be adjusted by the C.O. whose decision as to parties at fault and as to manner in which matter may be adjusted shall be binding and conclusive to all parties.

E. Each trade shall afford other trades every reasonable opportunity for installation of his/her work and for storage of his/her materials.

F. If the CONTRACTOR for general construction or any other contractor delays the project or interferes with the progress of any other CONTRACTOR, the C.O. may order or direct the CONTRACTOR at fault to accelerate work at any particular point; and such CONTRACTOR shall provide workmen at such point or points and execute such portion of their work as may be required to enable others to hasten and properly engage and carry on their work at no expense to the State.

G. Should any CONTRACTOR fail to comply with such notice, should he/she fail or refuse to make good condemned work, or should he/she neglect or refuse to diligently prosecute the work, or any part thereof, then the C.O. may, after three (3) calendar days' notice in writing to the CONTRACTOR and his/her Sureties cost thereof, together with any loss or damage that may accrue from such neglect, failure or refusal, shall be deducted from the amount of the CONTRACT. The expense of carrying on such work or operation shall be paid by the State, to such person or persons as present certificates from the C.O. therefore without entailing any personal liability upon the officers issuing certificates or making such payments. Should the infraction continue, then the C.O. shall terminate the CONTRACT and seek recourse from the surety as outlined in these General Conditions.

H. If, through acts of neglect on the part of the CONTRACTOR, any Subcontractor shall suffer loss or damage on the work, the CONTRACTOR agrees to settle with such other Subcontractors by agreement or arbitration if such other Subcontractor will so settle. If such other Subcontractor shall assert any claim against the State on account of any damage alleged to have been sustained, the C.O. shall notify the CONTRACTOR who shall indemnify and save harmless the State against any such claim.

I. The CONTRACTOR shall coordinate his/her operations with those of other subcontractor. Cooperation will be required in the arrangement for the storage of materials and in the detailed execution of the work. The CONTRACTOR, including his/her Subcontractors shall keep informed of the progress and the detail work. The Project Manager shall immediately report a lack of progress or defective workmanship on the part of other CONTRACTOR. Failure of a CONTRACTOR to keep informed of workmanship by others shall be construed as acceptance by them of the status of the work as being satisfactory for proper coordination with his/her own work.

69. COORDINATION OF WORK - RIGHTS OF OTHER CONTRACTORS

I. The General CONTRACTOR shall be responsible for coordinating the entire building operation from the beginning of the work until acceptance by the State.

J. The various other prime contractors shall coordinate his/her own work and shall cooperate with each other under the overall direction of the CONTRACTOR for general construction.

K. In case the CONTRACTOR, by his/her own act or neglect or the act or neglect of any person or persons in his/her employ, shall unnecessarily delay, in the opinion of the CONTRACTING OFFICER, Architect/Engineer, and/or the Construction Manager, the work of the owner `or other CONTRACTORS, by not coordinating or properly cooperating with them or by not affording them sufficient opportunity or facility to perform work as may be specified, the CONTRACTOR shall, in that case, pay all costs and expenses incurred by such other CONTRACTORS due to any such delays and he/she hereby authorize the owner to

deduct the amount of such costs and expenses from any monies due or to become due the CONTRACTOR under this Contract, based on the investigations and recommendations of the Architect/Engineer or the C.O. Nothing contained in this paragraph shall, however, relieve said CONTRACTOR from any liability or damage resulting to the owner on account of such delay or delays. It is the intent of the parties that the other CONTRACTORS on this project shall be third party beneficiaries of this provision and may bring an action directly against the CONTRACTOR for any and all damages occasioned by any act or neglect by the CONTRACTOR. This provision shall not give such third party beneficiaries any right of action against the State or the C.O.

L. The General Contractor shall schedule and hold bi-weekly meetings with subcontractors and distribute minutes for these meetings. The meeting date and time shall be provided to the C.O. or his/her representative for his/her attendance.

M. DMAVA shall determine and approve the date, time and location for the first project or coordination meeting. DMAVA shall also establish and approve what CONTRACTOR (s) or subcontractor(s) shall be required at meetings.

N. The General CONTRACTOR shall coordinate all work to be performed by utility companies such as Gas and Electric, telephone, cable, water and sewer. This includes any work related to the project performed by local, county or state agencies.

O. The CONTRACTOR for general construction shall have coordination responsibilities to include but not be limited to the following:

(1) Scheduling and holding subcontractor coordination meetings at least once every two weeks. The CONTRACTOR shall produce and distribute minutes for these meetings. The meeting schedule shall be provided to the State, the A/E or the Construction Manager for his/her project representatives" attendance.

(2) The HVAC Prime CONTRACTOR shall prepare Mylar backgrounds for the use of all other Prime Contractors to prepare his/her coordination drawings under the supervision of the CONTRACTOR. Minimum scale of the drawings shall be 3/8" = 1"0".

(3) CONTRACTOR to coordinate all work to be performed by utility companies including a provision for the new main electrical service, new roadway and parking lot lighting, temporary telephone lines and the location and installation of new telephone lines and the installation of a new gas line from the street to the building.

70. CLAIMS/DISPUTES/MEDIATION/ LITIGATION

A. The CONTRACTING OFFICER shall be, in the first instance, the interpreter of the requirements of this CONTRACT and the judge of the CONTRACTOR's performance hereunder. The extent and character of the work shall be subject to the general supervision, direction, control and approval of the CONTRACTING OFFICER to whom the CONTRACTOR shall report and be responsible.

B. Disputes between the parties will be resolved in accordance with the following process:

a. Written notice by the CONTRACTOR of his/her claim and a request for a CONTRACTING OFFICER's Hearing.
b. CONTRACTING OFFICER's hearing
c. Mediation
d. Litigation

C. Except as otherwise provided in this CONTRACT, disputes and claims concerning questions of fact or law arising under this CONTRACT which are not disposed of by mutual agreement shall be governed by the provisions of N.J.S. 59:13-1, et. Seq., the "New Jersey Contractual Liability Act."

D. The CONTRACTOR hereby agrees that only the law of New Jersey applies to all disputes arising out of this project and that all claims of every nature by or against the CONTRACTOR shall be brought only in the Superior Court of New Jersey and no other state. The CONTRACTOR hereby agrees to submit to the jurisdiction of the Superior Court of New Jersey even though all or any portions of the work may be performed outside New Jersey. The CONTRACTOR agrees to reference the applicability of the New Jersey Contractual Liability Act in all subcontracts and insert this paragraph in all subcontracts.

CONTRACTING OFFICER'S HEARINGS

A. The CONTRACTOR may at any time request a hearing of any claim, dispute or matter in question arising out of or relating to this CONTRACT. The CONTRACTING OFFICER's decision shall be the final decision of DMAVA.

B. The CONTRACTOR may also request a CONTRACTING OFFICER's hearing should they have any claims, dispute or matter in question arising out of or relating to their CONTRACT. The CONTRACTOR will be required to participate in such hearing either as a party to the dispute or as a CONTRACTING OFFICER's witness.

C. Based upon the Hearing Officer's findings of fact the CONTRACTING OFFICER will make a decision. Such action on the part of the CONTRACTING OFFICER shall be expeditiously taken. Except as otherwise provided in this CONTRACT, disputes and claims concerning a question of fact arising under this CONTRACT which are not disposed of by mutual agreement shall be reviewed by the CONTRACTING OFFICER who shall reduce a decision to writing and notify the CONTRACTOR. Pending such final decision the CONTRACTOR shall have no recourse to Court actions, assuming that the aforesaid administrative procedures take place within reasonable amount of time.

D. Pending final decision of such claim or dispute, the CONTRACTOR and consultants shall proceed diligently with the performance of his/her CONTRACT responsibilities.

MEDIATION

A. The parties of this CONTRACT agree to use mediation as the first step in resolving disputes prior to arbitration or litigation. Any party or parties to a dispute under this CONTRACT may initiate mediation. Parties desiring the mediation of a dispute shall initiate a written request and forward it to the C. O. The C.O. shall respond in writing within thirty (30) days. He/she will jointly agree to seek a mediator through the American Arbitration Association; firms engaged in mediation services or through other state agencies who have certified mediators in his/her employment. The C.O. shall request a list of names from the organization agreed upon. Qualifications of the mediator(s) will be reviewed by both parties and be in agreement on a choice. Each party agrees to jointly select a single mediator; however, a mediation team may be used if agreed upon by both parties.

B. No person shall serve as a mediator in any dispute under this CONTRACT if the person(s) has any financial or personal interest in the result of the mediation. Prior to accepting an appointment, the prospective mediator shall disclose any circumstance likely to create a presumption of bias or prevent a prompt meeting with the parties. The person or firm must present evidence of credentials and experience so all parties can make an educated selection. In the event that a mediator becomes unwilling or unable to serve, he/she shall give written notice to the parties involved at least thirty (30) days in advance of ceasing services.

C. Persons of his/her choice may represent any party to the dispute. The name(s) and address(es) from the CONTRACTOR(s) shall be communicated to the C.O. at least thirty (30) days in advance of any meetings. The mediator shall fix the time and place of the mediation session(s).

D. At least ten (10) days in advance, DMAVA and the CONTRACTOR shall provide the mediator with a brief memorandum setting forth its position with regard to the issues that need to be resolved. These memoranda may be distributed to the parties at the direction of the mediator.

E. The mediator does not have the authority to impose a settlement upon the parties but will attempt to help the parties reach a satisfactory resolution of his/her dispute. The mediator is authorized to conduct joint and separate meetings with the parties and to make oral and written recommendations for settlement. The mediator may obtain expert advice when delineation of technical information is required. The parties must agree to this and be willing to assume expenses associated with obtaining such advice. Once expert advice is agreed to, the mediator shall make the necessary arrangements for obtaining the advice. The mediator is authorized to end mediation if, in his/her opinion, further efforts would not contribute to a resolution.

F. Mediation sessions are private and the information confidential. The mediator shall not disclose any information discussed by the parties or witnesses in the course of the mediation. All records, reports or other documents received by a mediator during the course of a session or sessions shall be confidential. The mediator shall not be compelled to divulge such records or to testify in regard to the mediation in any adversary proceeding or judicial forum. The parties shall maintain the confidentiality of the mediation and shall not rely on, or introduce as evidence in any arbitral, judicial or other proceeding:

(a) Views expressed, or suggestions made by the other party with respect to a possible settlement of the dispute;
(b) admission made by the other party in the course of the mediation proceedings;
(c) proposals made, or view expressed by the mediation; or
(d) The fact that the other party had or had not indicated willingness to accept a proposal for settlement made by the mediator.

G. There shall be no stenographic record of the mediation process. Other persons may attend only with agreement from all parties involved.

H. Termination of mediation shall be made when:
(a) The execution of a settlement agreement by the parties;
(b) by a written declaration of the mediator to the effect that further efforts at mediation are no longer worthwhile; or
(c) by a written declaration of a party or parties to the effect that the mediation proceedings are terminated.

I. The mediator shall not be a necessary party to a judicial proceeding relating to the mediation. The mediator shall not be liable to any party for any act or omission in connection with any mediation conducted under this agreement.

LITIGATION

A. If the parties to a dispute for damages do not mutually agree to mediation or arbitration as set forth, the parties to the dispute agree to litigate the matter in a court of law of this State having jurisdiction.

B. No litigation, arising out of or relating to such a dispute, shall include by consolidation, joiner or any other manner, the State or the Government when the State or the Government has no direct responsibility in the dispute or for the damages arising therefrom.

C. Nothing contained herein shall, however, relieve said CONTRACTOR or his/her subcontractor(s), or the Architect-Engineer, from any liability or damage resulting to the State on account of such dispute damages.

INDEMNIFICATIONS

A. The CONTRACTOR agrees to: Except as set forth in this Article, defend, indemnify, protect and save harmless the State and the Government and its agents, servants, and employees from and against any and all suits, claims, demands, or damages of whatsoever kind of nature arising solely out of any negligent act, error or omission of the CONTRACTOR or his/her subcontractors, its agents, servants and employees, in the performance of professional services under the CONTRACT, including but not limited to reasonable expenditures for and costs of investigations, hiring of expert witnesses, court costs, counsel fees, settlements, judgments or awards.

B. The CONTRACTOR shall be liable to the State for any reasonable costs incurred by it to correct, modify or redesign any drawings submitted by his/her Architect-Engineer that are found to be defective or not in accordance with the provisions of this agreement as a result of negligent act, error or omission on the part of his/her Architect-Engineer, agents, servants or employees. The CONTRACTOR's Architect-Engineer shall be given reasonable opportunity to correct any deficiencies.

71. DISPUTES BETWEEN CONTRACTOR'S AND THEIR SUBCONTRACTOR(S)

A. The CONTRACTOR agrees to make no claim for damages against the State or Government when the State or Government has no direct responsibility for said damages, by reason of any act, error or omission, by any CONTRACTOR, or in connection with such CONTRACTOR.

B. These provisions shall not require the CONTRACTOR to consider modifications of any nature proposed which affect esthetics or safety; to consider modifications or substitution unless accompanied by engineering and other technical data required to permit proper evaluation and unless the CONTRACTOR has undertaken to reimburse the Architect-Engineer for all cost involved in the evaluation; to provide interpretation of the CONTRACT Documents or review shop drawings within less than a reasonable time (including time required for testing and consultation with consultants); to consider shop drawings which are not accompanied by data and other related shop drawings as required to permit proper review; or to act on shop drawings within a normal time when they are submitted in unusually great volume rather than spaced in a reasonable manner. In no case shall the Architect-Engineer be required to perform his services in a manner, which is at variance with his/her own professional judgment.

72. RIGHT OF THE OWNER TO TERMINATE CONTRACT

A. In the event that any of the provisions of this CONTRACT are violated by the CONTRACTOR, or by any of his/her Subcontractors, the C.O. may serve written notice upon the CONTRACTOR and the Surety of his intention to terminate the CONTRACT.

B. Such notices shall contain the reasons for such intention to terminate the CONTRACT.

C. The CONTRACT shall be terminated unless within five (5) working days after the serving of such notice upon the CONTRACTOR, such violation or delay shall cease and satisfactory arrangements of correction be made. Should the violation or delay not be resolved then the C.O. shall, upon the expiration of said **five (5) working days**, cease and terminate the CONTRACT.

D. In the event of any such termination, the C.O. shall immediately serve notice thereof upon the Surety and the CONTRACTOR, and the Surety shall have the right to take over and perform the CONTRACT; provided, however, that if the Surety does not commence performance thereof within five (5) working **days** from the date of the mailing to such Surety of Notice of Termination, the C.O. may take over the work and prosecute the same to completion by CONTRACT or by "NJDMAVA's Construction Force" and at the expense of the CONTRACTOR and the CONTRACTOR and his/her Surety shall be liable to the State for any excess cost occasioned by the State and any other such damages caused by the breach including liquidated damages caused by the delay to the date of completion thereby, and in such event the State may take the site of the work and necessary therefore.

73. ASSIGNMENT OF CLAIMS

A. Pursuant to the provisions of the Assignment of Claims Act of 1940, as amended (31 U.S. Code 203, 41 U.S. Code 15), if this CONTRACT provides for payments aggregating $1,000 or more, claims for money due or to become due the CONTRACTOR from the State or Government under this CONTRACT may be assigned to a bank, trust company, or other financing institution, including any Federal-lending agency, and may thereafter be further assigned and reassigned to any such institution. Any such assignment or reassignment shall cover all amounts payable under this CONTRACT and not already paid, and shall not be made to more than one party, except that any such assignment or reassignment may be made to one party as agent or trustee for two or more parties participating in such financing.

B. Notwithstanding any provisions of this CONTRACT, payments to an assignee of any moneys due or to become due under this CONTRACT shall not, to the extent provided in said Act, as amended, be subject to reduction or set-off.

74. SUBSTANTIAL COMPLETION

A. On the request of the State, the A/E, the CONTRACTOR, and the C.O. shall make a joint inspection of the work and if all determine that the work is substantially completed and shall prepare a certificate of substantial completion. The Veterans Administration Engineer may also, in the case of Veterans facilities, be present at this inspection. Such certification shall in no way relieve the CONTRACTOR of any contractual obligation.

B. Standard guarantee periods for equipment, workmanship, and materials shall commence on the date of substantial completion for the project or portions thereof so certified unless specified to the contrary as a condition of partial acceptance and approved in writing by the C.O.

75. PUNCH LISTS

A. At the request of the CONTRACTOR, when he believes his work to be completed, and with concurrence of the A/E or Construction Manager, the C.O. shall direct the A/E or Construction Manager to inspect the facility and develop a punchlist.

B. The Project Manager shall develop this punchlist by conducting a walk thru of the entire facility and identifying any and all work that must be accomplished to allow NJDMAVA to take Final Acceptance of the facility. Once this punchlist is develop and prior to it being given to any CONTRACTOR, NJDMAVA C.O. shall conduct a walk thru to verify its accuracy and to add items believed to have been missed.

C. Once the punch list is completed and validated, it shall be forwarded to the CONTRACTOR for completion. The CONTRACTOR shall commence completion of the punchlist within five (5) working days of receipt of the list. Every effort shall be made to complete the list in the minimum amount of time. Once the punchlist items are repaired, the A/E, Construction Manager and the C.O. shall re-inspect for completion. Should items be found incomplete, his/her shall be so noted and the CONTRACTOR directed to complete them.

D. NJDMAVA shall make the sole determination that the project is complete and ready for inspection and development of the punchlist. The C.O. shall not accept a building as complete if it would be obvious to a laymen that there is still work to be done in the normal execution of the CONTRACT. The CONTRACTOR shall make a good faith effort to complete every item of work that is required in the normal execution of his/her CONTRACT before making any requests for an inspection and punchlist.

E. NJDMAVA's inspection and development of a punchlist in no way eliminates the CONTRACTORS responsibility to meet the requirements of DCA for final inspection and the issuance of a Temporary Certificate of Occupancy or Certificate of Occupancy. All items identified by DCA shall be completed by the CONTRACTORS in accordance with the applicable codes and regardless of not being identified on any punchlist.

76. FINAL ACCEPTANCE

A. Once all punchlist items have been completed NJDMAVA shall accept the building and its systems and order the CONTRACTOR to submit it final invoice and Final Acceptance Certificate. The Project Manager and the C.O. shall sign off this form and a copy shall be sent to the CONTRACTOR. The date of this document shall be the date that all warranties shall commence.

B. Should the CONTRACT be such that there are multiple phases to the project and acceptance of each phase shall be a logical step then the C.O. shall issue a memorandum for record indicating final acceptance of a particular phase. This shall not eliminate the CONTRACTORS obligation to finish the remainder of his/her CONTRACT nor shall it be construed as allowing the warrantee period to start on portions of the CONTRACT not completed.

C. The C.O. shall be the sole determiner of any final acceptance being initiate against any phase of the project.

77. GUARANTEE

A. Neither the final certificate of payment nor any provision in the CONTRACT Documents nor partial or entire occupancy of the premises by the State shall constitute an acceptance of work not done in accordance with the CONTRACT Documents or relieve the CONTRACTOR of liability in respect to any express or implied warranties or responsibility for faulty materials or workmanship. The State will give notice of observed defects with reasonable promptness.

B. In addition to guarantee otherwise specified in other sections of the specifications, the CONTRACTOR and each individual Subcontractor shall guarantee and warrant in writing the work to be performed and all materials to be furnished under this CONTRACT against defects in materials or workmanship and pay for any damage to other work resulting therefrom. All guarantees, bonds, etc. required by the specifications shall be in writing in requisite legal form, and delivered to the C.O. at the time of submission of requisition for final payment. All Subcontractors' guarantees, bonds, etc. shall be underwritten by the CONTRACTOR, who shall obtain and deliver same to the C.O. before the work shall be deemed finished and accepted. Such guarantees shall be for a period of one (1) year from final acceptance.

C. The CONTRACTOR shall, at his/her own expense and without cost to the State, within a reasonable time after receipt of written notice thereof, make good any defects in material or workmanship which may develop during stipulated guarantee period, and any damage to other work caused by such defects, or the repairing of same.

D. The CONTRACTOR shall furnish a written statement from each manufacturer of equipment and materials used in the project that all such equipment and materials are the latest models manufactured at the time of installation of the work and that, for a period of seven (7) years, all components and replacement parts of such equipment and materials will be available for purchase by the Owner.

78. AUDIT BY OFFICE OF THE STATE COMPTROLLER

A. In accordance with N.J.A.C. 17:44-2.2, the CONTRACTOR shall maintain all documentation related to products, transactions, or services under this contract for a period of five (5) years from the date of final payment. Such records shall be made available to the New Jersey Office of the State Comptroller upon request.

END OF SECTION

PREBID REQUEST FOR INFORMATION

1.1 NOTICE TO BIDDERS

A. A MANDATORY PRE-BID MEETING will be held on **September 12, 2022** at **10:00 AM** at the Cape May National Guard Armory, 600 Garden State Parkway, Cape May Court House NJ 08210.

B. Bidders shall familiarize themselves with the conditions of the project site, plans, specifications and contents of the project manual.

C. All technical questions regarding plans and specification are to be addressed and submitted via e-mail to DMAVA Project Officer Mr. Mirza Baig at mirza.baig@dmava.nj.gov and Design Architect Ms. Christina D`Arrigo at cdarrigo@tjdarchitects.com

D. All other contractual and non-technical questions are to be addressed and submitted via e-mail to Ms. Deborah Soto at deborah.soto@dmava.nj.gov

E. Telephonic inquiries will not be accepted.

1.2 DEADLINE FOR SUBMITTAL OF PRE-BID REQUEST FOR INFORMATION (RFI)

A. It is the policy of the Contracting Officer to accept questions and inquiries from bidder. **The deadline for pre-bid request for information (RFIs) is 4:00 PM on September 19, 2022**. No request for information will be accepted after that time and date. It is the bidder's responsibility to ensure that all properly submitted questions are answered.

1.3 RESPONSES TO PRE-BID REQUEST FOR INFORMATION

A. A final addendum (if required) will be provided to the list of bidders prior to the bid date.

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

BID DOCUMENT SUBMISSION CHECKLIST

Bidder Initials

1. Bid Form (Section 004113) _____
2. Notice of Classification (Section 004513) _____
3. Non-Collusion Affidavit (Section 004519) _____
4. Certification of Non-Segregated Facilities (Section 004533) _____
5. Disclosure Affidavit (Section 004547) _____
6. Certification of Uncompleted Contracts (Section 004548) _____
7. Certification of McBride Principles (Section 004550) _____
8. Disclosure of Investment Activities in Iran (Section 004551) _____
9. Disclosure of Prohibited Activities in Russia Belarus (Section 004552) _____
10. Certification Pursuant to Executive Order 117 (Section 004553) _____
11. Certification Pursuant to PL 2005, Chapter 51 (Section 004554) _____
12. NJSTART registration _____

SIGNATURE: The undersigned hereby acknowledges and has submitted the above listed requirements.

FIRM NAME: Aliano Brothers General Contractors, Inc.

SIGNATURE: _____

PRINTED NAME: Michael Aliano

PRINTED TITLE: President

DATED: 09/29/2022

SECTION 011000 – SUMMARY FOR:

STATE OF NEW JERSEY DEPARTMENT OF MILITARY & VETERAN AFFAIRS (NJDMAVA)
BATHROOM REHABILITATION AT THE CAPE MAY ARMORY

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Project information.
2. Work covered by Contract Documents.
3. Phased construction.
4. Work under separate contracts.
5. Access to site.
6. Coordination with occupants.
7. Work restrictions.
8. Specification and drawing conventions.

B. Related Section:

1. Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.2 PROJECT INFORMATION

A. Project Identification:
Cape May Armory (CM002)
600 Garden State Parkway
Cape May, NJ 08210

B. Owner:
State of New Jersey Department of Military & Veteran Affairs (NJ DMAVA)
101 Eggert Crossing Road, Lawrenceville, NJ 08648

Owner's Representative:
Project manager: Mirza Baig
Phone: (609) 530-7127
Email: Mirza.Baig@dmava.nj.gov

C. Architect:
TJD Architects & Engineers PC
Thomas J. D'Arrigo, AIA
135 American Avenue, Bridgeton, NJ 08302
Phone: (856) 455-4422

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of the Project is defined by the Contract Documents and consists of the following:

The contract for General Construction activities relating to the modernization and expansion of the existing male and female latrine facilities within the existing Armory shall meet all current applicable code requirements as well as the guidelines for ADA Accessibility. The scope of work shall include provisions for all selective demolition activities including HAZMAT abatement, temporary barriers, utility shut off's and temporary facilities required to complete the scope of work as defined on the Contract Documents.

The scope includes the selective demolition and all related HAZMAT abatement efforts of the existing latrine facilities and support spaces as required to achieve the new design as identified on the contract documents. All new interior wall partitions will be of masonry construction and will receive interior finishes as specified on the drawings. The work includes new underground and above ground plumbing within the scope limits; involving but not limited to new sewer laterals, water piping, plumbing fixtures and related accessories. New concrete floor toppings, vapor barriers and waterproof membranes are included in the scope.

Mechanical and Electrical upgrades and improvements for new exhaust ventilation, central air-conditioning, Hydronic heating, power, lighting, emergency lighting and all related controls are in the scope.

Fire suppression modifications are in the scope. G.C. is responsible for any/all costs for relocating any sprinkler system elements that may interfere with the new work and restoring the system back to working condition.

Interior finishes include but are not limited to the following; new interior wall finishes, new interior floor finishes, new interior ceiling finishes, new metal frames, doors and hardware, new interior toilet partitions and shower partition doors, new lockers, new lavatory countertops and related accessories & mirrors, new finish paint, new built-in bench's and stone caps, etc.

NOTE:

a. G.C. is responsible for any/all costs for adjusting, re-aligning of any HVAC obstructions that affect the new work scope and restoring them back to a fully functional and balanced state.

b. G.C. is responsible for any/all costs relating to new roof penetrations necessary to complete the new scheduled work of this contract; and restoring the roof such that the owner's roof warranty is unaffected by the work.

c. If there are any discrepancies between the construction documents and specification manual the contractor shall submit a formal Request for Information (RFI) for clarification.

d. Additive Bid Item (ABI) #1: Provide a lump sum price for a complete installation to include labor and materials needed to replace existing sewer pump with new sewer ejector pump into existing lines. Modify control panel to operate new pump.

B. Type of Contract.

1. Project will be constructed under a single prime contract.

1.4 PHASED CONSTRUCTION

A. The Work shall be conducted in a single phase.

1.5 WORK UNDER SEPARATE CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

1.6 ACCESS TO SITE

A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

B. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Limits: Limit site disturbance, including earthwork and clearing of vegetation, to 10 feet (3 m) beyond surface walkways, patios, surface parking, and utilities less than 12 inches in diameter.

2. Driveways, Walkways and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weather tight condition throughout construction period. Repair damage caused by construction operations.

1.7 COORDINATION WITH OCCUPANTS

A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction

operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

1.8 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7:00 a.m. to 5:00 p.m., Monday through Friday, except as otherwise indicated.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Notify Owner not less than five (5) days in advance of proposed utility interruptions.
2. Obtain Owner's written permission before proceeding with utility interruptions.

D. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet (8 m) of entrances, operable windows, or outdoor air intakes.

E. Controlled Substances: Use of tobacco products and other controlled substances on the Project site is not permitted.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

B. Types of allowances include the following:
   1. Testing and inspecting allowances.
   2. Contingency allowances.

C. Related Sections:

   1. Division 01 Section "Unit Prices" for procedures for using unit prices.

1.2 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Architect from the designated supplier.

1.3 SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

B. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

C. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

D. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.4 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.5 CONTINGENCY ALLOWANCES

A. Use the contingency allowance only as directed by Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.

B. Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation, taxes, insurance, equipment rental, and similar costs.

C. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit margins.

D. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

1.6 TESTING AND INSPECTING ALLOWANCES

A. Testing and inspecting allowances include the cost of engaging testing agencies, actual tests and inspections, and reporting results.

B. The allowance does not include incidental labor required to assist the testing agency or costs for retesting if previous tests and inspections result in failure. The cost for incidental labor to assist the testing agency shall be included in the Contract Sum.

C. Costs of services not required by the Contract Documents are not included in the allowance.

D. At Project closeout, credit unused amounts remaining in the testing and inspecting allowance to Owner by Change Order.

1.7 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.

1. Include installation costs in purchase amount only where indicated as part of the allowance.
2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.

1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

3.1 SCHEDULE OF ALLOWANCES

A. ALLOWANCE NO. 1:

1. General Contingency Allowance: Contractor shall provide a general allowance for miscellaneous contingent items in the amount of $ 10,000.00 to be used at the discretion of DMAVA. If un-used, this allowance will be retained by DMAVA.

END OF SECTION 012100

SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

B. Related Section:

1. Division 01 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders.

1.2 DEFINITIONS

A. Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.3 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

B. Measurement and Payment: Refer to individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Unit Price No. 1: Isolation Valves

1. Description: Removal and replacement of isolation valves beyond what is identified on contract drawings. Refer to bid form for unit cost breakdown.

B. Unit Price No. 2 Thin-Set Porcelain Wall Tile

1. Description: Fully delivered and installed wall tile as defined on the contract drawings and specifications; and inclusive of all incidental materials and accessories for a fully completed installation. Unit price shall include material cost, receiving, handling, and installation and Contractor overhead and profit.
2. Unit of Measurement: 1 square foot of area

C. Unit Price No. 3 Mud-set Porcelain/Mosaic Floor Tile

1. Description: Fully delivered and installed wall tile as defined on the contract drawings and specifications; and inclusive of all incidental materials and accessories for a fully completed installation. Unit price shall include material cost, receiving, handling, and installation and Contractor overhead and profit.
2. Unit of Measurement: 1 square foot of area

END OF SECTION 012200

SECTION 024119 - SELECTIVE STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.

1.2 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Re-install: Detach items from existing construction, prepare for reuse, and reinstall where indicated.

C. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.3 PRE-DEMOLITION MEETINGS

A. Pre-demolition Conference: Conduct conference at Project site.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Pre-demolition Photographs or Video: Submit before Work begins.

C. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician.

1.5 CLOSEOUT SUBMITTALS

A. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.6 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.7 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work.
2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

D. Storage or sale of removed items or materials on-site is not permitted.

E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.8 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 PEFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

D. Survey of Existing Conditions: Record existing conditions by use of pre-construction photographs and/or videotapes.

1. Comply with requirements specified in Division 01 Section "Photographic Documentation."

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage. Provide demolition for portions of existing systems identified for modification or removal.

1. Comply with requirements for existing services/systems interruptions specified in Division 01 Section "Summary."

B. Existing Services/Systems to be modified: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Coordinate with Building Manager to arrange to shut off indicated services/systems when requested by sub contractors.
2. Arrange to shut off indicated utilities with utility companies and coordinate with Building Manager.
3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.

    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
    g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.

C. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Comply with requirements for access and protection specified in Division 01 Section "Temporary Facilities and Controls."

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
4. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
5. Dispose of demolished items and materials promptly. Comply with requirements in Division 01 Section "Construction Waste Management and Disposal."

B. Reuse of Building Elements: Project has been designed to result in end-of-Project rates for reuse of building elements as follows. Do not demolish building elements beyond what is indicated on Drawings without Architect's approval.
1. Pack or crate items after cleaning. Identify contents of containers.
2. Store items in a secure area until delivery to Owner.
3. Transport items to Owner's storage area [**on-site**] [**off-site**] [**designated by Owner**] [**indicated on Drawings**].

C. Removed and Re-installed Items:

1. Clean and repair items to functional condition adequate for intended reuse.

2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition[**and cleaned**] and reinstalled in their original locations after selective demolition operations are complete.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be[reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.6 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 028200 – SELECTIVE ABATEMENT OF ASBESTOS MATERIAL

(WRAP AND CUT OF PIPE INSULATIION REMOVAL AND NON FRIABLE FLOOR TILE AND MASTIC REMOVAL)

PART 1 - GENERAL

1.1 INTRODUCTION

A. Perform all planning, administration, execution and cleaning necessary to safely complete non-subchapter 8 removals of asbestos containing pipe insulation including elbows and joints (wrap and cut procedures) and non-friable floor tile and mastic removal. These materials will be impacted by the upcoming renovations including selective demolition to the first and second floor latrines located in the Cape May Armory, located in Cape May, New Jersey.

B. Asbestos containing materials that will be removed prior to the renovations include pipe insulation with associated elbows and joints located in the first and second floor chases, first floor corridor, men's latrine and ladies latrines. In addition, the floor tile and mastic located in the entrance to the ground floor men's latrine will be removed. The fire doors, that have been identified to be removed in the demo drawings prepared by others, will also be removed.

C. Prior to demolition of the Men's Latrine ceiling, the contractor shall clean the ceiling by utilizing HEPA vacuuming the ceiling and removing all debris identified on the ceiling. In addition, the abatement contractor will spray a lock down encapcilant on the ceiling prior to completing the operations and maintenance phase of the project.

D. The demolition of the interior walls, ceiling (if necessary) and pipe chases that are needed so that the asbestos containing pipe insulation can be accessed will be completed by the asbestos abatement contractor utilizing limited containment with negative air. Prior to commencing the demolition the asbestos, contractor must construct a remote decontamination chamber in the vicinity of latrines. The decontamination chamber will be located in an area as to not interfere with the operation of the armory.

E. The asbestos contractor will remove all pipe insulation including the elbows and joints identified above by utilizing limited containment (wrap and cut procedures) with negative air. The heat shield will be removed intact utilizing limited containment with negative air. All floor tile removal will be completed utilizing non-friable removal methods with limited containment and negative air. Upon completion of the removal, the contractor shall encapsulate the walls and floors of the pipe chases for final air testing by Transmission Electron microscopy.

F. **In order for the asbestos contractor to confirm and identify the locations of either the renovation or demolition phases of the project, the asbestos contractor must utilize the drawings provided by the architect and the asbestos survey provided with these specifications for removal.**

G. Approval of, or acceptance by, the Contracting Officer's Technical Representative (COTR) of various construction activities or methods proposed by Contractor does not constitute an

assumption of liability either by the COTR or building owner for adequacy or adverse consequences of said activities or methods.

1.2 INVENTORY OF ASBESTOS CONTAINING MATERIALS

A. The following table lists locations, quantities and conditions of confirmed asbestos containing materials.

Material Description	Location	Approx. Quantity	Condition
Pipe Insulation	Outside of Men's and Women's Latrines in Hallway and Above the Ceiling and Inside Pipe Chases of Both Latrines	1,500 LF	Poor
Dark Red Floor Tile and Mastics	Hallway Outside of Men's and Women's Latrines and Office Space	1,000 SF	Good
Pipe Insulation Debris on Ceiling	Men's Latrine	500 SF	Poor

1.3 DESCRIPTION OF ABATEMENT WORK

A. The asbestos abatement shall also include, but not be limited to the following:

1. Notification to regulatory agencies
2. Regulatory permits, licenses and approvals
3. Worker health and safety program
4. Air monitoring
5. Construction of temporary containment barrier/decontamination enclosures
6. Preparation for abatement operations
7. Removal of existing asbestos-containing material
8. Transport and disposal of asbestos-containing material
9. Decontamination and cleaning
10. Application of lockdown encapsulant**s**
11. Removal of temporary containment barrier/decontamination enclosures
12. Final job close-out

B. Summary Listing of Work Locations and Approximate Quantity: The Contractor shall review all contract documents and make a site visit to make his/her own determination about quantity values prior to applying for the required federal, state, or local permits from agencies having authority or jurisdiction.

C. Drawings and Other Information: Drawings of the project area(s) and the reference location(s) within the building may be provided upon request to assist in the Contractor's planning of the abatement work effort for protection of occupants and contents.

D. Other Work Not Included: Concurrently with this contract, the owner reserves the right to collect and analyze samples or retain an independent testing laboratory to provide supplemental sampling services. These services will in no way relieve the Contractor from compliance

liability or from providing the testing required by these specifications or any other requirements of other agencies with jurisdiction authority.

E. NOTE: The owner has contracted independent air monitoring and testing services.

1.4 DEFINITIONS

A. Abatement: Procedures to control or eliminate fiber release from asbestos-containing building materials, to include encapsulation, enclosure and removal.

B. Abatement Work Area (regulated area): An area established by the employer to demarcate areas where Class I, II, III and IV asbestos work is conducted, and any adjoining area where debris and waste from such asbestos work accumulate; and a work area within which airborne concentrations of asbestos, exceed or there is a reasonable possibility they may exceed the permissible exposure limit.

C. Airlock: A system of enclosures within the containment area consisting of two (2) doorways, curtained with polyethylene sheeting, at least 1 meter apart.

D. Air Filtration Units: A local exhaust unit, utilizing high-efficiency particulate air (HEPA) filtration and capable of maintaining a minimum negative pressure differential of 0.05 mm of water within the containment barrier with respect to that of the environment surrounding the containment barrier. The unit also cleans recirculated air or generates a constant air flow from adjacent areas into the abatement work area through the decontamination enclosure.

E. Air Monitoring**:** The process of measuring the fiber content of a specific volume of air during a stated period of time.

F. Air Pressure Monitoring: The process of measuring the air pressure differential between the containment barrier and the surrounding area using a micromanometer unit.

G. Amended Water: Water to which a surfactant (wetting agent) has been added to increase the ability of the liquid to penetrate asbestos containing materials (ACM).

H. ANSI**:** American National Standards Institute.

I. ASTM**:** American Society for Testing and Materials.

J. Asbestos: Asbestiform varieties of chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite.

K. Asbestos-Containing Material (ACM): Any material containing more than 1% asbestos by volume of any type or mixture of types.

L. Authorized Person: Any person authorized by the SI and required by work duties to be present in a regulated area.

M. Caulking: High-grade rubber base caulk for masonry and/or for other materials to be used or existing, as appropriate.

N. Class I Asbestos Work: Activities involving the removal of thermal systems insulation (TSI) and surfacing ACM and presumed asbestos containing materials (PACM).

O. Class II Asbestos Work: Activities involving the removal of ACM which is not TSI or surfacing material. This includes, but is not limited to, the removal of asbestos-containing wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastics.

P. Class III Asbestos Work: Repair and maintenance operations, where ACM, including TSI and surfacing ACM and PACM, is likely to be disturbed.

Q. Class IV Asbestos Work: Maintenance and custodial activities during which employees contact but do not disturb ACM or PACM and activities to clean up dust, waste and debris resulting from Class I, II and III activities.

R. Clean Room: An uncontaminated area or room which is part of the abatement worker/equipment decontamination enclosure, with provisions for storage of workers' or visitors' street clothing, protective equipment and uncontaminated materials and equipment. It may be used for changing clothes.

S. Competent Person: In addition to the definition in 29 CFR 1926.32 (f), one who is capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, who has the authority to take prompt corrective measures to eliminate them, as specified in 29 CFR 1926.32 (f)**.** In addition, the competent person shall have successfully completed training for Class I, Class II, Class III, and Class IV projects meeting the criteria set forth in the EPA Model Accreditation Plan (40 CFR 763) for project designer or supervisor, and operations and maintenance training.

T. Containment Barrier: A temporary enclosure constructed with fire-retardant plastic sheeting, suitable framing, tape (as defined in 1.3.52) and other adhesives within the abatement work area. This barrier serves to confine the asbestos abatement and decontamination work, and to contain the release of asbestos containing dust and debris through the action of pressure differential ventilation and air filtration systems. The only entrance is via the abatement worker/equipment decontamination enclosure.

U. COTR (Contracting Officer's Technical Representative): An individual representing the owner as the technical advisor to the NJDMVA Contracting Officer. This individual may be an employee of the consultant.

V. Critical Barrier: Those portions of the containment barrier which represent the minimum structural components necessary to maintain the asbestos removal area in airtight isolation from the surrounding areas. Critical barriers shall be placed on ventilation ducts, HVAC intakes other openings as necessary to achieve abatement work area isolation before putting up the double-layer plastic sheeting containment enclosure within which abatement work is performed. If a temporary plastic sheeting/stud wall must be erected, it shall be treated as a critical barrier. The double-layer plastic sheeting containment enclosure shall then be erected on that wall. A critical barrier will be required to be placed on the inside of all windows scheduled to be removed prior to the removal of any window system or caulk or glazing.

W. Curtained Doorway: A minimum 2-flap passageway to allow access or egress from one room to another while permitting minimal air movement between the rooms of the decontamination enclosure system. It is constructed by placing 2-3 overlapping sheets of plastic sheeting at least

three feet wide over an existing or temporarily framed doorway. The sheets shall be weighted at the bottom so that they close quickly after being released.

X. Decontamination Enclosure: A series of connected rooms with curtained doorways between each room, for the decontamination of the abatement workers and equipment/materials. A decontamination enclosure contains a minimum of three (3) separate rooms (typically with airlocks located between the rooms) consisting of an equipment room, shower room, and clean room. The system is constructed of an air-tight, impermeable, temporary barrier. Framing for enclosure shall be metal or fire retardant pressure impregnated wood.

Y. Disposal Bag: A properly labeled minimum 6 mm thick, leak-tight plastic bag used for transporting asbestos waste from the abatement work area to an EPA-approved disposal site for ACM waste.

Z. Disturbance: Contact which releases fibers from ACM or presumed asbestos-containing material (PACM) or debris containing ACM or PACM. This term includes activities that disrupt the matrix of ACM or PACM, render ACM or PACM friable, or generate visible debris. Disturbance includes cutting away small amounts of ACM and PACM, no greater than the amount which can be contained in one standard sized glove bag (as defined in 1.3.29) or waste bag in order to access a building component. In no event shall the amount of ACM or PACM so disturbed exceed that which can be contained in one glove bag or waste bag which shall not exceed 1.52 m in length and width.

AA. Encapsulant: A material applied after the removal of ACM or to the ACM-edges of partially abated substrates which surrounds or embeds residual asbestos fibers in an adhesive matrix to prevent their release into the atmosphere. Encapsulation for purpose of final lockdown is not to be accomplished until after the project has passed final air clearance tests and the COTR has authorized removal of the containment.

BB. Enclosure: Procedures necessary to completely enclose material containing asbestos behind airtight, impermeable, permanent barriers.

CC. Equipment Room: A contaminated area or room which is part of the decontamination enclosure, with provisions for storage of contaminated clothing and equipment and cleaning supplies for decontamination of equipment. Airlocks are required at all entrances to the equipment room.

DD. EPA: United States Environmental Protection Agency.

EE. Excursion Limit: Airborne concentration of asbestos in excess of 1.0 fiber per cubic centimeter of air (1 f/cc), as averaged over a sampling period of thirty minutes.

FF. Fiber: A particulate form of asbestos, 5 micrometers or longer, with a length-to-width ratio of at least 3 to 1.

GG. Fixed Object: A unit of equipment or furniture in the abatement work area which cannot be removed from the abatement work area.

HH. Glove Bag: A pouch, typically constructed of a minimum 0.15 mm thick, 1.5 m x 1.5 m (maximum), transparent polyethylene or polyvinylchloride plastic, with inward projecting sleeve gloves to abate ACM in a sealed micro-environment with designated inlets for amended

water and sealant application, and a HEPA filtered vacuum unit attachment. The pouch has capacity for tool storage and to hold removed ACM.

II. GFCI (Ground Fault Circuit Interrupter): A type of ground fault protection in areas where personnel are at high risk of receiving electrical shocks (for example, in damp locations); makes use of a device designed to trip at a ground current in the milliampere range, i.e., very much below currents that are normally harmful.

JJ. HEPA Filter: A High Efficiency Particulate Air (HEPA) filter capable of trapping and retaining 99.97% of all mono-dispersed particles 0.3 micrometer in diameter or larger.

KK. HEPA-Filtered Vacuum Cleaner: HEPA-filtered vacuuming equipment with a filter system capable of collecting and retaining asbestos fibers.

LL. Holding Area**:** A chamber between the washroom and uncontaminated area in the equipment decontamination enclosure system.

MM. Impermeable Waste-Disposal Containers: Suitable to receive and retain any asbestos-containing or contaminated material until disposal at an approved site. The containers shall be labeled in accordance with OSHA Regulation 29 CFR 1910.1001 and 29 CFR 1926.1101. Containers must be both water-tight and air-tight.

NN. Lockdown: The process of applying encapsulant as a finishing coat to abated surfaces after project has successfully passed final air clearance tests and the COTR has authorized removal of containment.

OO. Movable Object: A unit of equipment or furniture in the abatement work area which can be removed from the abatement work area.

PP. MSHA: Mine Safety and Health Administration.

QQ. Negative Exposure Assessment (NEA): A demonstration by the contractor, which complies with the criteria in OSHA 29 CFR 1926.1101(f)(2)(iii), that employee exposures during an operation are expected to be consistently below the permissible exposure limits (PELs). Such assessment is to be used to justify level of respiratory protection to be used on the job.

RR. NESHAPS: National Emissions Standard for Hazardous Air Pollutants.

SS. N.E.C.: National Electrical Code.

TT. NIOSH: National Institute for Occupational Safety and Health.

UU. OSHA: Occupational Safety and Health Administration.

VV. PACM: Presumed Asbestos-Containing Material, meaning thermal system insulation and surfacing material found in buildings constructed no later than 1980.

WW. PEL: Permissible Exposure Limit. An occupational limit of exposure to a chemical substance or physical agent.

XX. Personal Monitoring: Sampling of asbestos fiber concentrations within the breathing zone of an employee. Breathing zone is defined as a radius of 150 mm to 250 mm around the employee's head.

YY. Personal Protective Equipment: Equipment which may consist of coveralls, shoes, gloves, helmet, goggles, and respirator used for protection against asbestos exposure.

ZZ. Plastic Sheeting: Fire retardant Polyethylene sheet material of specified thickness used for protection of walls, floors, etc., and critical barriers in the abatement work area.

AAA. 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.

BBB. Respirator: A device designed to protect the wearer from the inhalation of harmful atmospheres and approved by NIOSH or MSHA for a specific category of use.

CCC. Surfactant: A chemical wetting agent added to water to decrease surface tension and improve material penetration.

DDD. Tape: Glass fiber or other tape capable of sealing joints of adjacent sheets of plastic (0.15 mm polyethylene) and for attachment of plastic sheets to finished or unfinished surfaces of dissimilar materials under both dry and wet conditions, including use of amended water. Minimum tape width shall be 51 mm.

EEE. Warning Labels and Signs: As required by OSHA regulations 29 CFR 1910.1001 and 1926.58.

FFF. Waste Water Filters: Discharged liquids shall pass through a primary filter and the output shall be particles 20 microns or smaller. The secondary filter shall have output particles 5 microns or smaller.

GGG. 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.

1.5 REGUATIONS AND REFERENCES

A. Regulations: Contractor shall comply with the most current edition of all federal, state, county, and city codes and ordinances as they apply to the location(s) in which the work is performed. Make available for review at the site one copy of all applicable federal, state, county and city regulations governing the abatement work, including but not limited to:

1. Occupational Safety and Health Administration (OSHA), U.S. Department of Labor:

    a. 29 CFR 1910 (General Industry) and 29 CFR 1926 (Construction) Occupational Safety and Health Standards
    b. 29 CFR 1910.1001 and 29 CFR 1926.1101 Asbestos
    c. 29 CFR 1910.134 Respiratory Protection
    d. 29 CFR 1910.1200 Hazard Communication

2. U. S. Department of Transportation:

   a. 49 CFR 171 Subchapter C, Hazardous Materials Regulations
   b. 49 CFR 172 Subchapter C, Shipping Container Specifications

3. U.S. Environmental Protection Agency:

   a. 40 CFR 763, Toxic Substances Control Act; particularly Subpart E, Asbestos Containing Materials in Schools
   b. 40 CFR 61, Sub-parts A and M, National Emission Standard for Hazardous Air Pollutants (NESHAPS)

4. American National Standards Institute (ANSI); 1430 Broadway, New York, New York 10018, Telephone (212)354-3300.

   a. ANSI Publication Z88.2 Practices for Respiratory Protection

5. American Society for Testing and Materials (ASTM); 1916 Race Street, Philadelphia, PA 19103, Telephone (215) 299-5400.

   a. ASTM Standard P-189 Specification for Encapsulants for Friable Asbestos Containing Building Materials Proposal

6. TSCA and all other applicable regulations.

1.6 SUBMITTALS

A. Reference Division 1, Section 01000 Supplementary Conditions for Construction, for additional requirements.

B. Contractor's Work Plan: The Contractor shall submit a Contractor's Work Plan for asbestos abatement work within 15 calendar days after contract award to the COTR for approval. Approval of the Plan is required prior to beginning abatement work. The Plan shall be on 220 mm x 280 mm paper in a binder indexed by the subjects listed below. Detail the procedures, instructions, and reports used to assure compliance with the contract documents.

   1. Bar Chart Schedule: Provide bar chart scheduling of the abatement work by daily and/or weekly increments for each abatement work area and individual decontamination enclosure system. The time line is to include all work, both on and off the job site, for the entire contract period.

   2. Notices: The contractor shall notify federal, state, and local regulatory agencies in writing immediately upon contract award and a minimum of 10 days in advance of any asbestos related work. Notifications shall be made by the Contractor as required by USEPA National Emission Standards for Hazardous Air Pollutants (NESHAPS) Asbestos Regulations (40 CFR 61, Subpart M). Submit copies of notifications and documentation to the COTR. If a project consists of multi-phases, with distinct start and stop dates, these shall be declared on the EPA Notice or individual notices shall be filed for each phase.

3. Permits and Licenses: Maintain current licenses and obtain applicable permits as required by federal and applicable state or local jurisdictions for the removal, transporting, disposal or other regulated activity relative to the abatement work of this contract. Submit copies of all state and local licenses and permits necessary to carry out the abatement work of this contract.

   a. All asbestos containing waste is to be transported by an entity maintaining a current "Industrial waste hauler permit" specifically for asbestos-containing materials, as required for transporting of waste asbestos-containing materials to a disposal site.

   b. Notices of Violations: Submit copies of all Notices of Violations issued to the contractor and its sub-contractors within the last three (3) years by federal, state, and local regulatory agencies.

4. Sequence of Work: Narrative description of the proposed sequencing of asbestos work and breakdown of abatement work areas requiring separate or individual decontamination enclosures. Include how enclosure systems will be erected and dismantled. Include how re-useable equipment will be cleaned for re-use before relocation or removal from the site. Include how waste disposal containers will be cleaned and removed from the abatement work area.

5. Abatement Work Area Layout Sketch: Layout sketch of decontamination enclosure systems and abatement work area. Describe assembly of construction, materials to be used and location of notices to be posted on the job site. Indicate which areas will be sealed off (and by what means). Show locations of facilities and equipment such as showers, lockers, storage, etc. Show locations of all filtration devices to be used, their exhaust, and calculations to determine the number of these devices needed to provide the minimum 4 air changes per hour in the abatement work area. These requirements shall be coordinated with the COTR and facility representative

6. Isolation of Abatement Work Areas: Methods to isolate/restrict access to abatement work areas. Include how access will be controlled, how building HVAC ventilation systems will be isolated from abatement area. Include how security and fire systems will be maintained within the containment. Include plans for electrical lock-out and dedicated electrical systems. These requirements shall be coordinated with the COTR and facility representatives.

7. Transportation and Disposal: Details of hauling equipment, materials and contaminated debris from inside the building. Submit written identification of licensed hauler and landfill location.

8. Personnel Organization and Responsibilities: The Contractor shall provide a list of all project personnel, both on-site and in the offices, and a statement of their responsibilities and authority for work on this project.

9. Personal Protective Equipment: Details of personal protective equipment and use, storage and maintenance at job site.

10. Posted Notices and Warning Signs: Submit copies of notices to be posted at the job site, as required by EPA and OSHA regulation for asbestos abatement activities.

11. Materials and Equipment Product Data: Submit manufacturer's literature and written information for all materials and equipment, including NFPA test report of flame resistant materials, and material safety data sheets for all chemical-content supplies. Contractor shall not change materials or equipment without approval of a new submittal to the COTR.

12. Contractor Monitoring Services: Before start of asbestos work, submit to the COTR the name of the contractor's industrial hygiene consultant and analytical laboratory for air monitoring.

13. Superintendent/Competent Person: Before start of asbestos work, submit to the COTR the name of job site supervisor who must meet the following requirements as a minimum. Furnish documentation that the General Superintendent:

    a. Has a minimum of five (5) years on-the-job experience as a supervisor of asbestos abatement projects.

    b. Is competent per Section 1.3.15 of this document.

    c. Is certified as an Asbestos Abatement Supervisor in accordance with 40 CFR Part 763.

    d. Is fluent in the English language and all other primary languages spoken by the abatement work crew.

14. Workers' Specialized Training: Submit training course descriptions, locations, and dates. Submit to the owner’s representative a written affidavit before start of asbestos and any lead removal as proof that all employees have had instruction on the hazards of asbestos exposure; and on all aspects of work procedures and personal protection and area protective measures as required and/or recommended by OSHA and EPA and other applicable regulations. The affidavit shall include course name, designation, installation, place, date taken, and student names.

    a. Training shall be in accordance with 29 CFR 1926.1101.

    b. Course certification shall be in accordance with EPA as required by 40 CFR 763.

    c. Workers should have a minimum of one (1) year experience as an asbestos worker and experience handling PCB contaminated materials.

15. Respiratory Program: Submit a written respiratory program as defined in OSHA 1926.1101 and in these specifications. Submit type of NIOSH/MSHA certified respiratory equipment intended for each operation required by this project. Selection criteria must meet 29 CFR 1926.1101 (h) (2). When a Type "C" supplied positive pressure air respiratory system is required by the abatement work, submit drawing showing assembly of components into a complete supplied air respiratory system. Include diagram showing location of compressor, filter banks, backup air supply tanks, hose line connections in abatement work area(s), routing of air lines to abatement work area(s) from compressor.

16. Negative exposure assessment data submitted to justify respiratory selection must be less than 12 months old and closely resemble the current project following criteria set forth in 29 CFR 1926.1101 (f) (2) (iii).

17. Emergency Preparedness: Submit an emergency plan to COTR for approval by Environmental Consultant. Office of Safety, Health and Environmental Management. The emergency plan shall address responses to fire, accident, power failure, pressure differential system failure, supplied air system failure, or any other event that may require modification or abridgement of decontamination or abatement work area isolation procedures. Show exit routes from the building, locations of the nearest manual pull stations, telephone number of security office, name of the designated employee responsible for fire protection, fire hazards inherent to the project and measures taken for prevention. All employees shall be familiar with the emergency plan and have initialed the plan after reading it, know how to activate the fire alarm, and trained in the use of portable fire extinguishers. One on-site employee shall be designated as responsible for fire protection. The plan shall be available at the job site in all primary languages of the abatement work crew. In addition, the following emergency information shall be posted at all entrances to the abatement work area:

    a. Exit route map
    b. Owner's representative

1.7 DAILY REPORTS

A. The Contractor shall correspond with the COTR for all matters related to this construction project, unless otherwise directed.

B. All correspondence with the owner shall be in the English language, signed and dated by the Contractor.

C. Reference General Conditions (Construction Contract Clauses) and Specifications Division 1 for Supplementary Conditions for Construction.

D. The Contractor shall maintain daily logs and reports of job-site activities and personnel exposure monitoring at the site and shall provide copies to the COTR for inspection upon request.

E. The Contractor shall maintain daily reports using the Contractor's Daily Report form. Reports shall be numbered consecutively and all sections shall be completed or noted as 'not applicable.' Each day's report shall contain detailed remarks including but not limited to progress on the job, problems discovered, and discussions with Smithsonian staff. Reports shall be submitted to the COTR each day for the previous work day. Copies shall be maintained at the jobsite and made available to the COTR upon request.

F. Reporting Unusual Events: When an event of unusual and significant nature occurs at site (examples: failure of pressure differential system, rupture of temporary enclosures, equipment or power failure, high airborne fiber reading), prepare and submit a special report listing chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information.

G. Accident Reporting: Report all accidents to the owner's representative first, then to the COTR. Prepare reports of significant accidents, at site and anywhere else work is in progress. 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, property loss of substance is sustained, or where the event posed a significant threat of loss or personal injury. Report shall be submitted to the COTR, who will forward copies to OSHEM and the facility Safety Coordinator.

H. Waste Manifest-Asbestos: At completion of hauling and disposal of each load, submit a copy of waste manifest, chain of custody form, and landfill receipt to the COTR. Waste manifest to be submitted shall be signed by the contractor, waste transporter, and the disposal facility. A copy of all manifests will be included in the post-job submittal.

I. Waste Manifest-Hazardous Waste: Any hazardous waste generated as a result of asbestos abatement activities will be disposed of by a Certified Hazardous Waste Disposal Contractor. A copy of the Hazardous Waste Manifest generated by this disposal is to be submitted to the COTR, who will forward a copy to the facility's Hazardous Waste Coordinator. A copy of all manifests will be included in the post-job submittal.

1.8 PRODUCT HANDLING

A. Delivery all materials in the original packages, containers, or bundles bearing the name of the manufacturer and the brand name.

B. 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. Remove from the premises all damaged or deteriorated materials. Dispose of materials that become contaminated with asbestos in accordance with applicable regulatory standards and these specifications.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Caulking: High-grade rubber base caulk for masonry and/or for other materials.

B. Encapsulant: Product shall be rated as acceptable for use intended when field tested in accordance with ASTM Proposed Specification P-189 "Specification for Encapsulants for Friable Asbestos Containing Building Materials". Use only materials that have a flame spread index of 25 or less when dry, when tested in accordance with ASTM E-84.

C. Impermeable Waste-Disposal Containers: Suitable to receive and retain any asbestos-containing or contaminated material until disposal at an approved site. The containers shall be labeled in accordance with OSHA Regulation 29 CFR 1910.1001 and 29 CFR 1926.1101. Containers must be both water-tight and air-tight.

D. Plastic Sheeting: Product Standard PS 17-69 and OSHA Regulation 29 CFR 1926.1101; Polyethylene plastic sheeting material 6 mm thickness for covering floors and walls, providing air locks, and sealing doors and windows; supply in appropriate widths to minimize seams. Must be flame-resistant material and must meet test criteria in NFPA 701. Reinforced sheeting is required for applications subject to wear and tear.

E. Surfactant: (Wetting Agent): 50% polyoxyethylene ester and 50% polyoxyethylene ether, or approved equal, shall be mixed with water to provide a concentration of 2 ml surfactant to 1 liters of water, or manufacturer's recommended concentration.

F. Tape: Glass fiber or other tape capable of sealing joints of adjacent sheets of plastic sheeting and for attachment of plastic sheets to finished or unfinished surfaces of dissimilar materials under both dry and wet conditions, including use of amended water. Minimum tape width shall be 50 mm.

G. Warning Labels and Signs: As required by OSHA regulations 29 CFR 1910.1001 and 1926.58.

H. Waste Water Filters: Discharged liquids shall pass through a primary filter and the output shall be particles 20 microns or smaller. The secondary filter shall have output particles 5 microns or smaller.

2.2 EQUIPMENT

A. Air Filtration Units: Shall be factory-sealed and equipped with HEPA filters (final), pre-filters, instrumentation to monitor pressure differential, and safety and warning devices.

1. Provide units with electrical components approved by the National Electrical Manufacturers Association (NEMA) and Underwriter's Laboratories (UL).

2. Access to the units for replacement of all air filters shall be from intake end. Provide units with pre-filters and intermediate filters installed either on or in the intake grid of the unit and held in place with special housings or clamps. The filter media shall be completely sealed on all edges with a structurally rigid frame with a continuous rubber gasket.

3. HEPA Filters: Provide units equipped with HEPA filters. Filters shall be individually tested and certified by the manufacturer.

4. Pre-filters: Provide a two-stage pre-filtration to extend the life of the primary HEPA filter. The first-stage pre-filter is a low-efficiency type effective for particles 100 micrometers and larger. The second-stage (or intermediate) filter has a medium efficiency effective for particles down to 5 micrometers.

5. Instrumentation: Provide units equipped with a magnehelic gauge or manometer to measure the pressure drop across filters and to indicate when filters have become loaded and need to be changed. A table indicating the usable air-handling capacity for various static pressure readings on the magnehelic gauge affixed near the gauge for reference, or the magnehelic reading indicating at what point the filters should be changed, noting cubic feet per minute (CFM) air delivery at that point. Provide an elapsed time meter to show the total accumulated hours of operation.

6. Safety and Warning Devices: Provide units with the following safety and warning devices:

   a. A Warning lights 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., rupture in HEPA filter or obstructed discharge)
   b. GFCIs.
   c. Audible alarm if unit shuts down due to operation of safety systems.
   d. Electrical overload protection sized for the equipment. The motor, fan, fan housing, and cabinet are to be grounded.

B. Respirators and Respirator Systems: Product Data: Must possess NIOSH and MSHA approval for each component in an assembly and/or for entire assembly.

PART 3 - EXECUTION

3.1 CONTROLLED ACCESS TO SITE

A. Access to the abatement work area shall be restricted to contractor's workers and authorized visitors as defined in these specifications.

B. Authorized visitors shall have access to the work site at all times following notification to COTR. Contractor shall supply protective clothing and equipment for visitors as necessary, except for respirators which are to be provided by the visitor in accordance with Section 3.4 of this document.

C. Contractor shall prominently post signs at all potential entry points to the abatement work area which clearly state: "Restricted Area Under Construction-Admittance by Special Permission Only - Protective Clothing Required Beyond This Point". Immediately inside entry point and outside critical barriers post a warning sign meeting specifications of OSHA 29 CFR 1910 and 1926. Suggested format is a sign of minimum size 508 mm by 356 mm displaying the following legend:

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DANGER
ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING ARE
REQUIRED IN THIS AREA

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D. All workers and authorized visitors shall enter the abatement work area only through the abatement worker/equipment decontamination enclosure, in accordance with Section 3.3 of this document.

E. All workers and authorized visitors, before entering the abatement work area, shall read and be familiar with all posted regulations, personal protection requirements, and emergency procedures and exit routes.

F. Contractor shall maintain a daily job site personnel log listing names and social security numbers of individuals who entered the abatement work area, and the times of entering and leaving the area.

3.2 WORKER AND VISITOR PROTECTION

A. No eating, drinking, smoking, or chewing gum is permitted within the abatement work area. The COTR shall designate a "break area" where these activities, except for smoking, are permitted. Smoking is prohibited in state facilities.

B. Workers and Visitors shall be fully protected with respirators and protective clothing during any work which may disturb asbestos-containing materials and result in fiber release. Full protection is not required during pre-abatement inspections of the containment, while work is not being conducted.

C. Protective Clothing and Equipment: Provide workers and visitors with sufficient sets of protective full body clothing, to include full body coveralls with hood, boots (for workers) and footwear coverings (for workers and visitors), and gloves. Provide eye protection and hard hats as required by applicable safety regulations. Contaminated non-disposal clothing and footwear shall be left in the equipment room until the end of the asbestos abatement work, at which time such items shall be disposed of as asbestos waste, or shall be thoroughly cleaned of all asbestos or asbestos-containing material. Contractor shall have at least six (6) sets of disposable protective full body clothing for COTR and authorized visitors for each work day. Provide storage facilities for visitors and workers for removed street clothing in the clean room.

1. Boots: Provide workers non-skid type work boots with protective shields as required by OSHA. Paint uppers of boots with red waterproof enamel paint as a permanent marking that the boots have been exposed to ACM abatement work areas. These boots are to be handled as asbestos-contaminated materials.

2. Hard Hats: Provide hard hats that meet ANSI Z89.1 for use where work is overhead, scaffolding is being used, or as otherwise required by OSHA. Label hats with same warning labels as required for ACM disposal bags.

3. Goggles: Provide goggles that meet ANSI Z87.1 as required by OSHA.

4. Gloves: Provide disposable work gloves for use in the abatement work area.

5. Coveralls with Hood: Provide disposable coveralls with hoods for use in the abatement work area.

6. Respirators: Provide workers with personally issued and marked respirator equipment approved by NIOSH/MSHA and, in accordance with these specifications, suitable for the asbestos exposure level in the abatement work area. Where respirators with disposable filters are employed, provide sufficient filters for replacement as necessary by the abatement worker, or as required by the applicable regulation. Authorized visitors must provide their own respirators, with fresh filters or cartridges as necessary, to enter the abatement work area. These are minimum requirements. Section 3.4 of this document is to be consulted for more detail.

3.3 ABATEMENT WORK AREA ENTRY AND EXIT PROCEDURES

A. Each time the abatement work area is entered remove all street clothes in the Clean Room of the Decontamination Enclosure and put on new disposable coveralls, new head cover, and a clean respirator. Proceed through shower room to equipment room and put on work boots.

B. Each time the abatement work area is exited, the following procedures shall be followed:

1. Before leaving the regulated area, employees and authorized visitors shall remove all gross contamination and debris from their protective clothing.

2. Personnel exiting the regulated area shall remove their protective clothing and equipment (except respirators) in the equipment room and deposit the clothing in labeled impermeable bags or containers.

3. Personnel shall remove their respirators in the shower room, washing and rinsing them.

4. Personnel shall shower thoroughly before entering the clean room.

5. After showering, employees shall enter the clean room before changing into street clothes.

3.4 RESPIRATORY PROTECTION

A. Contractor is hereby advised that asbestos has been determined by the U.S. Government to be a CANCER-CAUSING AGENT. Provide workers with respirators (which, as a minimum, meet the requirements of OSHA 29 CFR 1926.1101) and protective clothing during all phases of the abatement work and until final air tests are accepted by COTR.

B. The Contractor shall select respirators from among those jointly approved as being acceptable for protection by the MSHA and the NIOSH under the provisions of 30 CFR Part 11.

C. The Contractor shall select and provide respirators at no cost to the employee, and shall ensure that the employee uses the respirator provided.

D. Instruct and train each worker involved in asbestos abatement or maintenance and repair of asbestos-containing materials in proper respiratory use and require that each worker always wear in the abatement work area a respirator, properly fitted on the face. The respirator shall be worn from the start of any operation which may cause airborne asbestos fibers until the abatement work area is completely decontaminated.

E. Allow an individual to use only those respirators for which training and fit-testing have been provided. Require that each time an air-purifying respirator is put on it be checked for fit with a positive and negative pressure fit test in accordance with the manufacturer's instructions or ANSI Z88.2.

F. For all jobs that involve the removal of thermal system insulation (TSI) or surfacing materials (OSHA definition of Class I work) the employer shall provide respirator protection in accordance with 29 CFR 1926.1101 (h) Table 1 - Respiratory Protection for Asbestos Fibers.

This level of respiratory protection shall be maintained until the employer can produce a negative exposure assessment.

G. For all other abatement work, use respiratory protection appropriate for the fiber level encountered in the abatement work area or as required for other toxic or oxygen-deficient situations encountered. The level of respiratory protection which supplies an airborne fiber level inside the respirator, at the breathing zone of the wearer, at or below the permissible exposure limit (PEL) is the minimum level of protection allowed. (Table 1, Respiratory Protection for Asbestos Fibers, 29 CFR 1926.1101*)* Do not use single-use, disposable, or quarter-face respirators.

H. Authorized visitors are responsible for providing their own respirator and replacement filters and cartridges, with the exception of Type C which shall be provided by Contractor, and for having been previously and properly trained fit-tested, for the respirator used.

I. For use with air-purifying respirators, provide, at a minimum, HEPA type filters certified by NIOSH and MSHA for protection against asbestos fibers. In addition, a chemical cartridge may be added, if required for protection against chemicals used on this job.

J. For use with powered air purifying respirators, supply a sufficient quantity of HEPA filters approved for asbestos, so workers can change filters at any time that flow through the face piece decreases to the level at which the manufacturer recommends filter replacement.

K. For supplied-air respirator systems, provide equipment capable of producing air used for breathing in Type "C" supplied air respiratory systems that meets or exceeds standards set for C.G.A. Type 1, Gaseous Air, Grade D. System must be certified by NIOSH/MSHA as an approved Type "C" respirator assembly operating in pressure demand mode with a positive pressure face-piece including as a minimum the following:

1. Auxiliary backup system
2. Escape air supply
3. Backup air supply
4. Warning Alarm Device
5. Compressor Shut Down
6. Compressor Motor (electric)
7. Compressor Location (outside building)
8. Air Intake
9. After-Cooler

3.5 AIR MONITORING; STOP ACTION AND CLEARANCE LEVELS

A. This section describes work being performed by the consultant facility. The owner will not be performing air monitoring to meet Contractor's OSHA requirements for personal sampling or any other purpose. The Contractor is to conduct air monitoring required by OSHA for Contractor personnel.

B. Analytical Methods: The following methods will be used by the owner’s representative in analyzing filters used to collect air samples. Minimum sample volumes will be 1200 liters for clearance samples.

1. Phase Contrast Microscopy (PCM) - will be performed using the OSHA Reference Method, Appendix A to 29 CFR 1926.1101, or NIOSH Method 7400.

2. Transmission Electron Microscopy (TEM) - will be performed using the analysis method set forth in the AHERA regulation 40 CFR Part 763 Appendix A, or NIOSH Method 7402, whichever is deemed more appropriate by facility owner in each case.

C. Before Start of Work: The contractor will secure abatement work area air samples to establish a base line fiber level in each homogeneous abatement work area before start of work. All samples will be taken at the same time to ensure identical environmental conditions.

D. Daily: From start of abatement work through project decontamination, the consultant may be taking samples on a daily basis inside and outside each abatement work area.

E. All Clearance Air Samples will be taken using aggressive sampling techniques.

F. Stop Action: If any air sample taken outside of the abatement work area exceeds 0.01 f/cc by PCM, or 70 structures per mm^2 by TEM, depending on sampling method used, immediately and automatically stop all work except corrective action. PCM air samples will be re-analyzed by TEM to determine whether the high outside-of-work-area results were due to asbestos or non-asbestos fibers. The consultant and the abatement contractor will determine the source of the high reading. The contractor will correct the condition, as appropriate.

G. Abatement Work Area Final Clearance Levels: The owner's standard for abatement work area final clearance in all occupied areas for removing the critical barriers from the inside of the facility and re-occupancy is 70 structures per mm^2 by TEM using the analysis method set forth in the AHERA regulation 40 CFR Part 763 Appendix A.

3.6 INITIAL ISOLATION OF ABATEMENT WORK AREA

A. Contractor shall completely separate the abatement removal of the windows by placing 2 layers of 6 mil fire rated plastic on the interior side of the windows.

B. All heating, ventilating, and air conditioning (HVAC) components that are in, supply or pass through the window removal abatement work area shall be shut down. During asbestos removal and until job completion, elevators, exhaust fans, and HVAC vents and intakes will be key locked to not operate in the abatement work area.

C. Coordinate with the COTR and Building Representative which areas are to be shut down and for what duration. Seal all intake and exhaust vents, and seams in system components, with a double layer of 0.15 mm polyethylene sheeting.

D. If it becomes necessary to shut down electric power to the enclosed abatement work area, then the contractor shall provide temporary power and lighting and ensure safe installation of temporary power sources and equipment in accordance with NFPA 70 electric code requirements.

3.7 PREPARATION OF ABATEMENT WORK AREA AND TEMPORARY ENCLOSURES

A. Clean all Clean all contaminated furniture, equipment, and supplies with a HEPA-filtered vacuum cleaner or by wet wiping, as directed by the COTR, prior to being moved or covered within 5 feet of the interior wall or windows.

B. Before removal, clean by HEPA-filtered cleaner and/or by wet wiping, all electrical and mechanical items, (such as lighting fixtures, clocks, diffusers, registers, etc.) and general construction items (such as cabinets casework, door and window trim, moldings, etc.) which cover the surface of the abatement work as required to prevent interference with the abatement work. Reinstall all such materials upon completion of the removal work with materials, finishes, and workmanship to match existing installations before start of work.

C. Remove all removable furniture, equipment, and supplies that have been deemed by the COTR to be uncontaminated, or completely cover with 2 layers of polyethylene sheeting, at least 6 mm in thickness, securely taped in place with duct tape. Such furniture, equipment, and supplies shall be considered outside the abatement work area unless covering plastic or seal is breached.

D. Clean all surfaces in abatement work area with a HEPA-filtered vacuum cleaner or by wet methods prior to installation of primary barrier.

E. All critical barriers, including ventilation openings (supply and exhaust), lighting fixtures, clocks, doorways, interior of windows, and other openings into the abatement work area shall be individually sealed with two layers of 6 mil fire rated plastic sheeting and tape. Elevator doors, fire extinguisher cabinets and all other penetration in the floor, walls, or ceiling shall be sealed in the abatement work area. If a temporary polyethylene/stud wall must be erected, that wall shall be treated as a critical barrier. The double layer polyethylene containment enclosure shall then be erected on that wall. Critical barriers shall be sealed prior to installation of primary barriers

F. Cover plastic sheeting in areas where scaffolding is to be used with a single layer of 12.7 mm fire retardant plywood. Wrap edges and corners of each sheet with duct tape.

G. Tape all joints including the joining with the floor covering with duct tape or as otherwise indicated by the COTR.

H. A secondary barrier of plastic as a drop cloth shall be used to protect the primary layer from debris and shall be rolled and disposed as contaminated waste at the end of each workday.

I. Provide emergency exiting from the enclosure as required by NFPA 101, Life Safety Code. Arrange exit door(s) so that it is secure from outside the abatement work area but permits exiting from the abatement work area. Mark outline of door on barriers with luminescent paint at least 250 mm wide. Hang a razor knife on a string beside outline. Post a sign identifying "EMERGENCY EXIT", using letters at least 150 mm high, inside outline with luminescent paint. Arrows shall be taped on the polyethylene wall covering at eye level and at floor level to indicate location of exits. At entrance to decontamination chamber, post building floor plan and escape routes, plus locations of nearest exist and phone numbers of facility security. Emergency lighting shall be required, in accordance with the Life Safety Code.

J. A 4.5 kg ABC type portable fire extinguisher shall be located by each exit and clean room.

K. Provide GFCI protection for all electrical equipment.

L. Provide temporary lighting inside the decontamination enclosure facility.

3.8 CONSTRUCITON OF WORKER/EQUIPMENT DECONTAMINATION AND WASTE LOAD-OUT ENCLOSURES

A. Worker/Equipment decontamination enclosures shall be provided at each location where workers shall enter or exit the abatement work area.

B. The Contractor shall construct a worker/equipment decontamination enclosure consisting of at least a clean room, a shower room, and an equipment room, each separated by 900 mm air locks. Narrower air locks may be built if approved by the COTR.

1. All rooms shall be constructed of or fully lined with 6 mm thick fire rated polyethylene sheeting and suitable framing to make them as air-tight as possible. Where joining separate sheets of polyethylene is necessary, the two sheets of polyethylene shall be over-lapped at least 150 mm and adhered with an unbroken line of tape in such a manner to prohibit air movement. Stagger joints. Tape shall then be used to further seal the joint on the other side of the containment barrier so that both loose edges of the overlap are completely sealed.

2. Doorways will consist of three 3 sheets of 6 mm fire rated polyethylene from ceiling to floor. The width of these polyethylene sheets shall be sufficient to prevent air movement through the doorways when closed.

3. These doorways shall be the only source of make-up air for the HEPA negative air filtration unit under normal circumstances, unless other sources are specifically approved by the COTR.

4. Provide GFCI protection for all electrical equipment.

5. Provide temporary lighting inside the decontamination enclosure facility if needed.

C. The Clean Room shall have a curtained doorway leading to the outside of the abatement work area, and an airlock leading to the Shower Room. The clean room shall be of sufficient size to accommodate at least one worker, and a supply of clean disposable coveralls and storage facilities for street clothing, and uncontaminated equipment.

D. The Shower Room shall have two airlocks, one adjacent to the clean room and one adjacent to the equipment room. The Shower room shall provide hot and cold running water and soap and towels. It should have adequate space for a shower stall. Waste water from the shower shall be discharged through a water filtration unit efficient to 5 microns, then to a sanitary sewer. Shower room shall have opaque walls.

1. Shower Stall: Provide leak tight shower enclosure unit with integrated drain pan fabricated from fiberglass or other durable waterproof material. Equip with hose bibs for hot and cold water. 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 abatement work area. Provide splash proof entrances. Provide back flow prevention

device and vacuum breaker, where required. Connect drain to a reservoir, pump water from reservoir through filters to a drain. Mount filters inside shower stall in manner that allows for access for filters to be changed from inside the shower. Change filters daily or more often if necessary. Locate filters inside shower unit so that water lost during filter changes is caught by shower pan. Provide temporary extensions of existing (if available and authorized for Contractor use by COTR) hot and cold water and drainage, as necessary for a complete and operable shower.

2. Filtered Waste Water Drainage: Provide cascaded disposable HEPA filter units on drain lines from showers or any other fluid source carrying ACM. Connect so that discharged water passes primary filter and output of primary (particles 20 microns and smaller) filter passes through secondary (particles 5 microns and smaller) filter.

3. Sump Pump: Provide totally submersible waterproof sump pump with integral float switch. Provide unit sized to pump 2 times the flow capacity of all showers or hoses supplying water to the sump, through the filters specified herein when they are loaded to the extent that replacement is required. Provide unit capable of pumping debris, sand, plaster or other materials washed off during decontamination procedures without damage to mechanism of pump. Adjust float switch so that a minimum of 75 mm remains between top of liquid and top of sump pan.

E. The Equipment Room shall have two airlocks, one adjacent to the abatement work area and one adjacent to the shower room. The room shall be of sufficient size so as to accommodate at least one worker to change clothes, and temporarily house any equipment which the contractor wishes to store when not in use. The area shall have facilities for decontaminating material and equipment, and a container lined with 0.15 mm polyethylene bag for collection of disposable coveralls and foot coverings.

3.9 PRE-ABATEMENT INSPECTION, TESTING AND APPROVAL

A. Show proper operation of safety and warning devices

B. Show proper operation and calibration of instrumentation.

C. Show identification of equipment unit and fan capacity.

D. Use smoke tubes to demonstrate adequate air circulation, elimination of dead air pockets, and positive air motion through the decontamination enclosure system into the abatement work area.

E. Show the installation method for pre-filters and the HEPA primary filter in the air filtration unit. Show supply of filters available on site.

F. Demonstrate and record that a minimum 0.50 mm of water pressure differential has been achieved and can be maintained.

G. Demonstrate procedures for how workers will enter and exit the decontamination enclosure system.

H. Demonstrate procedures for handling emergencies and for the prevention of contamination of surrounding areas.

I. With COTR and Building Representative, identify disabled building ventilation systems and the positive means that will prevents accidental or premature restarting. Confirms means to have unit restarted at the conclusion of the abatement work. With COTR and Building Representative, verify that all equipment affected is secured at the main breaker.

J. Demonstrate how contaminated shower water is filtered and drained.

K. Use a pressure differential meter or manometer to demonstrate the required pressure differential at every barrier separating the abatement work area from the balance of the building, equipment, ductwork or outside.

L. Demonstrate that each air filtration unit is serviced by a dedicated minimum 115V-20A circuit with GFCI protection.

M. Demonstrate how asbestos will be removed and bagged for transport. Identify procedures for hauling through the building to the loading dock.

3.10 MAINTENANCE OF CONTAINMENT BARRIER AND ENCLOSURES

A. Ensure that the containment barrier, decontamination enclosure rooms, and other sealed doors, vents, etc., and plastic linings are effectively sealed and taped for the duration of the abatement work.

B. Repair damaged barriers and remedy defects immediately upon discovery. Visually inspect enclosure at the beginning of each work period.

C. Damaged or deteriorating materials shall not be used and shall be removed from the premises. Material that becomes exposed to and contaminated with asbestos shall be decontaminated or disposed of in accordance with the applicable regulations and special requirements.

D. Clean debris and residue from inside of the decontamination enclosure system on a daily basis. Damp wipe or hose down all surfaces after each shift change. Clean debris from shower pans on a daily basis.

E. Maintain floors in the clean room and airlocks as dry as possible to minimize slips and trips. Damp wipe all surfaces twice after each shift change with a disinfectant solution.

3.11 REMOVAL OF ASBESTOS-CONTAINING MATERIALS (ACM) – GENERAL

A. Prohibited Work Practices: The following methods shall not be used for work related to or disturbing asbestos, regardless of exposure level:

1. High-speed abrasive disc saws that are not equipped with point of cut ventilation or enclosures with HEPA-filtered exhaust air.

2. Compressed air used to remove asbestos, or materials containing asbestos, unless the compressed air is used in conjunction with an enclosed ventilation system designed to capture the dust cloud created by the compressed air.

3. Dry sweeping, shoveling or other dry cleanup of dust and debris containing ACM and PACM.

4. Employee rotation as a means of reducing employee exposure to asbestos.

B. Methods of Compliance: The following engineering controls and work practices shall be used, at a minimum, for all asbestos tasks:

1. HEPA-filtered vacuum cleaners.
2. Wet methods.
3. Prompt cleanup and disposal.

C. The following work shall be done only after the decontamination facilities have been constructed, the area has been isolated and can be maintained under negative air pressure as specified in the previous section, pre-abatement background sampling has been conducted, and arrangements have been made for disposing waste at an acceptable site.

D. Start abatement work at a location farthest from the fan units and proceed toward them. If an electric power failure occurs, immediately stop all abatement work and do not resume until power is restored and negative air filtration units are operating again. Immediately notify COTR of occurrence. Any torn or unsealed plastic sheeting shall be immediately repaired. Floor sheeting shall be replaced if damaged.

E. Wet Removal: Prior to stripping and/or tooling, the asbestos material shall be sprayed using an airless pump and wetting agents (amended water or removal encapsulant) to enhance penetration and reduce fiber dispersal into the air.

1. A fine spray of amended water shall be applied to reduce fiber release preceding the removal of the asbestos material. The material shall be sufficiently saturated to prevent emission of excessive airborne fibers.

2. Spray material repeatedly during the abatement work process to maintain a continuously wet condition. If a removal encapsulant is used, apply in strict accordance with manufacturer's instructions. Perforate outer covering of any insulation which has been painted and/or jacketed in order to allow penetration of water, amended water or removal encapsulant. Where necessary, carefully strip away while simultaneously wetting the insulation to minimize dispersal of asbestos fibers into the air.

3. Remove materials in manageable quantities and control the descent to the staging or floor below. If over 6 meters, use drop chutes to contain material during descent.

F. Gross removal of dust and debris from contaminated material, material containers, and equipment shall be accomplished in the containment barrier before removal to the equipment decontamination room for wet sponging before leaving the abatement work site.

1. Wrap material in felt and place in fiberboard drum lined with two disposal bags. Use caution to insure that all edges of wire lath that could cut plastic are covered with felt.

2. Place material directly in a steel drum. Use waste containers which are impervious to puncture, leakage, tearing, or ripping from wire lathe.

3.12 PORT REMOVAL - CLEANING AND CLEARANCE

A. Provide general clean-up of abatement work area concurrent with the removal of all asbestos-containing materials. Do not permit accumulation of debris on workspace floor.

B. Do not perform dry dusting or dry sweeping.

C. Maintain the minimum required pressure differential of 0.50 mm of water inside the abatement work area enclosure at all times, and until the COTR authorizes the Contractor to remove the enclosure.

D. During decontamination of automatic sprinkler and smoke detectors, the NJDMVA security office must be contacted for possible nuisance alarms. Care must be taken in the wiping down of the sprinkler heads and smoke detectors so as not to damage them. Smoke detectors must be vacuumed clean as directed by the Fire Alarm Shop, Office of Physical Plant.

E. Initial Phase Cleanup Sequence:

1. Remove all visible accumulations of asbestos-containing material and debris.

2. Wet clean and HEPA-vacuum all surfaces in the abatement work area.

3. Clean all equipment (excluding that which will be needed for further cleaning phases) used in the abatement work area and remove from abatement work area via the Equipment Decontamination Enclosure.

4. Remove the top layer (secondary barrier) of plastic sheeting, change all air filtration system pre-filters, and proceed with the second cleaning.

5. Replace all HEPA-filters and pre-filters in air filtration air machines with clean filters. Clean all air filtration machines.

6. Notify AST for observation of cleaning to determine completeness. Plastic sheeting surfaces will be considered clean when free from dust, dirt, residue, film, or discoloration resultant from abatement operations or other activities subordinate to these operations.

7. Perform no activity in abatement work area for at least 12 hours in order to allow settlement of airborne fibers. No reduction in this settling period will be allowed.

F. Secondary Phase Cleanup Sequence:

1. Wet clean and HEPA-vacuum all surfaces in abatement work area at least one more time.

2. Notify AST for observation to determine completeness of cleaning.

3. AST will perform a visual observation of the abatement work area in general accordance with ASTM 1368, *Standard Practice for Visual Inspection of Asbestos Abatement Projects.*

4. If visual clearance is not attained, then subsequent re-cleaning will be required. This sequence will continue until visual clearance is attained.

5. When visual clearance has been obtained, the plastic barriers down to the critical barriers may be removed.

G. Final Air Clearance Testing:

1. AST will test for the final air clearance levels, in accordance with 3.5.7 of this specification, when areas have passed the visual clearance phase. Final air testing shall be performed using aggressive air sampling techniques.

Re-clean and continue to clean at Contractor's expense, areas which do not comply with the specified final clearance level.

H. Consider abatement work areas and all other decontaminated and cleaned areas clean when:

1. All phases of cleanup have been completed and level of cleanliness is approved by COTR.

2. All asbestos final clearance testing results will be as specified in 3.5.7 of this specification.

I. After area passes final air clearance dismantle Decontamination Enclosure Systems and thoroughly HEPA-vacuum and wet clean immediate areas.

J. Dispose of debris from removal operation, used cleaning materials, unsalvageable materials used for sturdy barriers, and any other remaining materials. Consider the materials to be contaminated, and dispose of accordingly.

K. The "COTR's Certification of Visual Inspection and Final Air Sampling for Asbestos Abatement" form or equivalent shall be completed, signed by the Contractor, AST, COTR and included with the COTR project records. The COTR shall provide written results of all visual inspections and final clearance testing to the facility safety coordinator.

3.13 POST CLEARANCE - APPLICATION OF LOCKDOWN ENCAPSULANT TO BASE MATERIAL

A. Pre-Lockdown Encapsulant Mock-up Test: Prior to beginning lockdown encapsulant work, provide a sample area for approval by the COTR. Notify the COTR a minimum of 72 hours in advance to schedule the test. Lockdown encapsulant shall be applied using methods set forth in ASTM Proposed Specification P-189 "Specification for Encapsulants for Friable Asbestos Containing Building Materials". The test must be witnessed by the COTR or as otherwise designated by the COTR. The approved procedures and materials shall serve as a standard for the balance of the lockdown encapsulant work.

B. Apply encapsulant only when environmental conditions in the abatement work area are as required by the manufacturer's instructions and the COTR. Prior to applying any encapsulant, ensure that its application will not cause the base material to fail and allow the encapsulated material to fall of its own weight or separate from the substrate.

C. Apply encapsulant with an airless spray gun with air pressure and nozzle orifice or as otherwise recommended by the encapsulant manufacturer.

1. Color the encapsulant with contrasting colors in alternate coats so that visual confirmation of complete and uniform coverage of each coat is possible. Adhere to manufacturer's instructions for coloring. At the completion of work, the encapsulated surface must be a uniform third color produced by the mixture.

3.14 CONTAINMENT BARRIER REMOVAL

A. Following area final clearance and lockdown encapsulation, leave pressure differential units running as long as feasible during containment barrier removal.

B. Equipment, machinery, scaffolding, tools, etc., within the abatement work area shall not be removed without first being thoroughly cleaned with amended water or in the case of delicate items susceptible to rust, an acceptable substitute.

C. After the abatement work area is found to be in compliance, the remaining sealed areas and exits are unsealed and the plastic sheeting, tape, and any other trash and debris are disposed of in sealable plastic bags and treated as asbestos waste. The AHERA Building Inspector will conduct a final walkthrough and document results for the COTR.

D. Before removal from the abatement work area, remove and properly dispose of pre-filter, decontaminate exterior of machine and seal intake to the machine with 0.15 mm polyethylene to prevent environmental contamination from the filters.

E. The contractor shall patch and paint and repair all damaged areas and restore them to their original, pre-contract condition.

3.15 WASTE DISPOSAL

A. The COTR reserves the right to restrict when containerized ACM will be moved outside of the abatement work area and pass through the building. Times chosen to move containerized ACM in the building shall be during non-public hours and when limited staff is in attendance or under other appropriate conditions as determined by the COTR.

B. Asbestos and PCB contaminated waste that has been containerized shall be transported out of the abatement work area either through the personnel/equipment decontamination enclosure or through a separate waste load-out enclosure. Waste load-out procedures shall be performed by two teams. The team inside the abatement work area shall clean the outside of properly labeled asbestos waste containers using HEPA vacuums and/or wet wiping, and place them into the waste load-out enclosure. No personnel from the inside team shall exit any further from the abatement work area. The team inside the-waste load-out area (wearing protective clothing and respirators) shall retrieve the waste containers from the load-out enclosure, double-bag the waste and pass them to an uncontaminated area outside the enclosure. No unprotected personnel from the outside team shall enter this enclosure. As applicable, routes to the elevator, the elevator itself, and route to covered carts shall be lined with polyethylene sheeting.

C. Water not disposed of with the asbestos-containing materials shall be filtered to remove asbestos fibers and debris before disposal into sanitary sewer.

D. Do not store containerized materials outside of the abatement work area. Take containers from the abatement work area directly to a sealed truck or dumpster.

E. Bulk and containerized asbestos and PCB waste shall be packed, labeled, and transported according to DOT Regulations 49 CFR 173.216 and 49 CFR 173.240. All removed ACM, plastic sheeting, tape, cleaning material, clothing, and all other disposable material or items used in the abatement work area shall be packed into double bagged sealable 0.15 mm plastic bags or double containerized with one bag and one drum. The bags shall be marked with the labels required by OSHA 29 CFR 1910.1001 and/or 1910.1200, and 1926.1101.

1. Line dumpster with 2 layers of 6 mil fire rated reinforced plastic and seal plastic liner prior to removal from site to an EPU approved waste disposal site for ACM and PCB contaminated waste.

    a. Line barrels with a 0.15 mm plastic liner to prevent leaking of contaminated material from the containers.

2. Minimum labeling required:

    First Label:

    ==========
    DANGER
    CONTAINS ASBESTOS FIBERS
    AVOID CREATING DUST
    CANCER AND LUNG DISEASE HAZARD
    ==========

    Second Label:

    ==========
    PROVIDE IN ACCORDANCE WITH U.S. DEPARTMENT OF TRANSPORTATION REGULATION ON HAZARDOUS WASTE MARKING. 49 CFR PART 172, SUBPART D: "RQ ASBESTOS NA 2212". PROVIDE A "CLASS 9" LABEL, PER 49 CFR PART 172, SUBPART E.
    ==========

3. Notify COTR prior to removing each trailer or other waste transport from the jobsite.

4. Notify COTR not less than 48 hours prior to the proposed time of delivery of contaminated waste to the landfill. Owner may elect to observe this operation.

5. The Contractor shall transport the approved sealed drums to an approved waste disposal site.

6. Allow only sealed plastic bags or impermeable containers to be deposited in landfill. Leave damaged, broken, or leaking plastic bags in the impermeable container and deposit entire barrel in landfill.

7. Ensure that there are no visible emissions to the outside air from site where materials and waste are deposited.

F. Contractor shall submit a disposal certificate from the EPA approved landfill confirming final disposal in accordance with EPA standards and regulations before final payment. Retain receipts from landfill or processor for materials disposed of. At completion of hauling and disposal of each load, submit copy of waste manifest, chain of custody form, and landfill receipt to the COTR.

G. The COTR shall provide copies of all hazardous waste disposal manifests to the facility hazardous waste coordinator.

3.16 JOB CLOSE-OUT

A. The Contractor shall submit to the COTR, Post Abatement Drawings to indicate location of the asbestos material removed. If required, the Contractor may edit the Project Drawing to show the actual or additional abatement work completed.

B. The Contractor shall remove from the site all other debris and rubbish resulting from removal and disposal operations and the temporary construction of containment barriers and enclosures.

C. The Contractor shall use positive means to demonstrate to the COTR that any building utilities that were temporarily disabled are now in full service. Notify the COTR when disabled building ventilation, systems, electrical power, smoke detectors, building access/egress passages may safely be re-started or used.

END OF SECTION 028200

SECTION 028319 – LIGHT BALLASTS, FLUORESCENT LIGHTS AND LEAD-SAFE WORK PRACTICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Quality assurance requirements including personnel training'

2. Regulatory requirements.

3. Work practices.

4. Requirements for transport and disposal of lead waste materials by legal and appropriate means.

5. PCB ballasts and florescent light bulbs

1.2 REFERENCES

A. United States Environmental Protection Agency (USEPA):

1. 40 CFR Part 260 - Hazardous waste Management system: General

2. 40 CFR Part 261 - Identification and Listing of Hazardous Waste.

3. 40 CFR Part 262 - Standards Applicable to Generators of Hazardous Waste.

4. 40 CFR Part 263 - Standards Applicable to Transporters of Hazardous Waste.

5. 40 CFR Part 264 - Standards for Owners and Operators of Hazardous Waste Treatment Storage, and Disposal Facilities.

6. 40 CFR Part 265 - Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities.

7. 40 CFR Part 266 - Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities.

8. 40 CFR Part 268 - Land Disposal Restrictions.

9. 40 CFR Part 270 – EPA Administered Permit Programs: The Hazardous Waste Permit Program.

10. 40 CFR Part 745, Subpart L - Lead-Based Paint Activities.

11. 40 CFR Part 745, Subpart E - Residential Property Renovation.

B. United States Department of Transportation (DOT):

1. 49 CFR 171 -General Information, Regulations, and Definitions.

2. 49 CFR 172 - Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements.

3. 49 CFR 173 - Shippers -General Requirements for Shipments and Packaging.

C. Occupational Safety and Health Administration (OSHA):

1. 29 CFR 1 926.62 - Construction Standard for Lead

1.3 SCOPE OF WORK

A. The scope of work for lead abatement safe work practices includes the management of lead and/or lead based painted surfaces and/or components known or presumed to contain lead in concentrations equal to or in excess of 1.0 milligrams/per square centimeter or 0.5% by weight during renovation activities in target housing and child occupied facilities as detailed within United States Environmental Protection Agency standard for Residential Property Renovation, cited as 40 CFR Part 745, Subpart E; The armory is not necessarily a child care facility as defined in in the lead safe practices rule; however the facility is utilized by children throughout the year for sporting events and other events.

B. All instances, including those where building components are known or suspected to contain lead in concentrations below 0.5% by weight, and construction, alteration and/or repair work is performed in areas of the building/exterior which are not considered target housing and/or child occupied facilities lead safe work practices shall include all provisions as set forth under Occupational Safety and Health Administration (OSHA) regulation for Occupational Exposure to Lead, cited as 29 CFR 1926.62 and also 40 CFR part 745,Subpart E, since the facility is occupied by children attending sporting events and other events throughout the year.

1.4 DEFINITIONS

A. Lead: Metallic lead, all inorganic lead compounds, and organic lead soaps. Excluded in this definition are all other organic lead compounds.

B. Lead-Based Paint (LBP): Paint or other surface coatings that contain lead equal to or in excess of 1.0 mg/cm^2 or 0.5% by weight or air.

C. Minor repair and maintenance activities are activities, including minor heating, ventilation conditioning work, electrical work, and plumbing, that disrupt 6 square feet or less of painted surface per room for interior activities or 20 square feet or less of painted surface for exterior where none of the work practices prohibited or restricted by §745.S5(a)(3) are used and when the work does not involve window replacement or demolition of painted surface areas. When removing painted components, or portions of painted components, the entire surface area removed is the amount of painted surface disturbed. Jobs, other than emergency renovations, performed in the same room within the same 30 days must be considered the same job for the purpose of determining whether the job is a minor repair and maintenance activity.

D. Renovation: The modification of any existing structure, or portion thereof, that results in the disturbance of painted surfaces, unless that activity is performed as part of an abatement as defined by this part (40 CFR 745.223). The term renovation includes, but is not limited to, the removal, modification or repair of painted surfaces or painted components (e.g., modification of painted doors, surface restoration, window repair, surface preparation activity such as sanding, scraping, or other such activities that may generate paint dust); the removal of building components (e.g., walls, ceilings, plumbing, windows); weatherization projects (e.g., cutting holes in painted surfaces to install blown-in insulation or to gain access to attics, planing thresholds to install weather-stripping), and interim controls that disturb painted surfaces. A renovation performed for the purpose of converting a building, or part of a building, into target housing or a child-occupied facility, is a renovation under this subpart. The term renovation does not include minor repair and maintenance activities.

E. Renovator: An individual who either performs or directs workers who perform renovations. A certified renovator is a renovator who has successfully completed a renovator course accredited by EPA or an EPA-authorized State or Tribal program.

F. Work Area: The area that the certified renovator establishes to contain the dust and debris generated by a renovation.

1.5 SYSTEM DESCRIPTION

A. Lead-Safe Work Practices: Lead-Safe Work Practices provide for disturbance of lead, including removal and disposal of lead-based paint; lead containing dust; and lead contaminated soil in accordance with all applicable codes, regulations, standards, laws and ordinances and provides anticipated general overview of requirements and conditions necessary to meet regulatory requirements and specific conditions of this Project. Failure to expressly refer to applicable code, regulation, standard, law and ordinance within Contract Documents does not imply that applicable regulatory requirements are not applicable to this Project.

1. Presumed Lead Containing Surfaces: Surfaces for which there is no analytical data, and are suspected to contain lead based on age, use or other factors, should be presumed to contain lead at a level above 0.5% until a negative determination can be made through recognized industry standards.

1.6 SUBMITTALS

A. Quality Control Submittals:

1. Submit the following items prior to beginning lead related activities at the site:

a. Valid Waste Transporter Permit, issued by New Jersey.

b. Written communication from designated treatment, storage or disposal facility that it:

1) Is authorized to receive and dispose of waste products generated by this Project;

2) Has the capacity to receive and dispose of waste products generated by this Project and;

3) Will provide or assure that ultimate disposal method indicated on manifest for particular hazardous waste(s) will be followed.

c. Instructions regarding requirements for distribution of waste manifest as completed at time of shipment.

d. Emergency Contact List.

e. A written acknowledgment that the owner has received the EPA pamphlet entitled Renovate Right: Important Lead Hazard Information for Families, Child Care Providers and Schools.

f. Provide a certificate of mailing at least seven (7) days prior to the renovation.

g. A statement describing the steps performed to notify all occupants, parents and guardians of the intended renovation activities and to provide the pamphlet.

2. Submit the following items during course of lead related activities at site:

a. Employee Training and Certification Documentation: Provide Owner with Valid Training and Certification documentation for all renovators in accordance with 40 CFR Part 745.90(a) prior to beginning work.

3. Submit the following items after completion of lead related activities at Site:

a. Daily Logs.

b. Sign in Sheets.

c. Documentation of Hazardous Waste Determination, consisting of Toxicity Characteristic Leachate Procedure sample analysis and documentation that identifies the material(s) sampled.

d. For waste that is known or determined to be hazardous, New Jersey State Uniform Hazardous Waste Manifest or manifest as required by the state where the waste is disposed.

e. Trip Tickets for all other waste.

4. Certificates: Submit certification that indicates compliance with requirements specified in Quality Control below.

1.7 QUALITY ASSURANCE

A. Qualifications:

1. Contractor:

a. Supervision: Provide full-time, on-site supervisor for each site.

b. Personnel Certification Requirements:

1) Lead Personnel: Received "Lead-Safe Work Practices" training approved by United States Department of Housing and Urban Development (HUD) within the last 12 months.

2) Lead Supervisory Personnel: Maintain current USEPA certification as a lead-based paint abatement supervisor as per 40 CFR 763.

c. Personnel Training Requirements: In addition to the training requirements for USEPA certification, all supervisory or Lead-Safe Work Practice personnel, including any personnel entering lead activity areas shall have training as required by 29 CFR 1926.62

2. Owner's Sampling / Monitoring Firm: Independent of Contractor and possessing current New Jersey Department of Health certification to perform lead-based paint activities.

a. Personnel Certification:

1) Monitoring: Possess current USEPA/New Jersey Department of Community Affairs certification, as per 40 CFR 745, subpart L, as either "Risk Assessor" or "Inspector".

2) Final Inspection or Clearance Testing Possess current USEPA New Jersey Department of Community Affairs certifications, as per 40 CFR 745, subpart L, as either "Risk Assessor" or "Inspector".

3. Lead Analysis Laboratories:

a. Maintain current National Lead Laboratory Accreditation Program (NLLAP) accreditation.

b. Maintain current New Jersey State Environmental Laboratory Approval Program (ELAP) accreditation in each method of analysis used.

c. Use most recent version of specified test method.

d. Analyze samples for waste characterization using:

1) Toxicity Characteristic Leachate Procedure - EPA Method 1311 and an acceptable, EPA recognized analysis method.

e. Analyze air samples for lead for total lead (if required) using an acceptable, EPA recognized analysis method.

f. Analyze wipe samples, paint chip samples and soil samples using an acceptable, EPA recognized analysis method.

B. Regulatory Requirements:

1. Hazardous Waste Generator Status: Owner is "Conditionally Exempt Small Quantity Generator. Schedule removal, on-site storage, and transport as required to maintain Owner's status as "Conditionally Exempt Small Quantity Generator.

C. Recordkeeping and Reporting Requirements: Firms performing renovations must retain and, if requested, make available to EPA at records necessary to demonstrate compliance with this subpart for a period of 3 years following completion of the renovation. This 3-year retention requirement does not supersede longer obligations required by other provisions for retaining the same documentation, including any applicable State or Tribal laws or regulations.

1. Records that must be retained pursuant to the above paragraph of this section shall include (where applicable):

a. Reports certifying that a determination had been made by an inspector (certified pursuant to either Federal regulations at §745.226 or an EPA-authorized State or Tribal certification program) that lead-based paint is not present on the components affected by the renovation, as described in §745.82(b)(1).

b. Signed and dated acknowledgments of receipt as described in §745.84(a)(1)(i), (a)(2)(i), (b)(1)(i), (c)(1)(i)(A), and (c)(1)(ii)(A).

c. Certifications of attempted delivery as described in §745.84(a)(2)(i) and (c)(1)(ii)(A).

d. Certificates of mailing as described in §745.84(a)(1)(ii), (a)(2)(ii), (b)(1)(ii), (c)(1)(i)(B) and (c)(1)(ii)(B).

e. Records of notification activities performed regarding common area renovations, as described in §745.B4(b)(3) and (b)(4), and renovations in child-occupied facilities, as described in §745.84(c)(2).

f. Any signed' and dated statements received from owner-occupants documenting that the requirements of §745.85 do not apply. These statements must include a declaration that the renovation will occur in the Owner’s residence, a declaration that no children under age 6 reside there, a declaration that no pregnant woman resides there, a declaration that the housing is not a child-occupied facility, the address of the unit undergoing renovation, the owner's name, an acknowledgment by the owner that the work practices to be used during the renovation will not necessarily include all of the lead-safe work practices contained in EPA's renovation, repair, and painting rule, the signature of the owner, and the date of signature. These statements must be written in the same language as the text of the renovation contract, if any.

g. Documentation of compliance with the requirements of §745.85, including documentation that a certified renovator was assigned to the project, that the certified renovator provided on-the job training for workers used on the project, that the certified renovator performed or directed workers who performed all of the tasks described in §745.85(a), and that the certified renovator performed the post-renovation cleaning verification described in §745.85(b). If the renovation firm was unable to comply with all of the requirements of this rule due to an emergency as defined in §745.82, the firm must document the nature of the emergency and the provisions of the rule that were not followed. This documentation must include a copy of the certified renovator's training certificate, and a certification by the certified renovator assigned to the Project that:

h. Training was provided to workers (topics must be identified for each worker).

i. Warning signs were posted at the entrances to the work area.

j. If test kits were used, that the specified brand of kits was used at the specified locations and that the results were as specified.

k. The work area was contained by:

1) Removing or covering all objects in the work area (interiors).

2) Closing and covering all HVAC ducts in the work area (interiors).

3) Closing all windows in the work area (interiors) or closing all windows in and within 20 feet of the work area (exteriors).

4) Closing and sealing all doors in the work area (interiors) or closing and sealing all doors in and within 20 feet of the work area (exteriors).

5) Covering doors in the work area that were being used to allow passage but prevent spread of dust.

6) Covering the floor surface, including installed carpet, with taped-down plastic sheeting or other impermeable material in the work area 6 feet beyond the perimeter of surfaces undergoing renovation or a sufficient distance to contain the dust, whichever is greater (interiors) or covering the ground with plastic sheeting or other disposable impermeable material anchored to the building extending 10 feet beyond the perimeter of surfaces undergoing renovation or a sufficient distance to collect falling paint debris, whichever is greater, unless the property line prevents 10 feet of such ground covering, weighted down by heavy objects (exteriors).

7) Installing (if necessary) vertical containment to prevent migration of dust and debris to adjacent property (exteriors).

l. Waste was contained on-site and while being transported off-site

m. The work area was properly cleaned after the renovation by:

1) Picking up all chips and debris, misting protective sheeting, folding it dirty side inward, and taping it for removal.

2) Cleaning the work area surfaces and objects using a HEPA vacuum and/or wet cloths or mops (interiors).

n. The certified renovator performed the post-renovation cleaning verification (the results of which must be briefly described, including the number of wet and dry cloths used).

o. When test kits are used, the renovation firm must, within 30 days of the completion of the renovation, provide identifying information as to the manufacturer and model of the test kits used, a description of the components that

were tested including their locations, and the test kit results to the person who contracted for the renovation.

p. If dust clearance sampling is performed in lieu of cleaning verification as permitted by §745.85(c), the renovation firm must provide, within 30 days of the completion of the renovation, a copy of the dust sampling report to the person who contracted for the renovation.

1.8 PROJECT/SITECONDITIONS

A. Emergency Contact List: Prepare emergency contact list providing means to contact applicable individuals and agencies in event of emergency at any time of day or night and including at least the following individuals and agencies:

1. Contractor Personnel:

a. Project manager
b. Project supervisor

2. Sampling Organization:

a. On Site Sampling Technician

3. Owner

4. Local police department

5. Local fire department

6. Local hospital and ambulance service

B. Restrict access to all work areas. Immediately report any access by unauthorized individuals to Owner and/or Owner's representative.

1.9 SEQUENCING AND SCHEDULING

A. Completion: Complete Lead related work in accordance with Construction Schedule requirements with each phase considered distinct and separate for purpose of schedule and substantial completion.

1. Substantial Completion of phase occurs when:

a. All components of phase have passed visual inspection by Supervisor; and
b. Satisfactory clearance criteria are achieved for each portion of phase; and
c. All containment barriers have been removed; and
d. Areas are returned to Owner.

2. lf Contractor fails to achieve substantial completion within specified schedule requirements, all costs associated with extension of schedule, including (but not limited to) cost of Architect's time and expenses, sampling costs, monitoring costs, direct costs incurred by Owner, and costs to accelerate sample analysis deducted from Final Payment.

B. Restrictions on Working Hours: Schedule work only during regular working hours approved by Owner prior to beginning lead related work. Do not use overtime or multiple shifts with "overtime" defined as any time in excess of 8 hours in single day, work on weekends, or work on holidays.

C. Changes in Working Hours: Advise Owner of any changes in hours or days when lead activities will be conducted at Site at least 24 hours prior to change. Contractor retains all liability resulting from Contractor failure to make required notification.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Respirators: Provide respirators approved as acceptable for protection by National Institute for Occupational Safety and Health (NIOSH) under provisions of 30 CFR Part 11.

1. Supply and use respirators as required in accordance with 29 CFR 1910.134 and 29 CFR 1926.62.

2. Provide respirators, filters and ancillary supplies as required for employees and authorized visitors.

3. Account for hazards other than lead in respirator selection.

B. Protective Clothing: Provide disposable protective clothing complying with requirements of 29 CFR 1926.62 that is disposed of after one use. Provide disposable clothing as required for employees and authorized visitors.

C. Lead Related Construction Facilities and Controls:

1. Polyethylene sheeting (plastic sheeting) - 6-mil thickness, sized to minimize seams.

2. Tape and/or adhesive spray capable of sealing joints in adjacent polyethylene sheets and for attachment of polyethylene sheet to finished or unfinished surfaces of dissimilar materials and capable of adhering under both dry and wet conditions, including use of amended water;

3. Polyethylene waste disposal bags -6-milthickness with preprinted labels;

4. HEPA filtered negative pressure equipment.

5. HEPA filtered vacuums.

6. Water filtration, 3 stage with final filtration to at least 5 microns.

7. Barrier tape.

8. Warning signs.

9. Hygiene facilities as required by 29 CFR 1926.62 including showers, cleansing agents and disposable towers.

10. Lead specific detergent similar to:

    a. “Ledizsolv Detergent” by LSV, Inc., New York, New York.

    b. “Sentines 805 EnviroWash” by Sentinel, Minneapolis, Minnesota.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions (by Contractor): Examine conditions under which lead related work is to be performed and notify Owner in writing of any conditions detrimental to proper and timely performance. Do not proceed with lead related work until unsatisfactory have been corrected in manner acceptable to Contractor.

3.2 PREPARATION

A. Notification:

1. While the renovation is ongoing, post informational signs describing the general nature and locations of the renovation and the anticipated completion date. These signs must be posted in areas where they can be seen by the parents or guardians of the children frequenting the child-occupied facility. The signs must be accompanied by a posted copy of the pamphlet or information on how interested parents or guardians can review a copy of the pamphlet or obtain a copy from the renovation firm at no cost to the parents or guardians.

2. Post signs clearly defining the work areas and warning occupants and other persons not involved in renovation activities to remain outside of the work areas. These signs must be posted before beginning the renovation and must remain in place and readable until the renovation and the post-renovation cleaning verification have been completed.

B. Protection:

1. Provide personal protective equipment as required by 29 CFR 1926.62 at no cost to employees or authorized visitors.

2. Institute respirator program in accordance with 29 CFR 1926.62 and 29 CFR 1910.134 (b), (d), (e) and (f).

3. Use protective clothing and respirators whenever lead is being disturbed, abated, cleaned up, and containerized or stored in vehicle or container used to transport waste to landfill in accordance with applicable regulations.

4. Institute medical surveillance program in accordance with 29 CFR 1926.62 for all employees performing or supervising lead handling work, entering work area containment, or using respirator.

C. Prior to all other preparation activities, construct wash station or decontamination facilities as required by applicable regulations adjacent to lead work area.

D. Before beginning the renovation, the firm must isolate the work area so that no dust or debris leaves the work area while the renovation is being performed. In addition, the firm must maintain the integrity of the containment by ensuring that any plastic or other impermeable materials are not torn or displaced, and taking any other steps necessary to ensure that no dust or debris leaves the work area while the renovation is being performed. The firm must also ensure that containment is installed in such a manner that it does not interfere with occupant and worker egress in an emergency.

E. Interior renovations: For all interior renovations, the firm conducting the work shall:

1. Remove all objects from the work area, including furniture, rugs, and window coverings, or cover them with plastic sheeting or other impermeable material with all seams and edges taped or otherwise sealed.

2. Close and cover all ducts opening in the work area with taped-down plastic sheeting or other impermeable material.

3. Close windows and doors in the work area. Doors must be covered with plastic sheeting or other impermeable material. Doors used as an entrance to the work area must be covered with plastic sheeting or other impermeable material in a manner that allows workers to pass through while confining dust and debris to the work area.

4. Cover the floor surface, including installed carpet, with taped-down plastic sheeting or other impermeable material in the work area 6 feet beyond the perimeter of surfaces undergoing renovation or a sufficient distance to contain the dust, whichever is greater.

5. Use precautions to ensure that all personnel, tools, and other items, including the exteriors of containers of waste, are free of dust and debris before leaving the work area.

6. The firm must clean all objects and surfaces in the work area and within 2 feet of the work area in the following manner, cleaning from higher to lower:

7. Clean walls starting at the ceiling and working down to the floor by either vacuuming with a HEPA vacuum or wiping with a damp cloth.

8. Thoroughly vacuum all remaining surfaces and objects in the work area, including furniture and fixtures, with a HEPA vacuum. The HEPA vacuum must be equipped with a beater bar when vacuuming carpets and rugs.

9. Wipe all remaining surfaces and objects in the work area, except for carpeted or upholstered surfaces, with a damp cloth. Mop uncarpeted floors thoroughly, using a mopping method that keeps the wash water separate from the rinse water, such as the 2-bucket mopping method, or using a wet mopping system.

F. Do not begin lead disturbance or removal activities until all preparation work, including installation of wash stations or decontamination enclosure systems and any required engineering controls (ex. negative air pressure equipment, etc.) has been completed as required by applicable regulations.

3.3 LEAD WORK PROCEDURES

A. Unacceptable Removal Methods:

1. Open flame burning or torching (includes propane-fueled heat grids).

2. Machine sanding, grinding, power planning, needle gun without HEPA local vacuum exhaust tool.

3. Hydroblasting or high-pressure wash.

4. Abrasive blasting or sandblasting without HEPA vacuum exhaust tool.

5. Heat guns operating above 1,100 deg. F.

6. Methylene chloride paint removal products.

7. Dry scraping.

B. Acceptable Removal Methods:

1. Component Removal:

a. Mist all disturbed paint and dust and maintain in moist condition.

b. Entirely remove indicated components.

c. Wet scrape residual paint from adjacent unpainted surfaces. Do not damage adjacent surfaces;

d. Collect all paint chips, dust and debris and seal in 6 mil plastic bags.

e. Seal removed building components in 6 mil plastic sheeting or 6 mil plastic bags.

2. Heat Gun Removal (operating at less than 1,100 deg. F):

a. Provide fire extinguishers in lead work area, and ensure adequate electrical power is available.

b. Use in limited areas only.

c. Do not gouge or abrade substrate.

3. Wet Scraping:

a. Apply adequate water to moisten surface completely; avoid large amounts of water on floor or ground.

b. Do not moisten areas near electrical circuits.

c. Use spray bottles or wet sponge attached to scraper.

4. Offsite Stripping:

    a. Apply paint removers in accordance with manufacturer's recommendations.

    b. Test paint remover in inconspicuous location approved by Architect to avoid damage to substrate.

    c. Identify building component to ensure reinstallation in same location.

    d. Mist all paint and dust disturbed and maintain in moist condition.

    e. Wet scrape residual paint from adjacent unpainted surfaces. Do not damage adjacent surfaces.

    f. Collect all paint chips, dust and debris and seal in 6 mil plastic bags. Seal removed building components in plastic sheeting. Inform offsite paint remover regarding presence of lead-based paint before shipping;

    g. Do not reinstall components until removal of residual paint and cleaning is complete and satisfactory clearance verification achieved.

5. Onsite Stripping:

    a. Apply paint removers in accordance with manufacture’s recommendations.

    b. Test paint remover in inconspicuous location approved by Architect to avoid damage to substrate.

    c. Do not damage adjacent surfaces.

    d. Collect all paint chips, dust and debris and seal in 6 mil plastic bags.

6. Work Stoppage Criteria During Lead Activities:

    a. During lead related activities, stop work immediately if damaged containment barriers are discovered or if dust or paint chips are discovered outside of lead work area.

    b. Prior to resumption of lead activities, perform cleanup of areas adjacent to lead work area using HEPA vacuums or wet cleaning methods.

C. Clean Up Procedures:

1. Exterior:

    a. At end of each day, whether or not lead related activities are complete, clean up and store all removed components, debris, and plastic sheeting drop cloths in lockable containers with solid floors, walls and ceilings until transported off site.

    b. HEPA vacuum and wash all plastic sheeting with lead specific detergent.

c. Place all plastic sheeting used to cover ground and seal openings to interior of building in containers.

d. A certified renovator must perform a visual inspection to determine whether dust, debris or residue is still present on surfaces in and below the work area, including windowsills and the ground. If dust, debris or residue is present, these conditions must be eliminated and another visual inspection must be performed. When the area passes the visual inspection, remove the warning signs.

2. Interior:

a. Conduct ongoing cleaning during lead related activities, including regular removal of large and small debris.

b. Clean up visible debris and components prior to leaving lead work site at end of work shift.

c. Decontaminate all tools, equipment, and worker protection gear before removing from contaminated areas.

d. Wait at least 1 hour after active lead removal or disturbance has ceased before final cleaning.

D. After a successful visual inspection, a certified renovator must:

1. Verify that each windowsill in the work area has been adequately cleaned, using the following procedure.

2. Wipe the windowsill with a wet disposable cleaning cloth that is damp to the touch. If the cloth matches or is lighter than the cleaning verification card, the windowsill has been adequately cleaned.

3. If the cloth does not match and is darker than the cleaning verification card, re-clean the windowsill, then either use a new cloth or fold the used cloth in such a way that an unused surface is exposed, and wipe the surface again. If the cloth matches or is lighter than the cleaning verification card, that windowsill has been adequately cleaned.

4. If the cloth does not match and is darker than the cleaning verification card, wait for t hour or entire surface has dried completely, whichever is longer.

5. After waiting for the windowsill to dry, wipe the windowsill with a dry disposable cleaning cloth. After this wipe, the windowsill has been adequately cleaned.

6. Wipe uncarpeted floors and countertops within the work area with a wet disposable cleaning cloth. Floors must be wiped using an application device with a long handle and a head to which the cloth is attached. The cloth must remain damp at all times while it is being used to wipe the surface for post-renovation cleaning verification. If the surface within the work area is greater than 40 square feet, the surface within the work area must be divided into roughly equal sections that are each less than 40 square feet. Wipe each such section separately with a new wet disposable cleaning cloth. If the cloth used to

wipe each section of the surface within the work area matches the cleaning verification card, the surface has been adequately cleaned.

7. If the cloth used to wipe a particular surface section does not match the cleaning verification card, re-clean that section of the surface as directed in paragraphs (a)(5)(ii)(B) and (a)(5)(ii)(C) of this section, then use a new wet disposable cleaning cloth to wipe that section again. If the cloth matches the cleaning verification card, that section of the surface has been adequately cleaned.

8. If the cloth used to wipe a particular surface section does not match the cleaning verification card after the surface has been re-cleaned, wait for 1 hour or until the entire surface within the work area has dried completely, whichever is longer.

9. After waiting for the entire surface within the work area to dry, wipe each section of the surface that has not yet achieved post-renovation cleaning verification with a dry disposable cleaning cloth. After this wipe, that section of the surface has been adequately cleaned. When the work area passes the post-renovation cleaning verification, remove the warning signs.

E. Removal of Work Area Containment:

1. Do not remove remaining plastic sheeting, barriers, wash station, decontamination facilities, engineering controls and ancillary items until satisfactory clearance verification results are achieved.

2. Notify Owner immediately if any residual lead debris is identified during removal of plastic sheeting, barriers, decontamination facilities, negative pressure equipment and ancillary items, and clean up debris.

3. Clean all tape, glue, staples, etc., used in lead work process.

4. Repair damage to walls, floors, ceilings, fixtures, or other items not scheduled for demolition or lead work to pre-lead work condition. Where finishes are damaged, refinish or repaint entire object or to nearest break in surface of walls, ceilings, soffits, etc.

5. Remove entire containment when partial occupancy by Owner is required before Owner occupies area or other contractors occupy space for additional construction as required.

6. Paint or otherwise seal treated surfaces not scheduled for painting.

3.4 WASTE SEGREGATION AND CHARACTERIZATION

A. Segregate waste in following categories:

1. Removed components (considered construction and demolition debris for bidding purposes).

2. Paint chips, dust and filters from HEPA vacuums (considered hazardous waste for bidding purposes).

3. Respirator filter cartridges, rags, sponges, mops, scrapers and other materials used for testing lead work, and clean-up (considered construction and demolition debris for bidding purposes).

4. Contaminated soil (considered hazardous waste for bidding purposes).

5. Cleaned plastic sheeting and disposable work clothes (considered construction and demolition debris for bidding purposes).

B. Sample each container of waste to determine if it is characterized as hazardous waste, treating each sample as follows:

1. Prepare using Toxicity Characteristic Leachate Procedure, EPA method 1311.

2. Analyze for lead using EPA method 6010, 6020, 7420 or 7421.

3. Analyze for any other hazardous characteristic introduced into waste by lead procedures.

C. Consider cleaned plastic sheeting and disposable work clothes not sufficiently cleaned as hazardous waste and dispose as hazardous waste at no additional cost to Owner.

D. Maintain each waste category above in separate hard walled lockable containers until waste characterization is complete. If waste mixed from different categories, dispose all mixed waste as hazardous waste at no additional cost to Owner.

3.5 FIELD QUALITY CONTROL

A. Inspection of Barriers: Provide inspection of all barriers at least twice daily by Contractor's Supervisor and record inspections and observations in daily project log.

B. Repairs to Barriers and/or Enclosure Systems: Repair damage and defects in barriers and enclosure systems immediately upon discovery and prior to resumption of lead activities.

C. Testing By Owner: Owner reserves right to obtain independent monitoring and sampling services to provide independent documentation regarding compliance with regulatory requirements. Place all plastic sheeting used to cover ground and seal openings to interior of building in containers. A certified renovator must perform a visual inspection to determine whether dust, debris or residue is still present on surfaces in and below the work area, including windowsills and the ground. If dust, debris or residue is present, these conditions must be eliminated and another visual inspection must be performed. When the area passes the visual inspection, remove the warning signs.

D. Contractor Requirements:

1. Provide air sampling as required by 29 CFR 1926.62.

2. Provide sampling and analysis for waste characterization.

3. Provide access to lead work areas for Owner's Monitor/Sampling Technician as needed to observe all lead related work and collect samples.

4. Provide adequate lighting, ladders, scaffolding, and similar items to enable Monitor/ Sampling Technician to perform visual inspections of all surfaces within lead work areas as needed.

5. Provide sufficient temporary electrical power to locations within lead work areas, as required, to supply high volume air sampling pumps for daily.

6. Do not perform any monitoring functions with Contractor's personnel or with firms wholly or partly owned by Contractor. Notify Owner and Architect immediately of any conflict of interest between Contractor and any firm providing monitoring, sampling or laboratory analysis.

7. Contractor retains complete and total responsibility for complying with Contract Documents and all regulatory requirements. Area Air Sampling Procedures (if used): Comply with provisions of NIOSH 7082.

E. Clearance Sampling Procedures (if used):

1. Owner reserves right to obtain independent monitoring and sampling services to provide independent documentation regarding compliance with regulatory requirements. Where Owner provides monitoring, sampling (or both), use most stringent results from inspections, daily air sampling and clearance sampling.

3.6 PACKAGING, TRANSPORTATION AND WASTE DISPOSAL PROCEDURES

A. Use hazardous waste characterization performed in accordance with “Waste Segregation and Characterization” above to document and confirm classification of waste. Prior to removing waste from site, confirm in writing to Owner:

1. Results of waste characterization testing.

2. Identification of waste documented to have waste classification identified in "Waste Segregation and Characterization" above.

3. Identification of waste characterization varying from "Waste Segregation and Characterization" above.

B. Packaging: Package, label, and mark all hazardous waste materials in accordance with applicable requirements of 49 CFR 173, 178 and 179.

C. Hazardous Waste Determination: Provide analysis required by Treatment, Storage or Disposal facility to document hazardous waste determination.

D. Hazardous Waste Manifests:

1. Maintain manifest from date of transport until date of disposal, destruction or recycling.

2. Return fully executed manifests to Owner within 60 days of date waste accepted by initial transporter.

3. Use following type of manifest as applicable:

a. If waste disposed of in New Jersey or if waste disposed in state not requiring use of specific manifest form, use New Jersey State Uniform Hazardous Waste Manifest.

b. If waste disposed of in state other than New Jersey State and use of specific manifest form is required, use manifest required by state where waste is disposed in lieu of New Jersey State Uniform Hazardous Waste Manifest.

4. Complete manifest and deliver to Owner for review and signature.

5. Retain copies of manifest required to remain with hazardous waste shipment and deliver remaining copies to Owner.

6. Advise Owner regarding required distribution of manifest, both verbally and in writing.

E. Disposal: Transport hazardous waste to treatment or disposal facility complying with following requirements:

1. Permitted, licensed or registered by state to dispose of hazardous waste.

2. Possesses interim status to dispose of hazardous waste.

3. Authorized to manage hazardous waste under Resource Conservation and Recovery Act (RCRA).

4. Beneficially uses/re-uses or legitimately recycles/reclaims waste; or treats waste prior to beneficial use/reuse or legitimate recycling/reclamation.

F. Construction and Demolition Debris: Dispose of material determined to be Construction and Demolition Debris. Provide trip tickets or other documentation clearly identifying amount of material removed from site, transported to disposal site and disposed of, including at least:

1. Name, address and telephone of waste generator.
2. Approximate quantity.
3. Name, and telephone of disposal site operator.
4. Name and physical site location of disposal site.
5. Name, address and telephone number of transporter.

3.7 BALLASTS AND FLUORESCENT LIGHT BULBS

A. The light ballasts are located in the latrine renovation areas. Approximately 10% of the ballasts were surveyed for the presence of PCBs. All light ballasts are considered as “Consumer Electronics” and can be disposed of or recycled in accordance with the USEPA Universal Waste Rule 40 CFR 273.

B. The contractor shall remove the light ballast from the fixtures store the ballasts in properly metal drums for proper disposal. All ballast not marked as PCB free will be treated as PCB containing and stored in separate drums from the ballast that are properly labeled as PCB free. All intact light ballast will not be disposed of as Hazardous waste and must be recycled.

C. The contractor must utilize a NJDEP approved recycling vendor for disposal of the light ballasts. The contractor may elect to utilize any of the following Universal Waste vendors:

AERC located in Allentown, PA, Cycle Chem, located in Elizabeth, New Jersey, Clean Earth, located in Kearny, New Jersey or any other NJDEP approved recycling vendor.

D. All fluorescent light bulbs will be removed carefully from the light fixtures and placed in tact in a container that will protect them from breakage. Once safely removed and packaged, the contractor shall recycle the bulbs in accordance with the requirements of both the State of New Jersey Department of Environmental Protection (NJDEP) Division of Solid and Hazardous Waste and USEPA Universal Waste Rule 40 CFR 273**.**

E. The contractor may elect to utilize any of the following Universal Waste vendors: AERC located in Allentown, PA, Cycle Chem, located in Elizabeth, New Jersey, Clean Earth, located in Kearny, New Jersey or any other NJDEP approved recycling vendor.

F. Universal Waste Manifests:

1. Maintain manifest from date of transport until date of disposal, destruction or recycling.

2. Return fully executed manifests to Owner within 60 days of date waste accepted by initial transporter.

3. Use the following type of manifest as applicable:

a. If waste disposed of in New Jersey or if waste disposed in state not requiring use of specific manifest form, use New Jersey State Uniform Universal Waste Manifest.

b. If waste disposed of in state other than New Jersey State and use of specific manifest form is required, use manifest required by state where waste is disposed in lieu of New Jersey State Uniform Universal Waste Manifest.

4. Complete manifest and deliver to Owner for review and signature.

5. Retain copies of manifest required to remain with hazardous waste shipment and deliver remaining copies to Owner.

6. Advise Owner regarding required distribution of manifest, both verbally and in writing.

G. Disposal: Transport hazardous waste to treatment or disposal facility complying with following requirements:

1. Permitted, licensed or registered by state to dispose of universal waste.

2. Possesses interim status to dispose of universal waste.

3. Authorized to manage hazardous waste under Resource Conservation and Recovery Act (RCRA).

4. Beneficially uses/re-uses or legitimately recycles/reclaims waste; or treats waste prior to beneficial use/reuse or legitimate recycling/reclamation.

END OF SECTION 028319

SECTION 031510 – HYDROPHILIC WATERSTOPS

PART 1 - GENERAL

1.1 SUMMARY

Section provides for an expanding hydrophilic waterstop as specified herein, illustrated on project drawings, or as required to complete the work to comply with waterproofing warranty requirements.

B. System Description:
   1. Waterstop Strip: A non-Bentonite hydrophilic waterstop with a minimum swell as per Section 2.02
   2. Accessories for complete waterstop application

C. Related Sections: Other specification sections which directly relate to the work of this section include, but are not
limited to, the following:
   1. Section 033000 – Cast-In-Place Concrete
   2. Section 042000 – Unit Masonry

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's product data, installation instructions, use limitations and recommendations.

B. Shop drawings showing locations and extent of waterstop.

C. Written documentation demonstrating Installers qualifications under the "Quality Assurance" article including reference projects of a similar scope.

D. Samples: Submit representative sample of actual product.

E. Warranty: Submit a sample warranty identifying the terms and conditions stated in Section 1.7.

1.03 QUALITY ASSURANCE

A. Manufacturer: Waterstop systems shall be manufactured and marketed by a firm with a minimum of 20 years' experience in the production and sales of building materials. Manufacturers proposed for use, but not named in these specifications shall submit evidence of ability to meet all requirements specified and include a list of projects of similar design and complexity completed within the past five years.

B. Installer Qualifications: A firm which has at least three (3) years experience in work for the type required by this section.

C. Material: Waterstop shall be by single source manufacturer and shall be specially engineered to be a swellable and conformable polyurethane/butyl blended rubber free of sodium bentonite that expands when in contact with water.

D. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Agenda for meeting shall include review of surface preparation, installation procedures, special details, inspection, protection, and repair procedures.

E. Expansion Joints: Adcor ES is not designed for moving joints.

F. Concrete: Concrete shall be normal weight structural concrete and provide a minimum cover of 3" around Adcor ES Waterstop.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products in the original, unopened containers with seals unbroken, labeled with the manufacturer's name, product brand name and type, date of manufacture and directions for storage and use.

B. Store and handle materials in strict compliance with manufacturer's instructions, recommendations and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.

1. Store material off of ground and keep dry.
2. Provide cover for material to protect top and sides.

C. Sequence deliveries to avoid delays but minimize on-site storage.

1.05 PROJECT CONDITIONS

A. Perform work only when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials and products used.

B. Proceed with installation only when substrate construction and preparation work is complete and in condition to receive waterstop.

C. Do not allow waste products (i.e. petroleum, grease, oil, solvents, vegetable or mineral oil, animal fat, acids, etc.) to come into contact with the waterstop. Any exposure to foreign materials or chemical discharges must be presented to the Membrane Manufacturer to determine the impact on the waterstop performance.

D. Maintain environmental conditions within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

E. General contractor shall assure adequate protection during and after the application of the waterstop.

1.06 WARRANTY

A. Upon completion of work, provide a copy of Manufacturer's standard warranty.

PART 2 — PRODUCTS

2.01 GENERAL

A. All waterstop materials shall be manufactured and supplied by:

GCP Advanced Technologies Construction Products or approved equal
62 Whittemore Avenue, Cambridge, MA. 02140
Telephone: 866-333-3726

2.02 MATERIALS

A. Hydrophilic Waterstop Strip: Adcor™ ES by GCP Advanced Technologies Construction Products; a swellable, conformable polyurethane/butyl blended rubber-based material free of sodium bentonite.

B. Waterstop Physical Properties:
PHYSICAL PROPERTIES FOR ADCOR™ ES HYDROPHYLIC WATERSTOP:

Property	Typical Value
Color	Grey
Size	1.0 in. x ½ in. x 16 ft. (25.4 mm x 12.7 mm x 4.9 m) rolls
Packaging	6 rolls per case
Hydrostatic Head Resistance	70 m (231 ft)
Wet - Dry Cycling [25 Cycles @ 231 ft. (70 m)]	No Effect
Adhesion to Concrete using Adcor ES Adhesive	Excellent

PART 3 — EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Examine conditions of substrates and other conditions under which this work is to be performed and notify the Architect, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected.

3.02 PREPARATION OF SUBSTRATES

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Do not install waterstop onto any substrates with standing water.

3.03 INSTALLATION

A. Refer to manufacturer's literature for recommendations on installation, including but not limited to, the following:

1. Construction Joint:
    a) On irregular concrete faces, apply a ½ in. (12 mm) bead of Adcor ES Adhesive as bedding for Adcor ES.
    b) Secure Adcor ES using masonry nails 1½ in. - 2 in. (40 mm – 50 mm) long with a washer ¾ in. (20 mm) in diameter. Hilti EM6-20-12 FP8 shot fired fixings with ¼ in. (6 mm) nuts and ¾ in. (20 mm) diameter washers may also be used. Fixings should be spaced at a maximum of 12 in. (300 mm) centers with a minimum spacing that ensures proper contact to substrate.
    c) Adcor ES joints should overlap a minimum of 4 in. (100 mm), ensuring full contact between jointed pieces.
    d) Adcor ES can be bent around corners; however, on complex geometry use Adocr ES Adhesive to fill any gaps.
    e) Any damaged sections should be removed and repaired with a new section of Adcor ES.
    f) Keep Adcor ES dry prior to pouring concrete.

2. Pipe Penetration:
    a) Adcor ES Adhesive must be applied to dry substrates only. Apply by brush to the substrate. Wait until surface is dry to touch, and then press Adcor ES firmly into place.
    b) Adcor ES joints should overlap a minimum of 4 in. (100 mm), ensuring full contact between jointed pieces.
    c) Keep Adcor ES dry prior to pouring concrete.

3.04 CLEANING AND PROTECTION

A. Protect membrane in accordance with manufacturer's recommendations until placement of concrete.
B. Inspect for damage just prior to placement of concrete and make repairs in accordance with manufacturer's recommendations.

END OF SECTION 031510

SECTION 033053 - MISCELLANEOUS CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cast-in-place concrete, including reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.
   1. Design Mixtures for Credit ID 1.1: For each concrete mixture containing fly ash as a replacement for Portland cement or other Portland cement replacements. For each design mixture submitted, include an equivalent concrete mixture that does not contain Portland cement replacements, to determine amount of Portland cement replaced.

B. Other Action Submittal:

   1. Design Mixtures: For each concrete mixture.

1.3 QUALITY ASSURANCE

A. Ready-Mix-Concrete 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.

B. Comply with ACI 301 (ACI 301M).

C. Comply with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

PART 2 - PRODUCTS

2.1 FORMWORK

A. Furnish formwork and formwork accessories according to ACI 301 (ACI 301M).

2.2 STEEL REINFORCEMENT

A. Recycled Content: Provide steel reinforcement with an average recycled content of steel products so that postconsumer recycled content plus one-half of pre-consumer recycled content is not less than 25 percent.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

C. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.

D. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from as-drawn steel wire into flat sheets.

E. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout Project:

1. Blended Hydraulic Cement: ASTM C 595, Type I (PM), pozzolan-modified Portland cement.

B. Normal-Weight Aggregate: ASTM C 33, graded, 1-1/2-inch (38-mm) nominal maximum aggregate size.

C. Water: ASTM C 94/C 94M.

D. Synthetic Fiber: Monofilament polypropylene fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, 1/2 to 1-1/2 inches (13 to 38 mm) long.

2.4 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. 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.

2.5 RELATED MATERIALS

A. Vapor Retarder: Plastic sheet, ASTM E 1745, Class A or B.

B. Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils (0.25 mm) thick; or plastic sheet, ASTM E 1745, Class C.

C. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.

2.6 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth or cotton mats.

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.

F. Clear, [**Waterborne**] [**Solvent-Borne**], Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.7 CONCRETE MIXTURES

A. Normal-Weight Concrete: Prepare design mixes, proportioned according to ACI 301 (ACI 301M), as follows:

1. Minimum Compressive Strength: 3000 psi (20.7 MPa) at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.50
3. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
4. Slump Limit: 4 inches (100 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture plus or minus 1 inch (25 mm).
5. Air Content: Maintain within range permitted by ACI 301 (ACI 301M). Do not allow air content of trowel-finished floor slabs to exceed 3 percent.

B. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate but not less than a rate of 1.0 lb./cu. yd. (0.60 kg/cu. m)

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116 and furnish batch ticket information.

1. When air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, construct, erect, brace, and maintain formwork according to ACI 301 (ACI 301M).

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.3 VAPOR RETARDERS

A. Install, protect, and repair vapor retarders according to ASTM E 1643; place sheets in position with longest dimension parallel with direction of pour.

1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended adhesive or joint tape.

3.4 STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.5 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Contraction Joints in Slabs-on-Grade: Form weakened-plane sawed contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness.

C. Isolation Joints: Install joint-filler strips at junctions with slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint fillers full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.

3.6 CONCRETE PLACEMENT

A. Comply with ACI 301 (ACI 301M) for placing concrete.

B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 (ACI 301M).

C. Do not add water to concrete during delivery, at Project site, or during placement.

D. Consolidate concrete with mechanical vibrating equipment.

3.7 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding 1/2 inch (13 mm).

1. Apply to concrete surfaces not exposed to public view

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch (3 mm).

1. Apply to concrete surfaces exposed to public view, or to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following rubbed finish, defined in ACI 301 (ACI 301M), to smooth-formed finished as-cast concrete where indicated:

1. Smooth-rubbed finish.
2. Grout-cleaned finish.
3. Cork-floated finish.

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.

3.8 FINISHING UNFORMED SURFACES

A. General: Comply with ACI 302.1R for screeding, re-straightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleed water appears on surface.

1. Do not further disturb surfaces before starting finishing operations.

C. Scratch Finish: Apply scratch finish to surfaces indicated and surfaces to receive concrete floor topping or mortar setting beds for ceramic or quarry tile, Portland cement terrazzo, and other bonded cementitious floor finishes, unless otherwise indicated.

D. Float Finish: Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, fluid-applied or direct-to-deck-applied membrane roofing, or sand-bed terrazzo.

E. Trowel Finish: Apply a hard trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system.

F. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set methods. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.

G. Nonslip Broom Finish: Apply a nonslip broom finish to surfaces indicated and to exterior concrete platforms, steps, and ramps. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.

3.9 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 with ACI 301 (ACI 301M) for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure formed and unformed concrete for at least seven days by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

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 (300 mm), 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.

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.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: GC will engage a qualified testing agency to perform tests and inspections.

B. Tests: Perform according to ACI 301 (ACI 301M).

1. Testing Frequency: One composite sample shall be obtained for each day's pour of each concrete mix exceeding 5 cu. yd. (4 cu. m) but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
2. Testing Frequency: One composite sample shall be obtained for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mix placed each day.

3.11 REPAIRS

A. Remove and replace concrete that does not comply with requirements in this Section.

END OF SECTION 033053

SECTION 035300 - CONCRETE TOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Emery-aggregate concrete floor topping.
2. Iron-aggregate concrete floor topping.

B. Related Sections:

1. Division 03 Section "Hydraulic Cement Underlayment" for polymer-modified, cementitious, self-leveling underlayment's.
2. Division 09 Section "Tiling" for medium-set and thickset mortar beds for tile.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for concrete floor topping.

C. Field quality-control test reports.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

B. Mockups: Place concrete floor topping mockups to demonstrate typical joints, surface finish, bonding, texture, tolerances, and standard of workmanship.

1. Build mockups approximately 100 sq. ft. (9.3 sq. m) in the location indicated or, if not indicated, as directed by Architect.
2. If Architect determines that mockups do not meet requirements, demolish and remove them from the site and cast others until mockups are approved.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

C. Pre-installation Conference: Conduct conference at Project site

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage, mixing with other components, and application.

B. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture or other detrimental effects.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting concrete floor topping performance.

1. Place concrete floor topping only when ambient temperature and temperature of base slabs are between 50 and 86 deg F (10 and 30 deg C).

B. Close areas to traffic during topping application and, after application, for time period recommended in writing by manufacturer.

PART 2 - PRODUCTS

2.1 CONCRETE FLOOR TOPPINGS

A. Emery-Aggregate Concrete Floor Topping: Factory-prepared and dry-packaged mixture of graded, crushed emery aggregate containing not less than 50 percent aluminum oxide, not less than 24 percent ferric oxide, and not more than 8 percent silica; Portland cement or blended hydraulic cement; plasticizers; and other admixtures to which only water needs to be added at Project site.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Anti-Hydro International, Inc.; A-H Emery A-1 Premix.
b. CONSPEC, by Dayton Superior; Conspec Emery Topping.
c. Dayton Superior Corporation; Emery Tuff Top.
d. L&M Construction Chemicals, Inc.; Emerytop 400.
e. Metalcrete Industries; Met-Top E.
f. US Concrete Materials, LLC; Florundum Emery 1-T Premix.
g. Laticrete

2. Compressive Strength (28 Days): 4,000 psi ASTM C 109/C 109M.

2.2 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. (305 g/sq. m) 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, 25 percent solids content, minimum.

2.3 RELATED MATERIALS

A. Semi-rigid Joint Filler: Two-component, semi-rigid, 100 percent solids, epoxy resin with a Type A Shore durometer hardness of 80.

B. Portland Cement: ASTM C 150, Type I or II.

C. Sand: ASTM C 404, fine aggregate passing No. 16 (1.18-mm) sieve.

D. Water: Potable.

E. Acrylic-Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

F. Epoxy Adhesive: ASTM C 881/C 881M, Type V, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements.

2.4 MIXING

A. Bonding Slurry: Mix Portland cement with water to a thick paint consistency.

B. Bonding Slurry: Mix 1-part Portland cement and 1-1/2 parts sand with water and an acrylic-bonding agent according to manufacturer's written instructions to a thick paint consistency.

C. Floor Topping: Mix concrete floor topping materials and water in appropriate drum-type batch machine mixer or truck mixer according to manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for conditions affecting performance of concrete floor topping.

B. Verify that base concrete slabs comply with scratch finish requirements specified in Division 03 Section "Cast-in-Place Concrete."

C. Verify that base slabs are visibly dry and free of moisture. Test for capillary moisture by the plastic sheet method according to ASTM D 4263.

D. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Existing Concrete: Remove existing surface treatments and deteriorated and unsound concrete. Mechanically abrade base slabs to produce a heavily scarified surface profile with an amplitude of 1/4 inch (6 mm.)

1. Prepare and clean existing base slabs according to concrete floor topping manufacturer's written instructions. Fill voids, cracks, and cavities in base slabs.
2. Mechanically remove contaminants from existing concrete that might impair bond of floor topping.
3. Saw cut contraction and construction joints in existing concrete to a depth of 1/2 inch (13 mm) and fill with semi-rigid joint filler.
4. To both sides of joint edges and at perimeter of existing base slab mechanically remove a 4-inch- (100-mm-) wide and 0- to 1-inch (0- to 25-mm-) deep, tapered wedge of concrete and retexture surface.

B. Install joint-filler strips where topping abuts vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with topping surface, unless otherwise indicated.
2. Terminate full-width, joint-filler strips 1/2 inch (13 mm) below topping surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.3 FLOOR TOPPING APPLICATION

A. Start floor topping application in presence of manufacturer's technical representative.

B. Deferred Floor Topping: Within 72 hours of placing base slabs, mix and scrub bonding slurry into dampened concrete to a thickness of 1/16 to 1/8 inch (1.6 to 3 mm), without puddling. Place floor topping while slurry is still tacky.

C. Existing Concrete: Apply epoxy-bonding adhesive, mixed according to manufacturer's written instructions, and scrub into dry base slabs to a thickness of 1/16 to 1/8 inch (1.6 to 3 mm), without puddling. Place floor topping while adhesive is still tacky.

D. Place concrete floor topping continuously in a single layer, tamping and consolidating to achieve tight contact with bonding surface. Do not permit cold joints or seams to develop within pour strip.

1. Screed surface with a straightedge and strike off to correct elevations.
2. Slope surfaces uniformly where indicated.
3. Begin initial floating using bull floats to form a uniform and open-textured surface plane free of humps or hollows.

E. Finishing: Consolidate surface with power-driven floats as soon as concrete floor topping can support equipment and operator. Re-straighten, cut down high spots, and fill low spots. Repeat float passes and re-straightening until concrete floor topping surface has a uniform, smooth, granular texture.

1. Hard Trowel Finish: After floating surface, apply first trowel finish and consolidate concrete floor topping by power-driven trowel without allowing blisters to develop. Continue troweling passes and re-straighten until surface is smooth and uniform in texture.
   a. Finish and measure surface so gap at any point between surface and an unleveled freestanding 10-foot- (3-m-) long straightedge, resting on 2 high spots and placed anywhere on the surface, does not exceed 1/4 inch (6 mm).

F. Construction Joints: Construct joints true to line with faces perpendicular to surface plane of concrete floor topping, at locations indicated or as approved by Architect.

1. Coat face of construction joint with epoxy adhesive at locations where concrete floor topping is placed against hardened or partially hardened concrete floor topping.

G. Contraction Joints: Form weakened-plane contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete floor topping when cutting action will not tear, abrade, or otherwise damage surface and before random contraction cracks develop.

1. Form joints in concrete floor topping over contraction joints in base slabs, unless otherwise indicated.
2. Construct contraction joints for a combined depth equal to topping thickness and not less than one-fourth of base-slab thickness.
3. Construct contraction joints for a depth equal to one-half of concrete floor topping thickness, but not less than 1/2 inch (13 mm) deep.

3.4 PROTECTING AND CURING

A. General: Protect freshly placed concrete floor topping from premature drying and excessive cold or hot temperatures.

B. Evaporation Retarder: Apply evaporation retarder to concrete floor topping surfaces in hot, dry, or windy conditions before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying floor topping, but before float finishing.

C. Begin curing immediately after finishing concrete floor topping. Cure by one or a combination of the following methods, according to concrete floor topping manufacturer's written instructions:

1. Moisture Curing: Keep surfaces continuously moist for not less than 7 days with continuous water-fog spray or absorptive cover, water saturated and kept continuously wet. Cover topping surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
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 (300 mm), 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 two coats in continuous operations 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.

3.5 JOINT FILLING

A. Prepare and clean contraction joints and install semi-rigid joint filler, according to manufacturer's written instructions, once topping has fully cured.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semi-rigid joint filler full depth of contraction joints. Overfill joint and trim semi-rigid joint filler flush with top of joint after hardening.

3.6 REPAIRS

A. Defective Topping: Repair and patch defective concrete floor topping areas, including areas that have not bonded to concrete substrate.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Services: Testing and inspecting of completed applications of concrete floor toppings shall take place in successive stages, in areas of extent and using methods as follows:

1. Sample Sets: At point of placement, a set of 3 molded-cube samples shall be taken from the topping mix for the first 1000 sq. ft. (93 sq. m), plus 1 set of samples for each subsequent 5000 sq. ft. (464 sq. m) of topping, or fraction thereof, but not less than 6 samples for each day's placement. Samples shall be tested according to ASTM C 109/C 109M for compliance with compressive-strength requirements.
2. Concrete floor topping shall be tested for delamination by dragging a steel chain over the surface.
3. Concrete floor topping shall be tested for compliance with surface flatness and levelness tolerances.

C. Remove and replace applications of concrete floor topping where test results indicate that it does not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

END OF SECTION 035300

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units (CMU's).
2. Concrete building brick.

1.2 PRE-CONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
1. Mortar Test (Property Specification): For each mix required, according to ASTM C 109/C 109M for compressive strength**,** ASTM C 1506 for water retention, and ASTM C 91 for air content.
2. Mortar Test (Property Specification): For each mix required, according to ASTM C 780 for compressive strength.
3. Grout Test (Compressive Strength): For each mix required, according to ASTM C 1019.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For reinforcing steel. Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement.

C. Material Certificates: For each type and size of product indicated. For masonry units include material test reports substantiating compliance with requirements.

D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

1.4 QUALITY ASSURANCE

A. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

1.5 PROJECT CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

A. Regional Materials: Provide CMUs that have been manufactured within 500 miles (800 km) of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

B. Shapes: Provide shapes indicated and for lintels, bullnose corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

C. Integral Water Repellent: Provide units made with liquid polymeric, integral water repellent admixture that does not reduce flexural bond strength for all masonry units for project.

1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. ACM Chemistries; RainBloc.
b. BASF Aktiengesellschaft; Rheopel Plus.
c. Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block.

D. CMUs: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi (19.3 MPa)
2. Density Classification: Medium weight unless otherwise indicated.

E. Concrete Building Brick: ASTM C 55.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi (19.31 MPa)
2. Density Classification: Medium weight.

2.3 MASONRY LINTELS

A. General: Provide one of the following:

B. Concrete Lintels: ASTM C 1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated. Provide lintels with net-area compressive strength not less than CMUs.

C. Concrete Lintels: Precast or formed-in-place concrete lintels complying with requirements in Division 03 Section "Cast-in-Place Concrete," and with reinforcing bars indicated.

D. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout.

2.4 MORTAR AND GROUT MATERIALS

A. Regional Materials: Provide aggregate for mortar and grout, cement, and lime that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

B. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

C. Hydrated Lime: ASTM C 207, Type S.

D. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

E. Masonry Cement: ASTM C 91.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Capital Materials Corporation; Flamingo Color Masonry Cement.
    b. Cemex S.A.B. de C.V.; Brikset Type N
    c. Essroc, Italcementi Group; Brixment
    d. Holcim (US) Inc.; Mortamix Masonry Cement
    e. Lafarge North America Inc.; Magnolia Masonry Cement
    f. Lehigh Cement Company; Lehigh Masonry Cement
    g. National Cement Company, Inc.; Coosa Masonry Cement.

F. Aggregate for Mortar: ASTM C 144.

1. For joints less than 1/4 inch (6 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.

2. White-Mortar Aggregates: Natural white sand or crushed white stone.
3. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

G. Aggregate for Grout: ASTM C 404.

H. Epoxy Pointing Mortar: ASTM C 395, epoxy-resin-based material formulated for use as pointing mortar for structural-clay tile facing units (and approved for such use by manufacturer of units); in color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's colors.

I. Cold-Weather Admixture: Non-chloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Euclid Chemical Company (The); Accelguard 80.
b. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.
c. Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA.

J. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent by same manufacturer.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. ACM Chemistries; RainBloc for Mortar.
b. BASF Aktiengesellschaft; Rheopel Mortar Admixture.
c. Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.
d. Sika products

K. Water: Potable.

2.5 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).

B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.

1. Interior Walls: Mill galvanized, carbon steel.
2. Wire Size for Side Rods: 0.187-inch (4.76-mm) diameter.
3. Wire Size for Cross Rods: 0.187-inch (4.76-mm) diameter.
4. Wire Size for Veneer Ties: 0.187-inch (4.76-mm) diameter.
5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.

6. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units.

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

D. Masonry Joint Reinforcement for Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.187-inch- (4.76-mm-) diameter, hot-dip galvanized, steel continuous wire.

2.6 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
3. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches (50 mm) parallel to face of veneer.

C. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Corrugated Metal Ties: Metal strips not less than 7/8 inch (22 mm) wide with corrugations having a wavelength of 0.3 to 0.5 inch (7.6 to 12.7 mm) and an amplitude of 0.06 to 0.10 inch (1.5 to 2.5 mm) made from 0.075-inch- (1.90 mm-)-thick. steel sheet, galvanized after fabrication with dovetail tabs for inserting into dovetail slots in concrete and sized to extend to within 1 inch (25 mm) of masonry face.

D. Partition Top anchors: 0.105-inch- (2.66-mm-) thick metal plate with 3/8-inch- (9.5-mm-) diameter metal rod 6 inches (152 mm) long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

E. Rigid Anchors: Fabricate from steel bars 1-1/2 inches (38 mm) wide by 1/4 inch (6.35 mm) thick by 24 inches (610 mm) long, with ends turned up 2 inches (51 mm) or with cross pins unless otherwise indicated.

1. Corrosion Protection Hot-dip galvanized to comply with ASTM A 153/A 153M

F. Anchor Bolts: L-shaped steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

2.7 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:

1. Metal Drip Edge: Fabricate from stainless steel. Extend at least 3 inches (76 mm) into wall and 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed.
2. Metal Sealant Stop: Fabricate from stainless steel. Extend at least 3 inches (76 mm) into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch (19 mm) and down into joint 1/4 inch (6 mm) to form a stop for retaining sealant backer rod.
3. Metal Expansion-Joint Strips: Fabricate from stainless steel to shapes indicated.

2.8 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Pre-molded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; formulated from neoprene.

B. Preformed Control-Joint Gaskets: Made from PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

2.9 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Diedrich Technologies, Inc.
b. EaCo Chem, Inc.
c. ProSoCo, Inc.

2.10 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use Portland cement-lime or masonry cement mortar unless otherwise indicated.

3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Pre-blended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a pre-blended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated.

1. For masonry below grade or in contact with earth, use Type M
2. For reinforced masonry, use Type N
3. For mortar parge coats, use Type N
4. For interior non-load-bearing partitions, Type O may be used instead of Type N.

D. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi (14 MPa).
3. Provide grout with a slump of 8 to 11 inches (203 to 279 mm) as measured according to ASTM C 143/C 143M.
   a. Glazed structural clay facing tile.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, un-chipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

B. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

3.2 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch (12 mm) or minus 1/4 inch (6 mm).
2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4-inch (6 mm) in a story height or 1/2-inch (12 mm) total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2-inch (12 mm) maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12 mm) maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12 mm) maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12 mm) maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).
2. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm).

3.3 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

D. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

E. Fill cores in hollow CMUs with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.

3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.5 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).

1. Space reinforcement not more than 16 inches (406 mm) o.c.
2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

3.6 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:

1. Provide an open space not less than 1 inch (25 mm) wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches (610 mm) o.c. vertically and 36 inches (915 mm) o.c. horizontally.

3.7 FIELD QUALITY CONTROL

A. Testing and Inspecting: GC will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections: Level 2 special inspections according to the "International Building Code."

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of tests for each 5000 sq. ft. (464 sq. m) of wall area or portion thereof.

E. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C 67 for compressive strength.

F. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

G. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

H. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.

I. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

3.8 REPAIRING, POINTING, AND CLEANING

A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
2. Protect surfaces from contact with cleaner.
3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
4. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.9 MASONRY WASTE DISPOSAL

A. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

SECTION 042113 - BRICK MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete facing brick.
2. Face brick.

B. Allowances: Face brick is included under Face Brick Allowances as specified in Division 01 Section "Allowances."

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:

1. Product Certificates for Credit MR 5.1[**and Credit MR 5.2**]: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

C. Samples: For each type and color of [**brick**] [**and**] [**colored mortar**].

D. Material Certificates: For each type and size of product indicated.

1.3 QUALITY ASSURANCE

A. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

B. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Division 01 Section "Quality Requirements" for mockups.

1. Build sample panels for each type of exposed unit masonry construction in sizes approximately [**48 inches (1200 mm)**] [**60 inches (1500 mm)**] <**Insert size**> long by [**36 inches (900 mm)**] [**48 inches (1200 mm)**] <**Insert size**> high[**by full thickness**].

1.4 PROJECT CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

2.2 CONCRETE BRICK

A. Regional Materials: Provide concrete brick that have been manufactured within 500 miles (800 km) of Project site from aggregates[**and cement**] that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

B. Integral Water Repellent: Provide concrete brick made with liquid polymeric, integral water repellent admixture that does not reduce flexural bond strength.

1. Products: Subject to compliance with requirements, [**provide the following**] [**provide one of the following**] [**available products that may be incorporated into the Work include, but are not limited to, the following**]:

a. ACM Chemistries, Inc.; RainBloc.
b. BASF Aktiengesellschaft; Rheopel Plus.
c. Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block.
d. <**Insert manufacturer's name; product name or designation**>.

C. Concrete Facing Brick: ASTM C 1634.

1. Density Classification: [**Lightweight**] [**Medium weight**] [**Normal weight**].
2. Size (Actual Dimensions): 3-5/8 inches (92 mm) wide by [**2-1/4 inches (57 mm)**] [**2-3/4 inches (70 mm)**] [**3-5/8 inches (92 mm)**] high by [**7-5/8 inches (194 mm)**] [**11-5/8 inches (295 mm)**] [**15-5/8 inches (397 mm)**] long.
3. Texture: [**Split-face finish**] [**Ground-face finish**] <**Insert description**>.

a. Match Architect's samples.

4. Colors: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**].

2.3 BRICK

A. Regional Materials: Provide brick that has been manufactured within 500 miles (800 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

B. General: Provide shapes indicated and as follows.

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

C. Face Brick: Facing brick complying with ASTM C 216 or hollow brick complying with ASTM C 652, Class H40V void areas between 25 and 40 percent of gross cross-sectional area.

1. Products: Subject to compliance with requirements available products that may be incorporated into the Work include, but are not limited to, the following:

2. Grade: Match existing
3. Type: Match existing
4. Initial Rate of Absorption: Less than 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67.
5. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
6. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet (3 m).
7. Size (Actual Dimensions): Match existing

2.4 MORTAR MATERIALS

A. Regional Materials: Provide aggregate for mortar**,** cement, and lime that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

B. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

C. Hydrated Lime: ASTM C 207, Type S.

D. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

E. Masonry Cement: ASTM C 91.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Capital Materials Corporation; Flamingo Color Masonry Cement.
    b. Cemex S.A.B. de C.V.; [Brikset Type N] [Citadel Type S] [Dixie Type S] [Kosmortar Type N] Richmortar Victor Plastic Cement.
    c. Essroc, Italcementi Group; Brixment or Velvet.
    d. Holcim (US) Inc.; Mortamix Masonry Cement Rainbow Mortamix Custom Buff Masonry Cement White Mortamix Masonry Cement.
    e. Lafarge North America Inc.; [Magnolia Masonry Cement] [Lafarge Masonry Cement] [Trinity White Masonry Cement].
    f. Lehigh Cement Company; [Lehigh Masonry Cement] [Lehigh White Masonry Cement].
    g. National Cement Company, Inc.; Coosa Masonry Cement.
    h. <Insert manufacturer's name; product name or designation>.

F. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Davis Colors; True Tone Mortar Colors.
    b. Lanxess Corporation; Bayferrox Iron Oxide Pigments.
    c. Solomon Colors, Inc.; SGS Mortar Colors.

G. Colored Cement Product: Packaged blend made from portland cement and hydrated lime or masonry cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Colored Portland Cement-Lime Mix:

        1) Capital Materials Corporation; Riverton Portland Cement Lime Custom Color.
        2) Holcim (US) Inc.; Rainbow Mortamix Custom Color Cement/Lime.
        3) Lafarge North America Inc.; Eaglebond Portland & Lime.
        4) Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.

    b. Colored Masonry Cement:

        1) Capital Materials Corporation; Flamingo Color Masonry Cement.
        2) Cemex S.A.B. de C.V.; Richcolor Masonry Cement.
        3) Essroc, Italcementi Group; Brixment-in-Color.
        4) Holcim (US) Inc.; Rainbow Mortamix Custom Color Masonry Cement.
        5) Lafarge North America Inc.; U.S. Cement Custom Color Masonry Cement.
        6) Lehigh Cement Company; Lehigh Custom Color Masonry Cement.
        7) National Cement Company, Inc.; Coosa Masonry Cement.

H. Aggregate for Mortar: ASTM C 144.

1. White-Mortar Aggregates: Natural white sand or crushed white stone.
2. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

I. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Euclid Chemical Company (The); Accelguard 80.
b. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.
c. Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA.

J. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. ACM Chemistries, Inc.; RainBloc for Mortar.
b. BASF Aktiengesellschaft; Rheopel Mortar Admixture.
c. Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.

2.5 REINFORCEMENT

A. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.

B. Masonry Joint Reinforcement for Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.187-inch- (4.76-mm-) diameter, hot-dip galvanized, carbon-steel continuous wire.

2.6 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.

B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches (50 mm) parallel to face of veneer.

C. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- (6.35-mm-) diameter, hot-dip galvanized steel wire.
2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch (25 mm) of masonry face, made from [**0.187-inch- (4.76-mm-)**] [**0.25-inch- (6.35-mm-)**] diameter, hot-dip galvanized steel wire.

D. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from [**0.060-inch- (1.52-mm-) thick, steel sheet, galvanized after fabrication**] [**01.05-inch- (2.66-mm-) thick, steel sheet, galvanized after fabrication**].
2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch (25 mm) of masonry face, made from [**0.187-inch- (4.76-mm-)**] [**0.25-inch- (6.35-mm-)**] diameter, hot-dip galvanized steel wire.
3. Corrugated Metal Ties: Metal strips not less than 7/8 inch (22 mm) wide with corrugations having a wavelength of 0.3 to 0.5 inch (7.6 to 12.7 mm) and an amplitude of 0.06 to 0.10 inch (1.5 to 2.5 mm) made from [**0.060-inch- (1.52- mm-) thick, steel sheet, galvanized after fabrication**] [**0.075-inch- (1.90-mm-) thick, steel sheet, galvanized after fabrication**] [**01.05-inch- (2.66-mm-) thick, steel sheet, galvanized after fabrication**] with dovetail tabs for inserting into dovetail slots in concrete and sized to extend to within 1 inch (25 mm) of masonry face.

E. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:

   a. Structural Performance Characteristics: Capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play in excess of 0.05 inch (1.3 mm).

2. Contractor's Option: Unless otherwise indicated, provide any of the following types of anchors:
3. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.

   a. Products: Subject to compliance with requirements, **available products that may be incorporated into the Work include, but are not limited to, the following**:

      1) Dayton Superior Corporation, Dur-O-Wal Division; [**D/A 213**] [**or**] [**D/A 210 with D/A 700-708**].
      2) Heckmann Building Products Inc.; [**315-D with 316**] [**or**] [**Pos-I-Tie**].
      3) Hohmann & Barnard, Inc.; [**DW-10**] [**DW-10HS**] [**or**] [**DW-10-X**].
      4) Wire-Bond; [**1004, Type III**] [**RJ-711**] [**or**] [**SureTie**].

b. Anchor Section: Rib-stiffened, sheet metal plate with screw holes top and bottom, having slotted holes for inserting wire tie.
c. Anchor Section: Corrosion-resistant, self-drilling, eye-screw designed to receive wire tie. Eye-screw has spacer that seats directly against framing and is same thickness as sheathing and has gasketed, washer head that covers hole in sheathing.
d. Fabricate sheet metal anchor sections and other sheet metal parts from [**0.075-inch- (1.90-mm-) thick, steel sheet, galvanized after fabrication**] [**1.05-inch- (2.66-mm-) thick, steel sheet, galvanized after fabrication**].
e. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from [**0.187-inch- (4.76-mm-)**] [**0.25-inch- (6.35-mm-)**] diameter, hot-dip galvanized steel wire.

4. Seismic Masonry-Veneer Anchors: Units consisting of a metal anchor section and a connector section designed to engage a continuous wire embedded in the veneer mortar joint.

a. Products: Subject to compliance with requirements, **available products that may be incorporated into the Work include, but are not limited to, the following**:

1) Dayton Superior Corporation, Dur-O-Wal Division; D/A 213S.
2) Hohmann & Barnard, Inc.; DW-10-X-Seismiclip.
3) Wire-Bond; RJ-711 with Wire-Bond clip.

b. Anchor Section: Rib-stiffened, sheet metal plate with screw holes top and bottom, having slotted holes for inserting connector section.
c. Connector Section: Rib-stiffened, sheet metal bent plate, sheet metal clip, or wire tie and rigid PVC extrusion designed to engage continuous wire. Size connector to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face.
d. Fabricate sheet metal anchor sections and other sheet metal parts from [**0.075-inch- (1.90-mm-) thick, steel sheet, galvanized after fabrication**] [**1.05-inch- (2.66-mm-) thick, steel sheet, galvanized after fabrication**].
e. Fabricate wire connector sections from [**0.187-inch- (4.76-mm-)**] [**0.25-inch- (6.35-mm-)**] diameter, hot-dip galvanized, carbon-steel wire.

5. Polymer-Coated, Steel Drill Screws for Steel Studs: ASTM C 954 except manufactured with hex washer head and neoprene or EPDM washer, and with organic polymer coating with salt-spray resistance to red rust of more than 800 hours per ASTM B 117.
6. Stainless-Steel Drill Screws for Steel Studs: ASTM C 954 except manufactured with hex washer head and neoprene or EPDM washer.

2.7 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with **SMACNA's "Architectural Sheet Metal Manual Division 07 Section "Sheet Metal Flashing and Trim"** and as follows:

1. Metal Drip Edge: Fabricate from stainless steel. Extend at least 3 inches (76 mm) into wall and 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees[**and hemmed**.

2. Metal Sealant Stop: Fabricate from stainless steel. Extend at least 3 inches (76 mm) into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch (19 mm) and down into joint 1/4 inch (6 mm) to form a stop for retaining sealant backer rod.

B. Flexible Flashing: Use **one of** the following unless otherwise indicated:

1. Copper-Laminated Flashing: **5-oz./sq. ft. (1.5-kg/sq. m) 7-oz./sq. ft. (2-kg/sq. m)** copper sheet bonded between 2 layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.

a. Products: Subject to compliance with requirements, **available products that may be incorporated into the Work include, but are not limited to, the following**:

1) Advanced Building Products Inc.; [**Copper Fabric Flashing**] [**Copper Sealtite 2000**].
2) Dayton Superior Corporation, Dur-O-Wal Division; Copper Fabric Thru-Wall Flashing.
3) Hohmann & Barnard, Inc.; H & B C-Fab Flashing.
4) Phoenix Building Products; Type FCC-Fabric Covered Copper.
5) Sandell Manufacturing Co., Inc.; Copper Fabric Flashing.
6) York Manufacturing, Inc.; Multi-Flash 500.
7) <**Insert manufacturer's name; product name or designation**>.

2. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than **0.030 inch (0.76 mm) 0.040 inch (1.02 mm)**.

a. Products: Subject to compliance with requirements, **available products that may be incorporated into the Work include, but are not limited to, the following**:

1) Advanced Building Products Inc.; Peel-N-Seal.
2) Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
3) Dayton Superior Corporation, Dur-O-Wal Division; Dur-O-Barrier Thru-Wall Flashing.
4) Fiberweb, Clark Hammerbeam Corp.; Aquaflash 500.
5) Grace Construction Products, W. R. Grace & Co. - Conn.; Perm-A-Barrier Wall Flashing.
6) Heckmann Building Products Inc.; No. 82 Rubberized-Asphalt Thru-Wall Flashing.
7) Hohmann & Barnard, Inc.; Textroflash.
8) W. R. Meadows, Inc.; Air-Shield Thru-Wall Flashing.
9) Polyguard Products, Inc.; [**Polyguard 300**] [**Polyguard 400**].
10) Sandell Manufacturing Co., Inc.; Sando-Seal.
11) Williams Products, Inc.; Everlastic MF-40.

3. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of a polyester-reinforced ethylene interpolymer alloy.

a. Products: Subject to compliance with requirements, **available products that may be incorporated into the Work include, but are not limited to, the following**:

1) DuPont; Thru-Wall Flashing.
2) Hohmann & Barnard, Inc.; Flex-Flash.
3) Hyload, Inc.; Hyload Cloaked Flashing System.

4. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D 4637, 0.040 inch (1.0 mm) thick.

a. Products: Subject to compliance with requirements, **available products that may be incorporated into the Work include, but are not limited to, the following**:

1) Carlisle Coatings & Waterproofing; Pre-Kleened EPDM Thru-Wall Flashing.
2) Firestone Specialty Products; FlashGuard.
3) Heckmann Building Products Inc.; No. 81 EPDM Thru-Wall Flashing.
4) Hohmann & Barnard, Inc.; Epra-Max EPDM Thru-Wall Flashing.
5) Sandell Manufacturing Co., Inc.; EPDM Flashing.

C. Solder and Sealants for Sheet Metal Flashings:[**As specified in Division 07 Section "Sheet Metal Flashing and Trim."**

D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.8 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; formulated from neoprene, urethane or PVC.

B. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

C. Weep/Vent Products: Use one of the following unless otherwise indicated:

1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe, in color selected from manufacturer's standard.

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) Advanced Building Products Inc.; Mortar Maze weep vent.
2) Blok-Lok Limited; Cell-Vent.
3) Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.
4) Heckmann Building Products Inc.; No. 85 Cell Vent.
5) Hohmann & Barnard, Inc.; Quadro-Vent.
6) Wire-Bond; Cell Vent.

2. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe; in color selected from manufacturer's standard.

    a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

        1) Mortar Net USA, Ltd.; Mortar Net Weep Vents.

        2) Or approved equal

3. Vinyl Weep Hole/Vent: One-piece, offset, T-shaped units made from flexible PVC, designed to fit into a head joint and consisting of a louvered vertical leg, flexible wings to seal against ends of masonry units, and a top flap to keep mortar out of the head joint; in color selected by Architect.

    a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

        1) Hohmann & Barnard, Inc.; #343 Louvered Weep Hole.
        2) Williams Products, Inc.; Williams-Goodco Brick Vent.
        3) Wire-Bond; Louvered Weepholes.
        4)

D. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Advanced Building Products Inc.; Mortar Break or Mortar Break II.
    b. Archovations, Inc.; CavClear Masonry Mat.
    c. Dayton Superior Corporation, Dur-O-Wal Division; Polytite MortarStop.
    d. Mortar Net USA, Ltd.; Mortar Net.

2. Provide one of the following configurations:

    a. Strips, full-depth of cavity and 10 inches (250 mm) high, with dovetail shaped notches 7 inches (175 mm) deep.
    b. Strips, not less than **1-1/2 inches (38 mm)** thick and 10 inches (250 mm) high, with dimpled surface designed to catch mortar droppings and prevent weep holes from clogging with mortar.
    c. Sheets or strips full depth of cavity and installed to full height of cavity.

2.9 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Diedrich Technologies, Inc.
    b. EaCo Chem, Inc.
    c. ProSoCo, Inc.

2.10 MORTAR MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

    1. Do not use calcium chloride in mortar.
    2. Use portland cement-lime , masonry cement or mortar cement mortar unless otherwise indicated.
    3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide Type N unless another type is indicated.

D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.

    1. Pigments shall not exceed 10 percent of portland cement by weight.
    2. Pigments shall not exceed 5 percent of masonry cement by weight.
    3. Application: Use pigmented mortar for exposed mortar joints.

E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

    1. Mix to match Architect's sample.
    2. Application: Use colored aggregate mortar for exposed mortar joints.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

B. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

C. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.2 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch (12 mm) or minus 1/4 inch (6 mm).
2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2 inch (12 mm) maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm); do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).
2. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm).[**Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3 mm).**]

3.3 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

D. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

A. Lay hollow brick as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With entire units, including areas under cells, fully bedded in mortar at starting course on footings.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.5 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:

1. Provide an open space not less than [**1/2 inch (13 mm)**] [**1 inch (25 mm)**] [**2 inches (50 mm)**] wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches (610 mm) o.c. vertically and 36 inches (915 mm) o.c. horizontally.

3.6 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to [**wall framing**] [**and**] [**concrete backup**] with[**seismic**] masonry-veneer anchors to comply with the following requirements:

1. Fasten [**screw-attached**] [**and**] [**seismic**] anchors [**through sheathing to wall framing**] [**and**] [**to concrete backup**] with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
2. Embed [**tie sections**] [**connector sections and continuous wire**] in masonry joints. Provide not less than 2 inches (50 mm) of air space between back of masonry veneer and face of sheathing.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.

4. Space anchors as indicated, but not more than 16 inches (406 mm) o.c. vertically and [**32 inches (813 mm)**] [**24 inches (610 mm)**] o.c. horizontally with not less than 1 anchor for each [**3.5 sq. ft. (0.33 sq. m)**] [**2.67 sq. ft. (0.25 sq. m)**] of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 36 inches (914 mm), around perimeter.

3.7 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.[**Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.**]

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At lintels and shelf angles, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.
3. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal drip edge.
4. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal flashing termination.

C. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:

1. Use [**specified weep/vent products**] [**or**] [**open head joints**] to form weep holes.
2. Space weep holes 24 inches (600 mm) o.c. unless otherwise indicated.

D. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

E. Install vents in head joints in exterior wythes at spacing indicated. Use [**specified weep/vent products**] [**or**] [**open head joints**] to form vents.

1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.8 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to

perform tests and inspections. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.

B. Inspections: Level 1 special inspections according to the "International Building Code."

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.

C. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

3.9 CLEANING

A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes
2. Protect adjacent surfaces from contact with cleaner.
3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
4. Clean brick by bucket-and-brush hand-cleaning method described in "BIA Technical Notes 20."
5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.10 MASONRY WASTE DISPOSAL

A. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.

B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042113

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Interior non-load-bearing wall framing.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As follows:

a. Dead Loads: Weights of materials and construction (10 psf)
b. Seismic Loads: comply with NJ IBC section 1607.13

2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
a. the wall height under a horizontal load of 5 lbf/sq. ft. (239 Pa).
b. Interior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height.

1.3 SUBMITTALS

A. Product Data: For each type of product and accessory indicated.

B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners.

1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Welding certificates.

D. Qualification data.

E. Product test reports.

F. Research/evaluation reports.

1.4 QUALITY ASSURANCE

A. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements.

B. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code--Sheet Steel."

C. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

D. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Truss Design."
2. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

E. Comply with AISI's "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of pre-consumer recycled content is not less than 25 percent.

B. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: ST33H (ST230H) As required by structural performance.
2. Coating: G60 (Z180) or equivalent

2.2 INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm)
2. Flange Width: 1-5/8 inches (41 mm)

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and same minimum base-metal thickness as steel studs.

C. Vertical Deflection Clips: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

D. Single Deflection Track: Where indicated on drawings, provide Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads.

2.3 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members, unless otherwise indicated.

B. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

C. Anchor Bolts: ASTM F 1554, Grade 36 threaded carbon-steel hooked bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by mechanically deposition according to ASTM B 695, Class 50.

D. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

E. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

F. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

2.4 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035 ASTM A 780.

B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Shims: Load bearing, high-density multi-monomer plastic, non-leaching.

D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

PART 3 - EXECUTION

3.1 PREPARATION

A. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.

B. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.2 INSTALLATION, GENERAL

A. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

B. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.

C. Install framing members in one-piece lengths.

D. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

E. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

F. Install insulation, specified in Division 07 Section "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

G. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

H. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.3 INTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:

1. Stud Spacing: 16 inches (406 mm)

C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deflection tracks and anchor to building structure.
2. Install double deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to bypassing studs and anchor to primary building structure.

E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.

1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 18 inches (450 mm) of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.

a. Install solid blocking at 96-inch (2440-mm) centers

2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
3. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
4. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable curtain-wall-framing system.

3.4 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.5 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass-fiber blanket insulation.
2. Mineral-wool blanket insulation.
3. Spray polyurethane foam insulation.
4. Vapor retarders.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product test reports.

C. Research/evaluation reports.

PART 2 - PRODUCTS

2.1 GLASS-FIBER BLANKET INSULATION

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. CertainTeed Corporation.
2. Johns Manville.
3. Owens Corning.

B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

C. Polypropylene-Scrim-Kraft-Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type II (non-reflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier).

2.2 MINERAL-WOOL BLANKET INSULATION

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Fibrex Insulations Inc.
2. Owens Corning.
3. Roxul Inc.
4. Thermafiber.

B. Unfaced, Mineral-Wool Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

2.3 SPRAY POLYURETHANE FOAM INSULATION

A. Closed-Cell Polyurethane Foam Insulation: ASTM C 1029, Type II, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. BASF Corporation.
   b. Dow Chemical Company (The).
   c. Henry Company.

2. Minimum density of 1.5 lb/cu. ft. (24 kg/cu. m), thermal resistivity of 6.2 deg F x h x sq. ft./Btu x in. at 75 deg F (43 K x m/W at 24 deg C).

2.4 VAPOR RETARDERS

A. Polyethylene Vapor Retarders: ASTM D 4397, 10 mils (0.25 mm) thick, with maximum permeance rating of 0.13 perm (7.5 ng/Pa x s x sq. m).

B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.2 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Glass-Fiber or Mineral-Wool Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
5. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
6. For wood-framed construction, install blankets according to ASTM C 1320 and as follows:

    a. With faced blankets having stapling flanges, secure insulation by inset, stapling flanges to sides of framing members.
    b. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.

7. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.

    a. Exterior Walls: Set units with facing placed toward interior of construction
    b. Interior Walls: Set units with facing placed toward areas of high humidity.

C. Spray-Applied Insulation: Apply spray-applied insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.

D. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Loose-Fill Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).
2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.3 INSTALLATION OF VAPOR RETARDERS

A. Place vapor retarders on side of construction indicated on Drawings. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives or other anchorage system as indicated. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

B. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs.

1. Before installing vapor retarders, apply urethane sealant to flanges of metal framing including runner tracks, metal studs, and framing around door and window openings. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.
2. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacturer.

C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.

D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

END OF SECTION 072100

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Urethane joint sealants.
3. Latex joint sealants.
4. Preformed joint sealants.
5. Acoustical joint sealants.

1.2 PRECONSTRUCTION TESTING

A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates. Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

1.3 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples: For each kind and color of joint sealant required.

C. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

D. Product test reports.

E. Preconstruction compatibility and adhesion test reports.

F. Preconstruction field-adhesion test reports.

G. Field-adhesion test reports.

H. Warranties.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

B. Pre-installation Conference: Conduct conference at project site.

1.5 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: five (5) years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):

1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

B. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.

C. Stain-Test-Response Characteristics: Where sealants are specified to be non-staining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

D. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

2.2 SILICONE JOINT SEALANTS

A. Mildew-Resistant Silicone Joint Sealant JS-#1: ASTM C 920.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2.
   a. Dow Corning Corporation.
   b. GE Advanced Materials - Silicones.
   c. Pecora Corporation.
   d. Sika Corporation; Construction Products Division.

3. Type: Single component (S)
4. Grade: non-sag (NS)
5. Class: 100/50.
6. Uses Related to Exposure: Non-traffic (NT)

2.3 URETHANE JOINT SEALANTS

A. Urethane Joint Sealant JS #2: ASTM C 920.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. BASF Building Systems.
   b. Pecora Corporation.
   c. Polymeric Systems, Inc.
   d. Schnee-Morehead, Inc.
   e. Sika Corporation; Construction Products Division.
   f. Tremco Incorporated.

2. Type: Single component (S)
3. Grade: nonsag (NS).
4. Class: 100/50
5. Uses Related to Exposure: Traffic (T)

2.4 LATEX JOINT SEALANTS

A. Latex Joint Sealant JS-#3: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. BASF Building Systems.
   b. Bostik, Inc.

c. Pecora Corporation.
d. Tremco Incorporated.

2.5 PREFORMED JOINT SEALANTS

A. Preformed Foam Joint Sealant JS-#4: Manufacturer's standard preformed, pre-compressed, open-cell foam sealant manufactured from urethane foam with minimum density of 10 lb/cu. ft. (160 kg/cu. m) and impregnated with a nondrying, water-repellent agent. Factory produce in pre-compressed sizes in roll or stick form to fit joint widths indicated; coated on one side with a pressure-sensitive adhesive and covered with protective wrapping.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Dayton Superior Specialty Chemicals.
b. EMSEAL Joint Systems, Ltd.
c. Sandell Manufacturing Co.
d. Willseal USA, LLC.

2.6 ACOUSTICAL JOINT SEALANTS

A. Acoustical Joint Sealant JS-#5: Manufacturer's standard non-sag, paintable, non-staining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Pecora Corporation.
b. USG Corporation.
c. BASF

2.7 JOINT SEALANT BACKING

A. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer.

2.8 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.

C. Masking Tape: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

1. Remove laitance and form-release agents from concrete.
2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.2 INSTALLATION

A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.

F. Acoustical Sealant Installation: Comply with ASTM C 919 and with manufacturer's written recommendations.

G. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.3 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:

a. Perform three (3) tests for the first 500 of joint length for each kind of sealant and joint substrate.
b. Perform 1 test for each 1000 feet (300 m) of joint length thereafter or 1 test per each floor per elevation.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.4 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces JS-#1.

1. Joint Locations:

   a. Control and expansion joints in brick pavers.
   b. Isolation and contraction joints in cast-in-place concrete slabs.
   c. Joints between plant-precast architectural concrete paving units.
   d. Joints in stone paving units**,** including steps.
   e. Tile control and expansion joints.
   f. Joints between different materials listed above.
   g. Other joints as indicated.
2. Joint Sealant: Urethane.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal non-traffic surfaces JS-#2.

1. Joint Locations:

   a. Construction joints in cast-in-place concrete.
   b. Joints between plant-precast architectural concrete units.
   c. Control and expansion joints in unit masonry.
   d. Joints in dimension stone cladding.
   e. Joints in glass unit masonry assemblies.
   f. Joints in exterior insulation and finish systems.
   g. Joints between metal panels.
   h. Joints between different materials listed above.
   i. Perimeter joints between materials listed above and frames of doors, windows and louvers
   j. Control and expansion joints in ceilings and other overhead surfaces.
   k. Other joints as indicated.
2. Joint Sealant: Urethane.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces JS-#3.

1. Joint Locations:
   a. Control and expansion joints in tile flooring.
   b. Other joints as indicated.

2. Joint Sealant: Silicone.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal non-traffic surfaces JS-#4.

1. Joint Locations:

   a. Control and expansion joints on exposed interior surfaces of exterior walls.

b. Perimeter joints of exterior openings where indicated.
c. Tile control and expansion joints.
d. Vertical joints on exposed surfaces of interior unit masonry concrete walls and partitions.
e. Perimeter joints between interior wall surfaces and frames of interior doors, and windows
f. Other joints as indicated.

2. Joint Sealant: Latex.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

E. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal non-traffic surfaces JS-#5.

1. Joint Sealant Location:

a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
b. Tile control and expansion joints where indicated.
c. Other joints as indicated.

2. Joint Sealant: Silicone.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

F. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal non-traffic surfaces JS-#6.

1. Joint Location:

a. Acoustical joints where indicated.
b. Other joints as indicated.

2. Joint Sealant: Acoustical.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Standard hollow metal doors and frames.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include elevations, door edge details, frame profiles, metal thicknesses, preparations for hardware, and other details.

C. Schedule: Prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings.

1.3 QUALITY ASSURANCE

A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252

1. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.

B. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 Label each individual glazed lite.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Amweld Building Products, LLC.
2. Benchmark; a division of Therma-Tru Corporation.
3. Ceco Door Products; an Assa Abloy Group company.

4. Deansteel Manufacturing Company, Inc.
5. Firedoor Corporation.
6. Habersham Metal Products Company.
7. Kewanee Corporation (The).
8. Steelcraft; an Ingersoll-Rand company.
9. Windsor Republic Doors.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, CS, Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, CS, Type B.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) metallic coating.

D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.

G. Mineral-Fiber Insulation: ASTM C 665, Type I.

H. Glazing: Division 08 Section "Glazing."

I. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat.

2.3 STANDARD HOLLOW METAL DOORS

A. General: Comply with ANSI/SDI A250.8.

1. Design: Flush panel
2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.

a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
b. Thermal-Rated (Insulated) Doors: R-value of not less than 12.3 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.

3. Vertical Edges for Single-Acting Doors: Manufacturer's standard.

4. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- (1.0-mm-) thick, end closures or channels of same material as face sheets.
5. Tolerances: SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Comply with ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Level 4 and Physical Performance Level A (Maximum Duty), [Model 1 (Full Flush)] [
2. Model 2 (Seamless)]

C. Interior Doors: Face sheets fabricated from metallic coated cold-rolled steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush)]Model 2 (Seamless).

D. Hardware Reinforcement: ANSI/SDI A250.6.

2.4 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8.

B. Exterior Frames: Fabricated from metallic-coated steel sheet.

1. Fabricate frames with mitered
2. Frames for Level 2 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.

C. Interior Frames: Fabricated from cold-rolled metallic-coated steel sheet.

1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as knocked down unless otherwise indicated.
3. Fabricate knocked-down, drywall slip-on frames for in-place gypsum board partitions.
4. Frames for Level 3 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
5. Frames for Level 4 Steel Doors: 0.067-inch- (1.7-mm-) thick steel sheet.
6. Frames for Wood Doors: 0.067-inch- (1.7-mm-) thick steel sheet.
7. Frames for Borrowed Lights: Same as adjacent door frame
8.

D. Hardware Reinforcement: ANSI/SDI A250.6.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (50 mm) wide by 10 inches (250 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
2. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.

3. Post-installed Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (50-mm) height adjustment. Terminate bottom of frames at finish floor surface.

2.6 HOLLOW METAL PANELS

A. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal work.

2.7 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch (0.8 mm) thick, same material as door face sheet.

B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated.

C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch (0.8 mm) thick, same material as frames.

D. Terminated Stops: Where indicated, terminate stops 6 inches (152 mm) above finish floor with a 90-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.

2.8 LOUVERS

A. Provide sightproof louvers for interior doors, where indicated, that comply with SDI 111C, with blades or baffles formed of 0.020-inch- (0.5-mm-) thick, cold-rolled steel sheet set into 0.032-inch- (0.8-mm-) thick steel frame.

2.9 ACCESSORIES (Not Used)

2.10 FABRICATION

A. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

B. Hollow Metal Doors:

1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors. Seal joints in top edges of doors against water penetration.
2. Glazed Lites: Factory cut openings in doors.
3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated.

C. Hollow Metal Frames: Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
4. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
5. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
        1) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.

    b. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:

        1) Three anchors per jamb up to 60 inches (1524 mm) high.

    c. Compression Type: Not less than two anchors in each jamb.
    d. Post-installed Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.

6. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers.

    a. Single-Door Frames: Three door silencers.
    b. Double-Door Frames: Two door silencers.

D. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive non-templated, mortised and surface-mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.

4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 electrical Sections.

E. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow metal work.
5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.11 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

1. Shop Primer: ANSI/SDI A250.10.

B. Factory-Applied Paint Finish: ANSI/SDI A250.3.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hollow Metal Frames: Comply with ANSI/SDI A250.11.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

a. At fire-protection-rated openings, install frames according to NFPA 80.
b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
c. Install frames with removable glazing stops located on secure side of opening.
d. Install door silencers in frames before grouting.
e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.

    a. Floor anchors may be set with powder-actuated fasteners instead of post-installed expansion anchors if so indicated and approved on Shop Drawings.

3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
6. In-Place Concrete or Masonry Construction: Secure frames in place with post-installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. In-Place Gypsum Board Partitions: Secure frames in place with post-installed expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame 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. Provide adjustable wedged or bolted anchorage to frame jamb members.
9. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

B. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

    a. Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
    b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
    c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
    d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to NFPA 105.

C. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (50 mm) o.c. from each corner.

3.2 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

C. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

SECTION 08710- DOOR HARDWARE

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes furnishing, installation of door hardware for doors specified in "Hardware Sets" and required by actual conditions: including screws, bolts, expansion shields, electrified door hardware, and other devices for proper application of hardware.

B. Where items of hardware are not specified and are required for intended service, such omission, error or other discrepancy to be submitted to Architect fourteen calendar days prior to bid date for clarification by addendum.

C. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

D. Related Divisions:
1. Division 08 Openings
2. Division 13 Special Construction

1.02 REFERENCES

A. American National Standards Institute/Builders Hardware Manufacturers Association (ANSI):
1. ANSI/BHMA A156.1 Butts & Hinges (2016)
2. ANSI/BHMA A156.4 Door Controls – Closers (2013)
3. ANSI/BHMA A156.6 Architectural Door Trim (2015)
4. ANSI/BHMA A156.7 Template Hinge Dimensions (2016)
5. ANSI/BHMA A156.8 Door Controls – Overhead Stops and Holders (2015)
6. ANSI/BHMA A156.13 Mortise Locks & Latches (2012)
7. ANSI/BHMA A156.14 Sliding & Folding Door Hardware (2013)
8. ANSI/BHMA A156.16 Auxiliary Hardware (2013)
9. ANSI/BHMA A156.18 Materials & Finishes (2016)
10. ANSI/BHMA A156.21 Thresholds (2014)
11. ANSI/BHMA A156.22 Door Gasketing Systems (2012)
12. ANSI/BHMA A156.28 Keying Systems (2013)
13. ANSI/BHMA A156.36 Auxiliary Locks (2016)
14. ANSI/BHMA A156.115 Hardware Preparation in Steel Doors and Steel Frames (2014)
15. ANSI/BHMA A156.115W Hardware Preparation in Wood Doors with Wood or Steel Frames (2016)

B. International Code Council/American National Standards Institute (ICC/ANSI)/ADA:
1. ICC/ANSI A117.1 Standards for Accessible and Usable Buildings and Facilities 2003
2. Americans with Disabilities Act Accessability Guidelines (ADAAG)

C. Underwriters Laboratories, Inc. (UL):
1. UL 10C Positive Pressure Fire Test of Door Assemblies.
2. UL 1784 Air Leakage Test of Door Assemblies.
3. UL/ULC Listed

D. Door and Hardware Institute (DHI):
1. DHI Publications – Keying Systems and Nomenclature (1989).
2. DHI Publication – Abbreviations and Symbols.

3. DHI Publication – Installation Guide for Doors and Hardware.
4. DHI Publication – Sequence and Format of Hardware Schedule (1996).

E. National Fire Protection Agency (NFPA):
1. NFPA 70 National Electrical Code 2005.
2. NFPA 80 Standard for Fire Doors and Other Opening Protectives 1999.
3. NFPA 101 Life Safety Code 2003.
4. NFPA 105 Standard for the Installation of Smoke Door Assemblies 2003.

F. Building Codes
1. IBC International Building Code 2006
2. Local Building Code

1.03 SUBMITTALS

A. Submit in accordance with Conditions of the Contract and Division 1 Administrative Requirements and Submittal Procedures Section.

B. Shop Drawings:
1. Organize hardware schedule in vertical format as illustrated in DHI Publications Sequence and Formatting for the Hardware Schedule. Include abbreviations and symbols page according to DHI Publications Abbreviations and Symbols. Complete nomenclature of items required for each door opening as indicated.
2. Coordinate final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of hardware.
3. Architectural Hardware Consultant (AHC), as certified by DHI, who will affix seal attesting to completeness and correctness, including the review of the hardware schedule prior to submittal.

C. Submit manufacturer's catalog sheet on design, grade, and function of items listed in hardware schedule. Identify specific hardware item per sheet, provide an index, and cover sheet.

D. Coordination: Distribute door hardware templates to related divisions within fourteen days of recieving approved door hardware submittals.

E. Closeout Submittals: Submit to Owner in a three-ring binder or CD if requested.
1. Warranties.
2. Maintenance and operating manual.
3. Maintenance service agreement.
4. Record documents.
5. Copy of approved hardware schedule.
6. Copy of approved keying schedule with bitting list.
7. Door hardware supplier name, phone number, and fax number.

1.04 QUALITY ASSURANCE

A. Hardware supplier will employ an Architectural Hardware Consultant (AHC) as certified by DHI and a member of the seal program who will be available at reasonable times during course of work for Project hardware consultation.

B. Door hardware conforming to ICC/ANSI A117.1: Handles pulls, latches locks and operating devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.

C. Fire Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and/or labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL 10C, unless otherwise indicated.

D. Fire Door Inspection: Prior to receiving certificate of occupancy have fire rated doors inspected by an independent Certified Fire and Egress Door Assembly Inspector (FDAI), as certified by Intertek (ITS), a written report be submitted to Owner and Contractor. Doors failing inspection must be adjusted, replaced or modified to be within appropriate code requirements. (Use for a building under IBC 2009 or newer.)

E. Smoke and Draft Control Door Assemblies: Where smoke and draft control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

F. Door hardware certified to ANSI/BHMA standards as noted, participate and be listed in BHMA Certified Products Directory.

G. Substitution request: Include the reason for requesting the substitution, clear catalog copy highlighting the proposed product and options, compliance statement, technical data, product warranty and lead time, to show how the proposed can meet or exceed established level of design, function, and quality. Approval of request is at the discretion of the owner, architect, and their designated consultants and will be addressed via addendum prior to bid date.

H. Meetings: Comply with requirements in Division 1 Section "Project Meetings."
   1. Keying Meeting
      a. Within fourteen days of receipt of approved door hardware submittals, contact Owner with representative from hardware supplier to establish a keying conference. Verify keyway, visual key identification, number of master keys and keys per lock. Provide keying system per Owner's instructions.
   2. Pre-installation Meeting
      a. Convene meeting within fourteen days of receipt of approved door hardware submittals. Participants required to attend: Contractor, installer, material supplier, manufacturer representatives.
      b. Include in-conference decisions regarding proper installation methods and procedures for receiving and handling hardware.
      c. Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.

I. Installer Qualifications: Specialized in performing installation of this Section and have five years minimum documented experience.

J. Hardware listed in 3.07 – Hardware Schedule is intended to establish minimum level of design, type, function and grade of hardware to be used.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Provide clean, dry and secure room for hardware delivered to Project but not yet installed. Shelve hardware off of the floor and with larger items of hardware being stored on wooden pallets. Arrange locksets and keyed cylinders by opening number. Organize the balance of hardware by brand, model of hardware, and hardware set number. Leave the door markings of the hardware visible for installers.

B. Furnish hardware that is not bulk packed with each unit marked and numbered in accordance with approved finish hardware schedule. Include architect's opening number, hardware set number, and item number for each type of hardware. Include keyset symbols and corresponding hardware component for keyed products.

C. Pack each item complete with necessary parts and fasteners in manufacturer's original packaging.

D. Waste Management and Disposal: Separate waste materials for use or recycling in accordance with Division 1.

1.06 WARRANTY

A. General Warranty: Owner may have under provisions of the Contract Documents and be an addition and run concurrently with other warranties made by Contractor under requirements of the Contract documents.

B. Special Warranty: Warranties specified in this article will not deprive Owner of other rights.
1. Ten years for manual door closers.
2. Five years for mortise, auxiliary and bored locks.
3. Five years for exit devices.
4. One year for electromechanical door hardware.

C. Replace or repair defective products during warranty period in accordance with manufacturer's warranty at no cost to Owner. There is no warranty against defects due to improper installation, abuse, and failure to exercise normal maintenance.

D. Maintenance Tool and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, removal and replacement of door hardware.

PART 2 – PRODUCTS

2.01 HINGES

A. Hinges, electric hinges, and self-closing hinges of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Products to be certified and listed by the following:
1. Butts and Hinges: ANSI/BHMA A156.1.
2. Template Hinge Dimensions: ANSI/BHMA A156.7.

C. Butt Hinges:
1. Hinge weight and size unless otherwise indicated in hardware sets:
   a. Doors up to 36" wide and up to 1-3/4" thick provide hinges with a minimum thickness of .134" and a minimum of 4-1/2" in height.
   b. Doors from 36" wide up to 42" wide and up to 1-3/4" thick provide hinges with a minimum thickness of .145" and a minimum of 4-1/2" in height.
   c. For doors from 42" wide up to 48" wide and up to 1-3/4" thick provide hinges with a minimum thickness of .180" and a minimum of 5" in height.
   d. Doors greater than 1-3/4" thick provide hinges with a minimum thickness of .180" and a minimum of 5" in height.
   e. Width of hinge is to be minimum required to clear surrounding trim.
2. Base material unless otherwise indicated in hardware sets:
   a. Exterior Doors: 304 Stainless Steel, Brass or Bronze material.
   b. Interior Doors: Steel material.

c. Fire Rated Doors: Steel or 304 Stainless Steel materials.
d. Stainless Steel ball bearing hinges to have stainless steel ball bearings. Steel ball bearings are unacceptable.

3. Quantity of hinges per door unless otherwise stated in hardware sets:
   a. Doors up to 60" in height provide 2 hinges.
   b. Doors 60" up to 90" in height provide 3 hinges.
   c. Doors 90" up to 120" in height provide 4 hinges.
   d. Doors over 120" in height add 1 additional hinge per each additional 30" in height.
   e. Dutch doors provide 4 hinges.
4. Hinge design and options unless otherwise indicated in hardware sets:
   a. Hinges are to be of a square corner five-knuckle design, flat button tips and have ball bearings unless otherwise indicated in hardware sets.
   b. Out-swinging exterior and out-swinging access controlled doors are required to have Non-Removable Pins (NRP) to prevent removal of pin while door is in closed position.
   c. When full width of opening is required, use hinges that are designed to swing door completely from opening when door is opened to 95 degrees.
   d. When shims are necessary to correct frame or door irregularities, provide metal shims only.

5. Acceptable Manufacturers:

	Standard Weight	Heavy Weight
Hager	BB1279/BB1191	BB1168/BB1199
Bommer	BB5000/BB5002	BB5004/BB5006
McKinney	TA2714/TA2314	T4A3786/T4A3386

2.02 LOCKS AND LATCHES (GRADE 1 MORTISE)

A. Locks and latches of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Product to be certified and listed by following:
   1. ANSI/BHMA A156.13 Series 1000 Certified to Grade 1 for Operational and Security.
   2. UL/cUL Labeled and listed up to 3 hours for single doors up to 48" in width and up to 96" in height.
   3. UL10C/UBC 7-2 Positive Pressure Rated.
   4. ICC/ANSI A117.1.

C. Lock and latch function numbers and descriptions of manufacturer's series as listed in hardware sets.

D. Material and Design:
   1. Lock cases from fully wrapped, 12 gauge steel, zinc dichromate for corrosion resistance.
   2. Non-handed, field reversible without opening lock case.
   3. Break-away spindles to prevent unlocking during forced entry or vandalism.
   4. Levers, zinc cast, forged brass or stainless steel and plated to match finish designation in hardware sets.
   5. Sectional Roses, solid brass or stainless steel material and have a minimum diameter of 2-7/16".
   6. Escutcheons, of solid brass or stainless steel material.
   7. Armor fronts, self-adjusting to accommodate a square edge door or a standard 1/8" beveled edge door.

E. Latch and Strike:
   1. Stainless steel latch bolt with minimum of 3/4" throw and deadlocking for keyed and exterior functions.
   2. Strike is to fit a standard ANSI A115 prep measuring 1-1/4" x 4-7/8" with proper lip length to protect surrounding trim.

3. Deadbolts to be 1-3/4" total length with a minimum of a 1" throw and 3/4" internal engagement when fully extended and made of stainless steel material.

F. Acceptable Manufacturers:

Hager	3800 Series
Best	45H Series
Sargent	8200 Series

2.03 MORTISE DEADBOLTS

A. Mortise deadbolts of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Manufacturer to be certified by the following:
1. ANSI/BHMA A156.13 Series 2000 Grade 1 Operational and Security.
2. UL/cUL listed for functions up to 3 hours for "A" label.
3. UL10C/UBC 7-2 Positive Pressure Rated.
4. ADA – Thumb turn.

C. Deadbolt function numbers and descriptions of manufacturer's series as listed in hardware sets.

D. Material and Design:
1. Latch bolt projection 1" throw.
2. Case steel, zinc dichromate.
3. Armor front 5-9/16". Case dimension 4-5/16" x 3-9/16' x 1".

E. Acceptable Manufacturers:

Hager	3830 Series
Best	48H Series
Sargent	4870 Series

2.04 CYLINDERS AND KEYING

A. Cylinders of one manufacturer as listed for continuity of design and consideration of warranty.

B. Products to be certified and listed by the following:
1. Auxiliary Locks: ANSI/BHMA A156.5
2. DHI Handbook "Keying Syetems and Nomeclature" (1989).

C. Cylinders:
1. Manufacturer's standard tumbler type, to match the existing key system.
2. Furnish with cams/tailpieces as required for the locking device that is being furnished for this project.

D. Keying:
1. Copy of owners approved keying schedule submitted to Owner and Architect with documentation of which keying conference was held at Owners sign-off.
2. Key into Owner's existing key system if applicable.

3. Provide a bitting list to Owner of combinations as established, and expand to twenty-five percent for future use or as directed by Owner.
4. Keys to be shipped directly to the Owner's Representative as established during the keying conference.
5. Provide visual key control identification on keys.

E. Acceptable Manufacturers:

Hager
Schlage
Sargent

2.05 PUSH/PULL PLATES AND BARS

A. Push/Pull plates and bars of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Manufacturer to be certified by the following:
1. Architectural Door Trim: ANSI/BHMA A156.6.
2. Americans with Disabilities Act Accessibility Guidelines (ADAAG).

C. Push plates: .050" thick, square corner and beveled edges with countersunk screw holes. Width and height as stated in hardware sets.

D. Acceptable Manufacturers:

Hager	30S
Rockwood	
Trimco	

E. Pull Plates: .050" thick, square corner and beveled edges. Width and height as stated in hardware sets, 3/4" diameter pull, with clearance of 2-1/2" from face of door.

F. Acceptable Manufacturers:

Hager	33E
Rockwood	
Trimco	

2.06 CLOSERS (CAST IRON BODY GRADE 1)

A. Closers of one manufacturer as listed for continuity of design and consideration of warranty, unless otherwise indicated on hardware schedule, comply with manufacturer's recommendations for size of closer, depending on width of door, frequency of use, atmospheric pressure, ADAAG requirement, and fire rating.

B. Standards: Manufacturer to be certified and or listed by the following:
1. BHMA Certified ANSI A156.4 Grade 1.
2. ADA Complaint ANSI A117.1.
3. UL/cUL Listed up to 3 hours.
4. UL10C Positive Pressure Rated.
5. UL10B Neutral Pressure Rated.

C. Material and Design:
1. Provide cast iron non-handed bodies with full plastic covers.
2. Closers will have separated staked adjustable valve screws for latch speed, sweep speed, and backcheck.

3. Provide Tri-Pack arms and brackets for regular arm, top jamb, and parallel arm mounting.
4. One-piece seamless steel spring tube sealed in hydraulic fluid.
5. Double heat-treated steel tempered springs.
6. Precision-machined heat-treated steel piston.
7. Triple heat-treated steel spindle.
8. Full rack and pinion operation.

D. Mounting:
1. Out-swing doors use surface parallel arm mount closers except where noted on hardware schedule.
2. In-swing doors use surface regular arm mount closers except where noted on hardware schedule.
3. Provide brackets and shoe supports for aluminum doors and frames to mount fifth screw.
4. Furnish drop plates where top rail conditions on door do not allow for mounting of closer and where backside of closer is exposed through glass.

E. Size closers in compliance with requirements for accessibility (ADAAG). Comply with following maximum opening force requirements.
1. Interior hinged openings: 5.0 lbs.
2. Fire-rated and exterior openings use minimum opening force allowable by authority having jurisdiction.

F. Fasteners: Provide self-reaming, self-tapping wood and machine screws, and sex nuts and bolts for each closer.

G. Acceptable manufacturers:

Hager	5100 Series
LCN	4040XP Series
Sargent	281 Series

2.07 PROTECTIVE TRIM

A. Protective trim of one manufacturer as listed for continuity of design and consideration of warranty.

B. Size of protection plate: single doors, size two inches less door width (LDW) on push side of door, and one inch less door width on pull side of door. For pairs of doors, size one inch less door width (LDW) on push side of door, and 1/2 inch on pull side of door. Adjust sizes to accommodate accompanying hardware, such as, edge guards, astragals and others.
1. Kick Plates 10” high or sized to door bottom rail height.
2. Mop Plates 4” high.
3. Armor Plates 36” high.

C. Products to be certified and listed by the following:
1. Architectural Door Trim: ANSI/BHMA A156.6.
2. UL.

D. Material and Design:
1. 0.050” gage stainless steel.
2. Corners square, polishing lines or dominant direction of surface pattern so they run across door width of plate.
3. Bevel top, bottom, and sides uniformly leaving no sharp edges.
4. Countersink holes for screws. Space screw holes so they are no more than eight inches CTC, along a centerline not over 1/2” in from edge around plate. End screws maximum of 0.53” from corners.

E. UL label stamp required on protection plates when top of plate is more than 16 inches above bottom of door on fire rated openings. Verify door manufacturer's UL listing for maximum height and width of protection plate to be used.

F. Acceptable Manufacturers:

Hager	190S
Trimco	
Burns	

2.08 STOPS AND HOLDERS

A. Stops and holders of one manufacturer as listed for continuity of design and consideration of warranty.

B. Wall Stops: Provide door stops wherever necessary to prevent door or hardware from striking an adjacent partition or obstruction. Provide wall stops when possible. Door stops and holders mounted in concrete floor or masonry walls have stainless steel machine screws and lead expansion shields.

C. Products to be certified and listed by the following:
1. Auxiliary Hardware: ANSI/BHMA A156.16.

D. Acceptable Manufacturers:

	Convex	Concave
Hager	232W	236W
Rockwood		
Burns		

E. Overhead Stops and Holders: Provide overhead stops and holders for doors that open against equipment, casework sidelights and other objects that would make wall stops/holders and floor stops/holders inappropriate. Provide sex bolt attachments for mineral core wood door applications.

F. Products to be certified and listed by the following:
1. Overhead Stops and Holders: ANSI/BHMA A156.8 Grade 1.

G. Acceptable Manufacturers:

	Heavy Duty Surface	Heavy Duty Concealed
Hager	7000 SRF Series	7000 CON Series
Glynn Johnson	90 SRF Series	100 Series
Sargent	590 Series	690 Series

2.09 SILENCERS

A. Where smoke, light, or weather seal are not required, provide three silencers per single door frame, two per double door frame and four per Dutch door frame.

B. Products to be certified and listed by the following:
1. Auxiliary Hardware: ANSI/BHMA A156.16

C. Acceptable Manufacturers:

	Hollow Metal Frame	Wood Frame
Hager	307D	308D
Rockwood		
Trimco		

2.10 FINISHES

A. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if within range of approved samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within range of approved samples.

B. Comply with base material and finish requirements indicated by ANSI/BHMA A156.18 designations in hardware schedule.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine doors and frames, with Installers present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install hardware using manufactures recommended fasteners and installation instructions, at height locations and clearance tolerances that comply with:
1. NFPA 80
2. NFPA 105
3. ICC/ANSI A117.1
4. ANSI/BHMA A156.115 Hardware Preparation in Steel Doors and Steel Frames
5. ANSI/BHMA A156.115W hardware Preparation in Wood Doors with Wood or Steel Frames
6. DHI Publication – Installation Guide for Doors and Hardware
7. UL10C/UBC7-2
8. Local Building Code
9. Approved shop drawings
10. Approved finish hardware schedule

B. Do not install surface mounted items until finishes have been completed on substrates involved. Set unit level, plumb and true to line location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

3.03 FIELD QUALITY CONTROL

A. Material supplier to schedule final walk through to inspect hardware installation ten (10) business days before final acceptance of Owner. Material supplier will provide a written report detailing discrepancies of each opening to General Contractor within seven (7) calendar days of walk through.

3.04 ADJUSTMENT, CLEANING, AND DEMONSTRATING

A. Adjustment: Adjust and check each opening to ensure proper operation of each item of finish hardware. Replace items that cannot be adjusted to operate freely and smoothly or as intended for application at no cost to Owner.

B. Cleaning: Clean adjacent surfaces soiled by hardware installation. Clean finish hardware per manufacturer's instructions after final adjustments have been made. Replace items that cannot be cleaned to manufacturer's level of finish quality at no cost to Owner.

C. Conduct a training class for building maintenance personnel demonstrating the adjustment, operation of mechanical and electrical hardware. Special tools for finish hardware to be turned over and explained usage at the meeting. Record all training and provide to the Owner for future reference.

3.05 PROTECTION

A. Leave manufacturer's protective film intact and provide proper protection for all other finish hardware items that do not have protective material from the manufacture until Owner accepts project as complete.

3.06 HARDWARE SET SCHEDULE

A. Guide: Door hardware items have been placed in sets which are intended to be a guide of design, grade, quality, function, operation, performance, exposure, and like characteristics of door hardware, and may not be complete. Provide door hardware required to make each set complete and operational.

B. Hardware schedule does not reflect handing, backset, method of fastening, and like characteristics of door hardware and door operation.

C. Review door hardware sets with door types, frames, sizes and details on drawings. Verify suitability and adaptability of items specified in relation to details and surrounding conditions.

3.07 HARDWARE SCHEDULE

Hardware Sets

SET #1

Doors: 100
Each Opening to receive:

3	Hinge	BB1199 4 1/2 X 4 1/2	US32D	HA
1	Deadlock	3833S Less Cyl	US26D	HA
1	Mortise Cylinder	MATCH EXISTING SYSTEM		
1	Push Plate	30S 4 X 16	US32D	HA
1	Door Pull	33E 4 X 16	US32D	HA
1	Closer	5100 MLT	ALM	HA
1	Mop Plate	190S 4" X 1" LDW	US32D	HA
1	Kick Plate	190S 10" X 2" LDW	US32D	HA
1	Wall Stop	236W	US32D	HA
3	Door Silencer	307D	GREY	HA

SET #2

Doors: 200
Each Opening to receive:

3	Hinge	BB1199 4 1/2 X 4 1/2	US32D	HA
1	Lockset	3880 SECT ARC Less Cyl	US26D	HA
1	Mortise Cylinder	MATCH EXISTING SYSTEM		
1	Closer	5100 MLT	ALM	HA
1	Kick Plate	190S 10" X 2" LDW	US32D	HA
1	Mop Plate	190S 4" X 1" LDW	US32D	HA
1	Door Holder	327W	US26D	HA
3	Door Silencer	307D	GREY	HA

SET #3

Doors: 300, 400
Each Opening to receive:

3	Hinge	BB1199 4 1/2 X 4 1/2 NRP	US32D	HA
1	Deadlock	3833S Less Cyl	US26D	HA
1	Mortise Cylinder	MATCH EXISTING SYSTEM		
1	Push Plate	30S 4 X 16	US32D	HA
1	Door Pull	33E 4 X 16	US32D	HA
1	Closer	5100 5955-HDCS	ALM	HA
3	Door Silencer	307D	GREY	HA

SET #4

Doors: 500
Each Opening to receive:

3	Hinge	BB1199 4 1/2 X 4 1/2 NRP	US32D	HA
1	Lockset	3880 SECT ARC Less Cyl	US26D	HA
1	Closer	5100 5954-HDHOCS	ALM	HA
1	Kick Plate	190S 10" X 2" LDW	US32D	HA
1	Mortise Cylinder	MATCH EXISTING SYSTEM		
1	Drip Cap	810S 40"	MIL	HA
1	Set Weatherstrip	890S N 1 x 36" 2 x 84"	MIL	HA
1	Door Sweep	754S N 36"	CLR	HA
1	Threshold	412S 36"	MIL	HA

SET #5

Doors: 401
Each Opening to receive:

3	Hinge	BB1199 4 1/2 X 4 1/2 NRP	US32D	HA
1	Lockset	3880 SECT ARC Less Cyl	US26D	HA
1	Mortise Cylinder	MATCH EXISTING SYSTEM		
1	Closer	5100 5954-HDHOCS	ALM	HA
1	Kick Plate	190S 10" X 2" LDW	US32D	HA
1	Mop Plate	190S 4" X 1" LDW	US32D	HA
1	Door Holder	327W	US26D	HA
3	Door Silencer	307D	GREY	HA

SET #6

Doors: 600
Each Opening to receive:

3	Hinge	BB1168 4 1/2 X 4 1/2	US26D	HA
1	Lockset	3870 SECT ARC Less Cyl	US26D	HA
1	Mortise Cylinder	MATCH EXISTING SYSTEM		
1	Closer	5100 5955-HDCS	ALM	HA
1	Kick Plate	190S 10" X 2" LDW	US32D	HA
1	Mop Plate	190S 4" X 1" LDW	US32D	HA
3	Door Silencer	307D	GREY	HA

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Access doors and frames for walls and ceilings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each door face material.

D. Schedule: Types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 tested according to the following test method:

1. NFPA 252 or UL 10B for fire-rated access door assemblies installed vertically.
2. NFPA 288 for fire-rated access door assemblies installed horizontally.

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:

1. Access Panel Solutions.
2. Acudor Products, Inc.
3. Alfab, Inc.
4. Babcock-Davis.
5. Cendrex Inc.
6. Jensen Industries; Div. of Broan-Nutone, LLC.

7. J. L. Industries, Inc.; Div. of Activar Construction Products Group.
8. Larsen's Manufacturing Company.
9. MIFAB, Inc.
10. Milcor Inc.
11. Williams Bros. Corporation of America (The).

C. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.

D. Aluminum Flush Access Doors

1. Basis-of-Design Product: Larsen L-LCP Series
2. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
3. Locations: Wall and ceiling
4. Door Size: 24 x 36
5. Aluminum Sheet for Door: Nominal 0.064 inch (1.63 mm)

    a. Finish: Mill

6. Frame Material: .094 Aluminum same finish as door
7. Hinges: Manufacturer's standard (concealed)
8. Hardware: Latch

E. Fire-Rated, Flush Access Doors with Exposed Flanges

1. Basis-of-Design Product: Larsen
2. Assembly Description: Fabricate door to fit flush to frame, with a core of mineral-fiber insulation enclosed in sheet metal. Provide self-latching door with automatic closer and interior latch release. Provide manufacturer's standard-width exposed flange, proportional to door size.
3. Locations: Wall and/or ceiling
4. Fire-Resistance Rating: Not less than that indicated that of adjacent construction, but not less than 2 hours.
5. Temperature-Rise Rating: 250 deg F (139 deg C) at the end of 30 minutes.
6. Uncoated Steel Sheet for Door: Nominal 0.036 inch (0.91 mm), 20 gauge.

    a. Finish: Factory finish

7. Metallic-Coated Steel Sheet for Door: Nominal 0.040 inch (1.02 mm), 20 gage thickness.

    a. Finish: Factory prime

8. Frame Material: Same material, thickness, and finish as door
9. Hinges: Manufacturer's standard
10. Hardware: Lock

2.3 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

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

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.

D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

1. For cylinder locks, furnish two keys per lock and key all locks alike.
2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

E. Extruded Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

2.4 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Steel and Metallic-Coated-Steel Finishes:

1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
2. Factory Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry-film thickness of 1 mil (0.025 mm) for topcoat.

E. Aluminum Finishes:

1. Mill finish.
2. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.2 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 083113

SECTION 089000 - LOUVERS AND VENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fixed, extruded-aluminum and formed-metal louvers.
2. Wall vents (brick vents).

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer, using structural and seismic performance requirements and design criteria indicated.

B. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors.

1. Wind Loads: Determine loads based on pressures as indicated on Drawings.
2. Wind Loads: Determine loads based on a uniform pressure of 20 lbf/sq. ft. (957 Pa)] [30 lbf/sq. ft. (1436 Pa) acting inward or outward.

C. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

C. Samples: For each type of metal finish required.

D. Delegated-Design Submittal: For louvers indicated to comply with structural performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Product Test Reports: Based on tests performed according to AMCA 500-L.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Fasteners: Use types and sizes to suit unit installation conditions.

1. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
2. For fastening galvanized steel, use hot-dip-galvanized steel or 300 series stainless-steel fasteners.
3. For fastening stainless steel, use 300 series stainless-steel fasteners.
4. For color-finished louvers, use fasteners with heads that match color of louvers.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.2 FABRICATION, GENERAL

A. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

B. Join frame members to each other and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.3 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal Storm-Resistant Louver

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Air Balance Inc.; a Mestek company.
    b. Air Flow Company, Inc.
    c. Airolite Company, LLC (The).
    d. All-Lite Architectural Products.
    e. Construction Specialties, Inc.
    f. Industrial Louvers, Inc.
    g. NCA Manufacturing, Inc.
    h. Nystrom Building Products.

2. Louver Depth: 5 inches (125 mm)
3. Frame and Blade Nominal Thickness: Not less than 0.060 inch (1.52 mm) for blades and 0.080 inch (2.03 mm) for frames.

4. Louver Performance Ratings:

    a. Free Area: Not less than fifty percent open area (50%).
    b. Air Performance: Not more than 0.10-inch wg (25-Pa) static pressure drop at 600-fpm (3.0-m/s) free-area exhaust velocity.
    c. Wind-Driven Rain Performance: Not less than 95 percent effectiveness when subjected to a rainfall rate of 8 inches (200 mm) per hour and a wind speed of 50 mph (22.4 m/s)

5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

B. Horizontal, Drainable-Blade Louver

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Air Balance Inc.; a Mestek company.
    b. Air Flow Company, Inc.
    c. Airolite Company, LLC (The).
    d. Cesco Products; a division of Mestek, Inc.
    e. Construction Specialties, Inc.
    f. Dowco Products Group; Safe-Air of Illinois, Inc.
    g. Greenheck Fan Corporation.
    h. Industrial Louvers, Inc.
    i. Louvers & Dampers, Inc.; a division of Mestek, Inc.
    j. Metal Form Manufacturing Inc.
    k. NCA Manufacturing, Inc.
    l. Nystrom Building Products.

2. Louver Depth: 4 inches (100 mm)
3. Frame and Blade Nominal Thickness: Not less than 0.060 inch (1.52 mm) for blades and 0.080 inch (2.03 mm) for frames.
4. Louver Performance Ratings:

    a. Free Area: Not less than fifty percent (50%).
    b. Point of Beginning Water Penetration: Not less than 1000 fpm (5.1 m/s)] [1050 fpm (5.3 m/s)
    c. Air Performance: Not more than [00-fpm (3.6-m/s)] [750-fpm (3.8-m/s) exhaust velocity.
    d. Air Performance: Not more than static pressure drop at 900-fpm (4.6-m/s free-area exhaust velocity.

5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.4 LOUVER SCREENS

A. General: Provide screen at each exterior louver.

B. Louver Screen Frames: Same kind and form of metal as indicated for louver to which screens are attached.

C. Louver Screening:

1. Bird Screening: Aluminum, 1/2-inch- (13-mm-) square mesh, 0.063-inch (1.60-mm) wire.
2. Bird Screening: Stainless steel, 1/2-inch- (13-mm-) square mesh, 0.047-inch (1.19-mm) wire.
3. Bird Screening: Flattened, expanded aluminum, 3/4 by 0.050 inch (19 by 1.27 mm) thick.
4. Bird Screening: Galvanized steel, 1/2-inch- (13-mm-) square mesh, 0.041-inch (1.04-mm) wire.

2.5 WALL VENTS (BRICK VENTS) Not Used

2.6 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

2.7 GALVANIZED-STEEL SHEET FINISHES

A. Finish louvers after assembly.

B. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and repair according to ASTM A 780.

C. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard 2-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil (0.025 mm) for topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).

1. Color and Gloss: As selected by Architect from manufacturer's full range.

2.8 STAINLESS-STEEL SHEET FINISHES

A. Repair sheet finish by grinding and polishing irregularities, weld spatter, scratches, and forming marks to match surrounding finish.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weather-tight connection.

C. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

D. Repair damaged finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory and refinish entire unit or provide new units.

E. Protect galvanized and nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint.

END OF SECTION 089000

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

C. Low Emitting Materials: For ceiling and wall assemblies, provide materials and construction identical to those tested in assembly and complying 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."

2.2 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following.

1. American Gypsum.
2. Georgia-Pacific Gypsum LLC.
3. National Gypsum Company.
4. USG Corporation.
5. Long Edges: Tapered

B. Gypsum Ceiling Board: ASTM C 1396/C 1396M.

1. Thickness: 1/2 inch (12.7 mm).
2. Long Edges: Tapered.

C. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: 5/8 inch (15.9 mm), Type X.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D 3273, score of 10.

2.3 SPECIALTY GYPSUM BOARD (Not Used)

2.4 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. CertainTeed Corp.; FiberCement BackerBoard.
b. Custom Building Products; Wonderboard
c. FinPan, Inc.; Util-A-Crete Concrete Backer Board
d. James Hardie Building Products, Inc.; Hardiebacker
e. National Gypsum Company, Permabase Cement Board.
f. USG Corporation; DUROCK Cement Board.

2. Thickness: 1/2 inch (12.7 mm)] or as indicated.
3. Mold Resistance: ASTM D 3273, score of 10.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, or galvanized steel sheet

B. Aluminum Trim: ASTM B 221 (ASTM B 221M), Alloy 6063-T5.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.

3. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

2.7 AUXILIARY MATERIALS

A. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. Laminating adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Laminating adhesive 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."

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

C. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing).

1. Recycled Content of Blankets: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.

D. Acoustical Joint Sealant: ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings as demonstrated by testing according to ASTM E 90.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Pecora Corporation; AC-20 FTR
b. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
c. USG Corporation; SHEETROCK Acoustical Sealant.

2. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Thermal Insulation: As specified in Division 07 Section "Thermal Insulation."

F. Vapor Retarder: As specified in Division 07 Section "Thermal Insulation."

2.8 TEXTURE FINISHES (Not Used)

PART 3 - EXECUTION

3.1 APPLYING AND FINISHING PANELS

A. Comply with ASTM C 840.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

D. Install trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

1. Aluminum Trim: Install in locations indicated on Drawings

2. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

E. Prefill open joints beveled edges, and damaged surface areas.

F. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

G. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.

2. Level 2: Panels that are substrate for tile.

3. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

4. Primer and its application to surfaces are specified in other Division 09 Sections.

a. Primer and its application to surfaces are specified in other Division 09 Sections.

H. Protect adjacent surfaces from drywall compound and texture finishes and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

I. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION 092900

SECTION 093000 - TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ceramic tile.
2. Stone thresholds.
3. Waterproof membrane.
4. Crack isolation membrane.
5. Tile backing panels.
6. Metal edge strips.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples:

1. Each type and composition of tile and for each color and finish required.
2. Assembled samples, with grouted joints, for each type and composition of tile and for each color and finish required.
3. Stone thresholds in 6-inch (150-mm) lengths.

1.3 QUALITY ASSURANCE

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

1. Build mockup of each type of floor tile installation.
2. Build mockup of each type of wall tile installation.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 EXTRA MATERIALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 TILE PRODUCTS

A. ANSI Ceramic Tile Standard: Provide Standard grade tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

B. Tile Type **WALL TILE**: Factory-mounted **GLAZED** ceramic subway tile.

1. Manufacturers: Subject to compliance with requirements, **DALTILE**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **DALTILE/ ELEVARE GLAZED CERAMIC 4" x 16"/ color and detailing as indicated on Drawings** or comparable product by one of the following:

    a. American Olean; Division of Dal-Tile International Inc.
    b. Crossville, Inc.
    c. Daltile; Division of Dal-Tile International Inc.
    d. Deutsche Steinzeug America, Inc.
    e. Interceramic.
    f. Lone Star Ceramics Company.
    g. Grupo Porcelanite.
    h. Portobello America, Inc.
    i. Seneca Tiles, Inc.

3. Composition: Vitreous or impervious natural clay or porcelain.
4. Module Size: 4" x 16"
5. Thickness: 1/4 inch (6.35 mm).
6. Face: Pattern of design/ Stretcher Course w/ 33% off-set
7. Surface: Smooth, without abrasive admixture.
8. Finish: Glazed Finish.
9. Tile Color and Pattern: As selected by Architect from Manufacturer full range
10. Grout Thickness: 1/16" or as Selected by Architect
11. Grout Color: As selected by Architect from manufacturer's full range
12. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:

    a. Base Cove: Cove, 4 ¼" x 4 ½" or as selected by Architect
    b. External Corners: Surface bullnose

C. Tile Type **CEILING TILE (SHOWER STALL'S)**: **GLAZED** Ceramic Subway Tile.

1. Manufacturers: Subject to compliance with requirements, **DALTILE**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **DALTILE/ ELEVARE GLAZED CERAMIC 3" x 6"/ color and detailing as indicated on Drawings** or comparable product by one of the following:

    a. American Olean; Division of Dal-Tile International Inc.
    b. Crossville, Inc.

c. Daltile; Division of Dal-Tile International Inc.
d. Deutsche Steinzeug America, Inc.
e. Interceramic.
f. Lone Star Ceramics Company.
g. Grupo Porcelanite.
h. Portobello America, Inc.
i. Seneca Tiles, Inc.

3. Composition: Vitreous or impervious natural clay or porcelain.
4. Module Size: 3” x 6”
5. Thickness: 1/4 inch (6.35 mm).
6. Face: Pattern of design/ Stretcher Course w/ 33% off-set
7. Surface: Smooth, without abrasive admixture.
8. Finish: Glazed Finish.
9. Tile Color and Pattern: As selected by Architect from Manufacturer full range
10. Grout Thickness: 1/16” or as Selected by Architect
11. Grout Color: As selected by Architect from manufacturer's full range

D. Tile Type **FLOOR TILE**: **UNGLAZED** / **MATTE** ceramic mosaic tile

1. Manufacturers: Subject to compliance with requirements, **DALTILE**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **KEYSTONES COLORBODY PORCELAIN MOSAICS/ 2” X 2” HEXAGONALL TILES/ / color and detailing as indicated on Drawings** or comparable product by one of the following:

a. American Olean; Division of Dal-Tile International Inc.
b. Crossville, Inc.
c. Daltile; Division of Dal-Tile International Inc.
d. Deutsche Steinzeug America, Inc.
e. Interceramic.
f. Lone Star Ceramics Company.
g. Grupo Porcelanite.
h. Portobello America, Inc.
i. Seneca Tiles, Inc.

3. Composition: Vitreous or impervious natural clay or porcelain.
4. Module Size: 4” x 16”
5. Thickness: 1/4 inch (6.35 mm).
6. Face: Pattern of design/ Stretcher Course w/ 33% off-set
7. Surface: Smooth, without abrasive admixture.
8. Finish: Glazed Finish.
9. Tile Color and Pattern: As selected by Architect from Manufacturer full range
10. Grout Thickness: 1/16” or as Selected by Architect
11. Grout Color: As selected by Architect from manufacturer's full range
12. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:

a. Base Cove: Cove, 4 ¼" x 4 ½" or as selected by Architect
b. External Corners: Surface bullnose

E. Tile Type **FLOOR TILE**: **UNGLAZED** / **MATTE** quarry tile

1. Manufacturers: Subject to compliance with requirements, **DALTILE**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **QUARRY TILE/ 6"x6" / color and detailing as indicated on Drawings** or comparable product by one of the following:

a. American Olean; Division of Dal-Tile International Inc.
b. Crossville, Inc.
c. Daltile; Division of Dal-Tile International Inc.
d. Deutsche Steinzeug America, Inc.
e. Interceramic.
f. Lone Star Ceramics Company.
g. Grupo Porcelanite.
h. Portobello America, Inc.
i. Seneca Tiles, Inc.

3. Composition: Vitreous or impervious natural clay or porcelain.
4. Module Size: 4" x 16"
5. Thickness: 1/4 inch (6.35 mm).
6. Face: Pattern of design/ Stretcher Course w/ 33% off-set
7. Surface: Smooth, without abrasive admixture.
8. Finish: Glazed Finish.
9. Tile Color and Pattern: As selected by Architect from Manufacturer full range
10. Grout Thickness: 1/16" or as Selected by Architect
11. Grout Color: As selected by Architect from manufacturer's full range
12. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:

a. Base Cove: Cove, 4 ¼" x 4 ½" or as selected by Architect
b. External Corners: Surface bullnose

2.2 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch (1.5 mm) above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch (12.7 mm) or less above adjacent floor surface.

B. Marble Thresholds: ASTM C 503, with a minimum abrasion resistance of 12 per ASTM C 1353 or ASTM C 241 and with honed finish.

1. Description: Uniform, fine- to medium-grained white stone with gray veining.

2.3 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 or ASTM C 1325.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. C-Cure; C-Cure Board 990.
b. Custom Building Products; Wonderboard.
c. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
d. USG Corporation; DUROCK Cement Board.

2. Thickness: **1/2 inch (12.7 mm)**] **As indicated**.

B. Fiber-Cement Underlayment: ASTM C 1288.

1. Products: Subject to compliance with requirements, [**provide the following**] [**provide one of the following**] [**available products that may be incorporated into the Work include, but are not limited to, the following**]:

a. CertainTeed Corp.; FiberCement **BackerBoard**.
b. James Hardie; **Hardie backer 500**.

2. Thickness: **1/2 inch (12.7 mm)**

2.4 WATERPROOF MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated.

B. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.

1. Products: Redgard Liquid Applied Waterproofing/ Crack Isolation, Custom Building Products or approved equal

a. Boiardi Products, a QEP company; Elastiment 644 Membrane Waterproofing System.
b. Bonsal American, an Oldcastle company; B 6000 Waterproof Membrane.
c. Bostik, Inc.; Durabond D-222 Duraguard Membrane, Hydroment Gold.
d. C-Cure; Pro-Red Waterproofing Membrane 63.
e. Jamo Inc.; Waterproof.
f. Laticrete International, Inc.; Latapoxy 24hr HydroProofing] [Laticrete Watertight Floor N' Wall Waterproofing.
g. MAPEI Corporation; Mapelastic HPG.
h. Southern Grouts & Mortars, Inc.; Southcrete 1100 Crack Suppression and Waterproofing.
i. TEC, a subsidiary of H. B. Fuller Company; HydraFlex - Waterproofing Crack Isolation Membrane.

2.5 CRACK ISOLATION MEMBRANE

A. General: Manufacturer's standard product **Redgard Liquid Applied Waterproofing/ Crack Isolation, Custom Building Products or approved equal** that complies with ANSI A118.12 for performance and is recommended by the manufacturer for the application indicated.

B. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.

1. Products: **Redgard Liquid Applied Waterproofing/ Crack Isolation, Custom Building Products or approved equal**

a. Bostik, Inc.; [Durabond D-222 Duraguard Membrane] [Hydroment Gold].
b. C-Cure; [CureLastic 949] [Pro-Red Waterproofing Membrane 963].
c. Custom Building Products; Redgard Waterproofing and Crack Prevention Membrane
d. Jamo Inc.; Waterproof.
e. Mer-Kote Products, Inc.; Fracture-Guard 5000.
f. Southern Grouts & Mortars, Inc.; Southcrete 1100 Crack Suppression and Waterproofing.
g. TEC, a subsidiary of H. B. Fuller Company; HydraFlex - Waterproofing Crack Isolation Membrane.

2.6 SETTING MATERIALS

A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.

B. Dry-Set Portland Cement Mortar (Thin Set): ANSI A118.1.

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Boiardi Products; a QEP company.
b. Bonsal American; an Oldcastle company.
c. Bostik, Inc.
d. Custom Building Products.
e. Laticrete International, Inc.
f. MAPEI Corporation.
g. Southern Grouts & Mortars, Inc.

2. For wall applications, provide nonsagging mortar.

C. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Boiardi Products; a QEP company.
b. Bonsal American; an Oldcastle company.

c. Bostik, Inc.
d. Custom Building Products.
e. Laticrete International, Inc.
f. MAPEI Corporation.
g. Southern Grouts & Mortars, Inc.

2. Prepackaged, dry-mortar mix to which only water must be added.
3. Prepackaged, dry-mortar mix combined with liquid-latex additive.
4. For wall applications, provide nonsagging mortar.

2.7 GROUT MATERIALS

A. Sand-Portland Cement Grout: ANSI A108.10.

B. Standard Cement Grout: ANSI A118.6.

1. Manufacturers: Subject to compliance with requirements available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Boiardi Products; a QEP company.
b. Bonsal American; an Oldcastle company.
c. Bostik, Inc.
d. C-Cure.
e. Custom Building Products.
f. Jamo Inc.
g. Laticrete International, Inc.
h. MAPEI Corporation.
i. Southern Grouts & Mortars, Inc.
j. Summitville Tiles, Inc.
k. TEC; a subsidiary of H. B. Fuller Company.

C. Polymer-Modified Tile Grout: ANSI A118.7.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Boiardi Products; a QEP company.
b. Bonsal American; an Oldcastle company.
c. Bostik, Inc.
d. C-Cure.
e. Custom Building Products.
f. Jamo Inc.
g. Laticrete International, Inc.
h. MAPEI Corporation.
i. Southern Grouts & Mortars, Inc.
j. Summitville Tiles, Inc.
k. TEC; a subsidiary of H. B. Fuller Company.

2. Polymer Type: Dry, redispersible form, prepackaged with other dry ingredients.
3. Polymer Type: Liquid-latex form for addition to prepackaged dry-grout mix.

D. Water-Cleanable Epoxy Grout: ANSI A118.3.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Atlas Minerals & Chemicals, Inc.
b. Boiardi Products; a QEP company.
c. Bonsal American; an Oldcastle company.
d. Bostik, Inc.
e. C-Cure.
f. Custom Building Products.
g. Jamo Inc.
h. Laticrete International, Inc.
i. MAPEI Corporation.
j. Mer-Kote Products, Inc.
k. Southern Grouts & Mortars, Inc.
l. Summitville Tiles, Inc.
m. TEC; a subsidiary of H. B. Fuller Company.

E. Grout for Pregrouted Tile Sheets: Same product used in factory to pregrout tile sheets.

2.8 ELASTOMERIC SEALANTS

A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 07 Section "Joint Sealants."

1. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. DAP Inc.; 100 percent Silicone Kitchen and Bath Sealant.
b. Dow Corning Corporation; Dow Corning 786.
c. GE Silicones, a division of GE Specialty Materials; Sanitary 1700.
d. Laticrete International, Inc.; Latasil Tile & Stone Sealant.
e. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
f. Tremco Incorporated; Tremsil 600 White.

2.9 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Angle or L-shape, nickel silver exposed-edge material.

C. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints and that does not change color or appearance of grout.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Bonsal American, an Oldcastle company; Grout Sealer.
b. Bostik, Inc.; CeramaSeal Siloxane 220.
c. C-Cure; Penetrating Sealer 978.
d. Custom Building Products; Surfaceguard Sealer.
e. Jamo Inc.; Matte Finish Sealer.
f. MAPEI Corporation; KER 004, Keraseal Penetrating Sealer for Unglazed Grout and Tile.
g. Southern Grouts & Mortars, Inc.; Silicone Grout Sealer.
h. TEC, a subsidiary of H. B. Fuller Company; TA-256 Penetrating Silicone TA-257 Silicone Grout Sealer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.

C. Blending: For tile exhibiting color variations, use factory blended tile or blend tiles at Project site before installing.

D. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 INSTALLATION

A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:

    a. Exterior tile floors.
    b. Tile floors in wet areas.
    c. Tile swimming pool decks.
    d. Tile floors in laundries.
    e. Tile floors composed of tiles 8 by 8 inches (200 by 200 mm) or larger.
    f. Tile floors composed of rib-backed tiles.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

E. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Ceramic Mosaic Tile: 1/16 inch (1.6 mm).
2. Quarry Tile: 1/4 inch (6.35 mm)
3. Paver Tile: 1/4 inch (6.35 mm)
4. Glazed Wall Tile: 1/16 inch (1.6 mm).
5. Decorative Thin Wall Tile: 1/16 inch (1.6 mm).

F. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

G. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

H. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.

1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in latex-portland cement mortar (thin set).

I. Metal Edge Strips: Install **at locations indicated, where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile, [where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.**

J. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

K. Install cementitious backer units and fiber-cement underlayment and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.[Use latex-portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.

L. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.

M. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.

3.4 INTERIOR TILE INSTALLATION SCHEDULE

A. **INTERIOR FLOOR Installations, Concrete Subfloor:**

1. Tile Installation F121-17: Cement mortar bed (thickset) on waterproof membrane; TCA F121.

a. Tile Type: **REFER TO SCHEDULE ON DRAWINGS**
b. Thin-Set Mortar for Cured-Bed Method: Dry-set Portland cement mortar.
c. Grout: Polymer-modified sanded grout.

B. INTERIOR WALL Installations, Masonry or Concrete:

1. Tile Installation W202: Thin-set mortar; TCA W202.

a. Tile Type: REFER TO SCHEDULE ON DRAWINGS
b. Thin-Set Mortar: Dry-set Portland cement mortar.
c. Grout: Polymer-modified sanded grout.

2. Tile Installation W211: Cement mortar bed (thickset) bonded to substrate; TCA W211.

a. Tile Type: REFER TO SCHEDULE ON DRAWINGS
b. Bond Coat/Thin-Set Mortar: Dry-set Portland cement mortar.
c. Grout: Polymer-modified sanded grout.

3. Tile Installation W222: One-coat cement mortar bed (thickset) on metal lath over waterproof membrane]; TCA W222.

a. Tile Type: REFER TO SCHEDULE ON DRAWINGS
b. Bond Coat/Thin-Set Mortar: Dry-set Portland cement mortar.
c. Grout: Polymer-modified sanded grout.

C. SHOWER RECEPTOR & WALL Installations, Concrete or Masonry:

1. **Tile Installation B414: Cement mortar bed (thickset); TCA B414.**

a. Tile Type: REFER TO SCHEDULE OF DRAWINGS
b. Bond Coat/Thin-Set Mortar: Dry-set Portland cement mortar.
c. Grout: Polymer-modified sanded grout.

2. Tile Installation B421: Thin-set mortar on waterproof membrane; TCA B421.

a. Tile Type: REFER TO SCHEDULE OF DRAWINGS
b. Thin-Set Mortar: Latex-Portland cement mortar.
c. Grout: Polymer-modified sanded grout.

END OF SECTION 093000

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes acoustical panels and exposed suspension systems for ceilings.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Coordination Drawings: Drawn to scale and coordinating acoustical panel ceiling installation with hanger attachment to building structure and ceiling mounted items:

C. Samples: For each exposed finish.

D. Product test reports.

1.3 QUALITY ASSURANCE

A. Acoustical Testing Agency Qualifications: An independent testing laboratory or an NVLAP-accredited laboratory.

B. Fire-Test-Response Characteristics:

1. Fire-Resistance Characteristics: Where indicated, provide acoustical panel ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

    a. Identify materials with appropriate markings of applicable testing and inspecting agency.

2. Surface-Burning Characteristics: Acoustical panels complying with ASTM E 1264 for Class **A** materials, when tested per ASTM E 84.

    a. Smoke-Developed Index: 450 or less.

C. Seismic Standard: Comply with the following:

1. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
2. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's "Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings--Seismic Zones 0-2."

D. Pre-installation Conference: Conduct conference at Project site.

1.4 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.
2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of quantity installed.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANEL CEILINGS, GENERAL

A. Acoustical Panel Standard: Comply with ASTM E 1264.

1. Recycled Content: Provide acoustical panels with recycled content such that postconsumer recycled content plus one-half of pre-consumer recycled content constitutes a minimum of 25 percent by weight.

B. Metal Suspension System Standard: Comply with ASTM C 635.

1. Recycled Content: Provide products made from steel sheet with average recycled content such that postconsumer recycled content plus one-half of pre-consumer recycled content is not less than **25** percent.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Anchors in Concrete: Expansion anchors fabricated from corrosion-resistant materials, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.

D. Wire Hangers, Braces, and Ties: Zinc-coated carbon-steel wire; ASTM A 641/A 641M, Class 1 zinc coating, soft temper.

1. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.

E. Seismic perimeter stabilizer bars, seismic struts, and seismic clips.

F. Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

2.2 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING (Drawings A-900 series)

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide **Armstrong "Ceramaguard" Fine Fissured** or a comparable product by one of the following:

1. USG

2. Chicago metallic

C. Classification: Provide panels complying with ASTM E 1264 for type and form as follows:

1. Type and Form: Type XX, other types; described as high-density, ceramic- and mineral-base panels with scrubbable finish, resistant to heat, moisture, and corrosive fumes.

D. Color: White

E. NRC: Not less than .55 Type E-400 mounting per ASTM E 795.

F. CAC: Not less than 38

G. Edge/Joint Detail: Square

H. Thickness: 7/8 inch (22 mm)

I. Modular Size: 24 by 24 inches or as indicated on Drawings.

2.3 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong Prelude Plus XL or a comparable product by one of the following:

1. USG

2. Chicago metallic

B. Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, pre-painted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 (Z90) coating designation, with prefinished 15/16-inch- (24-mm-) wide metal caps on flanges.

1. Structural Classification: Heavy-duty system.
2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
3. Cap Material: Aluminum Steel or aluminum cold-rolled sheet.
4. Cap Finish: Painted white

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with ASTM C 636 and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders.

C. Suspend ceiling hangers from building's structural members, plumb and free from contact with insulation or other objects within ceiling plenum. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers, use trapezes or equivalent devices. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.

1. Do not attach hangers to steel deck tabs or to steel roof deck.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

END OF SECTION 095113

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following interior substrates:

1. Concrete.
2. Concrete masonry units (CMU).
3. Steel.
4. Cast iron.
5. Gypsum board.

1.2 DEFINITIONS

A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

G. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples: For each type of paint system and in each color and gloss of topcoat.

C. Product List: For each product indicated. Include printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 5 gallons of each material and color applied.

1.5 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include but are not limited to products listed in other Part 2 articles for the paint category indicated.

2.2 PAINT, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of

colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Non-flat Paints and Coatings: 150 g/L.
2. Primers, Sealers, and Undercoaters: 200 g/L.
3. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
4. Zinc-Rich Industrial Maintenance Primers: 340 g/L.

D. Low-Emitting Materials: Interior 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."

E. Colors: As selected by Architect from manufacturer's full range.

2.3 BLOCK FILLERS

A. Block Filler, Latex, Interior/Exterior: **MPI #4.**

1. **Sherwin Williams B42**: Epoxy Filler “Kem Cati-Cote HS” Epoxy Filler/Sealer or approved equal.

2.4 PRIMERS/SEALERS

A. Primer, Alkali Resistant, Water Based: **MPI #3.**

1. Sherwin Williams ProMar 200 Latex Primer or approved equal.

2.5 WATER-BASED PAINTS

A. Moderate Industrial, 100% Acrylic (Gloss Level 3): **MPI #139.**

1. Sherwin Williams DTM B66 Acrylic Fast Cure or approved equal.

2.6 SOLVENT-BASED PAINTS

A. Alkyd, Interior, Semi-Gloss (Gloss Level 5): **MPI #47.** For Steel Door Frames

1. Sherwin Williams B50 alkyd primer Kem Bond HS Universal Primer or approved equal.

2. Sherwin Williams B55 Metalastic Acrylic Modified Enamel or approved equal.

2.7 FLOOR COATINGS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Masonry (Clay and CMU): 12 percent.
3. Wood: 15 percent.
4. Gypsum Board: 12 percent.
5. Plaster: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

A. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

B. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 INTERIOR PAINTING SCHEDULE

A. CMU & Concrete (wall, non-traffic) Substrates:

1. High-Performance Epoxy System:

a. Block Filler: Block filler, Epoxy compatible, interior/exterior**, MPI #4**.
b. Intermediate Coat: Epoxy, interior, high performance Pro Industrial, matching topcoat.
c. Topcoat: Epoxy, interior, high performance Pro Industrial, (Gloss Level 3)**, MPI #139**.

B. Steel Substrates:

1. Alkyd System:
a. Prime Coat: Primer, alkyd, anti-corrosive, for metal**, MPI #79** or primer, alkyd, quick dry, for metal**, MPI #76**.
b. Intermediate Coat: Alkyd, interior, matching topcoat.
c. Topcoat: Alkyd, interior, semi-gloss (Gloss Level 5)**, MPI #47**.

C. Galvanized-Metal Substrates:

1. Institutional Low-Odor/VOC Latex System:

a. Prime Coat: Primer, galvanized, water based**, MPI #134**.
b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
c. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (Gloss Level 5)**, MPI #147**.

D. Gypsum Board & Plaster Substrates:

1. High-Performance Architectural Latex System:

a. Prime Coat: Primer sealer, latex, interior**, MPI #50**.
b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.

c. Topcoat: Latex, interior, high performance architectural, (Gloss Level 2)**, MPI #138**.

E. Spray-Textured Ceiling Substrates: (Not Used)

END OF SECTION 099123

SECTION 101400 - SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Plaques.
2. Dimensional characters.
3. Panel signs.
4. Illuminated panel signs.

1.2 DEFINITIONS

A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details for signs.

1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
2. Provide message list, typestyles, graphic elements, including tactile characters and Braille, and layout for each sign.
3. Wiring Diagrams: Power, signal, and control wiring.

C. Samples: For each sign type and for each color and texture required.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).

2.2 PLAQUES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Subject to compliance with requirements, provide EN400 Series by ASE, Inc. Manufacturing Architectural Signs & Engraving; Interior ADA and Custom-Building Signage as indicated on plans or a comparable product by one of the following:

1. Advance Corporation; Braille-Tac Division.
2. A. R. K. Ramos.
3. Gemini Incorporated.
4. Matthews International Corporation; Bronze Division.
5. Metal Arts; Div. of L&H Mfg. Co.
6. Mills Manufacturing Company.
7. Nelson-Harkins Industries.
8. Southwell Company (The).
9. ASE, INC. Manufacturing Architectural Signs & Engraving

2.3 DIMENSIONAL CHARACTERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Subject to compliance with requirements, provide EN400 by ACE, Inc. Manufacturing Architectural Signs & Engraving for all Interior ADA and Custom Building Signage or a comparable product by one of the following:

1. ACE Sign Systems, Inc.
2. Advance Corporation; Braille-Tac Division.
3. A. R. K. Ramos.
4. ASI-Modulex, Inc.
5. Bunting Graphics, Inc.
6. Charleston Industries, Inc.
7. Gemini Incorporated.
8. Grimco, Inc.

9. Innerface Sign Systems, Inc.
10. Metal Arts; Div. of L&H Mfg. Co.
11. Mills Manufacturing Company.
12. Mohawk Sign Systems.
13. Nelson-Harkins Industries.
14. Signature Signs, Incorporated.
15. Southwell Company (The).

2.4 PANEL SIGNS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Subject to compliance with requirements, provide ACE, Inc. Manufacturing Architectural Signs & Engraving for all Interior ADA and Custom Building Signage or a comparable product by one of the following:

1. ACE Sign Systems, Inc.
2. Advance Corporation; Braille-Tac Division.
3. Allen Industries Architectural Signage
4. Allenite Signs; Allen Marking Products, Inc.
5. APCO Graphics, Inc.
6. ASI-Modulex, Inc.
7. Best Sign Systems Inc.
8. Bunting Graphics, Inc.
9. Fossil Industries, Inc.
10. Gemini Incorporated.
11. Grimco, Inc.
12. Innerface Sign Systems, Inc.
13. InPro Corporation
14. Matthews International Corporation; Bronze Division.
15. Mills Manufacturing Company.
16. Mohawk Sign Systems.
17. Nelson-Harkins Industries.
18. Seton Identification Products.
19. Signature Signs, Incorporated.
20. Supersine Company (The)

D. Interior Panel Signs: Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner, complying with the following requirements:
1. Acrylic Sheet: 1/8” thick.
2. Edge Condition: Square cut
3. Corner Condition: Rounded to radius indicated
4. Mounting: Unframed

    a. Wall mounted with concealed anchors

b. Manufacturer's standard anchors for substrates encountered.

5. Color: Field/ Black, Text/ White
6. Tactile Characters: Characters and Grade 2 Braille raised 1/32 inch above surface with contrasting colors.

E. Brackets: Fabricate brackets and fittings for bracket-mounted signs from extruded aluminum to suit panel sign construction and mounting conditions indicated. Factory paint brackets in color matching background color of panel sign.

F. Tactile and Braille Sign: Manufacturer's standard process for producing text and symbols complying with ADA-ABA Accessibility Guidelines and with ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed or rounded shape.

1. Panel Material: Opaque acrylic sheet
2. Raised-Copy Thickness: Not less than 1/32 inch (0.8 mm).

G. Subsurface Copy: Apply minimum 4-mil- (0.10-mm-) thick vinyl copy to back face of clear acrylic sheet forming panel face to produce precisely formed opaque image. Image shall be free of rough edges.

H. Subsurface Engraved Acrylic Sheet: Reverse-engrave back face of clear acrylic sheet. Fill resulting copy with enamel. Apply opaque background color coating over enamel-filled copy.

I. Colored Coatings for Acrylic Sheet: For copy, background and frame colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are UV and water resistant for five years for application intended.

1. Color: Black, as selected by Architect from manufacturer's full range

2.5 ACCESSORIES

A. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.6 ACRYLIC SHEET FINISHES

A. Colored Coatings for Acrylic Sheet: For copy and background and frame colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and that are UV and water resistant for five years for application intended.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.

1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.

B. Wall-Mounted Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.

1. Two-Face Tape: Mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.
2. Hook-and-Loop Tapes: Mount signs to smooth, nonporous surfaces.
3. Magnetic Tape: Mount signs to smooth, nonporous surfaces.
4. Silicone-Adhesive Mounting: Attach signs to irregular, porous, or vinyl-covered surfaces.
5. Shim Plate Mounting: Provide 1/8-inch thick, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other mounting methods are not practicable. Attach plate with fasteners and anchors suitable for secure attachment to substrate. Attach panel signs to plate using method specified above.
6. Mechanical Fasteners: Use nonremovable mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.
7. Signs Mounted on Glass: Provide matching opaque plate on opposite side of glass to conceal mounting materials.

C. Dimensional Characters: Mount characters using standard fastening methods to comply with manufacturer's written instructions for character form, type of mounting, wall construction, and condition of exposure indicated. Provide heavy paper template to establish character spacing and to locate holes for fasteners.

1. Flush Mounting: Mount characters with backs in contact with wall surface.
2. Projected Mounting: Mount characters at projection distance from wall surface indicated.

END OF SECTION 101400

SECTION 102113 - TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Solid-polymer toilet compartments configured as toilet enclosures and urinal screens.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachments to other work.

C. Samples for each exposed product and for each color and texture specified.

D. Product certificates.

1.3 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84, or another standard acceptable to authorities having jurisdiction, by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 450 or less.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1 for toilet compartments designated as accessible.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Doors, Panels and Pilasters:

   1. High density polyethylene (HDPE), fabricated from extruded polymer resins, forming single thickness panel.
   2. Waterproof and nonabsorbent, with self-lubricating surface, resistant to marks by pens, pencils, markers, and other writing instruments.

3. 1 inch thick with edges rounded to 1/4 inch radius.
4. Recycled content: Minimum 25 percent.
5. Fire hazard classification: Not required.

2.2 SOLID-POLYMER UNITS

A. Basis-of-Design Product: Subject to compliance with requirements, provide **Scranton Products "Eclipse" series with Stainless-Metallic collection** color and texture patterns as defined on project drawings); or comparable product by one of the following:

1. Bradley Corporation; Mills Partitions.
2. Comtec Industries/Capitol Partitions.
3. General Partitions Mfg. Corp.
4. Knickerbocker Partition Corporation.
5. Metpar Corp.
6. Rockville Partitions Incorporated.
7. Santana Products, Inc.
8. Sanymetal; a Crane Plumbing company.

B. Toilet-Enclosure Style: Floor anchored; Overhead braced

C. Urinal-Screen Style: Wall hung

D. Door, Panel**,** Screen, and Pilaster Construction: Solid, high-density polyethylene (HDPE) panel material, not less than 1 inch (25 mm) thick, seamless, with eased edges, no-sightline system, and with homogenous color and pattern throughout thickness of material.

1. Integral Hinges: Configure doors and pilasters to receive integral hinges.
2. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum or stainless-steel strip fastened to exposed bottom edges of solid-polymer components to prevent burning.
3. Polymer Panel Finish: One color and pattern in each room.

    a. Color and Pattern: As selected by Architect from manufacturer's full range

E. Pilaster Shoes and Sleeves (Caps): Manufacturer's standard design; stainless steel.

1. Polymer Color and Pattern: Contrasting with pilaster, as selected by Architect from manufacturer's full range.

F. Urinal-Screen Post: Manufacturer's standard post design of material matching the thickness and construction of pilasters or 1-3/4-inch- (44-mm-) square, aluminum tube with satin finish with shoe and sleeve (cap) matching that on the pilaster.

G. Brackets (Fittings):

1. Stirrup Type: Ear or U-brackets, clear-anodized aluminum plated brass.
2. Full-Height (Continuous) Type: Manufacturer's standard design; extruded aluminum or stainless steel.

a. Polymer Color and Pattern: Contrasting with panel, as selected by Architect from manufacturer's full range

2.3 ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.

1. Material: Aluminum
2. Hinges: Manufacturer's **Regal Hinge** integral hinge for solid-polymer doors.
3. Latch and Keeper: Manufacturer's standard surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
5. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors
6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel.

2.4 FABRICATION

A. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

B. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

C. Ceiling-Hung Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for connection to structural support above finished ceiling. Provide assemblies that support pilasters from structure without transmitting load to finished ceiling. Provide sleeves (caps) at tops of pilasters to conceal anchorage.

D. Floor-and-Ceiling-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment at tops and bottoms of pilasters. Provide shoes and sleeves (caps) at pilasters to conceal anchorage.

E. Urinal-Screen Posts: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment at tops and bottoms of posts. Provide shoes and sleeves (caps) at posts to conceal anchorage if applicable.

F. Door Size and Swings: Unless otherwise indicated, provide 24-inch- (610-mm-) wide, in-swinging doors for standard toilet compartments and 36-inch- (914-mm-) wide, out-swinging doors with a minimum 32-inch- (813-mm-) wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

B. Clearances: Maximum 1/2 inch (13 mm) between pilasters and panels; 1 inch (25 mm) between panels and walls.

C. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than brackets attached at midpoint and near top and bottom of panel. Locate wall brackets so holes for wall anchors occur in masonry or tile joints. Align brackets at pilasters with brackets at walls.

3.2 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors and doors in entrance screens to return doors to fully closed position.

END OF SECTION 102113

SECTION 102116 - SHOWER AND DRESSING COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Shower compartment doors fabricated from solid polymer
2. Dressing compartments fabricated from solid polymer

1.2 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84, or another standard acceptable to authorities having jurisdiction, by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1 for shower and dressing compartments designated as accessible.

PART 2 - PRODUCTS

2.1 SOLID-POLYMER COMPARTMENTS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Scranton Products “Eclipse” series with Stainless-Metallic collection or comparable product by one of the following:

1. Comtec Industries/Capitol Partitions.
2. General Partitions Mfg. Corp.
3. Global Steel Products Corp.
4. Metpar Corp.
5. Rockville Partitions Incorporated.
6. Santana Products, Inc.
7. Sanymetal; a Crane Plumbing company.

B. Configuration: As shown on Drawings

C. Enclosure Style: Overhead braced

D. Panel and Pilaster Construction: Solid HDPE panel material, not less than 1 inch (25 mm) thick, seamless, with eased edges and with homogenous color and pattern throughout thickness of material.

1. Integral Hinges: Configure doors and pilasters to receive integral hinges.
2. Heat-Sink Strip: Manufacturer's standard, continuous, clear-anodized extruded-aluminum or stainless-steel strip fastened to exposed bottom edges of solid-polymer components to prevent burning.
3. Color and Pattern: as selected by Architect from manufacturer's full range. Match solid-polymer toilet compartments specified in Division 10 Section "Toilet Compartments"

E. Door Construction: Match panels.

F. Pilaster Shoes and Sleeves (Caps): Manufacturer's standard design; polymer or stainless steel.

1. Polymer Color and Pattern as selected by Architect from manufacturer's full range; Match solid-polymer toilet compartments specified in Division 10 Section "Toilet Compartments"

G. Brackets (Fittings):

1. Full-Height (Continuous) Type: Manufacturer's standard design; clear-anodized extruded aluminum or clear-anodized extruded aluminum

2. Stirrup Type: Ear or U-brackets; clear-anodized aluminum or stainless steel
3. Dressing-Compartment Brackets: Match toilet-compartment brackets specified in Division 10 Section "Toilet Compartments."

2.2 ACCESSORIES

A. Door Hardware and Accessories: Manufacturer's standard design, heavy-duty, operating hardware and accessories.

1. Material: Clear-anodized aluminum, Stainless steel, or Chrome-plated brass
2. Hinges: Manufacturer's standard, integral hinge for solid-polymer doors
3. Latch and Keeper: Manufacturer's standard, surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at each compartment, accessible or not at compartments designated as accessible.
4. Clothing Hooks: Manufacturer's standard clothing hooks in each dressing compartment; include one combination hook and rubber-tipped bumper at in-swinging doors, sized to prevent door from hitting wall panel or compartment-mounted accessories.
5. Door Bumper: Manufacturer's standard, rubber-tipped bumper at out-swinging doors.
6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.

B. Overhead Bracing: Manufacturer's standard, continuous, extruded-aluminum head rail or cap with antigrip profile; in manufacturer's standard finish.

C. Head Rail with Hooks: Manufacturer's standard, continuous, extruded-aluminum head rail or cap with curtain hooks running in concealed track; with antigrip profile; in manufacturer's standard finish.

2.3 FABRICATION

A. Overhead-Braced Compartments: Provide manufacturer's standard, corrosion-resistant supports, leveling method, and anchors at pilasters and walls to suit floor and wall conditions. Provide shoes at pilasters to conceal supports and leveling method.

B. Floor-and-Ceiling-Anchored Compartments: Provide manufacturer's standard, corrosion-resistant anchoring assemblies at pilasters and walls with leveling adjustment at tops and bottoms of pilasters. Provide shoes and sleeves (caps) at pilasters to conceal anchorage.

C. Door Sizes and Swings: Unless otherwise indicated, provide 24-inch- (610-mm-) wide, in-swinging doors for standard shower and dressing compartments, and 36-inch- (914-mm-) wide, out-swinging doors with a minimum 32-inch- (813-mm-) wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install compartments rigid, straight, level, and plumb. Secure compartments in position with manufacturer's recommended anchoring devices.

B. Clearances for Dressing Compartment: Maximum 1/2 inch (13 mm) between pilasters and panels; 1 inch (25 mm) between panels and walls.

C. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than two brackets attached and three brackets attached at midpoint and near top and bottom of panel. Locate wall brackets so holes for wall anchors occur in masonry or tile joints. Align brackets at pilasters with brackets at walls.

3.2 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 102116

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Public-use shower room accessories.
3. Private-use bathroom accessories.
4. Healthcare accessories.
5. Warm-air dryers.
6. Under lavatory guards.
7. Custodial accessories.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify products using designations indicated.

C. Maintenance data.

D. Warranty: Sample of special warranty.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.4 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PUBLIC-USE WASHROOM ACCESSORIES

1. Manufacturers: Subject to compliance with requirements, Bobrick Washroom Equipment, Inc.

B. Basis-of-Design Product: BOBRICK WASHROOM EQUIPMENT, INC.

Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bradley Corporation.

C. Toilet Tissue (Roll) Dispenser; Refer to Bathroom Accessory Schedule/ Drawing A-500:

1. Basis-of-Design Product: BOBRICK B-2840 Toilet Tissue Dispenser with Utility Shelf.

D. Combination Towel (Folded) Dispenser/Waste Receptacle: Refer to Bathroom Accessory Schedule/ Drawing A-500

1. Basis-of-Design Product: BOBRICK B-43949/ Contura Series

E. Liquid-Soap Dispenser: Refer to Plumbing Accessory Schedule/ Drawing P-100

1. Basis-of-Design Product: Bradley Corporation: Wash bar All-in One (Clean/Rinse/Dry)
2. Description: Designed for dispensing soap in Foam form.
3. Mounting: Deck mounted on lavatory

F. Grab Bar: Refer to Bathroom Accessory Schedule/ Drawing A-500

1. Basis-of-Design Product: Bobrick
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch (1.3 mm) thick.

4. Outside Diameter: 1-1/2 inches (38 mm)
5. Configuration and Length: As indicated on Drawings and Schedules

G. Sanitary-Napkin Disposal Unit: Refer to Bathroom Accessory Schedule/ Drawing A-500

1. Basis-of-Design Product: Bobrick: B270/ Contura Series
2. Mounting: Surface mounted
3. Receptacle: Removable.
4. Material and Finish: Stainless steel, No. 4 finish (satin)

H. Seat-Cover Dispenser: Refer to Bathroom Accessory Schedule/ Drawing A-500

1. Basis-of-Design Product: Bobrick MODEL # B221
2. Mounting: Surface mounted
3. Minimum Capacity: 250 seat covers.

4. Exposed Material and Finish: Stainless steel, No. 4 finish (satin)

I. Mirror Unit: Refer to Bathroom Accessory Schedule/ Drawing A-500

1. Basis-of-Design Product: ¼" Flush Mounted Mirror
2. Frame: 3/8" J-Channel at all perimeter edges
3. Size: As indicated on Drawings

J. Hooks: Refer to Bathroom Accessory Schedule/ Drawing A-500

1. Basis-of-Design Product: Bobrick Double Coat Hooks/ B-549

K. Toiletry Shelf: Refer to Bathroom Accessory Schedule/ Drawing A-500

1. Basis-of-Design Product: BOBRICK/ STAINLESS STEEL TOILETRY SHELF/ B683 x 24

2.2 PUBLIC-USE SHOWER ROOM ACCESSORIES

A. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.

Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bradley Corporation.

B. Shower Curtain Rod: Drawing A-200

1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.
2. Description: 1-inch (25.4-mm) OD; fabricated from nominal 0.0375-inch- (0.95-mm-thick stainless steel
3. Finish**:** No. 4 (satin)

2.3 PRIVATE-USE BATHROOM ACCESSORIES (Not Used)

2.4 HEALTHCARE ACCESSORIES (Not Used)

2.5 WARM-AIR DRYERS

A. Basis-of-Design Product: Bradley Corporation, Inc.

Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. American Specialties, Inc.
2. Bobrick Washroom Equipment, Inc.
3. Excel Dryer Corporation.

B. Warm-Air Dryer: Refer to Plumbing Accessory Schedule/ Drawing P-100

1. Basis-of-Design Product: Bradley Corporation: Wash bar Duo All-in One (Clean/Rinse/Dry)

2.6 CHILDCARE ACCESSORIES

A. Basis-of-Design Product: Bobrick Washroom Equipment/ Koala Kare Products

Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. American Specialties, Inc.
2. Brocar Products, Inc.
3. Diaper Deck & Company, Inc.

B. Diaper-Changing Station: Refer to Bathroom Accessory Schedule/ Drawing A-500

1. Basis-of-Design Product: Bobrick Washroom/Koala Kare Products: KB110-SSWM

2.7 UNDERLAVATORY GUARDS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Plumberex Specialty Products, Inc.
2. Truebro by IPS Corporation.

B. Under lavatory Guard:
1. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.
2. Material and Finish: Antimicrobial, molded plastic, white.

2.8 CUSTODIAL ACCESSORIES

A. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.

Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bradley Corporation.

B. Utility Shelf:
1. Description: With exposed edges turned down not less than 1/2 inch (13 mm) and supported by two triangular brackets welded to shelf underside.
2. Size: 16 inches (406 mm) long by 6 inches (152 mm) deep]

3. Material and Finish: Not less than nominal 0.05-inch- (1.3-mm-) thick stainless steel, No. 4 finish (satin).

C. Mop and Broom Holder:
1. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf
2. Length: 36 inches (914 mm)
3. Hooks: Three
4. Mop/Broom Holders: Four, spring-loaded, rubber hat, cam type.
5. Material and Finish: Stainless steel, No. 4 finish (satin).

a. Shelf: Not less than nominal 0.05-inch- (1.3-mm-) thick stainless steel.
b. Rod: Approximately 1/4-inch- (6-mm-) diameter stainless steel.

2.9 FABRICATION

A. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six (6) keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units' level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F 446.

END OF SECTION 102800

SECTION 105126 – SOLID PLASTIC LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid HDPE Plastic Lockers

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For lockers. Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For units with factory-applied color finishes.

D. Maintenance data.

E. Warranty: Sample of special warranty.

F. Compliance References: NFPA 286

1.3 QUALITY ASSURANCE

A. Regulatory Requirements: Where lockers and benches are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1.

B. Pre-installation Conference: Conduct conference at Project site

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver master and control keys to Owner by registered mail or overnight package service.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.

1. Warranty Period for Solid Plastic Lockers: 15 years against breakage, corrosion, and delamination under normal conditions from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Solid plastic panels
1. High Impact, high density polyethylene (HDPE) formed under high pressure into solid plastic components with homogeneous color throughout, with smooth "orange peel" finish.
2. Edges machined to accept to accept assembly brackets.
3. NFPA 286 compliant
4. Color to be as selected by Architect from manufacturer's full range of options

2.2 STANDARD LOCKERS

A. Basis-of-Design Product: **Scranton Products "Tufftec" Two-Tier* Solid Plastic (HDPE) Lockers with black color finish or as specified on drawings** or, subject to compliance with requirements, provide comparable product by one of the following:

1. Aquamax HDPE Double Tier (MSPL 1282-2A-WE)

2. Bradley HDPE (Lenox two-tier)

3. Royal Plastic Lockers (Two-Tier HDPE)*

4. One (1) Full Height ADA compliant Locker to be included*

B. Locker Arrangement: Double-tier

C. Material:

1. High impact, high density polyethylene (HDPE) formed under high pressure into solid plastic components with homogeneous color throughout, with smooth orange peel finish.
2. Edges machined to accept assembly brackets.
3. NFPA 286 compliant

2.3 COMPONENTS

A. Locker Doors: 1/2 inch thick.

B. Sides, Tops, Bottoms, Backs, and Shelves: 3/8 inch thick.

C. Latch: Continuous type, manufactured from HDPE, capable of accepting various locking mechanisms,

fastened to entire length of door.

D. Door Hinge: Heavy-duty zinc-plated steel, full length, assembled onto door and locker front. Doors to have perforated mesh vents

E. Assembly: Tongue-and-groove joint construction using 3/8 inch thick HDPE, full height

F. Coat Hooks: Two-prong, high impact plastic, mounted to bottom of shelf or divider, one per door opening.

2.4 FABRICATION

A. Fabricate locker components square and rigid, finish free from scratches and chips.

B. Fabricate locker components for snap-together assembly or slide-together dovetail connections providing solid and secure, anti-racking construction.

C. Fabricate adjacent lockers with common side panel. Fabricate locker units for assembly in maximum of three adjacent lockers.

END OF SECTION 105113

SECTION 220516 - EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipe loops and swing connections.
   2. Alignment guides and anchors.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Delegated-Design Submittal: For each anchor and alignment guide indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

   1. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and swing connections.
   2. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
   3. Alignment Guide Details: Detail field assembly and attachment to building structure.
   4. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.

C. Welding certificates.

D. Product certificates.

E. Maintenance data.

1.3 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 ALIGNMENT GUIDES AND ANCHORS

A. Alignment Guides:

1. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding spider for bolting to pipe.

B. Anchor Materials:

1. Steel Shapes and Plates: ASTM A 36/A 36M.
2. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel hex head.
3. Washers: ASTM F 844, steel, plain, flat washers.
4. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.

    a. Stud: Threaded, zinc-coated carbon steel.
    b. Expansion Plug: Zinc-coated steel.
    c. Washer and Nut: Zinc-coated steel.

5. Chemical Fasteners: Insert-type-stud, bonding-system anchor for use with hardened portland cement concrete, with tension and shear capacities appropriate for application.

    a. Bonding Material: ASTM C 881/C 881M, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
    b. Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud unless otherwise indicated.
    c. Washer and Nut: Zinc-coated steel.

PART 3 - EXECUTION

3.1 EXPANSION-JOINT INSTALLATION

A. Install expansion joints of sizes matching sizes of piping in which they are installed.

B. Install metal-bellows expansion joints according to EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."

3.2 PIPE LOOP AND SWING CONNECTION INSTALLATION

A. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.

B. Connect risers and branch connections to mains with at least five pipefittings including tee in main.

C. Connect risers and branch connections to terminal units with at least four pipe fittings including tee in riser.

D. Connect mains and branch connections to terminal units with at least four pipe fittings including tee in main.

3.3 ALIGNMENT-GUIDE AND ANCHOR INSTALLATION

A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.

B. Install **two** guide(s) on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four pipe diameters from expansion joint.

C. Attach guides to pipe and secure guides to building structure.

D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

E. Anchor Attachments:

1. Anchor Attachment to Black-Steel Pipe: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
2. Anchor Attachment to Galvanized-Steel Pipe: Attach with pipe hangers. Use MSS SP-69, Type 42, riser clamp welded to anchor.
3. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24, U-bolts bolted to anchor.

F. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.

1. Anchor Attachment to Steel Structural Members: Attach by welding.
2. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.

G. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

END OF SECTION 220516

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Grout.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

2.2 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Metraflex Company (The).
4. Pipeline Seal and Insulator, Inc.
5. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: stainless steel
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level.

2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.

3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 Section "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 Section "Penetration Firestopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

   a. Piping Smaller Than NPS 6 (DN 150) Galvanized-steel-pipe sleeves
   b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-pipe sleeves

2. Exterior Concrete Walls below Grade:

   a. Piping Smaller Than NPS 6 (DN 150) Galvanized-steel-pipe sleeves with sleeve-seal system

      1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

   b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-pipe sleeves with sleeve-seal system

      1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

   a. Piping Smaller Than NPS 6 (DN 150) Galvanized-steel-pipe sleeves with sleeve-seal system

      1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-pipe sleeves with sleeve-seal system

1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

a. Piping Smaller Than NPS 6 (DN 150) Galvanized-steel-pipe sleeves
b. Piping NPS 6 (DN 150 and Larger: Galvanized-steel-pipe sleeves

5. Interior Partitions:

a. Piping Smaller Than NPS 6 (DN 150)Galvanized-steel-pipe sleeves.
b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-sheet sleeves

END OF SECTION 220517

SECTION 220518 - ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated and rough-brass finish and setscrew fastener.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.

e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.
h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type.
j. Bare Piping in Equipment Rooms: One-piece, cast-brass type with rough-brass finish.
k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 220518

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Bronze ball valves.
2. Bronze swing check valves.
3. Iron swing check valves.
4. Iron swing check valves with closure control.
5. Bronze gate valves.
6. Iron gate valves.
7. Bronze globe valves.
8. Iron globe valves.

1.2 SUBMITTALS

A. Product Data: For each type of valve indicated.

1.3 QUALITY ASSURANCE

A. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.

B. NSF Compliance: NSF 61 for valve materials for potable-water service.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 8 (DN 200) and larger.
2. Handwheel: For valves other than quarter-turn types.
3. Handlever: For quarter-turn valves NPS 6 (DN 150) and smaller except plug valves.

E. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:

1. Gate Valves: With rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: With extended neck.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Solder Joint: With sockets according to ASME B16.18.
3. Threaded: With threads according to ASME B1.20.1.

2.2 BRONZE BALL VALVES

A. One-Piece, Reduced-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. American Valve, Inc.
b. Conbraco Industries, Inc.; Apollo Valves.
c. NIBCO INC.

2. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 400 psig (2760 kPa).
c. Body Design: One piece.
d. Body Material: Bronze.
e. Ends: Threaded.
f. Seats: PTFE or TFE.
g. Stem: Bronze.
h. Ball: Chrome-plated brass.
i. Port: Reduced.

2.3 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. American Valve, Inc.
b. Hammond Valve.
c. Milwaukee Valve Company.
d. NIBCO INC.
e. Powell Valves.

f. Red-White Valve Corporation.
g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

B. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Hammond Valve.
b. Milwaukee Valve Company.
c. NIBCO INC.
d. Red-White Valve Corporation.
e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-80, Type 4.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: PTFE or TFE.

2.4 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Hammond Valve.
b. Legend Valve.
c. Milwaukee Valve Company.
d. NIBCO INC.
e. Powell Valves.
f. Red-White Valve Corporation.
g. Sure Flow Equipment Inc.
h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-71, Type I.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged.
f. Trim: Bronze.
g. Gasket: Asbestos free.

B. Class 125, Iron Swing Check Valves with Nonmetallic-to-Metal Seats:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.

2. Description:

a. Standard: MSS SP-71, Type I.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged.
f. Trim: Composition.
g. Seat Ring: Bronze.
h. Disc Holder: Bronze.
i. Disc: PTFE or TFE.
j. Gasket: Asbestos free.

2.5 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125, Iron Swing Check Valves with Lever- and Spring-Closure Control:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. NIBCO INC.

2. Description:

a. Standard: MSS SP-71, Type I.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged.
f. Trim: Bronze.
g. Gasket: Asbestos free.
h. Closure Control: Factory-installed, exterior lever and spring.

B. Class 125, Iron Swing Check Valves with Lever- and Weight-Closure Control:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Hammond Valve.
   b. Milwaukee Valve Company.
   c. NIBCO INC.
   d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

   a. Standard: MSS SP-71, Type I.
   b. CWP Rating: 200 psig (1380 kPa).
   c. Body Design: Clear or full waterway.
   d. Body Material: ASTM A 126, gray iron with bolted bonnet.
   e. Ends: Flanged.
   f. Trim: Bronze.
   g. Gasket: Asbestos free.
   h. Closure Control: Factory-installed, exterior lever and weight.

2.6 BRONZE GATE VALVES

A. Class 125, NRS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. American Valve, Inc.
   b. Hammond Valve.
   c. Milwaukee Valve Company.
   d. NIBCO INC.
   e. Powell Valves.
   f. Red-White Valve Corporation.
   g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

   a. Standard: MSS SP-80, Type 1.
   b. CWP Rating: 200 psig (1380 kPa).
   c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
   d. Ends: Threaded or solder joint
   e. .
   f. Stem: Bronze.
   g. Disc: Solid wedge; bronze.
   h. Packing: Asbestos free.

B. Class 125, RS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. American Valve, Inc.
    b. Hammond Valve.
    c. Milwaukee Valve Company.
    d. NIBCO INC.
    e. Powell Valves.
    f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

    a. Standard: MSS SP-80, Type 2.
    b. CWP Rating: 200 psig (1380 kPa).
    c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
    d. Ends: Threaded or solder joint.
    e. Stem: Bronze.
    f. Disc: Solid wedge; bronze.
    g. Packing: Asbestos free.

2.7 IRON GATE VALVES

A. Class 125, NRS, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Flo Fab Inc.
    b. Hammond Valve.
    c. Legend Valve.
    d. Milwaukee Valve Company.
    e. NIBCO INC.
    f. Powell Valves.
    g. Red-White Valve Corporation.

2. Description:

    a. Standard: MSS SP-70, Type I.
    b. CWP Rating: 200 psig (1380 kPa).
    c. Body Material: ASTM A 126, gray iron with bolted bonnet.
    d. Ends: Flanged.
    e. Trim: Bronze.
    f. Disc: Solid wedge.
    g. Packing and Gasket: Asbestos free.

B. Class 125, OS&Y, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Flo Fab Inc.
   b. Hammond Valve.
   c. Legend Valve.
   d. Milwaukee Valve Company.
   e. NIBCO INC.
   f. Powell Valves.
   g. Red-White Valve Corporation.
   h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

   a. Standard: MSS SP-70, Type I.
   b. CWP Rating: 200 psig (1380 kPa).
   c. Body Material: ASTM A 126, gray iron with bolted bonnet.
   d. Ends: Flanged.
   e. Trim: Bronze.
   f. Disc: Solid wedge.
   g. Packing and Gasket: Asbestos free.

2.8 BRONZE GLOBE VALVES

A. Class 125, Bronze Globe Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Hammond Valve.
   b. Milwaukee Valve Company.
   c. NIBCO INC.
   d. Powell Valves.
   e. Red-White Valve Corporation.
   f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

   a. Standard: MSS SP-80, Type 1.
   b. CWP Rating: 200 psig (1380 kPa).
   c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
   d. Ends: Threaded or solder joint.
   e. Stem and Disc: Bronze.
   f. Packing: Asbestos free.

B. Class 125, Bronze Globe Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.
c. NIBCO INC.
d. Red-White Valve Corporation.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded or solder joint]
e. Stem: Bronze.
f. Disc: PTFE or TFE.
g. Packing: Asbestos free.

2.9 IRON GLOBE VALVES

A. Class 125, Iron Globe Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Hammond Valve.
b. Milwaukee Valve Company.
c. NIBCO INC.
d. Powell Valves.
e. Red-White Valve Corporation.
f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-85, Type I.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Packing and Gasket: Asbestos free.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

3.2 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, gate valves.
2. Throttling Service: ball, or butterfly valves.
3. Pump-Discharge Check Valves:

    a. NPS 2 (DN 50) and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
    b. NPS 2-1/2 (DN 65) and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring.
    c. NPS 2-1/2 (DN 65) and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged ends.
4. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 (DN 125) and Larger: Flanged ends.

3.4 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG (1035 kPa) OR LESS)

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze or brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: One piece, full port, brass or bronze with bronze trim.
3. Bronze Swing Check Valves: Class 125, bronze disc.
4. Bronze Gate Valves: Class 125, NRS

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to NPS 100): May be provided with threaded ends instead of flanged ends.
2. Iron, Single-Flange Butterfly Valves: 200 CWP, NBR seat, ductile-iron disc.
3. Iron Swing Check Valves: Class 125, metal nonmetallic-to-metal seats.
4. Iron Gate Valves: Class 125, NRS

3.5 HIGH-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 TO 200 PSIG (1035 TO 1380 kPa))

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: One piece, full port, brass or bronze with bronze trim.
3. Bronze Swing Check Valves: Class 125, bronze disc.
4. Bronze Gate Valves: Class 125, NRS

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to NPS 100): May be provided with threaded ends instead of flanged ends.
2. Iron, Single-Flange Butterfly Valves: 200 CWP, NBR seat, ductile-iron disc.
3. Iron Swing Check Valves: Class 125, metal seats.
4. Iron Gate Valves: Class 125, NRS

3.6 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze Angle Valves: Class 125, bronze disc.
3. Ball Valves: One piece, full port, brass or bronze with bronze trim.
4. Bronze Swing Check Valves: Class 125bronze disc.
5. Bronze Gate Valves: Class 125, NRS
6. Bronze Globe Valves: Class 125, bronze disc.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to NPS 100): May be provided with threaded ends instead of flanged ends.
2. Iron, Single-Flange Butterfly Valves: 200 CWP, EPDMseat, aluminum-bronze disc.
3. Iron Swing Check Valves: Class 125, metal nonmetallic-to-metal seats.
4. Iron Swing Check Valves with Closure Control: Class 125, lever and spring
5. Iron Gate Valves: Class 125, NRS
6. Iron Globe Valves: Class 125.

3.7 SANITARY-WASTE VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: One piece, full port, [brass or bronze with bronze trim.
3. Bronze Swing Check Valves: Class 125, bronze disc.
4. Bronze Gate Valves: Class 125, NRS
5. Bronze Globe Valves: Class 125, bronze disc.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to NPS 100): May be provided with threaded ends instead of flanged ends.
2. Iron Swing Check Valves: Class 125, nonmetallic-to-metal seats.
3. Iron Swing Check Valves with Closure Control: Class 125, lever and spring
4. Iron Gate Valves: Class 125, NRS
5. Iron Globe Valves: Class 125.

END OF SECTION 220523

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Pipe positioning systems.
6. Equipment supports.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7

1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Welding certificates.

1.4 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel

C. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) with 125-psig (862-kPa) minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.6 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.7 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. See Division 22 plumbing fixture Sections for requirements for pipe positioning systems for plumbing fixtures.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Insulated Piping:

1. Attach clamps and spacers to piping.

a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.

5. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm)

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F (566 deg C), pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches (100 mm) of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.
9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.

2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb (340 kg).
    b. Medium (MSS Type 32): 1500 lb (680 kg).
    c. Heavy (MSS Type 33): 3000 lb (1360 kg).

8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

R. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.

1.2 SUBMITTAL

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Stainless steel, 0.025-inch (0.64-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
3. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black
3. Background Color: White
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

7. Fasteners: Stainless-steel rivets or self-tapping screws
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black

C. Background Color: White

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches (38 mm) high.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to [25 feet (7.6 m) in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Pipe Label Color Schedule:

1. Domestic Water Piping:

   a. Background Color: White
   b. Letter Color: Blue

2. Sanitary Waste Piping:

   a. Background Color: Yellow
   b. Letter Color: Black

END OF SECTION 220553

SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic hot-water piping.
2. Domestic recirculating hot-water piping.
3. Roof drains and rainwater leaders.
4. Supplies and drains for handicap-accessible lavatories and sinks.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

1.3 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

B. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Pittsburgh Corning Corporation; Foamglas.

2. Special-Shaped Insulation: ASTM C 552, Type III.
3. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
4. Preformed Pipe Insulation with Factory-Applied ASJ Comply with ASTM C 552, Type II, Class 2.
5. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Aeroflex USA, Inc.; Aerocel.
    b. Armacell LLC; AP Armaflex.
    c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

H. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, **available products that may be incorporated into the Work include, but are not limited to, the following**:

    a. Fibrex Insulations Inc.; Coreplus 1200.
    b. Johns Manville; Micro-Lok.

c. Knauf Insulation; 1000-Degree Pipe Insulation.
d. Manson Insulation Inc.; Alley-K.
e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 Deg F (454 Deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

I. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Armacell LLC; Tubolit.
b. Nomaco Insulation; IMCOLOCK and NOMALOCK.

2.2 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F (minus 73 to plus 93 deg C).

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-84.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Use adhesive that complies 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," including 2004 Addenda.

C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Aeroflex USA, Inc.; Aeroseal.
    b. Armacell LLC; Armaflex 520 Adhesive.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
    d. K-Flex USA; R-373 Contact Adhesive.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Use adhesive that complies 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," including 2004 Addenda.

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
    b. Eagle Bridges - Marathon Industries; 225.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
    d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Use adhesive that complies 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," including 2004 Addenda.

E. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
    b. Eagle Bridges - Marathon Industries; 225.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.
    d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Use adhesive that complies 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," including 2004 Addenda.

F. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Dow Corning Corporation; 739, Dow Silicone.
b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
c. P.I.C. Plastics, Inc.; Welding Adhesive.
d. Speedline Corporation; Polyco VP Adhesive.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Use adhesive that complies 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," including 2004 Addenda.

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
b. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
b. Eagle Bridges - Marathon Industries; 550.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
d. Mon-Eco Industries, Inc.; 55-50.
e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.5 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
b. Eagle Bridges - Marathon Industries; 405.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
d. Mon-Eco Industries, Inc.; 44-05.
e. Pittsburgh Corning Corporation; Pittseal 444.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
5. Color: White or gray.
6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Use sealants that 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," including 2004 Addenda.

B. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
b. Eagle Bridges - Marathon Industries; 405.

c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
d. Mon-Eco Industries, Inc.; 44-05.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: Aluminum.
6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Use sealants that 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," including 2004 Addenda.

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: White.
6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Use sealants that 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," including 2004 Addenda.

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. (34 g/sq. m) with a thread count of 10 strands by 10 strands/sq. in. (4 strands by 4 strands/sq. mm), in a Leno weave, for pipe.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Mast-A-Fab.
b. Vimasco Corporation; Elastafab 894.

2.8 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Johns Manville; Zeston.
b. P.I.C. Plastics, Inc.; FG Series.
c. Proto Corporation; LoSmoke.
d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: **White**
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

C. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
c. RPR Products, Inc.; Insul-Mate.

2. Factory cut and rolled to size.
3. Finish and thickness are indicated in field-applied jacket schedules.

4. Moisture Barrier for Indoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper
5. Factory-Fabricated Fitting Covers:

    a. Same material, finish, and thickness as jacket.
    b. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
    c. Tee covers.
    d. Flange and union covers.
    e. End caps.
    f. Beveled collars.
    g. Valve covers.
    h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

D. Underground Direct-Buried Jacket: 125-mil- (3.2-mm-) thick vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Pittsburgh Corning Corporation; Pittwrap.
    b. Polyguard Products, Inc.; Insulrap No Torch 125.

2.9 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. ABI, Ideal Tape Division; 428 AWF ASJ.
    b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
    c. Compac Corporation; 104 and 105.
    d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches (75 mm).
3. Thickness: 11.5 mils (0.29 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. ABI, Ideal Tape Division; 491 AWF FSK.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
c. Compac Corporation; 110 and 111.
d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches (75 mm).
3. Thickness: 6.5 mils (0.16 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. ABI, Ideal Tape Division; 370 White PVC tape.
b. Compac Corporation; 130.
c. Venture Tape; 1506 CW NS.

2. Width: 2 inches (50 mm).
3. Thickness: 6 mils (0.15 mm).
4. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. ABI, Ideal Tape Division; 488 AWF.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
c. Compac Corporation; 120.
d. Venture Tape; 3520 CW.

2. Width: 2 inches (50 mm).
3. Thickness: 3.7 mils (0.093 mm).
4. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

2.10 SECUREMENTS

A. Aluminum Bands: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, [3/4 inch (19 mm) wide with wing seal or closed seal.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. ITW Insulation Systems; Gerrard Strapping and Seals.
    b. RPR Products, Inc.; Insul-Mate Strapping and Seals.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

C. Wire: 0.062-inch (1.6-mm) soft-annealed, stainless steel.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. C & F Wire.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches (100 mm) o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.

2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 INSTALLATION OF POLYOLEFIN INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of polyolefin pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install cut sections of polyolefin pipe and sheet insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.9 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

C. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

3.10 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.11 FIELD QUALITY CONTROL

A. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.12 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.13 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Hot and Recirculated Hot Water: Insulation shall be one of the following:

1. Flexible Elastomeric: 3/4 inch (19 mm) thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
3. Polyolefin: 1 inch (25 mm) thick.

B. Stormwater and Overflow: Insulation shall be[**one of**] the following:

1. Flexible Elastomeric: 1 inch (25 mm)] thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
3. Polyolefin: 1 inch (25 mm) thick.

C. Roof Drain and Overflow Drain Bodies: Insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch (25 mm) thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
3. Polyolefin: 1 inch (25 mm) thick.

D. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities: Insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch (25 mm) thick.
2. Polyolefin: 1 inch (25 mm)thick.

3.14 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:
1. PVC 20 mils (0.5 mm) thick.

D. Piping, Exposed:
1. PVC 20 mils (0.5 mm) thick.

END OF SECTION 220719

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
2. Specialty valves.
3. Flexible connectors.
4. Water meters furnished by utility company for installation by Contractor.

1.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Domestic water piping and support and installation shall withstand effects of earthquake motions determined according to ASCE/SEI 7.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic, potable domestic water piping and components.

C. Comply with NSF 61 for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B) and ASTM B 88, Type M (ASTM B 88M, Type C)] water tube, drawn temper.

1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
5. Copper Pressure-Seal-Joint Fittings:

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

        1) Elkhart Products Corporation; Industrial Division.
        2) NIBCO INC.
        3) Viega; Plumbing and Heating Systems.

    b. NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
    c. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.

6. Copper Push-on-Joint Fittings:

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

        1) NVent LLC.

    b. Description: Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22; with stainless-steel teeth and EPDM-rubber O-ring seal in each end instead of solder-joint ends.

B. Soft Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A) and ASTM B 88, Type L (ASTM B 88M, Type B) water tube, annealed temper.

1. Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
2. Copper Pressure-Seal-Joint Fittings:

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

        1) Elkhart Products Corporation; Industrial Division.
        2) NIBCO INC.
        3) Viega; Plumbing and Heating Systems.

b. NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
c. NPS 3 and NPS 4 (DN 80 and DN 100): Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.

2.3 DUCTILE-IRON PIPE AND FITTINGS

A. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.

1. Standard-Pattern, Push-on-Joint Fittings: AWWA C110, ductile or gray iron.

a. Gaskets: AWWA C111, rubber.

2. Compact-Pattern, Push-on-Joint Fittings: AWWA C153, ductile iron.

a. Gaskets: AWWA C111, rubber.

2.4 GALVANIZED-STEEL PIPE AND FITTINGS

A. Galvanized-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B Standard Weight. Include ends matching joining method.

1. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Standard Weight, seamless steel pipe with threaded ends.
2. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
3. Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface, and female threaded ends.
4. Flanges: ASME B16.1, Class 125, cast iron.

2.5 CPVC PIPING

A. CPVC Tubing System: ASTM D 2846/D 2846M, SDR 11, tube and socket fittings.

2.6 PEX TUBE AND FITTINGS

A. PEX Distribution System: ASTM F 877, SDR 9 tubing.

1. Fittings for PEX Tube: ASTM F 1807, metal-insert type with copper or stainless-steel crimp rings and matching PEX tube dimensions.
2. Manifold: Multiple-outlet, plastic or corrosion-resistant-metal assembly complying with ASTM F 877; with plastic or corrosion-resistant-metal valve for each outlet.

2.7 PVC PIPE AND FITTINGS

A. PVC Pipe: ASTM D 1785, Schedule 40 and Schedule 80.

1. PVC Socket Fittings: ASTM D 2466 for Schedule 40 and ASTM D 2467 for Schedule 80.

2.8 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

E. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493.

1. CPVC solvent cement shall have a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Solvent cement and adhesive primer 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."

F. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Solvent cement and adhesive primer 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."

G. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.9 SPECIALTY VALVES

A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.

B. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

C. CPVC Union Ball Valves:

1. Description:

a. Standard: MSS SP-122.
b. Pressure Rating: 150 psig (1035 kPa) at 73 deg F (23 deg C)
c. Body Material: CPVC.
d. Body Design: Union type.
e. End Connections for Valves NPS 2 (DN 50) and Smaller: Detachable, socket.
f. End Connections for Valves NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Detachable, socket.
g. Ball: CPVC; full port.
h. Seals: PTFE or EPDM-rubber O-rings.
i. Handle: Tee shaped.

D. PVC Union Ball Valves:

1. Description:

a. Standard: MSS SP-122.
b. Pressure Rating: 150 psig (1035 kPa) at 73 deg F (23 deg C)
c. Body Material: PVC.
d. Body Design: Union type.
e. End Connections for Valves NPS 2 (DN 50) and Smaller: Detachable, socket.
f. End Connections for Valves NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Detachable, socket
g. Ball: PVC; full port.
h. Seals: PTFE or EPDM-rubber O-rings.
i. Handle: Tee shaped.

E. PVC Butterfly Valves:

1. Description:

a. Pressure Rating: 150 psig (1035 kPa) at 73 deg F (23 deg C)
b. Body Material: PVC.
c. Body Design: Lug or wafer type.
d. Seat: EPDM rubber.
e. Seals: PTFE or EPDM-rubber O-rings.
f. Disc: PVC.
g. Stem: Stainless steel.
h. Handle: Lever.

F. CPVC Ball Check Valves:

1. Description:

a. Pressure Rating: 150 psig (1035 kPa) at 73 deg F (23 deg C)

b. Body Material: CPVC.
c. Body Design: Union-type ball check.
d. End Connections for Valves NPS 2 (DN 50) and Smaller: Detachable, socket.
e. End Connections for Valves NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Detachable, socket .
f. Ball: CPVC.
g. Seals: EPDM- or FKM-rubber O-rings.

G. PVC Ball Check Valves:

1. Description:

a. Pressure Rating: 150 psig (1035 kPa) at 73 deg F (23 deg C)
b. Body Material: PVC.
c. Body Design: Union-type ball check.
d. End Connections for Valves NPS 2 (DN 50) and Smaller: Detachable, socket.
e. End Connections for Valves NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Detachable, socket
f. Ball: PVC.
g. Seals: EPDM- or FKM-rubber O-rings.

H. CPVC Gate Valves:

1. Description:

a. Pressure Rating: [125 psig (860 kPa)] [150 psig (1035 kPa)] <**Insert pressure**> at [73 deg F (23 deg C)] <**Insert temperature**>.
b. Body Material: CPVC.
c. Body Design: Nonrising stem.
d. End Connections for Valves NPS 2 (DN 50) and Smaller: Socket.
e. End Connections for Valves NPS 2-1/2 to NPS 4 (DN 65 to DN 100): [**Socket**] [**Flanged**].
f. Gate and Stem: Plastic.
g. Seals: EPDM rubber.
h. Handle: Wheel.

I. PVC Gate Valves:

1. Description:

a. Pressure Rating: 150 psig (1035 kPa) at 73 deg F (23 deg C)
b. Body Material: PVC.
c. Body Design: Nonrising stem.
d. End Connections for Valves NPS 2 (DN 50) and Smaller: Socket.
e. End Connections for Valves NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Socket
f. Gate and Stem: Plastic.
g. Seals: EPDM rubber.
h. Handle: Wheel.

2.10 TRANSITION FITTINGS

A. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

B. Sleeve-Type Transition Coupling: AWWA C219.

C. Plastic-to-Metal Transition Fittings:

1. Description: CPVC or PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert and one solvent-cement-socket or threaded end.

D. Plastic-to-Metal Transition Unions:

1. Description: CPVC or PVC four-part union. Include brass or stainless-steel threaded end, solvent-cement-joint plastic end, rubber O-ring, and union nut.

2.11 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:

1. Description:

a. Pressure Rating: 150 psig (1035 kPa) at 180 deg F (82 deg C).
b. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Description:

a. Factory-fabricated, bolted, companion-flange assembly.
b. Pressure Rating: 150 psig (1035 kPa) minimum 300 psig (2070 kPa).
c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Kits:

1. Description:

a. Nonconducting materials for field assembly of companion flanges.
b. Pressure Rating: 150 psig (1035 kPa)
c. Gasket: Neoprene or phenolic.
d. Bolt Sleeves: Phenolic or polyethylene.
e. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:

1. Description:

    a. Electroplated steel nipple.
    b. Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C.
    c. End Connections: Male threaded or grooved.
    d. Lining: Inert and noncorrosive, propylene.

2.12 FLEXIBLE CONNECTORS

A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

    1. Working-Pressure Rating: Minimum 200 psig (1380 kPa) 250 psig (1725 kPa).
    2. End Connections NPS 2 (DN 50) and Smaller: Threaded copper pipe or plain-end copper tube.
    3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged copper alloy.

B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

    1. Working-Pressure Rating: Minimum 200 psig (1380 kPa)
    2. End Connections NPS 2 (DN 50) and Smaller: Threaded steel-pipe nipple.
    3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged steel nipple.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.

E. Install shutoff valve immediately upstream of each dielectric fitting.

F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for pressure-reducing valves.

G. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.

H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

I. Install seismic restraints on piping. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.

J. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

K. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

L. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

M. Install piping adjacent to equipment and specialties to allow service and maintenance.

N. Install piping to permit valve servicing.

O. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.

P. Install piping free of sags and bends.

Q. Install fittings for changes in direction and branch connections.

R. Install PEX piping with loop at each change of direction of more than 90 degrees.

S. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

T. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages.

U. Install thermostats in hot-water circulation piping. Comply with requirements in Division 22 Section "Domestic Water Pumps" for thermostats.

V. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

W. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

X. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

Y. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.

E. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

G. Copper-Tubing, Push-on Joints: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.

H. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
3. PVC Piping: Join according to ASTM D 2855.

J. PEX Piping Joints: Join according to ASTM F 1807.

K. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE INSTALLATION

A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.

B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 (DN 50) and smaller. Use butterfly or gate valves for piping NPS 2-1/2 (DN 65) and larger.

C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."

1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.

D. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 (DN 50) and smaller and butterfly valves for piping NPS 2-1/2 (DN 65) and larger. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves.

3.5 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. NPS 1-1/2 (DN 40) and Smaller: Fitting-type coupling.
2. NPS 2 (DN 50) and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 (DN 50) and Smaller: Plastic-to-metal transition fittings or unions.

3.6 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric nipples.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100) Use dielectric flange kits

D. Dielectric Fittings for NPS 5 to NPS 6 (DN 125 to DN 150) Use dielectric flange kits.

3.7 FLEXIBLE CONNECTOR INSTALLATION

A. Install flexible connectors in suction and discharge piping connections to each domestic water pump and in suction and discharge manifold connections to each domestic water booster pump.

B. Install bronze-hose flexible connectors in copper domestic water tubing.

C. Install stainless-steel-hose flexible connectors in steel domestic water piping.

3.8 WATER METER INSTALLATION

A. Rough-in domestic water piping for water meter installation according to utility company's requirements.

B. Water meters will be furnished and installed by utility company.

C. Install water meters according to AWWA M6, utility company's requirements, and the following:

D. Install displacement-type water meters with shutoff valve on water-meter inlet. Install valve on water-meter outlet and valved bypass around meter unless prohibited by authorities having jurisdiction.

E. Install compound-type water meters with shutoff valves on water-meter inlet and outlet and on valved bypass around meter. Support meters, valves, and piping on brick or concrete piers.

F. Install remote registration system according to standards of utility company and of authorities having jurisdiction.

3.9 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.

B. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

    a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.

3. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch (10 mm).

E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 (DN 20) and Smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
4. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
5. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.
6. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.

F. Install supports for vertical copper tubing every 10 feet (3 m).

G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 (DN 32) and Smaller: 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
2. NPS 1-1/2 (DN 40): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
3. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.
4. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.
5. NPS 3 and NPS 3-1/2 (DN 80 and DN 90): 12 feet (3.7 m) with 1/2-inch (13-mm) rod.
6. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet (3.7 m) with 5/8-inch (16-mm) rod.
7. NPS 6 (DN 150): 12 feet (3.7 m) with 3/4-inch (19-mm) rod.

H. Install supports for vertical steel piping every 15 feet (4.5 m).

I. Install vinyl-coated hangers for CPVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1 (DN 25) and Smaller: 36 inches (900 mm) with 3/8-inch (10-mm) rod.
2. NPS 1-1/4 to NPS 2 (DN 32 to DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.

J. Install supports for vertical CPVC piping every 60 inches (1500 mm) for NPS 1 (DN 25) and smaller, and every 72 inches (1800 mm) for NPS 1-1/4 (DN 32) and larger.

K. Install vinyl-coated hangers for PEX piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1 (DN 25) and Smaller: 32 inches (815 mm) with 3/8-inch (10-mm) rod.

L. Install hangers for vertical PEX piping every 48 inches (1200 mm).

M. Install vinyl-coated hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 2 (DN 50) and Smaller: 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
2. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.

3. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 (DN 150): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.

N. Install supports for vertical PVC piping every 48 inches (1200 mm).

O. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.10 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
3. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
4. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 (DN 65) and larger.

3.11 IDENTIFICATION

A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.

B. Label pressure piping with system operating pressure.

3.12 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Piping Inspections:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Piping Tests:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and for corrective action required.

D. Domestic water piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.13 CLEANING

A. Clean and disinfect potable and non-potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
2) Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.14 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Under-building-slab, domestic water, building service piping, NPS 3 (DN 80) and smaller shall be the following:

1. Soft copper tube, ASTM B 88, Type K (ASTM B 88M, Type A) copper pressure-seal fittings; and pressure-sealed joints.

D. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 6 (DN 100 to DN 150) shall be the following:

1. Push-on-joint, ductile-iron pipe; standard pattern push-on-joint fittings; and gasketed joints.

E. Under-building-slab, domestic water piping, NPS 2 (DN 50) and smaller shall be the following:

1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); wrought-copper solder-joint fittings; and brazed joints.

F. Aboveground domestic water piping, NPS 2 (DN 50) and smaller shall be one of the following:
1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B) wrought- copper solder-joint fittings; and soldered joints.
2. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B) copper pressure-seal-joint fittings; and pressure-sealed joints.

G. Aboveground domestic water piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100) , shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B) cast-or wrought- copper solder-joint fittings; and brazed joints.
2. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B) copper pressure-seal-joint fittings; and pressure-sealed joints.

H. Aboveground domestic water piping, NPS 5 and NPS 6 (DN 65 and DN 150) be one of the following:

1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B) cast- or wrought-copper solder-joint fittings; and brazed joints.
2. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
3. Galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.
4. PVC, Schedule 80 pipe; PVC, Schedule 80 socket fittings; and solvent-cemented joints.

3.15 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball or gate valves for piping NPS 2 (DN 50) and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
2. Throttling Duty: Use ball or globe valves for piping NPS 2 (DN 50) and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
3. Hot-Water Circulation Piping, Balancing Duty: Memory-stop balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

C. Iron grooved-end valves may be used with grooved-end piping.

D. CPVC and PVC valves matching piping materials may be used.

END OF SECTION 221116

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following domestic water piping specialties:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Balancing valves.
5. Temperature-actuated water mixing valves.
6. Strainers.
7. Hose bibbs.
8. Wall hydrants.
9. Drain valves.
10. Water hammer arresters.
11. Trap-seal primer valves.

1.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: **125 psig (860 kPa)** unless otherwise indicated.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control test reports.

C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. NSF Compliance:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Ames Co.
    b. Cash Acme.
    c. Conbraco Industries, Inc.
    d. FEBCO; SPX Valves & Controls.
    e. Rain Bird Corporation.
    f. Toro Company (The); Irrigation Div.
    g. Watts Industries, Inc.; Water Products Div.
    h. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1001.
3. Size: NPS 1/4 to NPS 3 (DN 8 to DN 80), as required to match connected piping.
4. Body: Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Rough bronze

B. Hose-Connection Vacuum Breakers

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Arrowhead Brass Products, Inc.
    b. Cash Acme.
    c. Conbraco Industries, Inc.
    d. Legend Valve.
    e. MIFAB, Inc.
    f. Prier Products, Inc.
    g. Watts Industries, Inc.; Water Products Div.
    h. Woodford Manufacturing Company.
    i. Zurn Plumbing Products Group; Light Commercial Operation.
    j. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1001.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Rough bronze.

2.2 BACKFLOW PREVENTERS

A. Intermediate Atmospheric-Vent Backflow Preventers

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Cash Acme.
    b. Conbraco Industries, Inc.
    c. FEBCO; SPX Valves & Controls.
    d. Honeywell Water Controls.
    e. Legend Valve.
    f. Watts Industries, Inc.; Water Products Div.
    g. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1012.
3. Operation: Continuous-pressure applications.
4. Size: NPS 3/4 (DN 20).
5. Body: Bronze.
6. End Connections: Union, solder joint.
7. Finish: Rough bronze.

B. Double-Check Backflow-Prevention Assemblies

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Ames Co.
    b. Conbraco Industries, Inc.
    c. FEBCO; SPX Valves & Controls.
    d. Flomatic Corporation.
    e. Watts Industries, Inc.; Water Products Div.
    f. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1015.
3. Operation: Continuous-pressure applications, unless otherwise indicated.
4. Pressure Loss: 5 psig (35 kPa) maximum, through middle 1/3 of flow range.
5. Size: per drawings NPS (DN).>
6. Design Flow Rate: per drawings gpm (L/s).
7. Selected Unit Flow Range Limits: per drawings gpm (L/s).
8. Pressure Loss at Design Flow Rate: per drawings psig (kPa) for sizes NPS 2 (DN 50) and smaller; per drawings psig (kPa) for NPS 2-1/2 (DN 65) and larger.
9. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 (DN 65) and larger.
10. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
11. Configuration: Designed for horizontal, straight through flow.
12. Accessories:

a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.

2.3 WATER PRESSURE-REDUCING VALVES

A. Water Regulators

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Cash Acme.
   b. Conbraco Industries, Inc.
   c. Honeywell Water Controls.
   d. Watts Industries, Inc.; Water Products Div.
   e. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1003.
3. Pressure Rating: Initial working pressure of 150 psig (1035 kPa).
4. Size: per drawings NPS (DN).
5. Design Flow Rate: per drawings gpm (L/s).
6. Design Inlet Pressure: per drawings psig (kPa).
7. Design Outlet Pressure Setting: per drawings psig (kPa).
8. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).
9. Valves for Booster Heater Water Supply: Include integral bypass.
10. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).

2.4 BALANCING VALVES

A. Memory-Stop Balancing Valves

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Conbraco Industries, Inc.
   b. Crane Co.; Crane Valve Group; Crane Valves.
   c. Crane Co.; Crane Valve Group; Jenkins Valves.
   d. Crane Co.; Crane Valve Group; Stockham Div.
   e. Hammond Valve.
   f. Milwaukee Valve Company.
   g. NIBCO INC.
   h. Red-White Valve Corp.

2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.

3. Pressure Rating: 400-psig (2760-kPa) minimum CWP.
4. Size: NPS 2 (DN 50) or smaller.
5. Body: Copper alloy.
6. Port: Standard or full port.
7. Ball: Chrome-plated brass.
8. Seats and Seals: Replaceable.
9. End Connections: Solder joint or threaded.
10. Handle: Vinyl-covered steel with memory-setting device.

2.5 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Water-Temperature Limiting Devices

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Armstrong International, Inc.
    b. Cash Acme.
    c. Conbraco Industries, Inc.
    d. Honeywell Water Controls.
    e. Legend Valve.
    f. Leonard Valve Company.
    g. Powers; a Watts Industries Co.
    h. Symmons Industries, Inc.
    i. Taco, Inc.
    j. Watts Industries, Inc.; Water Products Div.
    k. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig (860 kPa).
4. Type: Thermostatically controlled water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded union inlets and outlet.
7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Tempered-Water Setting: 90 deg F (deg C).>
9. Tempered-Water Design Flow Rate: per drawings gpm (L/s).>
10. Valve Finish: Rough bronze.

B. Primary, Thermostatic, Water Mixing Valves

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Armstrong International, Inc.
    b. Lawler Manufacturing Company, Inc.
    c. Leonard Valve Company.
    d. Powers; a Watts Industries Co.

e. Symmons Industries, Inc.

2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig (860 kPa).
4. Type: Cabinet-type, thermostatically controlled water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded union inlets and outlet.
7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Valve Pressure Rating: 125 psig (860 kPa) minimum, unless otherwise indicated.
9. Tempered-Water Setting: 90 Insert deg F (deg C).>
10. Tempered-Water Design Flow Rate: per drawings gpm (L/s).
11. Selected Valve Flow Rate at 45-psig (310-kPa) Pressure Drop: per drawings gpm (L/s).
12. Pressure Drop at Design Flow Rate: <Insert psig (kPa).>
13. Valve Finish: Rough bronze.
14. Piping Finish: Copper.
15. Cabinet: Factory-fabricated, stainless steel, for surface mounting and with hinged, stainless-steel door.

2.6 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers

1. Pressure Rating: 125 psig (860 kPa) minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 (DN 65) and larger.
3. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Perforation Size:

   a. Strainers NPS 2 (DN 50) and Smaller: 0.033 inch (0.84 mm)
   b. Strainers NPS 2-1/2 to NPS 4 (DN 65 to DN 100): 0.062 inch (1.57 mm)
   c. Strainers NPS 5 (DN 125) and Larger: 0.125 inch (3.18 mm)

6. Drain: Pipe plug

2.7 HOSE BIBBS

A. Hose Bibbs

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 (DN 15 or DN 20) threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig (860 kPa).

7. Vacuum Breaker: Integral**,** nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Chrome or nickel plated.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Wheel handle
13. Operation for Finished Rooms: Wheel handle
14. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.8 WALL HYDRANTS

A. Nonfreeze Wall Hydrants

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Josam Company.
    b. MIFAB, Inc.
    c. Prier Products, Inc.
    d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    e. Tyler Pipe; Wade Div.
    f. Watts Drainage Products Inc.
    g. Woodford Manufacturing Company.
    h. Zurn Plumbing Products Group; Light Commercial Operation.
    i. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.21.3M for exposed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig (860 kPa).
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4 or NPS 1 (DN 20 or DN 25).
7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Box: Deep, flush mounting with cover.
9. Box and Cover Finish: Polished nickel bronze
10. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
11. Nozzle and Wall-Plate Finish: Polished nickel bronze
12. Operating Keys(s): Two with each wall hydrant.

2.9 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig (2760-kPa) minimum CWP.

3. Size: NPS 3/4 (DN 20).
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.10 WATER HAMMER ARRESTERS

A. Water Hammer Arresters

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. AMTROL, Inc.
    b. Josam Company.
    c. MIFAB, Inc.
    d. PPP Inc.
    e. Sioux Chief Manufacturing Company, Inc.
    f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    g. Tyler Pipe; Wade Div.
    h. Watts Drainage Products Inc.
    i. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Metal bellows
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.11 TRAP-SEAL PRIMER VALVES

A. Supply-Type, Trap-Seal Primer Valves

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. MIFAB, Inc.
    b. PPP Inc.
    c. Sioux Chief Manufacturing Company, Inc.
    d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    e. Watts Industries, Inc.; Water Products Div.

2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig (860 kPa) minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint.

6. Gravity Drain Outlet Connection: NPS 1/2 (DN 15) threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
3. Do not install bypass piping around backflow preventers.

C. Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.

D. Install balancing valves in locations where they can easily be adjusted.

E. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install thermometers and water regulators if specified.
2. Install cabinet-type units recessed in or surface mounted on wall as specified.

F. Install Y-pattern strainers for water on supply side of each control valve, and pump.

G. Install water hammer arresters in water piping according to PDI-WH 201.

H. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

I. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

J. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Intermediate atmospheric-vent backflow preventers.
2. Reduced-pressure-principle backflow preventers.
3. Double-check backflow-prevention assemblies.

4. Water pressure-reducing valves.
5. Primary, thermostatic, water mixing valves.
6. Supply-type, trap-seal primer valves.

K. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:

1. Test each reduced-pressure-principle backflow preventer and double-check backflow-prevention assembly according to authorities having jurisdiction and the device's reference standard.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.3 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 221119

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.

B. Related Section:

1. Division 22 Section "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.

1.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74[**, Service**] class.

B. Gaskets: ASTM C 564, rubber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. CISPI, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. ANACO-Husky.
    b. Dallas Specialty & Mfg. Co.
    c. Fernco Inc.
    d. Matco-Norca, Inc.
    e. MIFAB, Inc.
    f. Mission Rubber Company; a division of MCP Industries, Inc.
    g. Stant.
    h. Tyler Pipe.

2. Standards: ASTM C 1277 and CISPI 310.
3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. ANACO-Husky.
    b. Clamp-All Corp.
    c. Dallas Specialty & Mfg. Co.
    d. MIFAB, Inc.
    e. Mission Rubber Company; a division of MCP Industries, Inc.
    f. Stant.
    g. Tyler Pipe.

2. Standards: ASTM C 1277 and ASTM C 1540.
3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

C. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

D. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.5 ABS PIPE AND FITTINGS

A. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40.

B. Cellular-Core ABS Pipe: ASTM F 628, Schedule 40.

C. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.

D. Solvent Cement: ASTM D 2235.

1. ABS solvent cement shall have a VOC content of 325 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Solvent cement 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."

2.6 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

B. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.

C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

D. Adhesive Primer: ASTM F 656.

1. adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Adhesive primer 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."

E. Solvent Cement: ASTM D 2564.

1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Solvent cement 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."

2.7 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
3. Unshielded, Nonpressure Transition Couplings:

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

        1) Dallas Specialty & Mfg. Co.
        2) Fernco Inc.
        3) Mission Rubber Company; a division of MCP Industries, Inc.
        4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.

    b. Standard: ASTM C 1173.
    c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
    d. Sleeve Materials:

        1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
        2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
        3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

4. Shielded, Nonpressure Transition Couplings:

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

        1) Cascade Waterworks Mfg. Co.

2) Mission Rubber Company; a division of MCP Industries, Inc.

b. Standard: ASTM C 1460.
c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31 Section "Earth Moving."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

I. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

J. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

K. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 2 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

L. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

M. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

N. Install aboveground ABS piping according to ASTM D 2661.

O. Install aboveground PVC piping according to ASTM D 2665.

P. Install underground ABS and PVC piping according to ASTM D 2321.

Q. Plumbing Specialties:

1. Install backwater valves in sanitary waste gravity-flow piping. Comply with requirements for backwater valves specified in Division 22 Section "Sanitary Waste Piping Specialties."
2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Comply with requirements for cleanouts specified in Division 22 Section "Sanitary Waste Piping Specialties."
3. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Division 22 Section "Sanitary Waste Piping Specialties."

R. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

C. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

D. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

E. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in OD's.
2. In Drainage Piping: Shielded, nonpressure transition couplings.

3.5 VALVE INSTALLATION

A. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.
2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.
3. Install backwater valves in accessible locations.
4. Comply with requirements for backwater valve specified in Division 22 Section "Sanitary Waste Piping Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Install individual, straight, horizontal piping runs:

    a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting**,** valve, and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 and NPS 8 (DN 150 and DN 200): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.
5. Spacing for 10-foot (3-m) lengths may be increased to 10 feet (3 m). Spacing for fittings is limited to 60 inches (1500 mm).

G. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).

H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 (DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
2. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
3. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
4. NPS 3 and NPS 5 (DN 80 and DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.
5. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.
6. NPS 8 (DN 200): 10 feet (3 m) with 3/4-inch (19-mm) rod.

I. Install supports for vertical copper tubing every 10 feet (3 m).

J. Install hangers for ABS and PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 and NPS 8 (DN 150 and DN 200): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.

K. Install supports for vertical ABS and PVC piping every 48 inches (1200 mm).

L. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Install horizontal backwater valves with cleanout cover flush with floor
6. Comply with requirements for cleanouts and drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
7. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 (DN 65) and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.8 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.9 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.10 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed ABS and PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

3.11 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 (DN 100) and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
3. Copper DWV tube, copper drainage fittings, and soldered joints.
4. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
5. Solid-wall]PVC pipe, PVC socket fittings, and solvent-cemented joints.
6. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

C. Aboveground, soil and waste piping NPS 5 (DN 125) and larger shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; [CISPI] [heavy-duty] hubless-piping couplings; and coupled joints.
3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
4. Dissimilar Pipe-Material Couplings: Unshielded nonpressure transition couplings.

D. Aboveground, vent piping NPS 4 (DN 100) and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
3. Copper DWV tube, copper drainage fittings, and soldered joints.
4. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
5. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
6. Dissimilar Pipe-Material Couplings: Unshielded nonpressure transition couplings.

E. Aboveground, vent piping NPS 5 (DN 125) and larger shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
4. Dissimilar Pipe-Material Couplings: Unshielded nonpressure transition couplings.

F. Underground, soil, waste, and vent piping NPS 4 (DN 100) and smaller be any of the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; cast-iron hubless-piping couplings; and coupled joints.
3. Solid wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
4. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
5. Dissimilar Pipe-Material Couplings: Unshielded nonpressure transition couplings.

G. Underground, soil and waste piping NPS 5 (DN 125) and larger shall be any of the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; coupled joints.
3. Solid-wall PVC pipe; PVC socket fittings; and solvent-cemented joints.
4. Dissimilar Pipe-Material Couplings: Unshielded nonpressure transition couplings.

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:

1. Backwater valves.
2. Cleanouts.
3. Floor drains.
4. Roof flashing assemblies.
5. Miscellaneous sanitary drainage piping specialties.
6. Flashing materials.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

1.3 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 BACKWATER VALVES

A. Horizontal, Cast-Iron Backwater Valves

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Josam Company; Josam Div.
b. MIFAB, Inc.
c. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
d. Tyler Pipe; Wade Div.
e. Watts Drainage Products Inc.
f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.14.1.
3. Size: Same as connected piping.

4. Body: Cast iron.
5. Cover: Cast iron with bolted or threaded access check valve.
6. End Connections: Hub and spigot or hubless.
7. Type Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang open for airflow unless subject to backflow condition.
8. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

B. Drain-Outlet Backwater Valves

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Josam Company; Josam Div.
   b. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
   c. Watts Drainage Products Inc.
   d. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Size: Same as floor drain outlet.
3. Body: Cast iron or bronze made for vertical installation in bottom outlet of floor drain.
4. Check Valve: Removable ball float.
5. Inlet: Threaded.
6. Outlet: Threaded or spigot.

2.2 CLEANOUTS

A. Exposed Cast-Iron Cleanouts

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Josam Company; Josam Div.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.
   f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
5. Closure: Countersunk with brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Floor Cleanouts

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Josam Company; Josam Div.
    b. Oatey.
    c. Sioux Chief Manufacturing Company, Inc.
    d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    e. Tyler Pipe; Wade Div.
    f. Watts Drainage Products Inc.
    g. Zurn Plumbing Products Group; Light Commercial Operation.
    h. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M for adjustable housing cast-iron soil pipe with cast-iron ferrule heavy-duty, threaded, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Adjustable housing Cast-iron soil pipe with cast-iron ferrule Heavy-duty, Threaded, adjustable housing.
5. Body or Ferrule: Cast iron
6. Clamping Device: Not required
7. Outlet Connection: Threaded.
8. Closure: Brass plug with straight threads and gasket.
9. Adjustable Housing Material: Cast iron with threads
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy
11. Frame and Cover Shape: Square
12. Top Loading Classification: Heavy Duty.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Josam Company; Josam Div.
    b. MIFAB, Inc.
    c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    d. Tyler Pipe; Wade Div.
    e. Watts Drainage Products Inc.
    f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
5. Closure: Countersunk or raised-head, drilled-and-threaded brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
8. Wall Access: Square, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

2.3 FLOOR DRAINS

A. Cast-Iron Floor Drains

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Commercial Enameling Co.
    b. Josam Company; Josam Div.
    c. MIFAB, Inc.
    d. Prier Products, Inc.
    e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    f. Tyler Pipe; Wade Div.
    g. Watts Drainage Products Inc.
    h. Zurn Plumbing Products Group; Light Commercial Operation.
    i. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.3
3. Pattern: Area Floor drain.
4. Body Material: Gray iron
5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Side or bottom
9. Backwater Valve: Integral, ASME A112.14.1, swing-check type
10. Top or Strainer Material: Nickel bronze
11. Top of Body and Strainer Finish: Nickel bronze
12. Top Shape: Square
13. Dimensions of Top or Strainer: see drainings
14. Top Loading Classification: Heavy Duty
15. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
16. Trap Material: Cast iron
17. Trap Features: Cleanout and trap-seal primer valve drain connection

2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
2. Size: Same as connected waste piping with increaser fitting of size indicated.

B. Floor-Drain, Trap-Seal Primer Fittings

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 (DN 15) side inlet.

C. Air-Gap Fittings

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

D. Sleeve Flashing Device

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 2 inches (51 mm) above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

E. Stack Flashing Fittings
1. Size: Same as connected stack vent or vent stack.

F. Vent Caps

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

2.5 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft. (15-kg/sq. m), 0.0469-inch (1.2-mm) thickness.
3. Burning: 6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness.

B. Fasteners: Metal compatible with material and substrate being fastened.

C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

D. Solder: ASTM B 32, lead-free alloy.

E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

C. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
4. Locate at base of each vertical soil and waste stack.

D. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

E. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

F. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

    a. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35-mm) total depression.
    b. Radius, 30 to 60 Inches (750 to 1500 mm): Equivalent to 1 percent slope.
    c. Radius, 60 Inches (1500 mm) or Larger: Equivalent to 1 percent slope, but not greater than 1-inch (25-mm) total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

G. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

H. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

I. Assemble open drain fittings and install with top of hub 2 inches (51 mm) above floor.

J. Install deep-seal traps on floor drains and other waste outlets, if indicated.

K. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

L. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

M. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

N. Install vent caps on each vent pipe passing through roof.

O. Install grease interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.

1. Above-Floor Installation: Set unit with bottom resting on floor, unless otherwise indicated.
2. Flush with Floor Installation: Set unit and extension, if required, with cover flush with finished floor.
3. Recessed Floor Installation: Set unit in receiver housing having bottom or cradle supports, with receiver housing cover flush with finished floor.
4. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.

P. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Grease Interceptors: Connect inlet and outlet to unit, and connect flow-control fitting and vent to unit inlet piping. Install valve on outlet of automatic drawoff-type unit.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness or thinner.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches (250 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.4 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each grease interceptor.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.5 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

SECTION 224700 - DRINKING FOUNTAIN / WATER COOLERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Type PB, pressure with bubbler, Style W, wall-mounting water coolers.
   2. Fixture supports.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities for fixtures for people with disabilities.

C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

D. ARI Standard: Comply with ARI's "Directory of Certified Drinking Water Coolers" for style classifications.

E. ARI Standard: Comply with ARI 1010, "Self-Contained, Mechanically Refrigerated Drinking-Water Coolers," for water coolers and with ARI's "Directory of Certified Drinking Water Coolers" for type and style classifications.

F. ASHRAE Standard: Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants" for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant unless otherwise indicated.

PART 2 - PRODUCTS

2.1 PRESSURE WATER COOLERS

A. Water Coolers, (See schedule on drawings):

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

    a. Elkay Manufacturing Co. **(Model EZS8WSLK or equal)**
    b. Halsey Taylor.
    c. Haws Corporation.
    d. Oasis Corporation.
    e. Sunroc Corp.

2. Description: Accessible, ARI 1010, Type PB, pressure with bubbler, Style W, wall-mounting water cooler for adult-mounting height.

    a. Cabinet: stainless steel and vinyl-covered steel with stainless-steel top.
    b. Bubbler: One, with adjustable stream regulator, located on each cabinet deck. Flex-Guard Safety Bubble
    c. Bottle Filler.
    d. Supply: NPS 3/8 (DN 10) with ball valve.
    e. Filter: Non-Filtered
    f. Drain: Grid with NPS 1-1/4 (DN 32) minimum horizontal waste and trap complying with ASME A112.18.1.
    g. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.

        1) Capacity: 8 gph (0.0084 L/s) of 50 deg F (10 deg C) cooled water from 80 deg F (27 deg C) inlet water and 90 deg F (32 deg C) ambient air temperature.
        2) Electrical Characteristics: 1/3 hp (max); 115-V ac; single phase; 60 Hz.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Use carrier off-floor supports for wall-mounting fixtures, unless otherwise indicated.

3.2 INSTALLATION

A. Install off-floor supports affixed to building substrate and attach wall-mounting fixtures, unless otherwise indicated.

B. Install fixtures level and plumb. For fixtures indicated for children, install at height required by authorities having jurisdiction.

C. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping. Use ball, gate, or globe valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

D. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

E. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, traps, and risers, and with soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Water Cooler Testing: After electrical circuitry has been energized, test for compliance with requirements. Test and adjust controls and safeties.

1. Remove and replace malfunctioning units and retest as specified above.
2. Report test results in writing.

3.5 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

B. Adjust water cooler temperature settings.

END OF SECTION 224700

SECTION 224213.13 - COMMERCIAL WATER CLOSETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Water closets.
2. Flushometer valves.
3. Toilet seats.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 WALL-MOUNTED, BOTTOM-OUTLET WATER CLOSETS

A. Water Closets Wall mounted, bottom outlet, top spud.

1. Manufacturers: Subject to compliance with requirements,

Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings: **AMERICAN STANDARD AFWALL MILLENIUM/ 1.6 GPF FLUSHOMETER SYSTEM W/ HARD-WIRED FLUSH VALVE** or comparable product by one of the following:

a. American Standard America.
b. Briggs Plumbing Products, Inc.
c. Capizzi.
d. Crane Plumbing, L.L.C.
e. Ferguson Enterprises, Inc.; ProFlo Brand.
f. Gerber Plumbing Fixtures LLC.
g. Kohler Co.
h. Mansfield Plumbing Products LLC.
i. Peerless Pottery Sales, Inc.
j. St. Thomas Creations.

k. TOTO USA, INC.

2. Bowl:

a. Standards: ASME A112.19.2-2008/CSA B45.1-08 and ASME A112.19.5.
b. Material: Vitreous china.
c. Type: Siphon jet.
d. Style: Flushometer valve.
e. Height: Handicapped/elderly, complying with ICC/ANSI A117.1.
f. Rim Contour: Elongated.
g. Water Consumption: 1.6 gal. (6 L) per flush.
h. Spud Size and Location: NPS 1-1/2 (DN 40); top.
i. Color: White

3. Bowl-to-Drain Connecting Fitting: ASTM A 1045 or ASME A112.4.3.
4. Flushometer Valve: "Selectronic"-2008 Sensor Flushvalve ASSE 1037 ADA Compliant with lithium battery
5. Toilet Seat: Split type
6. Support:

a. Standard: ASME A112.6.1M.
b. Description: Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.
c. Water-Closet Mounting Height: Standard and where note; Handicapped/elderly according to ICC/ANSI A117.1.

2.2 FLUSHOMETER VALVES

A. Solenoid-Actuator, Diaphragm Flushometer Valves:
BASIS-OF-DESIGN PRODUCT: AMERICAN STANDARD "SELECTRONIC SENSOR OPERATED TOILET FLUSH VALVE/ HARD WIRED/ AC POWER/ CHROME/ MODEL # 606B.161 as indicated on Drawings or subject to compliance with requirements, provide comparable product by one of the following:

a. Kohler Co.
b. Moen Incorporated.

2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 125 psig (860 kPa).
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Style: Exposed.

8. Actuator: Solenoid complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
9. Trip Mechanism: **Hard-wired**, electronic sensor complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
10. Consumption: **1.0 gal. (3.8 L)** per flush.
11. Minimum Inlet: **NPS 3/4 (DN 20)**
12. Minimum Outlet: **NPS 3/4 (DN 20)**

2.3 TOILET SEATS

A. Toilet Seats
1. Basis-of-Design Product: Subject to compliance with requirements, provide American Standard or comparable product by one of the following:

    a. American Standard America.
    b. Bemis Manufacturing Company.
    c. Centoco Manufacturing Corporation.
    d. Kohler Co.
    e. Olsonite Seat Co.
    f. TOTO USA, INC.
    g. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Standard: IAPMO/ANSI Z124.5.
3. Material: Plastic.
4. Type: Commercial (Heavy duty).
5. Shape: Elongated rim, open front
6. Hinge: Self-sustaining, check
7. Hinge Material: Noncorroding metal.
8. Color: White

PART 3 - EXECUTION

3.1 INSTALLATION

A. Water-Closet Installation:

1. Install level and plumb according to roughing-in drawings.
2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
3. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:

1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
2. Use carrier supports with waste-fitting assembly and seal.

3. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.

C. Flushometer-Valve Installation:

1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
4. Install actuators in locations that are easy for people with disabilities to reach.

D. Install toilet seats on water closets.

E. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Division 22 Section "Escutcheons for Plumbing Piping."

F. Joint Sealing:

1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.
3. Comply with sealant requirements specified in Division 07 Section "Joint Sealants."

3.2 CONNECTIONS

A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.

B. Comply with water piping requirements specified in Division 22 Section "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Division 22 Section "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.3 ADJUSTING

A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

3.4 CLEANING AND PROTECTION

A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed water closets and fittings.

C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION 224213.13

SECTION 224213.16 - COMMERCIAL URINALS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Urinals.
2. Flushometer valves.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 WALL-HUNG URINALS

A. Urinals Wall hung, back outlet, siphon jet**,** standard and accessible.

1. Basis-of-Design Product: Subject to compliance with requirements, provide American Standard **"PINTBROOK" 0.125 GPF URINAL SYSTEM W/ HARD WIRED-POWERED FLUSH VALVE/ WHITE MODEL # 6002.525.020. REFER TO PLUMBING FIXTURE SCHEDULE/ DRAWING P-100** or comparable product by one of the following:
   a. Kohler Co.
   b. Mansfield Plumbing Products LLC.
   c. Peerless Pottery Sales, Inc.

2. Fixture:

   a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
   b. Material: Vitreous china.
   c. Type: Siphon jet
   d. Strainer or Trapway: Manufacturer's standard strainer with integral trap.
   e. Water Consumption: Low.

f. Spud Size and Location: NPS 3/4 (DN 20); top.
g. Outlet Size and Location: NPS 2 (DN 50); back.
h. Color: White

3. Flushometer Valve: American Standard Selectronic Flush Valve
4. Waste Fitting:

a. Standard: ASME A112.18.2/CSA B125.2 for coupling.
b. Size: NPS 2 (DN 50).

5. Support: ASME A112.6.1M, Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture. Include rectangular, steel uprights.

2.2 URINAL FLUSHOMETER VALVES

A. Solenoid-Actuator, Diaphragm Flushometer Valves:
BASIS-OF-DESIGN PRODUCT: AMERICAN STANDARD "SELECTRONIC SENSOR OPERATED TOILET FLUSH VALVE/ HARD WIRED/ AC POWER/ CHROME/ MODEL # 606B.161 as indicated on Drawings or subject to compliance with requirements, provide comparable product by one of the following:

a. Kohler Co.
b. Moen Incorporated.
c. Sloan Valve Company.
d. TOTO USA, INC.
e. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 125 psig (860 kPa).
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Style: Exposed.
8. Actuator: Solenoid complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
9. Trip Mechanism: **Hard-wired**, electronic sensor complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
10. Consumption: **1.0 gal. (3.8 L)** per flush.
11. Minimum Inlet: **NPS 3/4 (DN 20)**
12. Minimum Outlet: **NPS 3/4 (DN 20)**

EXECUTION

2.3 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before urinal installation.

B. Examine walls and floors for suitable conditions where urinals will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

2.4 INSTALLATION

A. Urinal Installation:

1. Install urinals level and plumb according to roughing-in drawings.
2. Install wall-hung, back-outlet urinals onto waste fitting seals and attached to supports.
3. Install wall-hung, bottom-outlet urinals with tubular waste piping attached to supports.
4. Install accessible, wall-mounted urinals at mounting height for the handicapped/elderly, according to ICC/ANSI A117.1.
5. Install trap-seal liquid in waterless urinals.

B. Support Installation:

1. Install supports, affixed to building substrate, for wall-hung urinals.
2. Use off-floor carriers with waste fitting and seal for back-outlet urinals.
3. Use carriers without waste fitting for urinals with tubular waste piping.
4. Use chair-type carrier supports with rectangular steel uprights for accessible urinals.

C. Flushometer-Valve Installation:

1. Install flushometer-valve water-supply fitting on each supply to each urinal.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible urinals with handle mounted on open side of compartment.
4. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

D. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Division 22 Section "Escutcheons for Plumbing Piping."

E. Joint Sealing:

1. Seal joints between urinals and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to urinal color.

3. Comply with sealant requirements specified in Division 07 Section "Joint Sealants."

2.5 CONNECTIONS

A. Connect urinals with water supplies and soil, waste, and vent piping. Use size fittings required to match urinals.

B. Comply with water piping requirements specified in Division 22 Section "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Division 22 Section "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to urinals, allow space for service and maintenance.

2.6 ADJUSTING

A. Operate and adjust urinals and controls. Replace damaged and malfunctioning urinals, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

2.7 CLEANING AND PROTECTION

A. Clean urinals and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed urinals and fittings.

C. Do not allow use of urinals for temporary facilities unless approved in writing by Owner.

END OF SECTION 224213.16

SECTION 224216.13 - COMMERCIAL LAVATORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Lavatories.
2. Faucets.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.

1. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

a. Servicing and adjustments of automatic faucets.

PART 2 - PRODUCTS

2.1 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

A. Lavatory Vitreous china, wall mounted, with back.
Basis-of-Design Product: **BRADLEY CORPORATION/ WASH-BASE ALL IN ONE (CLEAN/RINSE/DRY) MODEL # LD-5010-1-MOD-WB-TR1/ CHROME** or subject to compliance with requirements, provide comparable product by one of the following:

a. Ferguson Enterprises, Inc.; ProFlo Brand.
b. Kohler Co.
c. Peerless Pottery Sales, Inc.

2. Fixture:

   a. Standard: ASME A112.19.2/CSA B45.1.
   b. Type: For wall hanging.
   c. Nominal Size: Rectangular, 20 by 18 inches
   d. Faucet-Hole Punching: One hole
   e. Faucet-Hole Location: Top.
   f. Color: White
   g. Mounting Material: Chair carrier.

3. Faucet: American Standard Electronic Proximity Faucet with thermostatic Mixing Valve. Model No. 205B.102 (1.5 GPM) and Power Kit
4. Support: ASME A112.6.1M, Type II, concealed-arm lavatory carrier

2.2 SOLID-BRASS, SENSOR/BATTERY OPERATED FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

1. Lavatory Faucets American Standard Electronic Proximity Faucet with thermostatic Mixing Valve. Model No. 205B.102 (1.5 GPM) and Power Kit (solid-brass valve).

2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Bradley Corporation.
   b. Chicago Faucets.
   c. Delta Faucet Company.
   d. Elkay Manufacturing Co.
   e. Kohler Co.

3. Standard: ASME A112.18.1/CSA B125.1.
4. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
5. Body Type: Single hole
6. Body Material: Commercial, solid brass.
7. Finish: Polished chrome plate
8. Maximum Flow Rate: .5 gpm
9. Maximum Flow: 1.5 gal. (0.95 L) per metering cycle.
10. Mounting Type: Deck, concealed
11. Valve Handle(s): SENSOR
12. Spout: Rigid type.
13. Spout Outlet: Aerator
14. Operation: Hands Free

2.3 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Wheel handle

F. Risers:

1. NPS 3/8 (DN 10)
2. Chrome-plated, soft-copper flexible tube riser.

2.4 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/4 (DN 32) offset and straight tailpiece.

C. Trap:

1. Size: NPS 1-1/2 by NPS 1-1/4 (DN 40 by DN 32)
2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch- (0.83-mm-) thick brass tube to wall and chrome-plated, brass or steel wall flange.
3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch- (0.30-mm-) thick stainless-steel tube to wall; and stainless-steel wall flange.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.

B. Examine counters and walls for suitable conditions where lavatories will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install lavatories level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-mounted lavatories.

C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.

D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Division 22 Section "Escutcheons for Plumbing Piping."

E. Seal joints between lavatories and counters and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Division 07 Section "Joint Sealants."

F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Division 22 Section "Plumbing Piping Insulation."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Division 22 Section "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Division 22 Section "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. After completing installation of lavatories, inspect and repair damaged finishes.

B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed lavatories and fittings.

D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION 224216.13

SECTION 224216.16 - COMMERCIAL SINKS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Mop Receptors
2. Sink faucets.
3. Laminar-flow, faucet-spout outlets.
4. Supply fittings.
5. Waste fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 MOP RECEPTORS

A. Enameled Cast Iron, floor mounted Mop Receptor.

1. Manufacturers: Subject to compliance with requirements,
2. Basis-of-Design Product: **AMERICAN STANDARD "FLORWELL" SERVICE SINK MODEL # 7741.000.02** with Glossy porcelain rim guard; or subject to compliance with requirements, provide a comparable product by one of the following:
   a. Kohler K-6710-0
   b. Elkay Manufacturing Co.
   c. Griffin Products, Inc.

3. Fixture:

   a. Standard: ASME A112.19.3/CSA B45.4.
   b. Type: Corner model
   c. Overall Dimensions: 28" x 28" x 13"

4. Waste Fittings:

   a. Standard: ASME A112.18.2/CSA B125.2.
   b. Trap(s):

      1) Size: NPS 2 (DN 50).
      2) Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch- (0.30-mm-) thick stainless-steel tube to wall; and stainless-steel wall flange.

   c. Continuous Waste:

      1) Size: NPS 2 (DN 50)].
      2) Material: Chrome-plated, 0.032-inch- (0.83-mm-) thick brass tube.

5. Mounting: On counter with sealant.

2.2 SINK FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet-spout materials that will be in contact with potable water.

B. Sink Faucets Manual type, two-lever-handle wall mounted mixing valve.
   1. Basis-of-Design Product: Subject to compliance with requirements, **AMERICAN STANDARD RIGID UTILITY SINK FAUCET/ ROUGH CHROME/ MODEL # 8350235.004** or subject to compliance with requirements, provide a comparable product by one of the following:

      a. American Standard America.
      b. Bradley Corporation.
      c. Chicago Faucets.
      d. Elkay Manufacturing Co.
      e. GROHE America, Inc.
      f. Just Manufacturing.
      g. Kohler Co.

   2. Standard: ASME A112.18.1/CSA B125.1.
   3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
   4. Body Type: Widespread wall mounted
   5. Body Material: General-duty, solid brass
   6. Finish: Chrome plated
   7. Maximum Flow Rate: 4.0 gpm (15 L/min.)
   8. Handle(s): (2) Levers
   9. Mounting Type: Back/wall, exposed.
   10. Spout Type: Rigid, solid brass with wall brace
   11. Vacuum Breaker: Not required for hose outlet.
   12. Spout Outlet: Laminar flow with Hose thread according to ASME B1.20.7

2.3 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Wheel handle

F. Risers:

1. NPS 1/2 (DN 15)
2. ASME A112.18.6, braided or corrugated stainless-steel flexible hose.

2.4 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/2 (DN 40) offset and straight tailpiece.

C. Trap:

1. Size: NPS 1-1/2 (DN 40).
2. Material: Chrome-plated, two-piece, cast-brass trap and ground-joint swivel elbow with 0.032-inch- (0.83-mm-) thick brass tube to wall ; and chrome-plated brass or steel wall flange.
3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch- (0.30-mm-) thick stainless-steel tube to wall; and stainless-steel wall flange.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.

B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install sinks level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-hung sinks.

C. Install accessible wall-mounted sinks at handicapped/elderly mounting height according to ICC/ANSI A117.1.

D. Set floor-mounted sinks in leveling bed of cement grout.

E. Install water-supply piping with stop on each supply to each sink faucet.

1. Exception: Use ball, gate, or globe valves if supply stops are not specified with sink. Comply with valve requirements specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
2. Install stops in locations where they can be easily reached for operation.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Division 22 Section "Escutcheons for Plumbing Piping."

G. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Division 07 Section "Joint Sealants."

H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Division 22 Section "Plumbing Piping Insulation."

3.3 CONNECTIONS

A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Division 22 Section "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Division 22 Section "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

A. After completing installation of sinks, inspect and repair damaged finishes.

B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed sinks and fittings.

D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION 224216.16

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet (1000 m) above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.

4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Pre-lubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Equipment supports.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Welding certificates.

1.4 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized carbon steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized carbon steel.

C. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength and vapor barrier.

B. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

C. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

D. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.6 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Non-staining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Install lateral bracing with pipe hangers and supports to prevent swaying.

I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) <**Insert size**> and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

L. Insulated Piping:

1. Attach clamps and spacers to piping.

a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.

5. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.

4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm) .

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 Section "High-Performance Coatings."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applications.

G. Use copper-plated pipe hangers and or stainless-steel attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F (566 deg C), pipes NPS 4 to NPS 24 requiring up to 4 inches (100 mm) of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8
5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30
6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 from two rods if longitudinal movement caused by expansion and contraction might occur.
9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 .
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.

4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated l
   a. Medium (MSS Type 32): 1500 lb (680 kg).

8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529

SECTION 230548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Isolation mounts.
2. Housed spring mounts.
3. Spring hangers.
4. Restraining braces and cables.

1.2 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: A
2. Assigned Seismic Use Group or Building Category as Defined in the IBC: II.

a. Component Importance Factor: 1.5
b. Component Response Modification Factor: 1.5
c. Component Amplification Factor: 1.0

1.3 SUBMITTALS

A. Product Data: For each product indicated.

B. Delegated-Design Submittal: For vibration isolation and seismic-restraint calculations and details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Welding certificates.

D. Qualification Data: For professional engineer.

E. Field quality-control test reports.

1.4 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or pre-approval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ace Mountings Co., Inc.
2. Amber/Booth Company, Inc.
3. Isolation Technology, Inc.
4. Kinetics Noise Control.
5. Mason Industries.
6. Vibration Eliminator Co., Inc.
7. Vibration Mountings & Controls, Inc.

B. Pads arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene

C. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

D. Restrained Mounts ; All-directional mountings with seismic restraint.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.

2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

E. Spring Isolators; Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- (6-mm-) thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig (3447 kPa).
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

F. Housed Spring Mounts; Housed spring isolator with integral seismic snubbers.

1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.
2. Base: Factory drilled for bolting to structure.
3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch (6-mm) travel up or down before contacting a resilient collar.

G. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

2.2 SEISMIC-RESTRAINT DEVICES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Subject to compliance with requirements, provide Amber/Booth Company, Inc.

or a comparable product by one of the following:

2. Cooper B-Line, Inc.; a division of Cooper Industries.
3. Hilti, Inc.
4. Kinetics Noise Control.
5. Mason Industries.
6. TOLCO Incorporated; a brand of NIBCO INC.
7. Unistrut; Tyco International, Ltd.

C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

D. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

E. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

F. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.2 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Comply with requirements in Division 07 Section "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

B. Equipment Restraints:

1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).

C. Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of 40 feet (12 m) o.c., and longitudinal supports a maximum of 80 feet (24 m) o.c.
3. Brace a change of direction longer than 12 feet (3.7 m).

D. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

E. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

F. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid pre-stressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post-connection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 230548

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

    a. Variable-air-volume systems.

2. Balancing Hydronic Piping Systems:

    a. Constant-flow hydronic systems.

1.2 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An entity engaged to perform TAB Work.

1.3 SUBMITTALS

A. Strategies and Procedures Plan: Within [**30**] [**60**] [**90**] <**Insert number**> days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

B. Certified TAB reports.

1.4 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by NEBB or TABB.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by NEBB or TABB.
2. TAB Technician: Employee of the TAB contractor and who is certified by NEBB or TABB as a TAB technician.

B. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

C. TAB Report Forms: Use standard TAB contractor's forms approved by [**Architect**] [**Owner**] [**Construction Manager**] [**Commissioning Authority**].

D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Division 23 Section "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.

L. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

N. Examine system pumps to ensure absence of entrained air in the suction piping.

O. Examine operating safety interlocks and controls on HVAC equipment.

P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.

1. Comply with requirements in ASHRAE 62.1-2004, Section 7.2.2, "Air Balancing."

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "HVAC Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

B. Prepare schematic diagrams of systems' "as-built" piping layouts.

C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:

1. Open all manual valves for maximum flow.
2. Check liquid level in expansion tank.
3. Check makeup water-station pressure gage for adequate pressure for highest vent.
4. Check flow-control valves for specified sequence of operation, and set at indicated flow.
5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
6. Set system controls so automatic valves are wide open to heat exchangers.
7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.5 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

A. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:

1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.

a. If impeller sizes must be adjusted to achieve pump performance, obtain approval from Commissioning Authority and comply with requirements in Division 23 Section "Hydronic Pumps."

2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.

a. Monitor motor performance during procedures and do not operate motors in overload conditions.

3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
4. Report flow rates that are not within plus or minus 10 percent of design.

B. Measure flow at all automatic flow control valves to verify that valves are functioning as designed.

C. Measure flow at all pressure-independent characterized control valves, with valves in fully open position, to verify that valves are functioning as designed.

D. Set calibrated balancing valves, if installed, at calculated pre-settings.

E. Measure flow at all stations and adjust, where necessary, to obtain first balance.

1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

F. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.

G. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:

1. Determine the balancing station with the highest percentage over indicated flow.
2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
3. Record settings and mark balancing devices.

H. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.

I. Measure the differential-pressure-control-valve settings existing at the conclusion of balancing.

J. Check settings and operation of each safety valve. Record settings.

3.6

1. Comply with requirements in ASHRAE 62.1-2004, Section 7.2.2, "Air Balancing."

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "HVAC Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in [**inch-pound (IP)**] [**and**] [**metric (SI)**] units.

3.7 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Division 23 Section "Metal Ducts."

3.8 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
b. Measure static pressure directly at the fan outlet or through the flexible connection.
c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
6. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, sub-main ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of sub-main and branch ducts.

a. Where sufficient space in sub-main and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Re-measure each sub-main and branch duct after all have been adjusted. Continue to adjust sub-main and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.9 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS (NOT USED)

3.10 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

B. Prepare schematic diagrams of systems' "as-built" piping layouts.

C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:

1. Open all manual valves for maximum flow.
2. Check liquid level in expansion tank.
3. Check makeup water-station pressure gage for adequate pressure for highest vent.
4. Check flow-control valves for specified sequence of operation, and set at indicated flow.
5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
6. Set system controls so automatic valves are wide open to heat exchangers.
7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.11 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

A. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:

1. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.

a. Monitor motor performance during procedures and do not operate motors in overload conditions.

2. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
3. Report flow rates that are not within plus or minus 10 percent of design.

B. Measure flow at all automatic flow control valves to verify that valves are functioning as designed.

C. Measure flow at all pressure-independent characterized control valves, with valves in fully open position, to verify that valves are functioning as designed.

D. Set calibrated balancing valves, if installed, at calculated pre-settings.

E. Measure flow at all stations and adjust, where necessary, to obtain first balance.

1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

F. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.

G. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:

1. Determine the balancing station with the highest percentage over indicated flow.
2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
3. Record settings and mark balancing devices.

H. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.

I. Measure the differential-pressure-control-valve settings existing at the conclusion of balancing.

J. Check settings and operation of each safety valve. Record settings.

3.12 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

3.13 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.

4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.14 PROCEDURES FOR CHILLERS (NOT USED)

3.15 PROCEDURES FOR COOLING TOWERS (NOT USED)

3.16 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record compressor data.

3.17 PROCEDURES FOR BOILERS

A. Hydronic Boilers: Measure and record entering- and leaving-water temperatures and water flow.

3.18 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.

1. Measure and record the operating speed, airflow, and static pressure of each fan.
2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
3. Check the refrigerant charge.
4. Check the condition of filters.
5. Check the condition of coils.
6. Check the operation of the drain pan and condensate-drain trap.
7. Check bearings and other lubricated parts for proper lubrication.
8. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.

B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:

1. New filters are installed.

2. Coils are clean and fins combed.
3. Drain pans are clean.
4. Fans are clean.
5. Bearings and other parts are properly lubricated.
6. Deficiencies noted in the preconstruction report are corrected.

C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.

1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.
2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
3. If calculations increase or decrease the air-flow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
4. Balance each air outlet.

3.19 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent
2. Air Outlets and Inlets: Plus or minus 10 percent
3. Heating-Water Flow Rate: Plus or minus 10 percent
4. Cooling-Water Flow Rate: Plus or minus 10 percent

3.20 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.21 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

3.22 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 230713 - DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply and outdoor air.
2. Indoor, concealed return located in unconditioned space.
3. Indoor, concealed exhaust between isolation damper and penetration of building exterior.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
3. Detail application of field-applied jackets.
4. Detail application at linkages of control devices.

1.3 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type II with factory-applied vinyl jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide available products that may be incorporated into the Work include, but are not limited to, the following:

a. CertainTeed Corp.; SoftTouch Duct Wrap.
b. Johns Manville; Microlite.
c. Owens Corning; SOFTR All-Service Duct Wrap.

G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide available products that may be incorporated into the Work include, but are not limited to, the following:

a. CertainTeed Corp.; Commercial Board.
b. Fibrex Insulations Inc.; FBX.
c. Johns Manville; 800 Series Spin-Glas.
d. Owens Corning; Fiberglas 700 Series.

2.2 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a **2**-hour fire rating by an NRTL acceptable to authorities having jurisdiction.

1. Products: Subject to compliance with requirements, **provide available products that may be incorporated into the Work include, but are not limited to, the following**:

a. CertainTeed Corp.; FlameChek.
b. Johns Manville; Firetemp Wrap.
c. Thermal Ceramics; FireMaster Duct Wrap.
d. 3M; Fire Barrier Wrap Products.
e. Unifrax Corporation; FyreWrap.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
    b. Eagle Bridges - Marathon Industries; 225.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
    d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Use adhesive that complies 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," including 2004 Addenda.

C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
    b. Eagle Bridges - Marathon Industries; 225.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
    d. Mon-Eco Industries, Inc.; 22-25.

D. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Dow Corning Corporation; 739, Dow Silicone.
    b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
    c. P.I.C. Plastics, Inc.; Welding Adhesive.
    d. Speedline Corporation; Polyco VP Adhesive.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Use adhesive that complies 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," including 2004 Addenda.

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
   b. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirements, provide available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
   b. Eagle Bridges - Marathon Industries; 550.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
   d. Mon-Eco Industries, Inc.; 55-50.
   e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.5 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
    b. Eagle Bridges - Marathon Industries; 405.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
    d. Mon-Eco Industries, Inc.; 44-05.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: Aluminum.
6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Use sealants that 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," including 2004 Addenda.

B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: White.
6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Use sealants that 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," including 2004 Addenda.

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms (0.86 metric perm) when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products: Subject to compliance with requirements, provide available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Johns Manville; Zeston.
   b. P.I.C. Plastics, Inc.; FG Series.
   c. Proto Corporation; LoSmoke.
   d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White

2.8 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide available products that may be incorporated into the Work include, but are not limited to, the following:

   a. ABI, Ideal Tape Division; 428 AWF ASJ.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
   c. Compac Corporation; 104 and 105.
   d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches (75 mm).
3. Thickness: 11.5 mils (0.29 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, **provide available products that may be incorporated into the Work include, but are not limited to, the following**:

   a. ABI, Ideal Tape Division; 491 AWF FSK.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
   c. Compac Corporation; 110 and 111.
   d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches (75 mm).
3. Thickness: 6.5 mils (0.16 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, **provide available products that may be incorporated into the Work include, but are not limited to, the following**:

   a. ABI, Ideal Tape Division; 370 White PVC tape.
   b. Compac Corporation; 130.
   c. Venture Tape; 1506 CW NS.

2. Width

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide available products that may be incorporated into the Work include, but are not limited to, the following:

   a. ABI, Ideal Tape Division; 488 AWF.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
   c. Compac Corporation; 120.
   d. Venture Tape; 3520 CW.

2. Width: 2 inches (50 mm).
3. Thickness: 3.7 mils (0.093 mm).
4. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

2.9 SECUREMENTS

A. Aluminum Bands: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) wide with wing seal or closed seal.

1. Products: Subject to compliance with requirements, provide available products that may be incorporated into the Work include, but are not limited to, the following:

    a. ITW Insulation Systems; Gerrard Strapping and Seals.
    b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.

B. Insulation Pins and Hangers:

1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

    a. Products: Subject to compliance with requirements, provide available products that may be incorporated into the Work include, but are not limited to, the following:

        1) AGM Industries, Inc.; Tactoo Perforated Base Insul-Hangers.
        2) GEMCO; Perforated Base.
        3) Midwest Fasteners, Inc.; Spindle.

    b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
    c. Spindle: Aluminum fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
    d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

    a. Products: Subject to compliance with requirements, provide available products that may be incorporated into the Work include, but are not limited to, the following:

        1) AGM Industries, Inc.; RC-150.
        2) GEMCO; R-150.
        3) Midwest Fasteners, Inc.; WA-150.
        4) Nelson Stud Welding; Speed Clips.

    b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

C. Wire: 0.062-inch (1.6-mm) soft-annealed, galvanized steel.

2.10 CORNER ANGLES

A. Aluminum Corner Angles: 0.040 inch (1.0 mm) thick, minimum 1 by 1 inch (25 by 25 mm), aluminum according to ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches (100 mm) o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.3 PENETRATIONS

A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
4. Seal jacket to wall flashing with flashing sealant.

B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches (50 mm).

3.4 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for **50** percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
    b. On duct sides with dimensions larger than 18 inches (450 mm), place pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not over-compress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches (75 mm).
5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.

7. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches (75 mm).

8. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
9. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.

3.5 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

3.6 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

B. Insulate duct access panels and doors to achieve same fire rating as duct.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to 4 location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket 1-1/2 inches (38 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.

B. Concealed, Return-Air Duct and Plenum Insulation: Mineral-fiber blanket 1-1/2 inches (38 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.

C. Concealed, Exhaust-Air Duct and Plenum Insulation: Mineral-fiber blanket, 1-1/2 inches (38 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.

D. Exposed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket 1-1/2 inches (38 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.

E. Exposed, Return-Air Duct and Plenum Insulation: Mineral-fiber blanket, 1-1/2 inches (38 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.

END OF SECTION 230713

SECTION 230800 - COMMISSIONING OF HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes commissioning process requirements for HVAC systems, assemblies, and equipment.

B. Related Sections:

1. Division 01 Section "General Commissioning Requirements" for general commissioning process requirements.

1.2 DEFINITIONS

A. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

B. CxA: Commissioning Authority.

C. HVAC: Heating, Ventilating, Air Conditioning.

D. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.3 CONTRACTOR'S RESPONSIBILITIES

A. Perform commissioning tests at the direction of the CxA.

B. Attend construction phase controls coordination meeting.

C. Attend testing, adjusting, and balancing review and coordination meeting.

D. Participate in HVAC systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.

E. Provide information requested by the CxA for final commissioning documentation.

F. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.

1.4 CxA'S RESPONSIBILITIES

A. Provide Project-specific construction checklists and commissioning process test procedures for actual HVAC systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.

B. Direct commissioning testing.

C. Verify testing, adjusting, and balancing of Work are complete.

D. Provide test data, inspection reports, and certificates in Systems Manual.

1.5 COMMISSIONING DOCUMENTATION

A. Provide the following information to the CxA for inclusion in the commissioning plan:

1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
3. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for HVAC&R systems, assemblies, equipment, and components to be verified and tested.
4. Certificate of readiness, signed by the Contractor, certifying that HVAC&R systems, assemblies, equipment, components, and associated controls are ready for testing.
5. Certificate of completion certifying that installation, prestart checks, and startup procedures have been completed.
6. Certificate of readiness certifying that HVAC&R systems, subsystems, equipment, and associated controls are ready for testing.
7. Test and inspection reports and certificates.
8. Corrective action documents.
9. Verification of testing, adjusting, and balancing reports.

1.6 SUBMITTALS

A. Certificates of readiness.

B. Certificates of completion of installation, prestart, and startup activities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TESTING PREPARATION

A. Certify that HVAC systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify that HVAC instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.

C. Certify that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.

D. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

E. Inspect and verify the position of each device and interlock identified on checklists.

F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.

G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.2 TESTING AND BALANCING VERIFICATION

A. Prior to performance of testing and balancing Work, provide copies of reports, sample forms, checklists, and certificates to the CxA.

B. Notify the CxA at least 10 days in advance of testing and balancing Work, and provide access for the CxA to witness testing and balancing Work.

C. Provide technicians, instrumentation, and tools to verify testing and balancing of HVAC systems at the direction of the CxA.

1. The CxA will notify testing and balancing Contractor 10 days in advance of the date of field verification. Notice will not include data points to be verified.
2. The testing and balancing Subcontractor shall use the same instruments (by model and serial number) that were used when original data were collected.
3. Failure of an item includes, other than sound, a deviation of more than 10 percent. Failure of more than 10 percent of selected items shall result in rejection of final testing, adjusting, and balancing report. For sound pressure readings, a deviation of 3 dB shall result in rejection of final testing. Variations in background noise must be considered.
4. Remedy the deficiency and notify the CxA so verification of failed portions can be performed.

3.3 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.

B. Scope of HVAC testing shall include entire HVAC installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space. Testing shall include measuring capacities and effectiveness of operational and control functions.

C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

D. The CxA along with the HVAC Contractor testing and balancing Subcontractor shall prepare detailed testing plans, procedures, and checklists for HVAC systems, subsystems, and equipment.

E. Tests will be performed using design conditions whenever possible.

F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

G. The CxA may direct that set points be altered when simulating conditions is not practical.

H. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.

I. If tests cannot be completed because of a deficiency outside the scope of the HVAC system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

J. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.4 HVAC SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

A. Boiler Testing and Acceptance Procedures: Testing requirements are specified in Division 23 boiler Sections. Provide submittals, test data, inspector record, and boiler certification to the CxA.

B. HVAC&R Instrumentation and Control System Testing: Field testing plans and testing requirements are specified in Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls." Assist the CxA with preparation of testing plans.

C. Pipe system cleaning, flushing, hydrostatic tests, and chemical treatment requirements are specified in Division 23 piping Sections. HVAC Contractor shall prepare a pipe system cleaning, flushing, and hydrostatic testing plan. Provide cleaning, flushing, testing, and treating plan and final reports to the CxA. Plan shall include the following:

1. Sequence of testing and testing procedures for each section of pipe to be tested, identified by pipe zone or sector identification marker. Markers shall be keyed to Drawings for

each pipe sector, showing the physical location of each designated pipe test section. Drawings keyed to pipe zones or sectors shall be formatted to allow each section of piping to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.

2. Description of equipment for flushing operations.
3. Minimum flushing water velocity.
4. Tracking checklist for managing and ensuring that all pipe sections have been cleaned, flushed, hydrostatically tested, and chemically treated.

D. Energy Supply System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of hot-water systems and equipment at the direction of the CxA. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.

E. Refrigeration System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of chillers, cooling towers, refrigerant compressors and condensers, heat pumps, and other refrigeration systems. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.

F. HVAC&R Distribution System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of air, steam, and hydronic distribution systems; special exhaust; and other distribution systems, including HVAC terminal equipment and unitary equipment.

G. Vibration and Sound Tests: Provide technicians, instrumentation, tools, and equipment to test performance of vibration isolation and seismic controls.

END OF SECTION 230800

SECTION 232113 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:

1. Hot-water heating piping.

1.2 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature:

1. Hot-Water Heating Piping: psig (kPa) of existing system at 200 deg F (93 deg C) .

1.3 SUBMITTALS

A. Product Data: For each type of the following:

1. Pressure-seal fittings.
2. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
3. Hydronic specialties.

B. Shop Drawings: Detail, at 1/4 (1:50) scale, the piping layout, fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to the building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

C. Field quality-control test reports.

D. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L (ASTM B 88M, Type B)

B. Annealed-Temper Copper Tubing: ASTM B 88, Type K (ASTM B 88M, Type A).

C. DWV Copper Tubing: ASTM B 306, Type DWV.

D. Wrought-Copper Fittings: ASME B16.22.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Anvil International, Inc.
   b. S. P. Fittings; a division of Star Pipe Products.
   c. Victaulic Company.

2. Grooved-End Copper Fittings: ASTM B 75 (ASTM B 75M), copper tube or ASTM B 584, bronze casting.
3. Grooved-End-Tube Couplings: Rigid pattern, unless otherwise indicated; gasketed fitting. Ductile-iron housing with keys matching pipe and fitting grooves, pre-lubricated EPDM gasket rated for minimum 230 deg F (110 deg C) for use with housing, and steel bolts and nuts.

E. Wrought-Copper Unions: ASME B16.22.

2.2 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; type, grade, and wall thickness as indicated in Part 3 "Piping Applications" Article.

B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in Part 3 "Piping Applications" Article.

C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in Part 3 "Piping Applications" Article.

D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in Part 3 "Piping Applications" Article.

E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in Part 3 "Piping Applications" Article.

F. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.

2. End Connections: Butt welding.
3. Facings: Raised face.

G. Grooved Mechanical-Joint Fittings and Couplings:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Anvil International, Inc.
b. Central Sprinkler Company; a division of Tyco Fire & Building Products.
c. National Fittings, Inc.
d. S. P. Fittings; a division of Star Pipe Products.
e. Victaulic Company.

2. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47/A 47M, Grade 32510 malleable iron; ASTM A 53/A 53M, Type F, E, or S, Grade B fabricated steel; or ASTM A 106, Grade B steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
3. Couplings: Ductile- or malleable-iron housing and synthetic rubber gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

2.3 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

F. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

2.4 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Capitol Manufacturing Company.
   b. Central Plastics Company.
   c. Hart Industries International, Inc.
   d. Jomar International Ltd.
   e. Matco-Norca, Inc.
   f. McDonald, A. Y. Mfg. Co.
   g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   h. Wilkins; a Zurn company.

2. Description:

   a. Standard: ASSE 1079.
   b. Pressure Rating: 125 psig (860 kPa) minimum at 250 psig (1725 kPa).
   c. End Connections: Solder-joint copper alloy and threaded ferrous.

2.5 VALVES

A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Division 23 Section "General-Duty Valves for HVAC Piping."

B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Division 23 Section "Instrumentation and Control for HVAC."

C. Bronze, Calibrated-Orifice, Balancing Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Armstrong Pumps, Inc.
   b. Bell & Gossett Domestic Pump; a division of ITT Industries.
   c. Flow Design Inc.
   d. Gerand Engineering Co.
   e. Griswold Controls.
   f. Taco.
   g. Tour & Andersson; available through Victaulic Company.

2. Body: Bronze, ball or plug type with calibrated orifice or venturi.
3. Ball: Brass or stainless steel.

4. Plug: Resin.
5. Seat: PTFE.
6. End Connections: Threaded or socket.
7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
8. Handle Style: Lever, with memory stop to retain set position.
9. CWP Rating: Minimum 125 psig (860 kPa).
10. Maximum Operating Temperature: 250 deg F (121 deg C).

D. Diaphragm-Operated, Pressure-Reducing Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Amtrol, Inc.
    b. Armstrong Pumps, Inc.
    c. Bell & Gossett Domestic Pump; a division of ITT Industries.
    d. Conbraco Industries, Inc.
    e. Spence Engineering Company, Inc.
    f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Body: Bronze or brass.
3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Low inlet-pressure check valve.
8. Inlet Strainer: removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.
10. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

E. Diaphragm-Operated Safety Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Amtrol, Inc.
    b. Armstrong Pumps, Inc.
    c. Bell & Gossett Domestic Pump; a division of ITT Industries.
    d. Conbraco Industries, Inc.
    e. Spence Engineering Company, Inc.
    f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Body: Bronze or brass.
3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Wetted, Internal Work Parts: Brass and rubber.

8. Inlet Strainer: removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.
10. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

2.6 CHEMICAL TREATMENT

A. Bypass Chemical Feeder: Welded steel construction; 125-psig (860-kPa) working pressure; 5-gal. (19-L) capacity; with fill funnel and inlet, outlet, and drain valves.

1. Chemicals: Specially formulated, based on analysis of makeup water, to prevent accumulation of scale and corrosion in piping and connected equipment.

B. Ethylene and Propylene Glycol: Industrial grade with corrosion inhibitors and environmental-stabilizer additives for mixing with water in systems indicated to contain antifreeze or glycol solutions.

2.7 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig (860 kPa).

B. Expansion fittings are specified in Division 23 Section "Expansion Fittings and Loops for HVAC Piping."

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Hot-water heating piping, aboveground, NPS 2 (DN 50) and smaller, shall be any of the following:

1. Type L drawn-temper copper tubing, wrought-copper fittings, and pressure-seal joints.
2. Schedule 40 steel pipe; Class 150, malleable-iron fittings; cast-iron flanges and flange fittings; and threaded joints.

B. Hot-water heating piping, aboveground, NPS 2-1/2 (DN 65) and larger shall be any of the following:

1. Type L (B) drawn-temper copper tubing, wrought-copper fittings, and brazed joints.

2. Schedule 30steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
3. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.

C. Air-Vent Piping:

1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.
2. Outlet: Type K (A), annealed-temper copper tubing with soldered or flared joints.

D. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.

3.2 VALVE APPLICATIONS

A. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.

B. Install calibrated-orifice, balancing valves at each branch connection to return main.

C. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.

D. Install check valves at each pump discharge and elsewhere as required to control flow direction.

E. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; and pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

F. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

3.3 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

L. Install drains, consisting of a tee fitting, NPS 3/4 (DN 20) ball valve, and short NPS 3/4 (DN 20) threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

O. Install branch connections to mains using mechanically formed tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

P. Install valves according to Division 23 Section "General-Duty Valves for HVAC Piping."

Q. Install unions in piping, NPS 2 (DN 50) and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

R. Install flanges in piping, NPS 2-1/2 (DN 65) and larger, at final connections of equipment and elsewhere as indicated.

S. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 (DN 20) nipple and ball valve in blowdown connection of strainers NPS 2 (DN 50) and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2 (DN 50).

T. Install expansion loops, expansion joints, anchors, and pipe alignment guides as specified in Division 23 Section "Expansion Fittings and Loops for HVAC Piping."

U. Identify piping as specified in Division 23 Section "Identification for HVAC Piping and Equipment."

V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."

W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."

X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 23 Section "Escutcheons for HVAC Piping."

3.4 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with the following requirements for maximum spacing of supports.

B. Seismic restraints are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

C. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet (6 m) long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet (6 m) or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet (6 m) or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.

D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4 (DN 20): Maximum span, 6 feet (2.1 m); minimum rod size, 1/4 inch (6.4 mm).
2. NPS 1 (DN 25): Maximum span, 6 feet (2.1 m); minimum rod size, 1/4 inch (6.4 mm).
3. NPS 1-1/2 (DN 40): Maximum span, 8 feet (2.7 m); minimum rod size, 3/8 inch (10 mm).
4. NPS 2 (DN 50): Maximum span, 8 feet (3 m); minimum rod size, 3/8 inch (10 mm).
5. NPS 2-1/2 (DN 65): Maximum span, 8 feet (3.4 m); minimum rod size, 3/8 inch (10 mm).

E. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4 (DN 20): Maximum span, 5 feet (1.5 m); minimum rod size, 1/4 inch (6.4 mm).
2. NPS 1 (DN 25): Maximum span, 6 feet (1.8 m); minimum rod size, 1/4 inch (6.4 mm).
3. NPS 1-1/2 (DN 40): Maximum span, 8 feet (2.4 m); minimum rod size, 3/8 inch (10 mm).
4. NPS 2 (DN 50): Maximum span, 8 feet (2.4 m); minimum rod size, 3/8 inch (10 mm).
5. NPS 2-1/2 (DN 65): Maximum span, 8 feet (2.7 m); minimum rod size, 3/8 inch (10 mm).

3.5 PIPE JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

G. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.

H. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.

3.6 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Install piping from boiler air outlet, air separator, or air purger to expansion tank with a 2 percent upward slope toward tank.

C. Install in-line air separators in pump suction. Install drain valve on air separators NPS 2 (DN 50) and larger.

D. Install bypass chemical feeders in each hydronic system where indicated, in upright position with top of funnel not more than 48 inches (1200 mm) above the floor. Install feeder in minimum NPS 3/4 (DN 20) bypass line, from main with full-size, full-port, ball valve in the main between bypass connections. Install NPS 3/4 (DN 20) pipe from chemical feeder drain, to nearest equipment drain and include a full-size, full-port, ball valve.

1. Install tank fittings that are shipped loose.
2. Support tank from floor or structure above with sufficient strength to carry weight of tank, piping connections, fittings, plus tank full of water. Do not overload building components and structural members.

3.7 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.

D. Install ports for pressure gages and thermometers at coil inlet and outlet connections according to Division 23 Section "Meters and Gages for HVAC Piping."

3.8 CHEMICAL TREATMENT

A. Fill system with fresh water and add liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products from piping. Circulate solution for a minimum of 24 hours, drain, clean strainer screens, and refill with fresh water.

B. Add initial chemical treatment and maintain water quality in ranges noted above for the first year of operation.

C. Fill systems indicated to have antifreeze or glycol solutions with the following concentrations:

1. Hot-Water Heating Piping: Minimum percent **ethylene** glycol.

3.9 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, un-insulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

END OF SECTION 232113

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rectangular ducts and fittings.
2. Round ducts and fittings.
3. Sheet metal materials.
4. Sealants and gaskets.
5. Hangers and supports.
6. Seismic-restraint devices.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."
1. Seismic Hazard Level B: Seismic force to weight ratio, 0.30.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.

10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment**,** seismic restraints, and vibration isolation.
13.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations**,** including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports and seismic restraints

D. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.

E. Welding certificates.

1.4 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Lindab Inc.
    b. McGill AirFlow LLC.
    c. SEMCO Incorporated.
    d. Sheet Metal Connectors, Inc.
    e. Spiral Manufacturing Co., Inc.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches (1524 mm) in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger Than 90 inches (2286 mm) in diameter with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60 (Z180)
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Aluminum Sheets: Comply with ASTM B 209 (ASTM B 209M) Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

E. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

F. Tie Rods: Galvanized steel, 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.4 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 4 inches (102 mm)
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
11. Sealant 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."

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealant 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."

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg (0.14 L/s per sq. m at 250 Pa) and shall be rated for 10-inch wg (2500-Pa) static-pressure class, positive or negative.

2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.5 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electro-galvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.6 SEISMIC-RESTRAINT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper B-Line, Inc.; a division of Cooper Industries.
2. Ductmate Industries, Inc.
3. Hilti Corp.
4. Kinetics Noise Control.
5. Loos & Co.; Cableware Division.
6. Mason Industries.
7. TOLCO; a brand of NIBCO INC.
8. Unistrut Corporation; Tyco International, Ltd.

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.

D. Restraint Cables: ASTM A 603, galvanized steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.

E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

F. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches (38 mm).

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches (610 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."

B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install cable restraints on ducts that are suspended with vibration isolators.

E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction.

F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.

G. Drilling for and Setting Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid pre-stressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.

4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.6 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

B. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative 3-inch wg (750 Pa)
b. Minimum SMACNA Seal Class: **A** if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: **12**

C. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel

a. Exposed to Airstream: Match duct material
b. Not Exposed to Airstream: Galvanized

2. Stainless-Steel Ducts:

a. Exposed to Airstream: Match duct material.

D. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Velocity 1000 fpm (5 m/s) or Lower:

1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
2) Mitered Type RE 4 without vanes.

E. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: Spin in.

2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

a. Velocity 1000 fpm (5 m/s) or Lower: 90-degree tap.

END OF SECTION 233113

SECTION 233416 - CENTRIFUGAL HVAC FANS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: For each product.

1. Forward-curved centrifugal fans.

1.2 SUBMITTALS

A. Action Submittals: Product data for each type of product.

B. Informational Submittals: Field quality-control reports.

C. Closeout Submittals: Operation and maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AMCA Compliance: Comply with AMCA performance requirements and bear the AMCA-Certified Ratings Seal.

B. Capacities and Characteristics:

1. Total Airflow: 400 -1700 cfm (L/s).
2. External Static Pressure: 3 inches wg (Pa).
3. Class: **I**
4. Arrangement: manufacture’s standard discharge configuration.
5. Housing Material: galvanized steel
6. Wheel Size (Diameter): range: 8” – 20”
7. Wheel Material: galvanized steel
8. Brake Horsepower: <Insert value>.
9. Drive Type: Belt
10. Max RPM 546
11. Motor:

a. Electrical Characteristics:

1) Motor Size: manufacturer’s standard for specified CFM rating
2) Volts: **120**
3) Phase: **Single**
4) Hertz: 60.

12. Vibration Isolators: Restrained spring isolators having a static deflection of 1 inch (25 mm)
13. Spark-Resistance Class: A

2.2 FORWARD-CURVED CENTRIFUGAL FANS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings (Greenheck BDF-80) or comparable product by one of the following:

1. Acme Engineering & Mfg. Corp.
2. Central Blower Company.
3. Howden Buffalo Inc.
4. Lau Industries.
5. New York Blower Company (The).

B. Description:

1. Factory-fabricated, -assembled, -tested, and -finished, belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor, drive assembly, and support structure.
2. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations.
3. Factory-installed and -wired disconnect switch.

C. Housings:

1. Formed panels to make curved-scroll housings with shaped cutoff.
2. Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.
3. Horizontally split, bolted-flange housing.
4. Spun inlet cone with flange.
5. Outlet flange.

D. Forward-Curved Wheels:

1. Black-enameled or galvanized-steel construction with inlet flange, backplate, shallow blades with inlet and tip curved forward in direction of airflow.
2. Mechanically secured to flange and backplate; cast-steel hub swaged to backplate and fastened to shaft with set screws.

E. Shafts:

1. Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with adjustable alignment and belt tensioning.
2. Turned, ground, and polished hot-rolled steel with keyway. Ship with protective coating of lubricating oil.
3. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

F. Grease-Lubricated Shaft Bearings:

1. Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing.

G. Belt Drives:

1. Factory mounted, with adjustable alignment and belt tensioning.
2. Service Factor Based on Fan Motor Size: 1.5.
3. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
4. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
5. Belts: Oil resistant, non-sparking, and non-static; matched sets for multiple belt drives.
6. Belt Guards: Fabricate to comply with OSHA and SMACNA requirements of diamond-mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
7. Motor Mount: Adjustable for belt tensioning.

H. Accessories:

1. Access for Inspection, Cleaning, and Maintenance: Comply with requirements in ASHRAE 62.1.
2. Scroll Drain Connection: NPS 1 (DN 25) steel pipe coupling welded to low point of fan scroll.
3. Companion Flanges: Rolled flanges for duct connections of same material as housing.
4. Variable Inlet Vanes: With blades supported at both ends with two permanently lubricated bearings of same material as housing. Variable mechanism terminating in single control lever with control shaft for double-width fans.
5. Discharge Dampers: Assembly with parallel blades constructed of two plates formed around and to shaft, channel frame, and sealed ball bearings; with blades linked outside of airstream to single control lever of same material as housing.
6. Inlet Screens: Grid screen of same material as housing.
7. Shaft Cooler: Metal disk between bearings and fan wheel, designed to dissipate heat from shaft.
8. Spark-Resistant Construction: AMCA 99.
9. Shaft Seals: Airtight seals installed around shaft on drive side of single-width fans.
10. Weather Cover: Enameled-steel sheet with ventilation slots, bolted to housing.

2.3 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install centrifugal fans level and plumb.

B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

D. Equipment Mounting: Install centrifugal fans on cast-in-place concrete equipment base(s) using restrained spring isolators.

1. Minimum Deflection: 1/4 inch (6 mm)

E. Equipment Mounting: Install centrifugal fans using restrained spring isolators.

F. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

1. Minimum Deflection: 1/4 inch (6 mm)
2. Comply with requirements in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation and seismic-control devices.

G. Install units with clearances for service and maintenance.

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."

B. Install ducts adjacent to fans to allow service and maintenance.

C. Install piping from scroll drain connection, with trap with seal equal to 1.5 times specified static pressure, to nearest floor drain with pipe sizes matching the drain connection.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.

4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. See Division 23 Section "Testing, Adjusting, and Balancing For HVAC" for testing, adjusting, and balancing procedures.
10. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Controls and equipment will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 233416

SECTION 238126 - SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes split-system air-conditioning units consisting of separate evaporator-fan and compressor-condenser components.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

C. Operation and maintenance data.

D. Warranty: Sample of special warranty.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
2. Applicable requirements in ASHRAE 62.1-2004, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - " Procedures," and Section 7 - "Construction and System Start-Up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

a. For Compressor: Five year(s) from date of Substantial Completion.
b. For Parts: Five year(s) from date of Substantial Completion.
c. For Labor: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Carrier Corporation; Home Comfort and HVAC Building & Industrial Systems.
2. Friedrich Air Conditioning Company.
3. Lennox International Inc.
4. Mitsubishi Electric & Electronics USA, Inc.; HVAC Advanced Products Division.
5. Trane; a business of American Standard companies.
6. YORK; a Johnson Controls company.

2.2 INDOOR UNITS 5 TONS (18 kW) OR LESS

A. Concealed Evaporator-Fan Components:

1. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.
2. Insulation: Faced, glass-fiber duct liner.
3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 210/240.
4. Water Coil: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm); leak tested to 300 psig (2070 kPa) underwater; with a two-position control valve.
5. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements; with refractory ceramic support bushings, automatic-reset thermal cutout, built-in magnetic contactors, manual-reset thermal cutout, airflow proving device, and one-time fuses in terminal box for overcurrent protection.
6. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.
7. Fan Motors:

    a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
    b. Multi-tapped, multispeed with internal thermal protection and permanent lubrication.
    c. Wiring Terminations: Connect motor to chassis wiring with plug connection.

8. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
9. Filters: Permanent, cleanable.
10. Condensate Drain Pans:

    a. Fabricated with two percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.

        1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1-2004
        2) Depth: A minimum of 2 inches (50 mm) deep.

    b. Double-wall, galvanized steel sheet with space between walls filled with foam insulation and moisture-tight seal.
    c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.

        1) Minimum Connection Size: NPS 1 (DN 25)

    d. Pan-Top Surface Coating: Asphaltic waterproofing compound.

B. Floor-Mounted, Evaporator-Fan Components:

1. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect.

    a. Discharge Grille: Steel with surface-mounted frame
    b. Insulation: Faced, glass-fiber duct liner.
    c. Drain Pans: Galvanized steel, with connection for drain; insulated.

2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 210/240.
3. Water Coil: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm); leak tested to 300 psig (2070 kPa) underwater; with a two-position control valve.
4. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements; with refractory ceramic support bushings, automatic-reset thermal cutout, built-in magnetic contactors, manual-reset thermal cutout, airflow proving device, and one-time fuses in terminal box for overcurrent protection.
5. Fan: Direct drive, centrifugal[, with power-induced outside air].
6. Fan Motors:

    a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
    b. Multi-tapped, multispeed with internal thermal protection and permanent lubrication.

7. Air Filtration Section:

    a. General Requirements for Air Filtration Section:

1) Comply with NFPA 90A.
2) Minimum Arrestance: According to ASHRAE 52.1 and MERV according to ASHRAE 52.2.
3) Filter-Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.

b. Disposable Panel Filters:

1) Factory-fabricated, viscous-coated, flat-panel type.
2) Thickness: 1 inch (25 mm)
3) Arrestance according to ASHRAE 52.1: 80
4) Merv according to ASHRAE 52.2: 5
5) Media: Interlaced glass fibers sprayed with nonflammable adhesive and antimicrobial agent.
6) Frame: Galvanized steel, with metal grid on outlet side, steel rod grid on inlet side, and hinged; with pull and retaining handles.

C. Wall-Mounted, Evaporator-Fan Components:

1. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.
2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 210/240.
3. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements; with refractory ceramic support bushings, automatic-reset thermal cutout, built-in magnetic contactors, manual-reset thermal cutout, airflow proving device, and one-time fuses in terminal box for overcurrent protection.
4. Fan: Direct drive, centrifugal.
5. Fan Motors:

a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
b. Multi-tapped, multispeed with internal thermal protection and permanent lubrication.
c. Enclosure Type: Totally enclosed, fan cooled.
d. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
e. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.
f. Mount unit-mounted disconnect switches on exterior of unit.

6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
7. Condensate Drain Pans:

a. Fabricated with percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.

1) Length: Extend drain pan downstream from leaving face **to** comply with ASHRAE 62.1-2004
2) Depth: A minimum of 1 inch (25 mm) deep.

b. Double-wall, galvanized-steel sheet with space between walls filled with foam insulation and moisture-tight seal.

c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on [one end] [both ends] of pan.

1) Minimum Connection Size: NPS 1 (DN 25).

d. Pan-Top Surface Coating: Asphaltic waterproofing compound.

8. Air Filtration Section:

a. General Requirements for Air Filtration Section:

1) Comply with NFPA 90A.
2) Minimum Arrestance: According to ASHRAE 52.1 and MERV according to ASHRAE 52.2.
3) Filter-Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.

b. Disposable Panel Filters:

1) Factory-fabricated, viscous-coated, flat-panel type.
2) Thickness: 1 inch (25 mm)
3) Arrestance according to ASHRAE 52.1: 80
4) Merv according to ASHRAE 52.2: 5
5) Media: Interlaced glass fibers sprayed with nonflammable adhesive and antimicrobial agent.
6) Frame: Galvanized steel, with metal grid on outlet side, steel rod grid on inlet side, and hinged; with pull and retaining handles.

2.3 OUTDOOR UNITS (5 TONS (18 kW) OR LESS)

A. Air-Cooled, Compressor-Condenser Components:

1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

a. Compressor Type: Scroll.
b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
c. Refrigerant Charge: R-407C

d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid sub-cooler. Comply with ARI 210/240.

3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
4. Fan: Aluminum-propeller type, directly connected to motor.
5. Motor: Permanently lubricated, with integral thermal-overload protection.
6. Low Ambient Kit: Permits operation down to 45 deg F (7 deg C).
7. Mounting Base: Polyethylene.

2.4 ACCESSORIES

A. Control equipment and sequence of operation are specified in Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls."

B. Thermostat: Low voltage with sub-base to control compressor and evaporator fan.

C. Thermostat: Wireless infrared functioning to remotely control compressor and evaporator fan, with the following features:

1. Compressor time delay.
2. 24-hour time control of system stop and start.
3. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
4. Fan-speed selection including auto setting.

D. Automatic-reset timer to prevent rapid cycling of compressor.

E. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

F. Drain Hose: For condensate.

G. Additional Monitoring:

1. Monitor constant and variable motor loads.
2. Monitor variable-frequency-drive operation.
3. Monitor economizer cycle.
4. Monitor cooling load.
5. Monitor air distribution static pressure and ventilation air volumes.

2.5 CAPACITIES AND CHARACTERISTICS

A. Cooling Capacity:

1. Total: as noted on drawings
2. SEER: 14.0

B. Heating Capacity:
1. Hot Water:

a. Entering-Water Temperature: <Insert deg F (deg C)>.
b. Leaving-Water Temperature: <Insert deg F (deg C)>.
c. Water Flow: <Insert gpm (L/s)>.
d. Water Pressure Drop: <Insert feet of head (kPa)>.

C. Indoor Unit:

1. Fan Motor Electrical Characteristics:

a. Volts: 120
b. Phase: Single.
c. Hertz: 60.

2. Airflow: per drawings

D. Outdoor Unit:

1. Type: Air cooled
2. Electrical Characteristics:

a. Volts: 120
b. Phase: Single
c. Hertz: 60.
d. Minimum Circuit Ampacity: see equipment schedule
e. Maximum Overcurrent Protection: per mfr. Spec.
f. Fan Motor Full-Load Amperes: see Mfr's Spec.
g. Compressor Full-Load Amperes: per Mfr's Spec.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install ground-mounted, compressor-condenser components on 4-inch- (100-mm-) thick, reinforced concrete base that is 4 inches (100 mm) larger, on each side, than unit. Concrete shall be 3,000 psi min. ready-mix, with 6x6 W2.0 x W2.0 welded wire reinforcement.

D. Install roof-mounted, compressor-condenser components on equipment supports specified in Division 07 Section "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.

E. Install seismic restraints.

F. Install compressor-condenser components on restrained, spring isolators with a minimum static deflection of 1 inch (25 mm) See Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

G. Install and connect pre-charged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

1. Water Coil Connections: Comply with requirements specified in Division 23 Section "Hydronic Piping." Connect hydronic piping to supply and return coil connections with shutoff-duty valve and union or flange on the supply connection and with throttling-duty valve and union or flange on the return connection.
2. Remote, Water-Cooled Condenser Connections: Comply with requirements specified in Division 23 Section "Hydronic Piping" Connect hydronic piping to supply and return connections with shutoff-duty valve and union or flange on the supply connection and with throttling-duty valve and union or flange on the return connection.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

C. Duct Connections: Duct installation requirements are specified in Division 23 Section "Metal Ducts" Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 238126

SECTION 26 0500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies the basic requirements for electrical installations and includes requirements common to more than one section of Division 26. It expands and supplements the requirements specified in sections of Division 01.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 03 3000 - Cast-in-Place Concrete.
3. Section 09 9000 - Painting and Coating.
4. Division 14 - Conveying Equipment.
5. Division 23 - HVAC.
6. Division 27 – Communications.
7. Division 28 - Electronic Safety and Security.

C. Applicable Standards

1. ASTM D 709 (2007) – Laminated Thermosetting materials.
2. ANSI/NEMA FB-1 (2010) – Standard for Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable.
3. ANSI/NEMA 250 (2008) – Enclosure for Electrical Equipment (1000 Volts Maximum).
4. National Electrical Code (NEC) (2014).
5. IEEE C57.12.28 (2005) – Standard for Pad-Mounted equipment (Enclosure Integrity).
6. UL 1 (2005) – Standard for Flexible Metal Conduit.
7. UL 1242 (2007) – Standard for Electrical Intermediate Metal Conduit.
8. UL 506 (2008) – Specialty Transformers.
9. UL 6 (2010) – Electrical Rigid Metal Conduit-Steel.
10. UL 797 (2007) – Electrical Metallic Tubing-Steel.

11. UL 870 (2008) – Standard for Wireways, Auxiliary Gutters, and Associated Fittings

1.02 BASIC ELECTRICAL REQUIREMENTS

A. Quality Assurance:

1. Workers possessing the skills and experience obtained in performing work of similar scope and complexity shall perform the Work of this Division.

2. Refer to other sections of the Specifications for other qualification requirements.

B. Drawings and Specifications Coordination:

1. For purposes of clearness and legibility, Drawings are essentially diagrammatic, and the size and location of equipment is indicated to scale whenever possible. Verify conditions, dimensions, indicated equipment sizes, and manufacturer's data and information as necessary to install the Work of this Division. Coordinate location and layout with other Work.

2. Verify final locations for rough ins with field measurements and with the requirements of the equipment to be connected.

3. Drawings indicate required size and points of termination of conduits, number and size of conductors, and diagrammatic routing of conduit. Install conduits with minimum number of bends to conform to structure, avoid obstructions, preserve headroom, keep openings and passageways clear, and comply with applicable code requirements.

4. Routing of conduits may be changed provided that the length of any conduit run is not increased more than 10 percent of length indicated on the Drawings.

5. Outlet locations shall be coordinated with architectural elements prior to start of construction. Locations indicated on the Drawings may be distorted for clarity.

6. Coordinate electrical equipment and materials installation with building components and the Work of other trades

7. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

8. Coordinate connection of electrical systems with existing underground utilities and services.

C. Terminology:

1. Signal Systems: Applies to clock, bell, fire alarm, annunciator, sound, public address, buzzer, telephone, television, inter-communication, elevator access controls, lighting control systems and security systems.

2. Low Voltage: Applies to signal systems operating at 120 volts and less, and power systems operating at less than 600 volts. Medium voltage: Applies to power systems operating at more than 600 volts.

3. UL: Underwriter's Laboratories Inc, Nationally Recognized Testing Laboratory (NRTL), or equal.

D. Regulations: Work shall comply with the requirements of authorities having jurisdiction and the National Electrical and Building Codes. Material shall conform to regulations of the National Board of Fire Underwriters for electrical wiring and apparatus. Materials shall be new and listed by UL, or another NRTL.

E. Structural Considerations for Conduit Routing:

1. Where conduits pass through or interfere with any structural member, or where notching, boring or cutting of the structure is necessary, or where special openings are required through walls, floors, footings, or other buildings elements, conform to CBC, Part 2, Title 24, Section 1906.3 for conduits and pipes embedded in concrete and Sections 2308.9.10 and 2308.9.11 for notches and bored holes in wood; for steel, as detailed on the structural steel Shop Drawings.

2. Where a concrete encasement for underground conduit abuts a foundation wall or underground structure which the conduits enter, encasement shall rest on a haunch integral with wall or structure, or shall extend down to footing projection, if any, or shall be doweled into structure unless otherwise indicated. Underground structures shall include maintenance holes; pull boxes, vaults, and buildings.

3. Holes required for conduit entrances into speaker poles, floodlight poles or other poles, shall be drilled with the conduit nipple or coupling welded to poles. Welds shall be provided by the electric arc process and shall be continuous around nipple or coupling.

F. Electrically Operated Equipment and Appliances:

1. Furnished Equipment and Appliances:

a. Work shall include furnishing and installing wiring enclosures for, and the complete connection of electrically operated equipment and appliances and electrical control devices which are specified to be furnished and installed in this or other sections of the Specifications, wiring enclosures shall be concealed except where exposed Work is indicated on the Drawings.

b. Connections shall be provided as necessary to install equipment ready for use. Equipment shall be tested for proper operation and, if motorized, for proper rotation. If outlets are of incorrect electrical characteristics or any specified equipment fails to operate properly, repair and/or replace the outlet and/or equipment.

2. Equipment and Appliances Furnished by Others:

a. Equipment and appliances indicated on Drawings as "not in contract" (NIC), "furnished by others," or "furnished by the Owner," will be delivered to the Project site. Required electrical connections shall be performed for such equipment and appliances. Motorized equipment will be furnished factory-wired to a control panel or junction box unless otherwise indicated. Appliances will be furnished equipped with portable cord and cap. Provide disconnect switches where required.

b. Connections to equipment furnished under this Division shall be part of the Work of this section. Work shall include internal wiring, installation, connection and adjustment of bolted drive motors in which the motor is supplied as a separate unit, and connections only for equipment furnished with factory installed internal wiring, except as further limited by Drawings and this Specification. Work shall include furnishing and installing suitable outlets, disconnecting devices, starters, push-button stations, selector switches, conduit, junction boxes, and wiring necessary for a complete electrical installation. Work shall also include furnishing and installing conduit and boxes for HVAC control systems, furnished under Division 23. Devices and equipment furnished shall be of same type used elsewhere on the Work or as specified.

c. Electrical equipment furnished under other sections, for installation and connection under Work of this section, will be delivered to the Project site ready for installation.

d. Mechanical equipment furnished under other sections, and requiring electrical connection under this section, will be set in place as part of the Work of the section furnishing such equipment unless noted otherwise.

e. Suitability and condition of equipment furnished under other sections shall be determined in advance of installation. Immediate notice of damage, unsuitability, or lack of parts shall be given to the entity providing such equipment.

G. Protection of Materials:

1. Protect materials and equipment from damage and provide adequate and proper storage facilities during progress of the Work. Damaged materials and/or equipment shall be replaced.

H. Cleaning:

1. Exposed parts of Work shall be left in a neat, clean, usable condition. Finished painted surfaces shall be unblemished and metal surfaces shall be polished.

2. Thoroughly clean parts of apparatus and equipment. Exposed parts to be painted shall be thoroughly cleaned of cement, plaster, and other materials. Remove grease and oil spots with solvent. Such surfaces shall be wiped and corners and cracks scraped out. Exposed rough metal shall be smooth, free of sharp edges, carefully steel brushed to remove rust and other spots, and left in proper condition to receive finish painting.

3. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

I. WARRANTIES

1. Provide one year warranty on all material and labor performed, unless noted otherwise in specific sections.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. Advise the Inspector before starting the Work of this Division.

B. Exposed conduits shall be painted to match the surfaces adjacent to installation.

C. Salvaged materials removed from buildings shall be removed from the Project site as required by the OAR.

D. Trenches outside of barricade limits shall be backfilled and paved within 24 hours after being inspected by the Inspector. Provide traffic plates during the time that trenches are open in traffic areas and in areas accessible to students and staff.

E. Where existing structural walls are cored for new conduit runs, separation between cored holes shall be three inches edge to edge from new or existing holes, unless otherwise required by the Architect. All coring to be laid out and reviewed by Architect prior to drilling. Contractor to verify location of structural steel, rebar, stress cabling or similar prior to lay out.

F. Electrical equipment shall be braced and anchored for CBC Seismic Design requirements, or as otherwise indicated on the Drawings.

3.02 DELIVERY STORAGE AND HANDLING

A. Deliver products to project site with proper identification, which shall include names, model numbers, types, grades, compliance labels, and similar information needed for District identification; all products and materials shall be adequately packaged and protected to prevent damage during shipment, storage, and handling.

B. Coordinate deliveries of electrical materials and equipment to minimize construction site congestion.

3.03 CUTTING AND PATCHING

A. Cutting and patching of electrical equipment, components, and materials shall include the removal and legal disposal of selected materials, components, and equipment.

B. Do not endanger or damage installed Work through procedures and processes of cutting and patching.

C. Repair or restore other work, or surfaces damaged as a result of the work performed under this contract.

3.04 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose off the Project site.

B. Remove equipment and implements of service, and leave entire work area neat and clean, to the satisfaction of the Owner Authorized Representative.

3.05 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 26 0513 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Boxes, enclosures, keys and locks.
2. Receptacles and switches.
3. Identifications and signs.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Division 26 – Electrical.
3. Division 27 – Communications.
4. Division 28 - Electronic Safety and Security.

PART 2 - PRODUCTS

2.01 BOXES, ENCLOSURES, KEYS AND LOCKS

A. Outlet Boxes and Fittings:

1. Outlet boxes installed in concealed Work shall be galvanized steel, pressed, or welded type, with knockouts.
2. In exposed Work, where conduit runs change direction or size, outlet boxes and conduit fittings shall be cast metal with threaded hubs cast integral with box or fitting.
3. Fittings shall be cast metal and non-corrosive. Ferrous metal fittings shall be cadmium-plated or zinc galvanized. Castings shall be true to pattern, smooth, straight, with even edges and corners, of uniform thickness of metal, and shall be free of cracks, gas holes, flaws, excessive shrinkage, and burnt-out sand.
4. Covers for fittings shall be galvanized steel or non-corrosive aluminum and shall be designed for particular fitting installed.
5. Light fixture outlets shall be 4-inch octagon, 4-inch square, 2 1/8-inch deep or larger, depending upon number of conductors or conduits therein. Plaster rings shall be furnished with round opening with two ears drilled 2 23/32 inches center to center.

6. For local device outlets provide 4-inch square 2 1/8-inch deep, boxes for single gang, 5-inch square boxes for two-gang, and special solid gang boxes with gang plaster ring for more than two switches.

7. For TV outlets, and horns and strobes provide manufacturer's supplied back box as needed. For television outlets, provide 4-gang deep boxes and 4-gang plaster rings.

8. Plaster rings shall be provided on flush-mounted outlet boxes except where otherwise indicated or specified. Plaster rings shall be same depth as finished surface. Install approved ring extension to obtain depth to finish surface.

9. In existing plywood wall or drywall construction, and where flexible steel conduit is fished into walls, single-gang and 2-gang outlets for wiring devices may be sectional steel boxes with plaster ears. Boxes shall be fastened to plywood with flat-head screws in each plaster ear screw hole. Boxes fastened to gypsum board shall be Raco, Appleton, Cooper, Bowers, or equal.

10. Factory made knockout seals shall be installed to seal box knockouts, which are not intact.

11. Where flexible conduit is extended from flush outlet boxes, provide and install weatherproof universal box extension adapters.

B. Junction and Pull boxes:

1. Junction and pull boxes, in addition to those indicated, shall only be used in compliance with codes, recognized standards, and Contract Documents.

2. Interior and non-weatherproof boxes shall be constructed of blue or galvanized steel with ample laps, spot welded, and shall be rigid under torsion and deflecting forces. Boxes shall be furnished with auxiliary angle iron framing where necessary to ensure rigidity.

3. Covers shall be fastened to box with a sufficient number of machine screws to ensure continuous contact all around. Flush type boxes shall be drilled and tapped for cover screws if boxes are not installed plumb. Surfaces of pull and junction boxes and covers shall be labeled in black marker ink designating system, panelboard and circuit designation contained in box. In exposed Work, designation shall be installed on inside of pullbox or junction box cover.

4. Weatherproof NEMA 3R pull and junction boxes shall conform to foregoing for interior boxes with following modifications:

   a. Cover of flush mounting boxes shall be furnished with a weather-tight gasket cemented to, and trimmed even with, cover all around.

   b. Surface or semi-flush mounting pull and junction boxes shall be UL, or another Nationally Recognized Testing Laboratory (NRTL) listed as rain-tight and shall be furnished complete with threaded conduit hubs.

   c. Exposed portions of boxes shall be galvanized and finished with one prime coat and one coat of baked-on gray enamel, unless already furnished with factory baked-on finish.

5. Junction and pull boxes shall be rigidly fastened to structure and shall not depend on conduits for support.

6. Underground Concrete Pull Boxes:

   a. Pre-cast concrete pull boxes. Concrete pull boxes shall be traffic type, reinforced for H-20 wheel loading, pre-cast concrete. Pull boxes with inside dimensions of 2 feet by 3 feet by 3 feet deep shall consist of a base section, top ring, and cover. Base section shall be furnished with 2 knockouts measuring 10 inch by 10 inch in each 3 feet side, and one 20 inch by 20 inch knockout in each 2-foot side. Pull boxes with inside dimension 4 feet by 4 feet by 4 feet deep shall consist of a base section, midsection, topping, and cover. Base section shall be furnished with 2 knockouts measuring 8-inch by 16-inch on each of two opposite sides, and one 20-inch by 20-inch knockout on each of other two opposite sides. Pull boxes shall be furnished with a minimum of 6-inch diameter sump knockout and one inch diameter ground rod knockout. In pull boxes, furnish and install cable racks on walls. Racks shall be furnished with 3 porcelain cable holders on vertical steel mounting bars. Pull boxes shall be furnished with 3/4 inch diameter pull irons. Covers shall be traffic-type consisting of steel safety plate bolted to frame. Covers shall be marked as electrical, power, or signal as required. Pull boxes shall be as manufactured by Oldcastle Precast, Jensen Precast, Kistner, Western Precast, or equal.

   b. Provide end bells in duct entrances. Terminate each metal conduit with insulated bushing provided with a grounding terminal.

   c. Install pulling irons on opposite walls and below horizontal centerlines of ducts and bricked-up openings, and in bottom. Install pulling irons with each end hooked around a reinforcing bar.

   d. Remove floor drain knockout and provide a depth of 24 inches of crushed rock below box extending a minimum of 12 inches beyond on all sides.

   e. Permanently and effectively ground metal equipment cases, cable racks, and similar items in pull boxes to site grounding electrode system. Provide grounding conductor in compliance with NEC Article 250.

   f. Provide 6-inch deep sand base under pull boxes.

   g. Identify power and signal cables by tagging in manholes and pull boxes. Tie securely to cables with nylon cord.

   h. Top of steel plate shall provide a minimum coefficient of static friction of 0.5 for either wet or dry locations, when tested for any shoe sole material. Test shall comply with ASTM D 1047 or F 489 or F 609 standards. Submit manufacturer’s test results for Architect’s review as part of materials and equipment submittals.

   i. The use of underground extension boxes shall be limited to not more than 1 times the original depth of pull box.

7. Underground utility boxes shall be reinforced concrete with non-setting shoulders to prevent settlement following installation. Boxes shall be furnished with cast iron cover

with finger hole, size as indicated on Drawings. Utility boxes shall be as manufactured by Oldcastle,Jensen, Kistner, Western Precast, or equal.

8. Manholes, vaults, and pull boxes required by a utility company, and installed as part of this Contract, shall meet requirements of servicing utility company.

C. Floor Outlets:

1. Provided floor outlets, except for extension outlets, shall be Harvey Hubbell Inc. B-2503, Thomas & Betts 640 series, Legrand Omnibox, or equal, adjustable, cast iron, watertight floor boxes with flush brass floor plates, and shall be set to finish flush with finish floor covering, whether it be carpeted, wood, resilient floor covering, or other finish materials. Floor boxes shall be used in office, classrooms, and in library areas only.

2. Telephones above floor outlets, where not subjected to water, shall be provided with Harvey Hubbell Inc. SC-3098 pedestals with SC309T plates, Legrand 525 series, Thomas & Betts FPT-400 Series, or equal. Refer to other Division 26 sections. Floor boxes shall be used in office, classrooms and in Library areas only.

3. Plugs above floor outlets where not subjected to water shall be provided with Legrand 525 series, Thomas & Betts FPT-400 Series, Harvey Hubbell Inc. SC-3098, or equal, pedestal and with SS309D, or equal, device plates. Refer to other Division 26 sections. Floor boxes shall be used in office, classrooms, and library areas only.

4. Plugs above floor outlets where subjected to water shall be provided with a Harvey Hubbell Inc. SA-6685 or equal, single-gang outlet box, or SA-6687 or equal, 2-gang outlet box. Provide required cover plate. Refer to other Division 26 sections. Floor outlets shall be used in Cafeteria, Cafeteria serving areas, or any areas where floors are subjected to water.

5. Furnished extension floor outlets shall be cast iron floor boxes with cast iron covers and 1/2 inch offset entries for above-floor conduit extensions; Harvey Hubbell F3186, or equal. Boxes shall be designed to permit access to wiring without disturbing above-floor extensions and shall be set flush with finish floor.

6. Furnished above floor service fittings for surge suppression receptacles shall be Hubbell SC3098 with cover plates SS309DS, Legrand 525 series, Thomas & Betts FPT-400 Series, or equal.

7. Furnished above floor service fittings for data outlets shall be Hubbell SC3098 with required cover plates, Legrand 525 Series, Thomas & Betts FPT-400 Series, or equal. Refer to other Division 26 sections.

D. Floor Pockets:

1. Three-Gang: Furnished three-gang floor lighting pockets shall be flush floor type, with cast iron floor plate and hinged cast iron door notched for cables. Three-gang floor pockets shall be owner approved Legrand or Hubbell Recessed Floor Boxes, C.W. Cole TLS-353-6, or equal, for wood floors and C.W. Cole TLS-353-6-C, or equal, for concrete slabs. Each floor pocket shall be provided with three 20 amp, 3 wire, 125 volt receptacles with matching caps.

2. Single Gang:

a. Receptacle floor pockets shall be single gang, flush floor type, with cast iron floor plate, hinged cast iron door notched for cable and cast iron box; C.W. Cole TLA-362-1-FE, or Owner approved Legrand or Hubbell recessed floor box or equal. Provide each pocket with a standard, single grounding type receptacle unless otherwise indicated. Provide C.W. Cole TLS-362-1, or equal, in wood floors.

b. Microphone or projector floor pockets shall be single gang flush floor type with cast iron floor plate, hinged cast iron door, notched for cable and cast iron box, or owner approved Legrand or Hubbell recessed floor box, C.W. Cole TLA-362-3-FE, C.W. Cole TLS-362-3,in wood floors, or equal.

E. Keys and Locks:

1. Provide two keys with furnished door locks, including cabinet door locks and switchboard locks, two keys for lock switches on switchboards or control panels, and two keys with interlocks or other furnished lock switches. Deliver keys to OAR.

2. Locks shall be keyed to Corbin No. 60 keys for access to operate equipment and Corbin 70 keys for service access. Special keys and locks shall only be provided where specified.

2.02 RECEPTACLES AND SWITCHES

A. Receptacles:

1. Duplex receptacles shall be heavy-duty specification grade, grounding type. Terminal screws shall be back and side wired with internal screw pressure plates. Mounting strap shall feature heavy-duty brass construction. Receptacle back body shall be PVC. Receptacle face shall be ivory, impact resistant nylon. Receptacles shall have triple wipe brass power contacts.

NEMA #	Pass & Seymour	Hubbell	Leviton
(20 amps) NEMA 5-20	PS5362-I	HBL5362-I	5362-I
(15 amps) NEMA 5-15	PS5262-I	HBL5262-I	5262-I

2. Duplex receptacles on circuits supplied by panel boards with integral surge suppression shall be Pass & Seymour model number PS5262BL (blue), Hubbell DRUBTVSS15, Leviton 5262-SBU, 15 amps, 120 volts, or equal.

3. Single receptacles shall be heavy-duty specification grade, grounding type. Terminal screws shall be back and side wire with internal screw pressure plates. Mounting strap shall feature heavy-duty brass construction. Receptacle back body shall be thermoplastic. Receptacle face shall be ivory, impact resistant nylon. Receptacles shall have triple wipe brass power contacts. For circuits consisting of one single receptacle only, ampere rating of receptacle shall be same as circuit breaker or fuse.

NEMA #	Pass & Seymour	Hubbell	Leviton
(20 amps) NEMA 5-20R	5361-I	HBL5361-I	5361-I
(15 amps) NEMA 5-15R	5261-I	HBL5261-I	5261-I

4. 15 and 20 amps single receptacles on circuits supplied by panel boards with integral surge suppression shall be Pass & Seymour NEMA 5-20R model number 5361-BL

(blue), and NEMA 5-15R model number 5261-BL (blue) respectively. Equal receptacles by other Owner approved manufactures are acceptable.

5. For kiln receptacles and range receptacles, provide 3-pole, 4-wire, grounding type, rated 50 amps at 125/250 volts NEMA 14-50R. Provide with 2-gang, stainless steel plates, SS 703, or equal.

NEMA #	Pass & Seymour	Hubbell	Leviton
NEMA 14-50R	3894	HBL9450A	279
WALL PLATE	SS703	S703	84026

6. For dryer receptacles, provide 3-wire, non-grounding type, rated 30 amps at 125/250 volts, NEMA 10-30R, with 2-gang stainless steel plates. Coordinate location of junction box with the work of Section 10 2815, Hand and Hair Dryers.

NEMA #	Pass& Seymour	Hubbell	Leviton
NEMA 10-30R	3860	HBL9350	5207
WALL PLATE	SS703	S703	84026

7. Provide specification grade ground-fault circuit interrupter (GFCI) type receptacles in accordance with 2010 UL standards. GFCI receptacles shall have a trip indication light. Receptacle terminal screws shall be back and side wire with internal screw pressure plates. Test and reset buttons shall match device body and shall be ivory. GFCI receptacles shall be manufactured in standard configuration for installation with stainless steel smooth plates. Exterior mounted receptacles shall be mounted inside weatherproof enclosure.

NEMA #	Pass & Seymour	Hubbell	Leviton
NEMA 5-20R	2095-I	GFR5352-IA	7899-I
NEMA 5-15R	1595-I	GFR5252-IA	8598-I

8. Provide weatherproof receptacles, except where otherwise indicated or specified, consisting of GFCI receptacles, as specified herein, and metal plates with die-cast lockable hinged lids and weatherproof mats;

9. In Kindergarten and Early Education Center Classrooms provide tamper-resistant receptacles with thermoplastic dual mechanism shutter system to help prevent insertion of foreign objects. Receptacles shall have extra heavy-duty brass, one-piece mounting strap with integral ground. Receptacles shall be ivory color, impact resistant nylon face and back body. For tamper-resistant receptacles rated 20 amps/125 volts, provide NEMA 5-20R, ivory in color,. For tamper-resistant receptacles rated 15 amps/125 volts, provide NEMA 5-15R, ivory in color.

NEMA #	Pass & Seymour	Arrow Hart	Leviton
(20 amps) NEMA 5-20R	TR63-I	TR8300V	8300SGI
(15 amps) NEMA 5-15R	TR62-I	TR8200V	8200SGI

10. Provide transient voltage surge suppression (TVSS) receptacles offering metal oxide varistors (MOVs) protecting normal and common modes, (L-N, L-G, N-G) with 500V suppressed voltage. TVSS devices shall offer 3-mode equal protection with 210 joules minimum per mode of energy absorption and 13,000 amp maximum surge capability. TVSS devices shall have 3 thermal fuses and two over-current protection fuses. TVSS devices shall have LED visual only surge status indicator to alert user to surge suppression circuit condition. Visual indicator will be illuminated (red) when power is

on and surge suppression circuit is fully functional. Visual indicator will not be illuminated when power is off or unit experiences loss of surge suppression protection. Terminals shall be back and side wire including ground terminal. Color shall be blue.

NEMA #	Pass& Seymour	Hubbell	Leviton
(20 amps) NEMA 5-20R	5352BLSP	HBL5360SA	5380B
(15 amps) NEMA 5-15R	5252BLSP	HBL5260SA	5280B

11. Receptacles within 6 feet of water fountains, counter tops, or any sources of water shall be GFCI type.

B. Switches:

1. Local Switches:

a. Provide local switches, high strength thermoplastic toggle, specification industrial grade, rated 20 amps at 120-277 volts AC only, with plaster ears, external screw pressure plate back and side wired, and standard size composition cups which fully enclose mechanism. Switches shall be approved for installation at currents up to full rating on resistive, inductive, tungsten filament lamp and fluorescent lamp loads, and for up to 80 percent of rating for motor loads. Switches shall have oversized silver alloy contacts for long life and better heat dissipation. Provide switches as single pole, double pole, 3-way, 4-way, non-lock type. Provide non-lock type switches with ivory handles;

	Pass & Seymour	Hubbell	Leviton
Single pole	PS20AC1I	HBL1221I	1221-2I
Double pole	PS20AC2I	HBL1222I	1222-2I
Three way	PS20AC3I	HBL1223I	1223-2I
Four way	PS20AC4I	HBL1224I	1224-2I

b. Provide lock type switches, specification industrial grade, 20 amp, 120-277 volts with metal or nylon key guides with on/off indication, and operable by same key. Key shall be District standardized vertically oriented, tamper resistant, forked key with two each 5/16-inch long forks, 5/32-inch spacing between forks and 5/16-inch width overall.

	Pass & Seymour	Arrow Hart
Single pole	PS20AC1L w/#500 Key-2L	1221L w/1201LK Key
Double pole	PS20AC2Lw/#500 Key	1222L w/1201LK Key
Three way	PS20AC3L w/#500 Key	1223L w/1201LK Key
Four Way	PS20AC4L w/#500 Key	1224L w/1201LK Key

c. Rotary lock switches shall incorporate a tumbler type lock to prevent unauthorized operation. Lock shall be tumbler type by Corbin, keyed to a HH41 key. Lock switch to be installed with pin tumblers facing downward. Key shall be removable in all positions. Each device shall be complete with 2 keys. Keys shall be delivered only to the OAR. Switches shall be rated at 20 amps, 120-277 volt AC. Switch plates shall be of stainless steel, engraved with on and off positions indicated.

	Arrow Hart
Single pole	AH1191N
Double pole	AH1192N

Three way AH1193N

d. Pilot light switches shall be rated 20 amps and shall conform to specifications for local switches. Switches shall be furnished with red, Lexan handles that are lighted by long-lasting neon lamps. Pilot light shall light when load is on. Pilot light 120 volt switches

	Pass& Seymour	Hubbell	Leviton
Single pole	PS20AC1-RPL	HBL1221-PL	1221-PLR
Double pole	PS20AC2-RPL	HBL1222-PL	1222-PLR
Three way	PS20AC3-RPL	HBL1223-PL	1223-PLR

Same as above except rated at 20 amps at 277 volts.

	Pass & Seymour	Leviton	Hubbell
Single pole	PS20AC1-RPL	1221-7PR	HBL1221-PL7

e. Provide remote control switches for mechanically held contactors arranged for 3-wire control, toggle type, momentary contact, single pole, 3-position with center off position, rated 20 amps at 120-277 volts AC only, with plaster ears, binding screws for side wiring, standard size composition cups which fully enclose mechanism, and ivory handles

Pass & Seymour	Hubbell	Leviton
1251-I	HBL1557-I	1285-I

f. Provide remote control switches for magnetically held contactors arranged for 3-wire control, toggle type, maintained contact, single pole, 3-position with center off position, rated 20 amps at 120-277 volts AC only, with plaster ears, binding screws for side wiring, standard size composition cups which fully enclosed mechanism, and ivory handles.

Pass and Seymour	Hubbell	Leviton
1225-I	HBL 1385	1285-I

g. Momentary Contact locking key type switch. 20A 120/277V center off. Key shall be District standardized vertically oriented, tamper resistant, forked key with two each 5/16" long forks, 5/32" spacing between forks and 5/16" width overall.

Arrow Hart
AH1995L w/ AH2000 key

h. Momentary Contact switch low voltage 1 pole 3A 24VAC 3 position center off. Key for locking switch shall be District standardized vertically oriented, tamper resistant, forked key with two each 5/16" long forks, 5/31" spacing between forks and 5/16" width overall.

Pass and Seymour
Toggle 1081I
Locking 1081KGRY w/#500 Key

2. Time Switches and Photoelectric Controls for existing construction; use section 26 0923 for new construction.

a. Provide time switches with a 7-day, solid-state, electronic type capable of fully automatic or manual operation and housed in a sheet steel enclosure unless built into a panel or switchboard. Contacts rated for 25 amps resistive or inductive, each pole 240 VAC; 5 amps tungsten or 277 VAC pilot duty, each pole 240 VAC. Time switches to contain a non-volatile clock and non-volatile memory with a built-in rechargeable super capacitor power carry-over system. Battery carryover is not acceptable. Provide a minimum of 15 on/off set points per week. Timing to be in one minute increments with a minimum on or off time of one minute. Time switch digital displays to indicate days of week, hours, and minutes. Display to contain a load status light to indicate when equipment is in operation. Time switches; Paragon Model EC7000 Series, Tork Model EW 101B series, Intermatic ET7000 series, or equal. Features required for application:.

1) Liquid crystal display panel.

2) Holiday scheduling: Up to 40 dates may be assigned special holiday schedules, up to one year in advance.

3) Automatically adjusts to and from daylight savings time and for leap year.

4) Contact ratings: 10 amp at 240 VAC.

5) Safety override switch for each circuit to either provide shut down of circuit or to override on.

6) Selective review: All or part of schedule shall be displayed at touch of a key.

7) Super Capacitor for power carry over system.

8) Supply voltage: 120 V.

9) 365-day advance scheduling.

b. Photoelectric control: Shall be rated 2,000 watts, 120V with single pole, single throw, normally closed contact, enclosed in a die-cast aluminum gasketed enclosure with 1/2 inch conduit fitting, Tork series 2100, or equal.

3. Emergency Lighting Control Unit

a. The Emergency Lighting control Unit shall provide all required functionality to allow an standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building.

b. The emergency lighting control unit shall allow control of emergency lighting fixture in tandem with normal lighting in an area while ensuring that emergency lighting will turn on immediately to full brightness upon loss of normal power supplying the control device. Emergency lighting operation shall be independent for each controlled area and shall not require a generalized power failure for proper operation.

c. The device shall have normally closed dry contacts capable of switching 10 amp emergency ballast loads at 120-277 VAC, 60 Hz, or 2 amp tungsten loads at 120 VAC, 60Hz.

d. The device shall have universal rated voltage inputs provided for normal power sense and normal switched power at 120-277 VAC, 60 Hz.

e. The device shall provide separate LEDs to indicate the presence of normal and emergency power sources. The LEDs shall indicate the unit's current operational mode (normal or emergency)

f. The device's normal power input terminal shall be connected to the line side of the control device such that any upstream fault causing a loss of power, including the tripping of the branch circuit breaker, will force the unit into the emergency mode and turn on the emergency lighting.

g. The unit shall automatically switch emergency lighting on and off as normal lighting is switched. When normal power is not available, the unit shall force and hold emergency lighting on regardless of the state of any external control device until normal power is restored.

h. Device shall be WattStopper ELCU-100 Emergency Lighting Control Unit, LVS #EPC-PM Series, Lighting Control Design #GR 2001 series or Equal.

2.03 IDENTIFICATION AND SIGNS

A. Identification Plates:

1. Provide identification plates for the following unless otherwise specified, for switchboards, unit substations, motor control centers, control panels, push-button stations, time switches, contactors, motor starters, motor switches, panelboards, and terminal cabinets.

2. Identification plates shall be of plastic stock and shall adequately describe function, voltage and phase of identified equipment. Where identification plates are detailed or described on Drawings, inscription and size of letters shall be as indicated. For lighting and power panels, identification plates shall indicate panel designation, voltage, and phase of panel. For terminal cabinets, identification plates shall indicate system contained in terminal cabinet.

3. Identification plates shall be black-and-white nameplate stock of bakelite with characters cut through black exposing white. Plates shall be furnished with beveled edges and shall be securely fastened in place with No. 4 Phillips-head, cadmium-plated steel, self-tapping screws. Characters shall be 3/16 inch high, unless otherwise indicated.

B. Markings:

1. Install identification markings to surface-mounted starters, switches, disconnect switches, contactors, and other devices controlling motors and appliances. Provide abbreviations required along with an identifying number. Markings to be provided with locking type stencils using paint of a contrasting color. Figures shall be 3/8 inch high unless otherwise indicated. Dymo Industries Inc., self-sticking plastic labels, with embossed characters made with a typewriter may be installed instead of stencils and

paint; p-touch self adhesive plastic, or Brother P-Touch self sticking laminated plastic labels may be installed.

2. High Voltage: High voltage switchboards, cabinets, boxes, and conduits exposed in accessible locations, including under buildings and in attics, are required to be marked "WARNING-HIGH VOLTAGE- ABOVE 600 VOLTS". Markings for switchboards shall consist of 18 gage steel, porcelain enamel sign of standard manufacture. Markings for boxes, cabinets, and conduits shall be by means of stenciling or printed self-adhesive markers, Westline Tel-A-Pipe, or equal. Provide letters of black on orange background and not less than 1-7/8 inches high. On conduit runs, install markings at intervals not exceeding 10 feet in any individual area. Markings shall be installed after other painting Work is complete.

C. Warning Signs:

1. Provide a warning sign on outside of each door or gate to rooms or enclosures containing high voltage equipment. Signs required reading, "WARNING - HIGH VOLTAGE - KEEP OUT". Provide 2-inch high lettering.

2. Provide warning signs on each high-voltage non-load break disconnect and fused cutout (not oil filled). Signs required reading, "DO NOT OPEN UNDER LOAD". Provide 2 inch high lettering.

3. Provide signs of standard manufacture, 18-gage steel, with porcelain enamel finish. Provide red lettering on a white background.

PART 3 - EXECUTION

3.01 INSTALLATION AND SUPPORT OF BOXES

A. Install outlet boxes flush with finished surface of wall or ceiling. Install plumb and securely fastened to structure, independent of conduit. Except where otherwise indicated, provide factory-fabricated adjustable attachment bar hangers between studs to support outlet boxes. When installation is performed in fire rated walls, maintain the wall’s rating integrity by means of approved fire stop methods.

B. Outlet boxes installed in suspended or furred ceilings with steel runner or furring channels shall be supported, except where otherwise indicated, by a Unistrut P-4000 Tessco A1200HS-10, Cooper B-Line B22s-HG, or equal channel spanning main ceiling runner channels. Each box shall be supported from its channel by a 3/8 inch 16 threaded steel rod with a Unistrut P-4008, Fastenal #48604, Copper B-Line 78101140346 or equal nut and a Tomic No. 711-B Adapta-Stud, or equal. Rod shall be tightened to a jamb fit with channel and its nut. Box shall be locked to rod by means of a 1/2 inch locknut on stud and a 3/8 inch 16 hex nut locking stud to rod.

C. Heights of outlets and equipment indicated on Drawings shall govern. In absence of such indications, following heights shall be maintained with heights measured to centerline unless otherwise noted:

1. Install wall-mounted telephones, light switches, and other switches, 48 inches above finished floor. Refer to other Division 26, 27 and 28 Sections.

2. Outlet boxes for fire alarm pull stations shall be mounted at 45 inches above finished floor to insure that the operating handle of the initiating device is no higher than 48 inches at finished floor. Under no circumstances shall operating handle of the device exceed 48 inches above finished floor regardless of indicated height on drawing.

3. Wall mounted fire alarm strobe or horn/strobe devices shall be mounted such that the entire lens is not less than 80 inches above finished floor. If ceiling heights allow, wall mounted appliances shall have bottom of lens a minimum of 80 inches but not more than 96 inches to the top of lens.

4. Install outdoor fire alarm audible devices or fire alarm sprinkler flow bells at least 10 feet but not more than 12 feet above finished floor to center. Provide STI or equal protective covers for devices when required.

5. Voice evacuation speakers mounted indoors shall be mounted in ceiling space or if mounted on wall shall not be less than 10 feet to center above finished floor.

6. Install clocks and speakers, in classrooms and offices, 8 feet above finished floor. Unless otherwise indicated.

7. In rooms other than places of assembly such as, but not limited to, multipurpose rooms, auditoriums, and libraries, clock outlets and speakers in classrooms and offices shall be mounted 8 feet above finished floors. Other assembly areas such as gymnasiums shall be mounted 10 to 12 feet above finished floor. Provide STI, or equal protective covers for clocks when required.

8. Install fire alarm strobe lights 80 inches to bottom of light above finished floor.

9. Install outside bells and yard light outlets 4 feet above second floor level for 2 or more story buildings, 12 inches below top plate level for one story buildings without covered porch or arcade, and 12 inches below covered porch and arcade ceilings.

10. Install desk telephones, power receptacle outlets, and data outlets 15 inches above finished floor.

11. Install panelboards and terminal cabinets 6 feet 6 inches from finish floor to top of cabinet.

12. Install television outlets at a height corresponding to location of television monitor, or a minimum of 15 inches above finished floor.

13. The use of extension boxes shall be limited to not more than 1 times the original depth of junction box.

3.02 COVER PLATES

A. Provide a plate on each switch, plug, pilot light, data, interphone, public telephone, and television outlet, and on existing and reset outlets where so indicated or required. Plates shall be of stainless steel unless otherwise specified.

B. Flush wiring device and signal system outlets indicated to be blank covered, shall be covered with blank stainless steel plates. Flush lighting outlets to be blanked shall be covered with

Wiremold 5736 steel covers, or equal, painted to match surrounding finish. Provide stainless steel covers to blank indicated or required surface-mounted outlets.

C. In the following cases, and at required locations. Switch and receptacle plates shall be engraved with the device(s), or fixtures being controlled, or as indicated:.

1. Three-gang and larger gang switches in locations other than classrooms.

2. Lock switches.

3. Pilot switches.

4. Switches so located that operator cannot see fixtures, or items of equipment controlled while his hand is on the switch.

5. Switches not in same room with fixtures or items of unit heaters, air curtains, fly fans, etcetera.

6. Receptacles operating at other than 120 V shall be identified with the operating voltage.

7. Switches operating on 277 V shall be identified with the operating voltage.

8. Where indicated on Drawings.

D. Designations shall be as indicated on Drawings or as specified by Architect.

E. Standard GFI cover plates shall be Pass & Seymour 4600, Raco 5028-0, or equal. GFI cover plates shall be provided with a CAM lock mechanism with two keys or a padlock hasp that does not protrude through the face of the cover and will allow the shank of locks keyed Corbin No. 60 keys.

3.03 IDENTIFICATION OF CIRCUITS AND EQUIPMENT

A. Provide descriptive nameplates or tags permanently attached to switchboards, motor control centers, transformers, panelboards, circuit breakers, disconnect switches, starters, pushbutton control stations and other apparatus installed for operation or control of circuits, appliances, fire alarm control panel(s), fire alarm annunciator(s), power supplies, terminal cabinets, energy management control units, and Information technology system backbone and distribution equipment points.

B. Provide nameplates of engraved laminated plastic, or etched metal. Submit Shop Drawings denoting dimensions and format to Architect before installation. Fasten to equipment with escutcheon pins, rivets, self-tapping screws, or machine screws. Self-adhering or adhesive backed nameplates are not permitted.

C. Fasten tags to feeder wiring in conduits at every point where runs are broken or terminated, including pull wires in empty conduits. Indicate circuit, phase, and function. Tag branch circuits in panel boards and motor control centers. Tags may be manufactured of pressure-sensitive plastic or embossed self-attached stainless steel or brass ribbon.

D. Provide circuit identification cards and cardholders in all panel boards. Cardholders shall consist of metal frame retaining a clear plastic cover permanently attached to inside of panel door. List

of circuits shall be typewritten on a card. Circuit description shall include name or number of circuit, area and connected load.

E. Junction and pull boxes shall have covers stenciled with box number when indicated on Drawings, or circuit numbers according to panel schedules. Data shall be lettered in a conspicuous manner with a color contrasting with finish.

F. Name shall be correctly engraved, with a legend indicating function or areas, when required by codes or indicated on Drawings.

3.04 PROTECTION

A. Protect Work of this section until Substantial Completion.

3.05 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off Project site.

END OF SECTION

SECTION 26 0516 - MEDIUM-VOLTAGE CABLES, SPLICES AND TERMINATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Medium-voltage cables, splices and terminations.

2. Single conductor 15,000 volt shielded copper power cable insulated with ozone and discharge resistant flexible, rubber like thermosetting dielectric for medium-voltage applications, suitable for use in wet and dry locations in conduit and underground ducts.

1.02 SUBMITTALS

A. Samples: Submit three 36 inches long pieces of the proposed cable.

B. Submit a complete material list.

C. Shop Drawings: Submit a layout drawing of the proposed installation.

D. A certified test report per The Association of Edison Illuminating Companies (AEIC) CS-8 from the factory shall be furnished to the Project Inspector, before installation, for each length of cable delivered to the Project site. This report shall certify that cable meets latest requirements of Insulated Cable Engineers Association (ICEA) and shall include all required test data. High voltage cable shall not be installed until cable and test report has been reviewed by the Architect. Submit eight copies of the report, of which two will be returned. Test shall be performed in accordance with (NETA Specification) ANSI/ICEA S-97-682, S-97-649 and UL Standard 1072; the test could be performed by a Nationally Recognized Testing Laboratory (NRTL) or approved equal.

1.03 QUALITY ASSURANCE

A. The cable manufacturer shall have a minimum of 15 years manufacturing EPR insulated cables.

B. Cables shall be tested for corona discharge and shall comply with AEIC requirements. A copy of the original x-y plot showing discharge levels shall be included as part of the certified test reports. Submit test report for Architect/Engineer review prior to installation.

1.04 WARRANTY

A. The manufacturer shall provide a five-year material warranty.

PART 2 - PRODUCTS

2.01 CABLE

A. Medium-voltage cable shall be furnished where line-to-line operating voltage exceeds 600 volts. Cable shall be 15 KV, single conductor, 133 percent insulation level, ethylene propylene rubber insulated, shielded, PVC jacket Type MV-105.

B. Conductors shall be Class B stranded annealed, uncoated copper.

C. Insulation system conductor screens, insulation and insulation screens shall be capable of continuous operation at conductor temperatures of 105 degrees C. and emergency overload temperatures of 140 degrees C.

D. Cables shall be identified indicating manufacturer, size, insulation type, voltage rating, year manufactured, and UL, or other Nationally Recognized Testing Laboratory designations.

2.02 STANDARDS

A. Cables shall conform to the following standards where applicable:

1. Insulated Cable Engineers Association (ICEA).

2. Institute of Electrical and Electronic Engineers (IEEE).

3. National Electrical Code (NEC).

4. Underwriters' Laboratories (UL).

5. Association of Edison Illuminating Companies (AEIC).

B. Reels of furnished cable shall be newly manufactured of not more than 12 months old, and shall bear tags containing name of manufacturer, NEC designation, and year of manufacture.

PART 3 - EXECUTION

3.01 CABLE INSTALLATION

A. Installation of cable, including joints, splices, taps, bends, connections, terminations, and method of pulling cable into conduit shall be performed in accordance with manufacturer's recommendations. Install splices, taps and terminations in a manner recommended by cable manufacturer. Stress cones shall be installed on cable at joints, splices, and terminations as recommended by manufacturer of cable. Minimum bending radius of cable shall be in strict accordance with recommendations of manufacturer. Certified Cable Splicer with minimum experience of five years required. Pulling compound shall be environmentally safe.

B. Cables shall be identified at points of termination and points where conduit run is broken, as to phase leg and feeder designation, with markers. This requirement applies at manholes, switchboards, pull boxes, and like items. Markers shall be E-Z Code, Brady Perma-Code, or equal. ID tags shall be waterproof and one inch in size.

C. After cable is installed and connected, but with all equipment disconnected from cable system, each cable shall be subjected to a high potential DC test in presence of the

Inspector. Notify the Inspector not less than two working days in advance of proposed time for test. Hi-Pot test shall be NETA Acceptance Values.

D. Test shall be performed with equipment specifically designed for this type of test and in a manner recommended by cable manufacturer. Copies of test report shall be submitted to the Architect for review. Test voltage shall be raised gradually in steps to final voltage recommended by ICEA, which shall be applied for five minutes. Current readings shall be taken at each step after leakage current has stabilized and readings shall be plotted on graph paper. If breakdown is indicated during test by a sudden increase in current, discontinue tests and provide required repairs and replacements necessary to correct defective Work.

E. Provide new cable to replace entire length of each cable run not meeting minimum requirements of test. Perform splices and terminations necessary for replacement of cable. Repair and/or replace splices and terminations test results indicate to be defective Work.

3.02 CABLE TERMINATIONS

A. Provide termination kits capable of proper termination of 15 KV class single conductor cables. Kits shall meet Class I requirements and be design proof tested in accordance with IEEE 48-2009. Kits shall accommodate common forms of cable shielding/construction without the need for special adapters or accessories, and shall accommodate a range of cable sizes. Kits shall be capable of proper installation on out-of-round cable in accordance with ICEA and AEIC standards. Kits shall accommodate commercially available environmentally sealed connectors.

B. Terminations for single conductor shielded cables shall consist of heat shrinkable stress control and other required non-tracking insulation tubing or tapes. Kits shall also contain high relative permittivity stress relief mastic for insulation shield cutback treatment with a heat-activated sealant for environmental sealing.

C. Demonstrate actual field experience and suitable accelerated and real-time testing of weathering resistance. Test reports, which verify device stability with time, temperature, and electrical stress variations, shall be submitted for review.

3.03 CABLE SPLICES

A. Splices shall be factory-engineered kits that rebuild the cable insulation to that of the cable. Splices shall contain necessary components to reinstate the cable's primary insulation, metallic shielding and grounding systems, and an outer jacket.

B. Splices shall be capable of passing the electrical test requirements of IEEE-404-2006 and water immersion tests of ANSI/IEEE 386-2006. (NETA Specification)

C. Splices shall be of uniform cross-section, heat shrinkable polymeric construction utilizing an impedance layer stress control tube and high dielectric strength insulating layers. Outer insulating layer shall be bonded to a conducting layer for shielding. The splice shall be re-jacketed with a heat shrinkable adhesive-lined sleeve to provide a waterproof seal, or factory approved taping kit such as Scotch 5717, or equal.

D. Splices shall accommodate a range of cable sizes and be completely independent of cable manufacturer tolerances. Splices shall be capable of being properly installed on out of

round cable in accordance with ICEA and AEIC standards. Kits shall accommodate commercially available connectors.

E Splices, which consist of three or more cables, shall be performed with 600 AMP Elastamold T Bodies, Hubbell, Cooper or equal. The splice shall be capable of removing or adding a conductor and restoring the connection in an electrically safe and waterproof condition. Installation of 200 AMP T Bodies is not permitted.

3.04 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.05 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 26 0519 - LOW-VOLTAGE WIRES (600 VOLT AC)

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes: Low-voltage wire, splices, terminations and installation.

1.02 SUBMITTALS

A. Provide in accordance with Division 01.

PART 2 - PRODUCTS

2.01 WIRES

A. Wires shall be single conductor type THHN or THWN insulated with polyvinyl chloride and covered with a protective sheath of nylon, rated at 600 volts. Wires may be operated at 90 degrees C. maximum continuous conductor temperature in dry locations, and 75 degrees C. in wet locations and shall be listed by UL Standard 83 for thermoplastic insulated wires, listed by Underwriter's Laboratories (UL) for installation in accordance with Article 310 of the California Electrical Code (CEC). Conductors shall be solid copper for 12 AWG and smaller conductors, and stranded copper for 10 AWG and larger conductors. Conductors shall be insulated with PVC and sheathed with nylon. Wires shall be identified by surface markings indicating manufacturer's identification, conductor size and metal, voltage rating, UL symbol, type designations and optional rating. Indentations for lettering are not permitted. Wires shall be tested in accordance with the requirements of UL standard for types THWN, or THHN.

B. Conductors shall be solid Class B or stranded Class C, annealed uncoated copper in accordance with UL standards, or another Nationally Recognized Testing Laboratory (NRTL).

2.02 STANDARDS

A. THWN/THHN wires shall comply with the following standards:

1. UL 83 for thermoplastic insulated wires.

2. UL 1063 for machine tool wires and cables.

PART 3 - EXECUTION

1.1 INSTALLATION

A. Wires shall not be installed until debris and moisture is removed from conduits, boxes, and cabinets. Wires stored at site shall be protected from physical damage until they are installed and walls are completed.

B. Wire-pulling compounds furnished as lubricants for installation of conductors in raceways shall be

compounds approved and listed by UL, NRTL, or equal. Oil, grease, graphite, or similar substances are not permitted. Pulling of 2 AWG or larger conductors shall be performed with a cable pull machine. Any runs shorter than 50 feet are exempt. When pulling conductors, do not exceed manufacturer's recommended values

C. The Project Inspector will observe installation of feeder cables. Notify the Project Inspector not less than two working days in advance of the proposed time of feeder installation.

D. At outlets for light, power, and signal equipment, pigtail splices with 8-inch circuit conductor leads for connection to fixtures, equipment, and devices.

E. Pressure cable connectors, pre-insulated 3M Scotchlok, Hubbell Power, O-Z/Gedney or equal, Y, R or B spring-loaded twist-on type, may be furnished in splicing number 8 AWG or smaller wires for wiring systems; except public address and telephone systems.

F. Joints, splices, taps, and connections to switchboard neutral, bonding or grounding conductors, conductors to ground busses, and transformer connections for wires 6 gage and larger shall be performed with high-pressure cable connectors approved for installation with copper conductors. Connectors shall be insulated with heavy wall heat shrink WCSM, or cold-applied roll-on sleeve RVS. Insulation level shall be a minimum of 600V and joints, splices, and taps shall be qualified to ANSI C 119.1, UL, NRTL, or equal listed mechanical pressure connections.

G. Connections to any bussing and high-press cable connectors shall be securely bolted together with corrosion-resistant plated carbon steel, minimum grade five machine screws secured with constant pressure-type locking devices.

H. Connection of any bonding or grounding conductors shall be securely bolted together with corrosion-resistant plated carbon steel, minimum grade five machine screws secured with constant pressure-type locking devices.

I. Wire switchboards, panel cabinets, pull boxes, and other cabinets except public address, shall be neatly grouped and tied in bundles with nylon ties at 10-inch intervals. In switchboards, panels and terminal blocks, wires shall be fanned out to terminals. If bundles are longer than 24 inches, a maximum of nine current carrying conductors may be bundled together.

J. Install conductor lengths with a minimum length within the wiring space. Conductors must be long enough to reach the terminal location in a manner that avoids strain on the connecting lug.

K. Maintain the conductor required bending radius.

L. Neutral conductors larger than 6 gage, which are not color identified throughout their entire length, shall be taped, painted white or natural gray, or taped white where they appear in switchboards, cabinet, gutters or pull boxes. Neutral conductors 6 gage and smaller shall be white color identified throughout their entire length.

M. Fire alarm and clock wiring shall be continuous from terminal cabinets or from equipment to each device. Splices are not permitted between devices and/or terminal cabinets at junction and pull boxes. Wiring shall be terminated at terminal blocks or devices only.

N. Wiring systems shall be free from short circuits and grounds, other than required grounds. The contractor shall be responsible for the testing of feeder and branch circuit conductor's insulation

resistance. The insulation of the conductors shall be tested prior to connections to any panelboards, switchboards, variable frequency drives, lighting control systems, ballasts, and wiring devices such as but not limited to GFI receptacles, TVSS receptacles, or equipment. Insulation testing of panelboards and switchboards shall be independently performed from the insulation testing of any conductors as specified in other sections of this specification.

1. Utilize the services of an approved independent testing laboratory to perform megger time-resistance insulation testing of feeder conductors. Tests must be conducted with wires disconnected at both ends.

    a. Provide calibration program records to assure the testing instrument to be within rated accuracy. The test equipment accuracy shall be in accord with the requirements stated by the National Institute of Standards and Technology (NIST).

    b. Test equipment shall be provided with a label stating the date of last calibration. As a minimum the equipment shall have been calibrated within the past 12 months.

    c. Test reports shall include the following:

        1) Identification of the testing organization.

        2) Equipment identification.

        3) Ambient conditions.

        4) Identification of the testing technician.

        5) Summary of project.

        6) Description of equipment being tested.

        7) Description of tests.

        8) Test results.

        9) Analysis, interpretation and recommendations.

2. Utilize the services of an approved independent testing laboratory or a qualified contractor's employee (Technician certified in accordance with ANSI/NETA ETT-2000 Standard for Certification of Electrical Testing Personnel) to perform megger time-resistance insulation testing of branch circuit conductors. Tests must be conducted with wires disconnected at both ends.

3. Test equipment and report requirements stipulated under paragraph 3.01.N.1 apply to branch circuit testing.

4. Tests shall be performed in the presence of the Project Inspector.

5. Insulation resistance shall not be less than 100 mega-ohms.

3.02 COLOR CODES

A. General Wiring:

1. Color code conductor insulation as follows:

SYSTEM VOLTAGE		
Conductor	208Y/120	480Y/277
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Neutral	White	Natural Gray

Neutrals shall be colored-distinguished if circuits of two voltage systems are used in the same raceway.

2. For phase and neutral conductors 6 gage or larger, permanent plastic-colored tape may be furnished to mark conductor end instead of coded insulation. Tape shall cover not less than 2 inches of conductor insulation within enclosure.

B. Signal Systems: Wires for signal systems shall be color-coded and installed under observation of the Project Inspector. Except where otherwise specified, color-coding shall be as follows:

SYSTEM	COLOR CODE
Clocks	Pink, Gray and Orange
Program Bells (some existing elementary schools)	White (Common)Black
Initiating Devices (Non-Addressable)	Red (+) and Black (-)
Program Bells (some existing secondary schools)	White (120 volt, common) Black (C.R. program) Blue (Shop program) Brown (Gym program) Yellow (Auditorium fire alarm)
Fire Alarm Horns	Pink (+) and Gray (-)
Fire Alarm Strobes	Orange (+) and Blue (-)
Un-Interruptible 24 Volt Power (Annunciator, Water Flow, and Audible Device)	Yellow (+) and White (-) Note: A single white wire may be common to both
Interruptible 24 Volt Power	Brown (+) and White (-)

(4 wire smoke detectors, duct detectors)	Note: A single white wire may be common to both
Switch-Leg Sprinkler Bell (Between water flow and audible device)	Violet (+) and White (-)
Door Holding Magnets (Non Power Limited)	Black (+) and White (-)

3.03 FEEDER IDENTIFICATION

A. Feeder wires and cables shall be identified at each point the conduit run is broken by a cabinet, box, gutter, etc. Where terminal ends are available, identification shall be by means of heat shrink wire markers, which provide terminal strain relief. Markers shall be by Tyco Electronics, Panduit, Brady Perma-Sleeve, or equal. Identification in other areas shall be by means of wrap-around tape markers from Tyco Electronics, Panduit, Brady Perma-Code or equal. Markers shall include feeder designation, size, and description.

3.04 TAPE AND SPLICE KITS

A. Splices, joints, and connectors joining conductors in dry and wet locations shall be covered with insulation equivalent to that provided on conductors. Free ends of conductors connected to energized sources shall be taped. Voids in irregular connectors shall be filled with insulating compound before taping. Thermoplastic insulating tape approved by UL, NRTL, or equal for installation as sole insulation of splices shall be furnished and shall be installed according to manufacturer's printed specifications.

3.05 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.06 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 26 0526 - GROUNDING AND BONDING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Provide and install grounding system as indicated or required.

B. Related Requirements:

1. Refer to related sections for their system grounding requirements.

2. Section 26 0500: Common Work Results for Electrical.

3. Division 27: Communications.

1.02 QUALITY ASSURANCE

A. Reference Standards:

1. IEEE 142 Green Book.

2. Underwriter's Laboratories (UL).

3. National Electrical Code.

4. Building Industry Consultant Services International (BICSI) (Signal).

5. EIA/TIA (Signal and power).

6. Nationally Recognized Testing Laboratory (NRTL) or equal.

1.03 SYSTEM DESCRIPTION

A. Metallic objects on the Project site that enclose electrical conductors, or that are likely to be energized by electrical currents, shall be effectively grounded.

B. Metal equipment parts, such as enclosures, raceways, and equipment grounding conductors, and earth grounding electrodes shall be solidly joined together into a continuous electrically conductive system.

C. Metallic systems shall be effectively bonded to the main grounding electrode system.

D. A separately derived AC source shall be grounded to the equipment-grounding conductor, and to separate “made” electrode of building grounding electrode system.

E. Electrical continuity to ground metal raceways and enclosures, isolated from equipment ground by installation of non-metallic conduit or fittings, shall be provided by a green insulated grounding conductor of required size within each raceway connected to isolated metallic raceways, or enclosures at each end. Each flexible conduit over six feet in length shall be provided with a green insulated grounding conductor of required size.

F. Cold water, or other utility piping systems, shall not be utilized as grounding electrodes due to the installation of insulating couplings and non-metallic pipe in such installations. In addition to bonding to cold water pipe provide at least one of the following made grounding electrodes:

1. A dedicated "made" electrode, fabricated of at least 20 feet of galvanized 1/2 inch diameter rebar encased by at least two inches of concrete, and placed next to the bottom of a concrete foundation, or footing in direct contact with earth A welded extended portion shall surface at the location of the common grounding electrode bus bar and be extended by a 3/0 CAD welded bare copper cable, or be CAD welded directly to the bus. The CAD weld shall be at least four inches above finished floor in a dry location. The main grounding electrode and associated grounding conductors shall be in an enclosure and in conduit.

2. Grounding electrodes as specified hereafter in this section.

3. Concrete enclosed electrode, fabricated of at least 20 feet of No. 2 AWG, minimum size, bare copper conductor, encased by at least two inches of concrete, located within or near bottom of a concrete foundation, or footing, which is in direct contact with earth. Footing rebar shall be connected to copper wire with approved connectors. An external electrode, as specified hereafter or as required by the CEC, shall be installed and connected to foundation or footing rebar.

G. Non-current carrying metal parts of high-voltage equipment enclosures, signal and power conduits, switchboard and panelboard enclosures, motor frames, equipment cabinets, and metal frames of buildings shall be permanently and effectively grounded. Provide a CEC sized grounding conductor in every raceway.

H. Metallic or semi-conducting shields and lead sheaths of cables operating at high voltage, shall be permanently and effectively grounded at each splice and termination.

I. Neutral of service conductors shall be grounded as follows:

1. Neutral shall be grounded at only one point within the Project site for that particular service. Preferable location of grounding point shall be at the service switchboard, or main switch.

2. Equipment and conduit grounding conductors shall be bonded to that grounding point.

3. If other buildings or structures on the Project site are served from a switchboard or panelboard in another building, power supply is classified as a feeder and not as a service.

4. Equipment grounding conductor is installed from switchboard to each individual building. At building, grounding conductor is bonded with power equipment enclosures, metal frames of building, etc., to "made" electrode for that building.

5. Feeder neutrals shall be bonded at service entrance point only, neutrals of separately derived systems shall be bonded at the source only.

J. If there is a distribution transformer at a building the secondary neutral conductor shall be grounded to “made” electrode serving the building.

K. Within every building, the main switchboard or panelboard shall be bonded to the cold water line. Metallic piping systems such as gas, fire sprinkler, or other systems shall be bonded to the cold water line.

1.04 SUBMITTALS

A. Provide in accordance with Division 01.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Furnished yard boxes shall be precast concrete and shall be approximately 14 inches wide by 19 inches long by 12 inches deep or larger, if necessary to obtain required clearances. Boxes shall be furnished with bolt-down, checkered, cast iron covers and cast iron frames cast into boxes. Yard boxes shall be Jensen Precast, Oldcastle Precast, Western Precast, Kistner , or equal.

B. “Made” electrodes shall be copper-clad steel ground rods, minimum 3/4 inch diameter by ten feet long.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Grounding electrodes shall be installed in the nearest suitable planting area, where not otherwise indicated on Drawings, and each electrode shall terminate within a concrete yard box installed flush with finish grade. In planting areas, finish elevation of concrete yard boxes shall be two inches above planting surfaces.

B. If concrete enclosed electrode is provided, grounding wire shall be terminated to a suitable copper plate with grounding lugs and must be enclosed in a raceway or box..

C. Grounding rods shall be driven to a depth of not less than eight feet. Permanent ground enhancement material, (GEM) as manufactured by Erico Electrical Products, Loresco Powerset, Tessco Ultrafil or equal, shall be installed at each ground rod to improve grounding effectiveness. Install in accordance with manufacture's installation instructions.

D. Grounding electrodes shall provide a resistance to ground of not more than 25 ohms.

E. When installing grounding rods, if resistance to ground exceeds 25 ohms, two or more rods connected in parallel, or coupled together shall be provided to meet grounding resistance requirements.

F. Ground rods shall be separated from one another by not less than ten feet.

G. Parallel grounding rods shall be connected together with recognized fittings and grounding conductors in galvanized rigid steel conduit, buried not less than 12 inches below finish grade.

3.02 TESTING

A. Provide the services of an approved independent testing laboratory to test grounding resistance of "made" electrodes, ground rods, bonding of building steel, water pipes, gas pipes and other utility piping. Tests shall be performed as follows:

1. Visually and mechanically examine ground system connections for completeness and adequacy.

2. Perform fall of potential tests on each ground rod or ground electrode where suitable locations are available per IEEE Standard No. 81, Section 8.2.1.2. Where suitable locations are not available, measurements will be referenced to a known dead earth or reference ground.

3. Perform the two point method test per IEEE No. 81, Section 8.2.1.1 to determine ground resistance between ground rod and building steel, and utility piping - such as water, gas and panelboard grounds. Metal railings at building entrances and at handicapped ramps shall also be tested.

4. Test shall be performed in the presence of the Inspector.

B. Submit 3 copies of test results to the Architect. Test results shall be submitted on an official form from the independent testing laboratory recording Project location, test engineer, test conditions, test equipment data, ground system layout or diagram, and final test results.

3.03 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.04 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 26 0533 - RACEWAYS, BOXES, FITTINGS, AND SUPPORTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Raceways and wire ways.
2. Conduit installation.
3. Underground requirements.

B. Related Requirements:

1. Section 26 0500: Common Work Results for Electrical.
2. Section 26 0513: Basic Electrical Materials and Methods.
3. Division 27: Communications.
4. Division 28 - Electronic Safety and Security.

C. Applicable Standards and Codes.

1. EIA/TIA 569 Standards.
2. National American Standards Institute (ANSI).
3. National Electrical Manufacturer’s Association (NEMA).
4. Nationally Recognized Testing Laboratory (NRTL).
5. National Electrical Code (NEC).
6. Uniform Building Code (UBC).
7. Underwriters Laboratory (UL).

1.02 SUBMITTALS

A. Materials List: Provide in accordance with Division 01.

PART 2 - PRODUCTS

2.01 RACEWAYS

A. Conduit Materials:

1. Metallic conduit, and tubing shall be manufactured under the supervision of an UL, or another NRTL factory inspection and label service program. Each ten-foot length of conduit and tubing shall bear the UL or another NRTL label and manufacturer's name.
2. Rigid metallic conduit shall be rigid steel, heavy wall, mild steel, zinc-coated, with an inside and outside protective coating manufactured in accordance with ANSI C 80.1. Couplings, elbows, bends, conduits, bushings and other fittings shall be the same materials and finish as the rigid metallic conduit. Fittings, connectors, and couplings shall be threaded type, manufactured in accordance with ANSI C 80.1 and UL 6.

3. Electrical metallic tubing shall be steel tubing, zinc-coated with a protective enamel coating inside, manufactured in accordance with NEMA C 80.3. Fittings, couplings, and connectors shall be gland compression type, set screw couplings and connectors not permitted. All parts shall be manufactured in accordance with NEMA C80.3 and UL 6A Electrical metallic tubing is designated hereinafter as EMT. Steel and rain tight fittings shall be approved and listed for the intended application.

4. Flexible steel conduit shall be of flexible interlocking strip construction with continuous zinc coating on strips, manufactured in accordance with UL 1.

   a. Connectors and couplings shall be required fittings of the type, which threads into convolutions of flexible conduit.

5. Liquid-tight flexible metal conduit shall be galvanized heavy wall, flexible locked steel strip construction, UV rated, with smooth moisture and oil-proof, abrasion-resistant, extruded plastic jacket. Connectors shall be as required for installation with liquid-tight flexible conduit and shall be installed to provide a liquid-tight connection.

6. Non-metallic conduit shall be rigid PVC electrical conduit extruded to schedule 40 dimensions of Type II. Grade 1 high impact, polyvinyl chloride, sweeps, couplings, reducers and terminating fittings shall be listed under the UL, or another NRTL, and shall bear the manufacturer's listed marking.

7. Multi-cell raceway shall be four inch PVC, Type 40, UL or another NRTL listed for underground use with optical fiber and signal system cables. Raceway shall be furnished with 3-1/2 inch factory installed inner ducts with required internal spacers, and required couplers, sweeps, and end bells. Multicell raceway shall be Carlon Multigard, or District approved equal.

8. Metal Clad (MC) cable system is not allowed.

B. Sleeves for Conduits: Sleeves shall be adjustable type by Carlon, U.S. Plastic, PEP Plastic or equal.

C. Where conduit enters a building through a concrete foundation below grade, or ground water level, or where it is necessary to seal around a conduit where it passes through a concrete floor or wall, provide O-Z/Gedney Type FSK Thru Wall and Floor Seal, equivalent Cooper Crouse Hinds Thru-Wall, Legrand Thru-Wall, or equal.

D. Expansion Joints-Seismic Separations between building(s) and other locations as required:

1. Provide Thomas & Betts XJG-TB, O-Z/Gedney. type AX with bonding strap and clamps, Cooper XJGD or equal. At exterior locations, provide Thomas & Betts XJG-TB, O-Z/Gedney type EX, Cooper XJGD, or equal. Provide O-Z/Gedney type AXDX, or equal combination deflection/expansion fittings at all seismic separations. Provide manufacture’s internal and external bonding jumpers at all locations. Liquid-tight metal conduit or flexible metal conduit shall not be approved at expansion joints, separations between buildings or seismic separations.

2. Provide expansion fittings at intervals not exceeding 100 feet in conduits exposed to direct sunlight. Fittings may be installed in the conduit run or where conduit

attaches to junction or pull boxes. OZ/Gedney type AX, TX or EXE series, or equivalent by Thomas and Betts, Crouse-Hinds or approved equal.

E. Conduit Seal Fittings:

1. Provide conduit seal fittings where indicated on the Drawings. Conduit seals shall be of rigid galvanized steel. Seals in horizontal conduit installations shall be Thomas & Betts EYS, Appleton Type ESU, Crouse Hinds Type EYS, or equal. Seals in vertical conduit installations shall be Thomas & Betts EYD, Appleton Type SF, Crouse Hinds Type EYD, or equal, with continuous drain. When installing conduit seals make provision for percent fill space reduction in accordance with NEC.

2. Install sealing compound after wire has been installed. Ensure drain is not blocked in vertical seals when installing compound. Where conduit seals are installed in hazardous area applications, there shall be no conduit coupling, fitting, etc., between seal and boundary of hazardous area.

F. Surface Steel Raceway:

1. The surface steel raceway system for branch circuit wiring, data network, voice, video, and other low voltage wiring shall be as manufactured by the Wiremold Company, Hubbell, or Mono-Systems, Inc. or equal. The raceway system may be supplied pre-wired in accordance with all sections of these specifications and requirements herein, and shall be UL or another NRTL listed. Computer data installation shall be as required by other sections of this Division.

   a. If furnished pre-wired, the system must be listed in accordance with UL or another NRTL for “Multiple Outlet Assemblies” and so labeled on interior of the assembly. The pre-wired installation must contain no extra wire splices in the raceway as compared to a contractor assembled installation assembled from components. The pre-wired steel raceway shall be Hi-Pot tested at the factory to prevent any potential bare wire or shot circuit defects.

2. The raceway base, cover, and device bracket shall be manufactured of steel and finished in ivory, gray enamel or custom colors suitable for field painting to match adjacent finishes.

3. The raceway shall be a two-piece design with a metal base and snap-on metal cover, except for the Wiremold V700 system, Hubbell HBL750 series and Mono-Systems Inc. S145-700 series that shall be a one-piece design. The base and cover sections shall be a minimum of 0.040 inch wall thickness. The base section shall be available in ten-foot lengths. A hand-operated cutting tool shall be available for the base and cover to ensure clean, square cuts. Wiremold V500, Hubbell V500, and Mono Systems inc. SM500 series are not permitted.

4. A full complement of fittings shall be furnished, including but not limited to, flat internal and external elbows, tees, entrance fittings, wire clips, cover clips, couplings, support clips, C-hangers and end caps. The fitting color shall match the raceway color. Fittings shall be supplied with a base where indicated and/or

required. A take-off fitting shall be furnished as required to adapt to existing flush wall boxes.

5. Device brackets shall be furnished for mounting single or two-gang devices within the raceway. Devices shall be provided with the ability of mounting flush or in conjunction with standard steel, stainless steel, or manufacturer's metal faceplates.

6. The raceway shall be furnished with a complete line of connectivity outlets and modular inserts for unshielded twisted pair including category 5, fiber-optic, coaxial, and other cabling types with face plates and bezels to facilitate installation. Computer data installation shall be as required by other sections of this Division, and Division 27.

7. Raceway shall be furnished with corner elbows and tee fittings to maintain a cable bend radius which meets the requirements of fiber-optic and copper cables under EIA/TIA 569 for communications pathways.

G. Factory Pre-Wired Surface Metal Raceway:

1. Furnish and install pre-wired surface metal raceways as indicated on Drawings and as specified.

2. Metal Raceway shall be galvanized steel Wiremold V4000, Hubbell 4000 series, or Mono-Systems Inc. SMS-4000 series complete with raceway base, cover, fittings, receptacles and mounting plates required for a complete assembly. Raceway shall have two wiring compartments with integral dividing barrier for isolating the wiring compartments.

3. Pre-wired assembly shall be UL, or another NRTL listed as a multi-outlet assembly and surface raceway as labeled on interior of assembly.

4. Wiring devices and other components shall be factory installed, electrically wired and covers labeled as indicated on drawings. Each receptacle shall be identified with panelboard and circuit number from which it was fed. Grounding shall be maintained by means of factory installed grounding conductors.

5. Where shown on Drawings, Raceway covers shall have provisions for mounting computer data outlets.

6. Complete assembly is to consist of required fittings such as elbows, slide couplings for joining raceway sections, blank end caps and flat tees.

7. Prewired assembly must contain no wire splices.

8. Receptacles and wiring shall be as indicated on drawings and as specified.

9. Where raceway is used for power and computer data outlets, installation of data outlets shall be as required by other sections of this specification.

10. Prior and during installation, verify and comply with manufacturer's installation instructions.

11. Entire assembly shall be tested for shorts, opens, ground faults, and wire insulation at factory and certified. Raceways shall be electrically continuous and bonded in accordance with California Electrical Code.

12. Submit shop drawings for approval showing the complete layout of all components of each raceway, raceway lengths, each component description, location and circuit identification.

13. All wiring devices shall be removable without requiring disassembly of wireway.

14. Standard non OEM wiring devices shall be used as specified in District's specifications.

H. Wireways shall be 16 gage galvanized steel enclosed hinge/screw wiring troughs, surface metal raceway, wireway, and auxiliary gutter designed to enclose electrical wiring. Wireway fittings shall be furnished with removable covers and sides to permit complete installation of conductors throughout the entire wireway run. Cover shall be furnished with keyhole slots to accept captive screws locking the cover securely closed. Wireways shall be UL or another NRTL listed, and shall be Square D Type LDB NEMA-1 enclosure for interior applications, or Type RDB NEMA-3R enclosure for exterior applications, or equal by Cooper B-line, Hoffman, Wire Guard, or Circle AW.

I. Penetration in Fire-Rated Structures: Provide 3M, or equal, sealant and fire barriers for installing fire-rated seals around penetrations through floors, walls, and elevator hoistways. Fire stop system must be UL, or another NRTL listed, and classified for through-penetration applications of metallic conduits and busways.

J. Pull Wires: Install 1/8 inch polypropylene cords in empty or spare conduits.

PART 3 - EXECUTION

3.01 CONDUIT INSTALLATION

A. General Requirements:

1. Provide complete and continuous systems of rigid metallic conduit, outlet boxes, junction boxes, fittings and cabinets for systems of electrical wiring including lighting, power, and signal systems, except as otherwise specified.

2. EMT may be installed in interior concealed applications and in areas approved by owner. EMT shall not be installed in concrete, directly buried underground, outdoors, in boiler rooms, elevator pits, or where subject to damage.

3. Within buildings, flexible steel conduit may be installed instead of rigid steel conduit where permitted by code. Flexible steel conduit shall be installed:

   a. For continuous lengths not exceeding more than 50 feet between pull points (pull boxes, outlet boxes, etcetera).

   b. With no maximum total raceway length located within a building interior when the flex is located in concealed locations.

4. Flexible Steel conduit shall not exceed 1-1/2 inches in size.

5. Liquid-tight flexible steel conduit shall only be installed, except where otherwise specified, for final connection of motor terminal boxes, shop equipment, cafeteria equipment, HVAC equipment and other equipment, or for frequent interchange, and shall be of sufficient length, not exceeding 36 inches, to permit full travel or adjustment of motor on its base. Liquid-tight flexible conduit shall not be used for equipment not requiring adjustment or frequent interchange.

6. Connectors for flexible metal conduit shall be made of steel, and of the types which threads into convolutions of conduit. Connectors for watertight flexible metal conduit shall be as required for installation and shall be installed to provide a watertight connection.

7. Exposed conduit shall be installed vertically and horizontally following the general configuration of the equipment, using cast threaded hub conduit fittings where required and shall be clamped to equipment with suitable iron brackets and one hole pipe strap.

8. If connection is from a flush wall-mounted junction box, install an approved extension box.

9. Underground feeder distribution conduits for systems may be non-metallic conduit instead of rigid conduit except where otherwise specified or indicated.

10. Conduit shall be concealed unless otherwise indicated. Conduits exposed to view, except those in attic spaces and under buildings, shall be installed parallel or at right angles to structural members, walls, or lines of building. Conduits shall be installed to clear access openings.

11. Bends or offsets will not be permitted unless absolutely necessary. Radius of each conduit bend or offset shall be as required by ordinance. Bends and offsets shall be performed with standard industry tools and equipment or may be factory fabricated bends or elbows complying with requirements for radius of bend specified. Heating of metallic conduit to facilitate bending is not permitted. Public telephone conduit bends and offsets shall be provided with a radius which is not less than ten times trade size of conduit unless otherwise permitted. Refer to underground installation, specified in this section, for radius of bends and off-sets required for underground installations.

12. Running threads are not permitted. Provide conduit unions where union joints are necessary. Conduit shall be maintained at least six inches from covering of hot water and steam pipes and 18 inches from flues and breechings. Open ends of conduits shall be sealed with permitted conduit seals during construction of buildings and during installation of underground systems.

13. Expansion Joints/Seismic Separations/Separations between buildings/Locations Indicated: Provide Thomas & Betts XJG-TB, O-Z Electrical Mfg. Co. Inc. Type AX with bonding strap and clamps. Crouse Hinds XJGD, or equal. At exterior locations, provide Thomas & Betts XJG-TB, O-Z Electrical Mfg. Co. Inc. Type EX, Crouse Hinds XJGD, or equal. Provide Crouse Hinds, Thomas & Betts, or O-Z Electrical Mfg. Co. Type AXDX, or equal Combination Deflection/Expansion Fittings at all seismic separations. Provide manufactures internal and external Bonding Jumpers at all locations. Liquid-tight flexible conduit shall not be approved at expansion joints or seismic separations.

14. Where conduits are terminated in groups at panelboards, switchboards, and signal cabinets, etc., provide templates or spacers to fasten conduits in proper position and to preserve alignment. Conduits terminating at signal cabinets shall only enter cabinets in the following locations:

    a. Conduits entering top, side, and bottom of cabinets shall be aligned in a single row, centered two inches from rear of cabinet.

    b. Conduits entering back of cabinet shall be aligned in a single row centered two inches from top of cabinet.

    c. Conduits shall not be spaced closer than three inches on centers.

15. Conduits above metal lath ceilings shall be rigidly suspended with pipe hangers or pipe racks or shall be secured to superstructure with factory fabricated pipe straps.

Conduits in metal lath or steel stud partitions shall be tied to furring channels or studs. In ceiling spaces and in partitions, tie wires shall be spaced not more than 5 feet apart, shall fasten conduit tight against channels and studs at point of tie and shall not support any of conduit weight. Tie wire shall be 16 gage galvanized double annealed steel.

16. Where auxiliary supports, saddles, brackets, etc., are required to meet special conditions, they shall be fastened rigid and secure before conduit is attached.

17. Conduit in ceiling spaces, stud walls, and under floors, shall be supported with factory fabricated pipe straps or shall be suspended with pipe hangers or pipe racks. Pipe straps shall be attached to and shall fasten conduit tight at point of support against ceiling and floor joists, rafters, and wall studs, or two-inch x four-inch headers fitted between joists or wall studs.

18. Conduits installed on exposed steel trusses and rafters shall be fastened with factory fabricated conduit straps or clamps, which shall fasten conduit tight against supporting member at point of support.

19. Conduits installed under buildings shall be strapped with factory fabricated conduit straps to underside of concrete floor or joists, or wood floor joists, or shall be suspended with pipe hangers or pipe racks. Conduits under building are not permitted to be placed directly on grade; they shall be suspended from building or shall be buried below surface or ground. 1-1/4 inch and larger conduits under buildings shall be installed with conduit hangers or racks.

20. Pipe hangers for individual conduits shall be factory fabricated. Steel rods shall be 3/8 inch for two-inch conduit hangers and smaller and shall be 1/2 inch for 2 ½-inch conduit hangers and larger.

21. Pipe racks for groups of parallel conduits and for supporting total weights not exceeding 500 pounds shall be trapeze type and shall consist of a cross channel, Steel City Kindorf B-900, Unistrut P-1000, equivalent Cooper B-Line or equal, suspended with a 3/8 inch minimum diameter steel rod at each end. Rods shall be fastened with nuts, top and bottom to cross-channel and with square washers on top of channel. Conduits shall be clamped to top for cross-channel with conduit clamps, Steel City Kindorf C-105 or Unistrut P-1111 through P-1124, equivalent Cooper B-Line, or equal. Conduits shall not be stacked one on top of another, but a maximum of two tiers may be on same rack providing an additional cross-channel is installed. Where a pipe rack is to be longer than 24 inches, or if the supported weight exceeds 500 pounds, submit Shop Drawings of installation to the Architect for review.

22. Conduits suspended on rods more than two feet long shall be rigidly braced to prevent horizontal motion or swaying. Installation shall meet zone 4 seismic requirements.

23. Factory fabricated pipe straps shall be one or two-hole formed galvanized clamps, heavy-duty type, except where otherwise specified.

24. Hangers, straps, rods, or pipe supports under concrete shall be attached to inserts set at time concrete is placed, or with approved concrete anchors. Under wood, install bolts, lag bolts, or lag screws; under steel joists or trusses, install beam clamps. Contractor shall submit size of anchors, bolts, screws, and installation method to Architect for approval prior to start of any work.

25. Conduits shall be supported at intervals required by code, but not to exceed ten feet. One inch and smaller exposed conduits shall be fastened with one-hole malleable iron straps. Perforated straps and plumber's tape is not permitted for the support of conduits.

26. Conduits stubbed up through a roof or an arcade shall be flashed with a waterproof flashing. Refer to Division 07 for additional requirements.

27. Bushings and locknuts for rigid steel conduit shall be steel threaded insulating type. Setscrew bushings are not permitted.

28. Flex conduits shall be cut square and not at an angle.

29. Routing of conduits may be changed providing length of any conduit run is not increased more than ten percent of the length indicated on Drawings.

B. Underground Requirements:

1. Conduits and multicell raceways installed underground shall be entirely encased in three inch thick concrete on all sides , except where otherwise specified. Provide required spacers to prevent any deflection when concrete is placed and to preserve position and alignment. Conduits and raceways shall be tied to spacers. Anchors shall be installed to prevent floating of conduits and raceways during placing of concrete. Provide red colored concrete to encase conduits of systems operating above 600 volts.

2. Underground conduits and raceways shall be buried to a depth of not less than 24 inches below finished grade to top of the concrete envelope, unless otherwise specified.

3. Assemble sections of conduit with required fittings. Cut ends of conduit shall be reamed to remove rough edges. Joints in conduits shall be provided liquid-tight. Bends at risers shall be completely below surface where possible.

4. Conduits and raceways in a common trench shall be separated by at least three inches of concrete. Electrical power and/or lighting conduit runs installed in a common trench with conduits containing signal system wiring such as public address, telephone, intrusion detection, fire alarm, television, computer networking, and clock systems shall maintain a separation of a minimum of six inches from these types of signal system conduits and raceways. Electrical power, lighting and signal conduits and raceways installed in a common trench with other utility lines such as gas, water, sewer and storm lines shall maintain 12 inches separation from these types of utility lines.

5. The Inspector will observe underground installations before and during concrete placement. A mandrel shall be drawn through each run of conduit in presence of the Inspector before and after placing concrete. Mandrel shall be six inches in length minimum, and have a diameter that is within 1/4 inches of diameter of conduit to be tested.

6. Non-metallic conduit installations shall comply with following additional requirements. Joints in PVC conduit shall be sealed by means of required solvent-weld cement supplied by conduit manufacturer. Non-metallic conduit bends and deflections shall comply with requirements of applicable electrical code, except that minimum radius of any bend or offset for conduits sized from 1/2 inch to 1 ½-inch inclusive shall not be less than 24 inches. Bends at risers and risers shall be PVC-coated rigid steel conduit. Radius of curve of bends or offsets in non-metallic

conduit for public telephone system shall be not less than ten times trade size of conduit, unless otherwise specifically permitted.

7. Furnish and install a six-inch wide, polyethylene, red underground barrier type 12 inches above full length of concrete reading, "CAUTION ELECTRIC LINE BURIED BELOW".

8. Underground conduit systems provided for utility companies shall be furnished to meet the requirements of the utility companies requiring service.

9. Protect inside of conduit and raceway from dirt and rubbish during construction by capping openings.

10. Add bell-end bushings for conduit stub-up including underground entries to pull boxes, and manholes. Under floor standing switchboards and motor control centers provide a four-inch galvanized nipple with ground bushing.

11. Underground conduit for systems operating above 600 volts shall be a minimum size of four inches.

12. At portable classroom all stub ups shall be installed with a coupling flush to finish grade.

13. Underground conduits and raceways shall be swabbed prior to wire pull.

C. Rooftop conduit shall be supported from channels, stands, clamps, trapezes, rollers, or structures mounted on 100% rubber, UV resistant rooftop supports with reflective strips, Dura-Blok, or equal. Roller type supports shall be provided below and above conduit to prevent its dislodgement. Bottom of conduits shall clear the roof surface by 10 inches.

1. At PVC roofing provide walk tread, polyester reinforced, UV resistant, with surface embossment at rooftop supports. Heat welding of walk pads shall only be done by manufacturer certified installers.

   a. Sika-Sarnafil and Carlisle: Walk tread shall be no more than one inch larger than the plan area of the pipe support blocks and adhered to the roof membrane with Sika 1A or Carlisle Universal Single-Ply sealant, as applicable.

   b. Johns Manville: Walk tread shall be installed under the pipe support blocks and adhered to the blocks, if possible, and left loose laid on top of the PVC roof system. Walk-pad shall have a minimum of 4 inches of material past perimeter on all 4 sides of block.

2. Built-up roofing: Provide APP granulated modified torch-down at each pipe support block. Torch-down shall extend 2 to 4 inches beyond the edges of the block and adhered by torch application over existing cap sheet membrane. This work shall be performed by a certified roofer.

D. General Installation Requirements for Computer Network System Conduits:

1. Location of outlet boxes and equipment on Drawings is approximate, unless dimensions are indicated. Drawings shall not be scaled to determine position and routing of wireways, drops, and outlet boxes. Location of outlet boxes and equipment shall conform to architectural features of the building and other Work already in place and must be ascertained in the field before start of Work.

2. The maximum pulling tensions of the specified cables shall not be exceeded and proper radius of cable bends shall be maintained.

3. For computer network wiring, conduit types shall be limited to rigid metal conduit, electrical metallic tubing, schedule 40 PVC, multi-cell raceways, and flexible metallic conduit for lengths less than six feet.

4. Interior section of conduit run shall be not longer than 100 feet and shall not contain more than two bends of 90 degrees between pull points or pull boxes.

5. The inside radius of a conduit bend shall be at least six times the internal diameter of the conduit. When the conduit size is greater than two inches, the inside radius shall be at least ten times the internal diameter of the conduit. For fiber-optic cable, the inside radius of a conduit bend shall be at least ten times the internal diameter of the conduit.

6. Conduit shall be sized in accordance with Table 4.4-1 of EIA/ TIA 569 standard.

7. Splicing or terminating cables in pull boxes is not permitted.

8. For indoor application, a pull box shall be provided in conduit run where:

   a. The length is over 100 feet.

   b. There are more than two bends of 90 degrees.

   c. There is a reverse bend in the run.

9. Boxes shall be provided in a straight section of conduit and shall not be installed in lieu of a bend. The corresponding conduit ends are to be aligned with each other. Conduit fittings shall not be installed in place of pull boxes.

10. Where a pull box is provided with raceways, pull box shall comply with the following:

    a. For straight pull-through, provide a length of at least eight times the trade-size diameter of the largest raceway.

    b. For angle and U-pulls:

       1) Provide a distance between each raceway entry inside the box and the opposite wall of the box of at least six times the trade-size diameter of the largest raceway, this distance being increased by the sum of the trade-size diameters of the other raceways on the same wall of the box.

       2) Provide a distance between the nearest edges of each raceway entry enclosing the same conductor of at least:

          a) Six times the trade-size diameter of the raceway; or

          b) Six times the trade-size diameter of the larger raceway if they are of different size.

          c) For a raceway entering the wall of a pull box opposite to a removable cover, provide a distance from the wall to the cover of not less than the trade-size diameter of the largest raceway plus six times the diameter of the largest conductor.

11. Drawings generally indicate Work to be installed, but do not indicate all bends, transitions of special fittings required to clear beams, girders or other Work already in place. Investigate conditions where conduits and wireways are to be installed, and furnish and install required fittings.

E. Slabs on Grade:

1. Unless specifically reviewed by the Architect and DSA, conduits 1 ¼-inches and larger are not permitted to be installed in structural concrete slabs. Where conduits are permitted, and are installed in concrete slabs on grade, slabs shall be thickened at bottom where conduits occur to provide three inches of concrete between conduit and earth. Required excavation shall be part of the Work of this section.

2. If concrete slab is five inches or more in thickness with a moisture barrier plastic sheet between earth and slab, one inch and smaller conduits shall be installed in the slab with a minimum of one inch concrete between earth and conduit.

F. Concrete Walls, Beams, and Floors: Provide sleeves where conduits pierce concrete walls, beams, and floors, except floor slabs on grade. Sleeves shall provide 1/2 inch clearance around conduits. Sleeves shall not extend beyond exposed surfaces of concrete and shall be securely fastened to forms. Where conduits pass through walls below grade, seal with required sealant and backer materials between conduit and sleeve to provide a watertight joint. Sealant shall be as indicated in Section 07 9200: Joint Sealants.

3.02 STUBS

A. Panelboard: Install two one inch conduits from each flush mounted panelboard to access under floor space and to access above ceiling space where these conditions occur. Cap conduits with standard galvanized pipe caps.

B. Floor: At points where floor stubs are indicated in open floor areas, for connections to machines and equipment, conduits shall be terminated with couplings, tops flush with finished floor. Stubs shall extend above couplings the indicated distance. Where capped stubs are designated, couplings shall be closed with cast iron plugs with screw drive slots.

C. Underground:

1. Underground conduit stubs shall be terminated at locations indicated, and shall extend five feet beyond building foundations, steps, arcades, concrete walks and paving. Rigid metallic conduit stubs and non-metallic conduit stubs shall be capped by installing a coupling flush in end wall of concrete encasement and plugging with a permitted plug. Project record drawings shall indicate location of ends of underground conduit stubs fully dimensioned and triangulated with reference to buildings or permanent landmarks. These dimensions, including depth below finished grade, shall be marked on project record drawings in presence of the Inspector before backfilling trench. Where extending existing concrete encased stubs, clean, chip and wire brush end of existing concrete and brush on a heavy coat of neat cement paste or epoxy bonding agent.

2. Over ends of individual underground conduit stubs or groups of conduit stubs, install four-inch by 18-inch deep PVC filled with concrete, flush with finished grade in asphaltic concrete or lawns, and two inches above finished grade in planting areas. Cast a three-inch by three-inch brass plate engraved "ELECT" flush in top of concrete. Secure plate to concrete with brass dowels or as indicated on drawings.

3.03 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.04 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 26 0586 - MOTORS AND DRIVES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Furnishing and installation of electric motors, machinery drives, and equipment as indicated. Sizes, capacities, and operating conditions shall be as tabulated on equipment schedules.

C. Related Requirements:

1. Division 01 - General Requirements.

2. Section 23 0548: HVAC Sound, Vibration and Seismic Control.

3. Section 23 2013: HVAC Piping.

4. Section 23 6000: Central Cooling Equipment.

5. Section 23 8000: Heating, Ventilating and Air Conditioning Equipment.

6. Section 23 0900: HVAC Instrumentation and Controls.

1.02 ELECTRICAL REQUIREMENTS

A. Except where modified by specific requirements of an individual mechanical section, the following electrical Work required by Division 23 is included under Division 26, 27 and 28, and as indicated on Drawings:

1. Motor starters and disconnect switches for motors.

2. Line voltage wiring and conduit to motors, motor starters and controls.

3. Installation of line voltage wall-mounted electric controls.

B. Power Supply: Provide necessary power supplies for the intended operation and application as indicated on the Drawings. Verify indicated power supplies with Architect/Engineer prior to ordering equipment.

C. Pre-wired Control Panels: Where pre-wired control panels or equipment are provided under Division23, internal wiring shall extend neatly to a terminal strip which shall have same designation for terminals that are indicated on

wiring diagrams. Pre-wired panels shall be listed and labeled by UL, or other Nationally Recognized Testing Laboratory (NRTL).

D. Workmanship: Where Work of Division 23 includes either factory or field wiring, materials and workmanship shall conform to requirements of Division 26, 27 and 28 Specifications and governing codes.

1.03 SUBMITTALS

A. Provide in accordance with Division 01 and 23 0500: Common Work Results for HVAC.

B. Manufacturer's Data

1. Complete material list of items proposed to be provided under this section.

2. Manufacturer's specifications and other data required to demonstrate compliance with specified requirements.

3. Shop Drawings indicating complete system layout, diagrams, and schedules.

4. Manufacturer's recommended installation procedures.

C. Manufacturer's recommended installation procedures, when reviewed by the Architect, will become basis for inspecting actual installation procedures.

1.04 QUALITY ASSURANCE

A. Manufacturer and Installer Qualifications: Comply with provisions stated under Section23 0500: Common Work Results for HVAC.

1. Qualifications of Manufacturers: Products furnished for the Work of this section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a five-year history of successful production.

1.05 PRODUCT HANDLING

A. Protection, Replacement, Delivery, and Storage: Comply with provisions stated under Section23 0500: Common Work Results for HVAC.

PART 2 - PRODUCTS

2.01 EQUIPMENT

A. Electrical Motors: Motors shall provide adequate starting torque to bring driven equipment up to rated speed in the stipulated time intervals:

1. In general, motors 1/2 horsepower and larger shall be squirrel cage induction type for 3-phase, 60 cycle power supply.

2. Motors below 1/2 horsepower shall be capacitor start, induction run type or split-phase type for single phase, 60 cycle power supply.

B. Motors Furnished with Equipment: Where motors are an integral part of equipment, motors shall be as recommended by the equipment manufacturer.

C. Motor Operation Criteria:

1. Motors that are not directly exposed to weather, and are located in non-hazardous spaces, shall be furnished with drip-proof enclosures and shall be continuous duty rating of 100 degrees F.

2. Motors installed unprotected in outdoor locations shall be totally enclosed, fan-cooled, and continuous duty rating at 130 degrees F.

3. Single phase motors shall be furnished with built-in overload protection. Overload protectors shall be single pole automatic reset type, except where frequent start/stop may constitute a hazard, reset shall be manual.

4. Hermetic polyphase motors shall be furnished with built-in hermetic thermostatic protection devices, which shall interrupt the control circuit to protect the motor from overheating.

5. Motors shall be furnished with UL, or other NRTL approved terminal boxes. All motors including mountings and shaft sizes, shall be built to NEMA standard dimensions; except where integral with hermetic equipment

6. Where application is unique, or location is contaminated or hazardous, high starting torque totally enclosed or explosion-proof motors shall be provided.

7. Where Drawings schedule 3-phase for motors smaller than 1/2 horsepower or single phase for motors larger than 1/2 horsepower, specifically verify schedule with the Architect before ordering motors.

8. Two-speed motors shall be separately wound if speeds required are not a two-to-one ratio. If two-to-one speed ratio is required, motors shall be single wound. Two-speed motors shall be furnished with variable horsepower.

9. Motors shall be furnished with sealed lifetime lubricated ball bearings.

10. Motors shall be energy efficient complying with NEMA standards.

D. Machinery Drives:

1. Couplings: Where couplings are specified for direct drive, non-lubricated types shall be furnished and rating shall be at least 125 percent motor horsepower rating.

2. Belt Drives: Where V-belt drive is required, provide for overload in accordance with manufacturer's recommendations, but not for less than 150 percent of motor horsepower.

a. Drive selection shall provide not less than 95 percent efficiency.

b. Fan drives smaller than 25 horsepower shall be furnished with adjustable pitch drive sheaves.

c. Other drives shall be machined cast iron or steel fixed pitch.

E. Machinery Accessories:

1. Lubricating Devices: Provide level gages, oil pressure gages, grease cups, and grease gun fittings as required by the equipment. Extend lubricating fittings to readily accessible locations.

2. Guards: Rotating equipment shall be provided with guards to protect operating and/or maintenance personnel.

a. Belt guards shall enclose belts, pulleys and sheaves. They shall be constructed of galvanized expanded sheet steel, installed in an angle frame with angle or channel supports.

b. Couplings guards shall completely enclose rotating couplings and shall be constructed of galvanized sheet steel, installed to eliminate vibrations.

c. Guards shall be readily removable to provide access to belt drives and couplings.

d. Provide opening at shaft end for revolution counter.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install equipment as indicated on Drawings and in compliance with manufacturer's recommendations, with vibration isolation, mounting pads or foundations as specified in other sections.

3.02 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.03 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 26 0800 - ELECTRICAL SYSTEMS COMMISSIONING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Section Includes:

1. General requirements for Commissioning (Cx) of lighting systems components, lighting controls and HVAC systems line voltage interconnection components, including installation, start-up, testing and documentation according to Construction Documents and Commissioning Plan (CxP).
2. Standard procedures for the execution of commissioning work shall be in conformance with Division 1, Section 01 9113 General Commissioning Requirements. Coordinate work with the Commissioning Agent (CxA).

1.02 RELATED REQUIREMENTS:

1. Division 01 - General Requirements.
2. Section 01 9113: General Commissioning Requirements.
3. Section 01 7900: Maintenance and Operations Staff Demonstration and Training.
4. Section 23 8000: Heating, Ventilation, and Air Conditioning Equipment.
5. Section 23 0800: HVAC Systems Commissioning.
6. Section 26 0500: Common Work Results for Electrical.
7. Section 26 0513: Basic Electrical Materials and Methods.
8. Section 26 0526: Grounding and Bonding.
9. Section 26 0519: Low Voltage Wires (600 Volt AC).
10. Section 26 0586: Motors and Drives.
11. Section 26 2419: Motor Control Center and Motor Control Devices.
12. Section 26 5000: Lighting.
13. Section 26 0923: Lighting Control Systems.

1.03 REFERENCES

A. Applicable codes, standards, and references: inspections and tests shall be in accordance with the following applicable codes and standards:

1. National Electrical Testing Association – NETA.
2. National Electrical manufacturer's Association – NEMA.
3. American Society for Testing and Materials – ASTM.
4. Institute of Electrical and Electronic Engineers – IEEE.
5. American National Standards Institute – ANSI.

6. National Electrical Safety Code – NESC.
7. International Building Code – IBC.
8. National Electrical Code – NEC.
9. National Fire Protection Association – NFPA.
10. ANSI/NFPA 70 – National Electrical Code.
11. ANSI/NFPA 70B – Electrical Equipment Maintenance.
12. NFPA 70E – Electrical Safety Requirements for Employee Work Places.
13. ANSI/NFPA 101– Life Safety Code.

1.04 SUBMITTALS

A. Submittals shall include the following:

1. Submit required Cx submittals in accordance with Division 1 Specification Sections.
2. Copy of the Architect's reviewed and accepted submittals to the CxA via the OAR.
3. List of team members who will represent the Contractor in the Pre-functional Equipment Checks and Functional Performance Testing, at least two weeks prior to the start of Pre-functional Equipment Checks.
4. Detailed manufacturer installation and start-up, operating, troubleshooting and maintenance procedures, checklist documentation and field checklist forms to be used by factory or field technicians, and a copy of full details of Owner-contracted tests, full factory testing reports, if any, and Warranty information, including responsibilities of Owner to keep Warranty in force, clearly defined.
5. Detailed manufacturer's recommended procedures and schedules for Pre-functional Equipment Checks, supplemented by Contractor's specific procedures, and Pre-functional Tests, at least four weeks prior to the start of Pre-functional Performance Tests.
6. After facility's commission is complete, submit completed Pre-functional Equipment Checklists and Functional Performance Test checklists organized by system and by subsystem. Bind information in a single package. The results of failed tests shall be included along with a description of the corrective actions taken.

1.05 MEETINGS, SEQUENCING AND SCHEDULING

A. Meetings: Attend (Cx) meetings as required under Section 01 9113 and the Cx Plan.

B. Sequencing and Scheduling: The work described in this Section shall begin only after work required in related Division 26 Sections has been successfully completed, and tests, inspection reports and Operation and Maintenance manuals required in Division 26 Sections have been submitted and approved. The start-up and Pre-functional Equipment Checklists shall be completed and submitted to the Owner's Authorized Representative (OAR) prior to the Functional Performance Tests. Refer to the project Cx Plan for more details.

1. Coordinate electrical work with the work of other trades prior to scheduling of any Cx procedures.
2. Coordinate the completion of electrical testing, inspection, and calibration prior to start of Cx activities.
3. Cx activities shall be scheduled in accordance with project's Cx plan.

1.06 QUALITY CONTROL

A. Comply with Owner's Quality Control Specifications, Sections 01 4516 – 01 4519, as applicable.

B. Incorporate manufacturer's recommended Cx procedures for the systems and equipment to be commissioned under this Section.

PART 2 - PRODUCTS

2.01 TEST EQUIPMENT

A. Equipment to be utilized in the commissioning process shall meet the following requirements:

1. Provide test equipment as necessary for the equipment and systems to be commissioned.
2. Provide testing equipment and accessories that are free of defects and certified for use.
3. Provide testing equipment with current calibration labels per NIST Standards.
4. Testing equipment shall be UL Listed.

PART 3 – EXECUTION

3.01 COMMISSIONING PROCESS REQUIREMENTS

A. Work to be performed prior to commissioning:

1. Complete all phases of the work so the system(s) can be started, tested, adjusted, balanced, and otherwise commissioned.
2. Start-up services required to bring each system into full operational state and ready for functional performance testing:
    a. Completion of prefunctional checklists.
    b. Manufacturer's Authorized Representative Start-up as required
    c. Contractor start-up
    d. Testing.
    e. Motor rotation check.
    f. Control sequences of operation.
    g. Full and part load performance.
3. If modifications or corrections to the installed systems are required to bring the system(s) to acceptance levels due to Contractor's incorrect installation or

defective materials, such modifications or corrections shall be made at no additional cost to the Owner.

4. Start-up services required to bring each system into full operational state and ready for functional performance testing:
   a. Completion of prefunctional checklists.
   b. Manufacturer's Authorized Representative Start-up as required
   c. Contractor start-up
   d. Testing.
   e. Motor rotation check.
   f. Control sequences of operation.
   g. Full and part load performance.
5. Commissioning shall not start until each system is complete and the above items are completed and approval has been received by the OAR

B. Pre-commissioning Responsibilities: Inspection, calibration and testing of the equipment and apparatuses to commission the following systems:
1. Electrical Lighting Systems.
2. Lighting Controls.
3. HVAC line voltage electrical components.
4. Line voltage interface of Environmental Controls and Energy Management System with other systems.
5. Photovoltaic Systems

C. Commissioning Process Requirements:
1. Refer to Section 01 9113 General Commissioning Requirements, related sections and Cx Plan for information on meetings, start-up plans, Pre-Functional and Functional Performance Testing (FPT), operations and maintenance data, and other Commissioning activities.

3.02 PREPARATION

A. Provide certified electricians or other qualified personnel as required with tools and equipment necessary to perform Cx activities.

B. Provide equipment manufacturer's factory representative(s) for commissioning of classrooms lighting and its control system, Theatrical Lighting Controls, and Energy Management and Environmental Control Systems as required by the Cx Plan.

C. Provide certified testing agency personnel or report(s) as required in the Cx Plan.

3.03 TESTING

A. Testing documentation shall include the following minimum information:
1. Test number.
2. Equipment used for the test, with manufacturer and model number and date of last calibration.

3. Date and time of the test.
4. Indication of whether the record is the first commissioning test or a retest following correction of a previously identified problem or issue.
5. Identification of the system, subsystem, assembly, or equipment.
6. Conditions under which the test was conducted, including (as applicable) ambient conditions, set points, override conditions, and status and operating conditions that impact the results of the test.
7. Systems and assemblies test results, performance and compliance with contract requirements.
8. Issue number, if any, generated as the result of the test.
9. Name and signature(s) of witnesses and the person(s) performing the test.

B. Test lighting and controls systems performance to verify operation, functionality, light levels, energy usage, and compliance with construction documents.

1. Start up, test and document results under the observation of the CxA.
2. Execute the Functional Performance Test (FPT) under the observation of the CxA who will record the results of the Functional Performance Test procedures.
3. Equipment and Components to be tested: Refer to Article 3.01, B.
4. Functions and Testing Conditions:
   a. Occupancy sensors and timer controls for lighting:
      1) Verify that specified functions and features are set up, debugged and fully operable at time of test.
      2) Verify that occupant override feature functions properly and as intended in the contract documents.
      3) Verify that sensor durations are set properly.
      4) Test the sequence of operation for features and modes and confirm that adjustable timing matches the design specifications and contract documents.
   b. Electric lighting dimming, photocells and controls:
      1) Test the dimming controls during daytime when conditions are such that controls should be dimming electric lighting. Verify that amperage changes in light fixtures are proportional to external light changes. Verify that dimmed light levels at the specified work plane remain within specified limits.
      2) Verify that delays and ramp times are set and functioning so that the speed of change of light fixture output is slow enough to not bother occupants and in compliance with the specifications.
      3) Verify that dimming does not cause lower than specified light levels in adjacent “non-dimmed” spaces.
      4) Verify that the controls and sensors cannot be easily overridden or disabled by occupants.

5) Verify that dimming systems in places of assembly are interfaced with the Central Fire Alarm system. Dimmed lighting in these areas shall come back to full bright during a fire alarm condition.

c. Illumination Levels, Night Conditions:

1) Verify that lighting throughout the building is operating automatically.

2) Test with doors closed (to simulate actual occupancy) and after finishes are complete.

d. Illumination Levels, Day Conditions:

1) Verify that lighting throughout the building is operating automatically.

2) Test with doors closed (to simulate actual occupancy), after finishes are complete, and room is furnished.

3) Test at different times during the day, or under Owner-approved simulated conditions, to ensure proper system response and to determine that lighting levels are within specified requirements.

4) Test the system for the different pre-determined settings. Quiet time, AV mode, and normal standard class operation.

e. Lighting Power Density: Perform the test with interior lighting turned on and any manual or automatic controls temporarily overridden. The lighting power shall be measured at the building's electrical panels. Measurements shall be taken at least one minute after lighting in the building is on.

f. Emergency Lighting System: Verify that the system operates automatically under any condition, without human intervention, and that it resets back to normal operations after the power failure is over or cleared.

5. Acceptance Criteria:

a. Lighting Controls: For the conditions, sequences and modes tested, the dimming, occupancy, photocell, and timing controls, integral components and related equipment respond to changing conditions and parameters appropriately as defined in the Contract Documents.

b. Illumination Levels: Average light levels in the tested space at the work plane elevation shall not be less than ten percent below nor greater than 20 percent above the specified light level range for the space.

c. Lighting Power Density: Average instantaneous lighting power density is plus or minus ten percent of that indicated in the Construction Documents. Power factors on lighting circuits shall be 0.95, or as required by lighting fixture specifications.

6. Sampling Strategy for Identical Units:

a. Lighting Controls: Test automatic interior lighting controls.

b. Illumination Levels: At least 50 percent of space zones and rooms, chosen by the Owner, shall be verified as realizing proper light levels. If 25 percent of the spaces in the first sample fail the Functional Performance Tests, test another ten percent of the untested space zones and rooms (the second sample). If ten percent of the spaces in the second sample fail, test remaining spaces.

c. Power Density: Test lighting circuits.

C. HVAC Electrical Component Testing

1. Document HVAC Division 23 electrical components using the startup procedure submitted by Contractor and accepted by the CxA.

2. Complete requirements of the Prefunctional Checklists.

3. Verify the following information prior to HVAC system equipment startup.

a. Voltage.

b. Phase.

c. Motor Size.

d. Lock Rotor Amperage.

e. Full Load Amperage.

g. Minimum and Maximum Circuit Ampacity.

h. Feeder protection or branch circuit protection, breaker or fuse size as applicable.

4. Coordinate and check corresponding unit electrical protection size and code required clearances.

D. Participate and perform Cx related testing requirements prescribed under Sections 01 9113 and the approved project Cx Plan.

3.04 ADJUSTING

A. Systems improperly adjusted, incorrectly installed equipment or deficient Contractor performance may result in additional work being required for Cx acceptance.

1. Perform work required to correct installations not meeting contract requirements at no additional cost to the Owner.

B. Corrective work shall be completed in a timely manner to permit completion of the Cx process.

1. Refer to the Cx Plan for retesting requirements necessary to achieve required system performance.

2. If the systems' Cx deadline, as defined in the Cx Plan, goes beyond the scheduled completion of Commissioning without resolution of the problem, the Owner reserves the right to obtain supplementary services or equipment to resolve the problem.

3.05 TRAINING

A. Provide training and documentation as required in applicable Division 26 specification sections, and other related sections.

END OF SECTION

SECTION 26 0923 - LIGHTING CONTROL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Low-voltage lighting control system.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 26 0500: Common Work Results for Electrical.
3. Section 26 0513: Basic Electrical Materials and Methods.
4. Section 26 0519: Low-Voltage Wires (600 Volt AC).
5. Section 26 0533: Raceways, Boxes, Fittings, and Supports.
6. Section 26 2416: Panelboards and Signal Terminal Cabinets.
7. Section 26 5000: Lighting.

1.02 SUBMITTALS

A. Provide in accordance with Division 01.

B. Submit a complete one-line diagram of the proposed system configuration for Architect/Engineer’s review. The riser diagram shall identify but not be limited to wiring, equipment, components, interconnection with other systems, and location and type of raceways.

C. Manufacturer's Data: Submit catalog cuts and description of each system component.

D. Provide wiring diagrams and installation details for lighting control equipment.

E. Shop Drawings: Submit a complete set of detailed Shop Drawings for the entire lighting control system; the shop drawings shall include but not be limited to relay panels with designations and dimensions, day light sensors locations based on manufacturer’s recommendations, and system components with manufacturer’s part numbers.

F. Installation Instructions: Submit manufacturer's written installation instructions, wiring diagrams. Instructions shall include recommendations for handling of equipment and parts, and protection and storage requirements.

1.03 QUALITY ASSURANCE

A. Components shall be listed and labeled by Underwriter's Laboratories (UL), or another Nationally Recognized Testing Laboratory (NRTL).

B. Lighting Control Systems shall comply with the state of California Building and Electrical Codes, and Title 24 energy requirements in effect at time of submittal for building permit.

C. Conduct a coordination meeting with the lighting control contractor, electrical contractor, EOR, Manufacturer Representative, and the OAR to validate the location of lighting control system components, including daylight sensors. Sensors shall be located based on manufacturer's recommendations.

1.04 WARRANTY

A. Manufacturer shall provide a three year material warranty.

B. Installer shall provide a two year installation warranty.

1.05 SYSTEM REQUIREMENTS

A. Systems shall be furnished with networkable relay panels complete with relays, transformers, and control electronics. The system shall be furnished with hardware and resident software, occupancy sensors, constant light controllers, exterior light sensors, occupancy sensors, local wall switches and dimmer switches, conduit and wiring for a complete and functional installation.

1.06 LIGHTING CONTROL OVERVIEW-BY AREA CONTROLLED

A. Toilet Rooms:

1. Are controlled by a combination of occupancy sensors, and central dimming system.

a. The occupancy sensor is to automatically switch lights OFF when the room is not occupied.

b. The Central Dimming Panel shall light intensity according to the Owners requirements. The occupancy sensors to ensure d automatically turn ON when room is unoccupied.

c. Wall switches are to automatically switch lights ON and OFF. Switches shall comply with the operational requirements of the current T24, and include location of device, accessibility and override capability.

B. General Areas:

a. Are to be controlled by occupancy sensors. G. Emergency Lighting:

1. Emergency lighting controls shall be equipped with by pass circuitry that will bypass all manually operated switches, lighting control systems, dimmers and occupancy sensors during power failure situations. Design shall comply with applicable codes and regulations. Each area of luminaries or groups of luminaries shall be equipped with and controlled by a UL924 listed emergency lighting control unit to allow the detection of localized power failure.

PART 2 - PRODUCTS

2.01 OCCUPANCY SENSORS

A. Occupancy Sensors:

1. Ceiling-Mounted Dual Technology Sensors:

a. Sensors shall be dual technology infrared-ultrasonic capable of detecting presence in floor area to be controlled, by detecting Doppler shifts in transmitted ultrasound and infrared technology.

b. Detection shall be maintained when a person moves only within a maximum distance of 12 inches, in either a horizontal or vertical manner, at approximate speed of 12 inches per second. Lights shall not go off when a person is reading or writing while seated at a desk.

c. Each sensor shall be furnished with a convenient shunt provision, which will enable a person to by-pass sensor in event of failure.

d. Sensitivity shall not change more than ten percent in temperature range of 0 degrees F. to 120 degrees F., and in humidity range of ten percent to 80 percent. Sensitivity adjustment shall be provided for each technology.

e. Time delay range shall be adjustable from 15 seconds to 15 minutes.

f. Sensors shall operate on DC power (12 volts to 24 volts). Power supply shall be provided by power pack, consisting of a transformer and contact closure relay in one package. Power output of transformer shall be capable of operating a minimum of two sensors.

g. Manufacturers: Watt Stopper No. DT-200, similar as manufactured by Leviton, Sensor Switch, Unenco, or equal.

2. Passive Infrared Wall Switch Sensors with Daylight Controls:

a. Sensors shall be capable of detecting presence in floor area to be controlled, by detecting changes in infrared energy. Small

movements shall be detected such as when a person is writing while seated at a desk.

b. Passive infrared sensor shall utilize a dual-element sensor and a multi-element fresnel lens.

c. Sensor shall be furnished with a daylight filter which ensures that sensor is insensitive to short-wavelength infrared waves, such as those emitted by the sun.

d. Sensors shall be furnished with convenient bypass provisions, which enable lighting to be turned on in case of failure.

e. Time delay range shall be adjustable from 15 seconds to 15 minutes.

f. Sensitivity adjustment shall range from 0 (off) to ten (maximum).

g. Adjustments and mounting hardware shall be concealed under a removable cover to prevent tampering with adjustments and hardware.

h. Each sensor shall cover up to 800 square feet, with a field-of-view of 150 degrees.

i. Sensor shall be two-wire, completely self-contained control system that replaces standard toggle switch. Power supply shall be an internal transformer, and switching mechanism shall be a latching dry contact relay.

j. Sensor shall be capable of switching from 50 to 1000 watt, incandescent or fluorescent.

k. Sensor shall be furnished with a daylight feature, adjustable from ten to 400 foot-candles, that maintains lighting off when a desired foot-candle level is present.

l. Sensors shall be dual voltage, 120 volt and 277 volt.

m. Manufacturers: Watt Stopper No. WI 200, I 300, similar as manufactured by Leviton Sensor Switch, Unenco, or equal.

PART 3 – EXECUTION

3.01 GENERAL

A. Lighting control system shall not be used for ay other purpose other than its intended use and application.

B. Provide required interconnections with other systems such as emergency power sources, fire alarm systems, and building management system as required or indicated on drawings.

C. Installation shall meet or exceed standard practice of workmanship and quality.

D. Drawings generally indicate work to be provided, but do not indicate bends, transitions, or special fittings required to clear beams, girders or other work already in place. Investigate conditions where conduits are to be installed, and furnished and install required fittings.

3.02 INSTALLATION AND SET-UP

A. Verify that conduit for line voltage wires enters panel in line voltage areas and conduit for low-voltage control wires enters panel on low-voltage areas. Refer to manufacturer's drawings for location of line and low-voltage areas.

B. Panels shall be located so that they are readily accessible and not exposed to physical damage.

C. Panel locations shall be furnished with sufficient working space around panels to comply with the California Electrical Code.

D. Panels shall be securely fastened to the mounting surface by at least four points.

E. Unused openings in the cabinet shall be effectively closed.

F. Cabinets shall be grounded in accordance with Article 250 of the California Electrical Code, and manufacturer’s recommendations.

G. Lugs shall be suitable and listed for installation with the conductor being connected.

H. Conductor lengths shall be maintained to a minimum within the wiring gutter space. Conductors shall be long enough to reach the terminal location in a manner that avoids strain on the connecting lugs.

I. Maintain the required bending radius of conductors inside cabinets.

J. Clean cabinets of foreign material such as cement, plaster and paint.

K. Distribute and arrange conductors neatly in the wiring gutters.

L. Follow the manufacturer's torque values to tighten lugs.

M. Before energizing the panelboard, the following steps shall be taken:

1. Retighten connections to the manufacturer's torque specifications. Verify that required connections have been furnished.

2. Remove shipping blocks from component devices and the panel interior.

3. Remove debris from panelboard interior.

N. Follow manufacturers’ instructions for installation.

3.03 OPERATING/SERVICE MANUALS

A. Service and Operation Manuals:

1. Submit operation and service manuals. Complete manuals shall be bound in flexible binders and data shall be typewritten or drafted.

2. Provide a printed copy of the systems configuration as programmed, including system labeling codes, and passwords.

3. Provide an electronic copy on compact disk of the system configuration program.

4. Manuals shall include instructions necessary for proper operation and servicing of system and shall include complete wiring circuit diagrams of system, wiring destination schedules for circuits and replacement part numbers. Manuals shall include as-built cable Project site plot plans and floor plans indicating cables, both underground and in each building with conduit, and as-built coding used on cables. Programming forms of systems shall be submitted with complete information.

5. Record Drawings: Provide a copy on vellum of Project site and building drawings, indicating location of equipment, conduit and cable runs, and other pertinent information.

3.04 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.05 TESTING

A. Set-up, commissioning and testing of the lighting control system, and Owner instruction shall include:

1. Confirmation of system programming.

2. Confirmation of operation of individual relays, switches, occupancy sensors and daylight sensors.

3. Operation of system’s features under normal and emergency operations.

4. Before energizing check and demonstrate in the presence of the Project Inspector that cables and wire connections are free from short circuits, ground faults, and that there is continuity, and necessary insulation.

5. Confirm system operations and functionality.

6. Check system interface response to other systems such as fire alarm and emergency power system conditions.

7. Provide training to cover installation, maintenance, troubleshooting, programming, and repair and operation of the lighting control system.

3.06 INSTRUCTION PERIODS

A. Before Substantial Completion, arrange and provide an eight hours Owner instruction period for designated personnel.

3.07 SPARE PARTS

A. Provide a minimum of five percent spare parts of each type of relay, sensors, switches, and peripheral devices.

3.08 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 26 5000 - LIGHTING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Lighting fixtures, including lamps, ballasts, wiring, and lighting controls.

B. Light fixtures model numbers were determined at the time this specification was written; model numbers may need to be modified, or may require the addition or deletion of options to fully meet specification requirements.

C. Related Requirements:

1. Division 01 - General Requirements.

2. Section 26 0500: Common Work Results for Electrical.

3. Section 26 0513: Basic Electrical Materials and Methods.

4. Section 26 0526: Grounding and Bonding.

5. Section 26 0519: Low-Voltage Wires (600 Volt AC or less).

6. Section 26 0923: Lighting Controls Systems.

7. Section 26 0933: Central Dimming System

1.02 SUBMITTALS

A. List of Materials: Submit a complete list of materials proposed for this section.

B. Shop Drawings: Provide detailed and dimensioned Shop Drawings indicating kind, weight and thickness of materials, method of fitting and fastening parts together, location and number of sockets, size of lamps, and complete details of method of fitting suspension and fastening fixtures in place. Provide wiring diagrams for lighting control equipment. Drawings shall contain sufficient information to assemble and install equipment at the Project site without further instructions.

C. Prior to start of construction; provide photometric calculations with graphic of luminance levels of work plane, ceiling and walls of each representative classroom, library and multipurpose room. Calculations shall comply with IESNA recommendations.

D. Installation Instructions: Submit manufacturer's written installation instructions for fixtures and accessories.

E. Light fixtures shall be Underwriters Laboratory (UL) or Nationally Recognized Testing Laboratory (NRTL) listed, and in compliance with applicable industry standards and codes.

F. Submittals must comply with contract general provisions.

1.03 MOUNTING REQUIREMENTS

A. Design of lighting fixtures, accessories, supports, and method of fixture installation shall comply with requirements for earthquake-resistant construction of the State of California.

B. Provide suspension points at no more than two feet from fixture ends. Spacing between supports shall not exceed eight feet.

1.04 QUALITY ASSURANCE

A. Components and fixtures shall be listed and approved for the intended application by Underwriter's Laboratories (UL), or other Nationally Recognized Testing Laboratory (NRTL).

B. OWNER’s written approval shall be obtained for any equipment or materials substitutions prior to their use.

1.05 GUARANTEE

A. Provide a two year labor warranty.

B. Provide material warranty as specified:

1. Lamps: two years.

2. Ballasts: five years.

3. Standards: one year.

4. Controls: three years.

C. Warranty period begins at substantial completion or project acceptance for beneficial occupancy.

PART 2 - PRODUCTS

2.01 MATERIAL AND FABRICATION

A. Lighting fixtures shall be the type indicated on Drawings and as specified. Fixtures of same type shall be of one manufacturer.

B. Fixtures shall be of the types and manufacturers described in the FIXTURE TYPES section below, with lamps, wattage and voltage as indicated on Drawings Specific manufacturer and model number references are indicated as a standard of

performance and quality; other manufacturers' models may be supplied provided the product meets or exceeds the specifications. The alternate fixtures shall achieve the same photometric levels and uniformity ratios.

C. Fixtures shall be baked-on enamel or powder-coated, unless otherwise specified in subsections below.

D. Fluorescent fixtures shall be equipped with low or tall profile, medium Bi-Pin fluorescent lamp holders of high-strength, and quickwire pressure terminals with recessed wire wells to insulate against shorting. Lamp holders shall be manufactured of chemical-resistant thermoplastic body and be equipped with a captive nut.

E. Lighting fixtures shall have a minimum luminaire efficiency rating (LER) equal or greater than 75; fixtures with lower LER shall not be accepted without written approval from LAUSD Design Standards section.

2.02 LAMPS AND BALLASTS

A. Fluorescent Lamps and Ballasts:

1. Approved Ballast Manufacturers:

a. Osram Sylvania.

b. Advance.

c. Universal-Triad.

d. Lutron.

e. General Electric.

2. Ballast Type and Characteristics:

a. High efficiency program-start unless otherwise noted.

b. Dimming ballasts where indicated shall be for 0-10 volt DC control circuits, or two wire variable inputs such as Advance Mark 10 series. Or equal Ballasts shall be specifically compatible with the lighting control system being provided. Both the Ballast and lighting control system manufacturers shall certify such compatibility in writing.

c. Power Factor greater than 90.

d. Harmonic distortion less than 15 percent.

e. ANSI 82.11 color-coded.

f. Class A noise rated.

g. Comply with applicable state, federal, and industry standards including FCC 47, part 18 non-consumer RFI/EMI standards, and IEEE standards for line voltage transient protection and harmonic distortion.

h. 0 degrees Celsius minimum starting temperature.

i. Ballast per schedule as follow:

1) RLO = reduced light output, ballast factor 78 percent or less.

2) NLO = normal light output, ballast factor nominal 88 percent.

3) HLO = high light output, ballast factor nominal 120 percent.

3. Approved Lamp Manufacturers:

a. Osram Sylvania (“Sylvania” or “OSI”).

b. General Electric.

c. Philips.

4. Lamp Characteristics:

a. Color Temperature: lamps shall be 4100K unless indicated otherwise in lighting fixture schedule, or Drawings.

b. T-8 Lamps:

1) Four-foot unless otherwise indicated. Lamps shall be rated 3150 nominal initial lumens at 32 watts - GE “HL,” Sylvania “Xtreme”, Philips “Advantage,” or equal.

2) Four-foot unless otherwise indicated. Lamps shall be rated 2500 nominal initial lumens at 28 watts - GE “HL,” Sylvania “Xtreme”, Philips “Advantage,” or equal.

a. Fixtures receiving 28 watt lamps shall be conspicuously labeled “28 watt lamps only”

3) Color Rendering Index (CRI) shall be 82 minimum, unless indicated otherwise in lighting fixture schedule or lighting drawings.

4) Low-mercury type meeting federal “T-clip” standards.

5) Lamps must be from same manufacturer and batch.

c. Compact Fluorescent Lamps:

1) CF42, CF32, and CF26: triple tube amalgam, four pin lamp.

2) CF13: twin tube, four pin lamp.

3) Other lamps as indicated in lighting fixture schedule or Drawings.

4) Lamps must be from same manufacturer and batch.

B. Metal Halide Lamps and Ballasts:

1. Approved Ballast Manufacturers:

a. Osram Sylvania.

b. Advance.

c. Universal-Triad.

2. Ballast Type and Characteristics:

a. High frequency electronic ballast for pulse-start metal halide lamps, unless otherwise noted.

b. Ambient temperature rating of 55 degrees C max.

c. Power factor: greater than 90 percent.

d. Minimum ambient starting temperature of minus 20 degree Celsius.

e. Non-PBC dialectric capacitors.

f. Class H UL or another NRTL listed coil insulation.

3. Approved Lamp Manufacturers:

a. Osram Sylvania (“Sylvania” or “OSI”).

b. General Electric.

c. Philips.

4. Lamp Characteristics

a. Voltage or wattage of lamps shall be as indicated on the Drawings.

b. Provide lamps with fixtures.

2.03 FLUORESCENT FIXTURES

A. Lighting Fixture Types:

1. Ceiling Surface-Mounted with wraparound diffusers:

   a. Lens shall be extruded of clear acrylic plastic, 12 pattern prismatic with minimum 25 DR meeting the ASTM specifications for methacrylate molding compounds D-788-69A. The overall length of the lens, including end caps shall be same as the Holophane 7100 or 7400, or equal, of size and shape specified, 0.187 nominal thickness. Labels shall be attached to fixtures with manufacturer business information and date manufactured.

   b. Furnish fixtures with four-foot lamps as listed above.

   c. Spring-loaded barrel latches shall consist of sliding steel pins or rods operating through spring-loaded steel cylinders tack-welded or pop-riveted to fixture body. Pins shall be fabricated of solid steel with round cross-sectional areas of sufficient size to prevent bending when operating latches. Latches shall engage when pins are fitted into corresponding catches on diffusers. Latches shall disengage by applying finger pressure to a portion of the pin, turned up at 90 degrees, at operating end.

   d. Fixture channels shall be formed as single pieces of 20 gage metal without joints or splices and shall be assembled by means of spot-welding. Fixtures shall only permit super T8 lamps to be installed. Metal surfaces of fixtures shall be powder-coat painted after fabrication. Labels shall be fastened to fixtures with manufacturer business information and date manufactured. Provide two 8-32 screw knockouts for alignment on each end plate.

   e. Supply three, four and six lamp fixtures with minimum of two ballasts.

2. Linear Suspended Indirect Fluorescent:

   a. Fixture shall be minimum 20 gage CRS with die-cast end cap mechanically attached with no exposed fasteners.

   b. Housing shall come in three styles perforated, pierced or solid with a clear acrylic dust cover.

   c. Cable suspension canopy shall be a minimum of 3 ½-inch diameter with 1/16 inches diameter stainless steel aircraft cable adjustable up to 36 inches.

   d. Reflector shall be semi-specular aluminum.

   e. Lamp shall be two - super T8.

3. Linear Suspended Direct/Indirect Fluorescent:

a. Fixture shall be minimum 20 gage steel, cast aluminum end caps. No exposed fasteners or hardware.

b. Cable suspension shall be minimum 3 ½-inch diameter canopy with 1/16 inch diameter stainless steel aircraft cable adjustable up to 36, inches unless otherwise specified.

c. Housing shall be supplied with a clear acrylic dust cover.

d. Reflector shall be highly reflective aluminum.

e. Lamps shall be one, two, three super T8 lamps or one, two T5HO.

4. Ceiling Recessed Troffer Fixtures:

a. Fixture shall be 20 gage cold rolled steel housing with no exposed fasteners or hardware.

b. Approximately 4 ½-inch maximum depth housing with full length die-formed stiffeners, and contoured ballast wireway cover.

c. Die-formed captive lamp holder bracket.

d. Positive cam action steel latches and safety lock T-hinges to allow hinging and latching on ether side.

e. Baked white enamel finish.

f. Trim shall be painted to match ceiling color.

g. Reflector reflectance shall equal or exceed 89 percent.

h. Flat non-glare acrylic panel.

i. Minimum lens thickness 0.187 inch.

j. Furnish fixtures with number of lamps listed below, with ballasts, sockets, wiring and accessories.

k. Mounting shall be compatible with standard or slot T-grid systems.

l. Furnish mounting frames on recessed fixtures in plaster and tile surfaces.

m. Supply three-lamp fixtures with two dimmable ballasts.

n. Lamps shall be one, two, or three super T8 lamps or one, or two T5HO as indicated on drawings.

o. Manufacturers and catalog numbers: Modify catalog numbers for proper ceilings type as required.

5. Linear Suspended Mode Indirect/Direct Fluorescent:

   a. Fixture shall be minimum 20 gage perforated steel, cast aluminum end caps. No exposed fasteners or hardware.

   b. Cable suspension shall be minimum 3 ½-inch diameter canopy with 1/16 inch diameter stainless steel aircraft cable adjustable up to 36, inches unless otherwise specified.

   c. Housing shall be supplied with a clear acrylic dust cover.

   d. Reflector shall be highly reflective aluminum.

   e. Fixture shall have three super T8 lamps – Two indirect and one direct.

   f. Each fixture shall have dual switching.

   g. Fixture shall be Lightolier Energos EG1 Series, Finelite Series 12-ID, Focal Point Verve III, or equal.

6. Linear Suspended 100 percent Direct Fluorescent:

   a. Fixture shall be minimum 20 gage steel housing with steel ends.

   b. Fixture shall have a top reflector for 100 percent down light.

   c. Lens shall be high impact vandal resistant acrylic hinging from either side of housing.

   d. Fixture shall be Prudential Pru-7 Series, Finelite S10 Series, Focal Point FVRS, Lite Control SAE Series, or equal.

7. Recessed Linear Wall Washer:

   a. Fixture shall be minimum 20 gage steel with integral adjustable hanger clamps.

   b. High performance luminaire with low iridescent specular aluminum reflector.

   c. One piece body with integral hungers.

8. Linear Suspended or Wall Mounted Wall Washer:

   a. Fixture shall be 20 gage die formed steel.

   b. Reflector shall be die-formed white and/or semi specular.

   c. Fixture shall be an asymmetric distribution.

   d. Fixture shall come with the option for prismatic lens or louver.

e. Fixture shall have an option to be wall mounted or suspended.

9. Ceiling Surface-mounted or Recessed Troffer Fixtures:

a. 22 gage extruded aluminum doorframes, white baked enamel finish. Spring loaded and half recessed with flush latches and T-handle hinge, accessible from bottom to ballasts and wiring. Clear prismatic 100 percent pure virgin acrylic Pattern 12.

b. Recessed Troffer Housing minimum depth shall be 4 ½-inch to eliminate lamp images in lens.

c. Minimum lens thickness 0.187 inch.

d. Furnish fixtures with number of T8 fluorescent lamps listed below, with ballasts, sockets, wiring and accessories.

e. Furnish mounting frames on recessed fixtures in plaster and tile surfaces.

f. Supply three-lamp and four-lamp fixtures with two ballasts.

g. Manufacturers and catalog numbers: Modify catalog numbers for mounting in gypsum drywall ceilings, as required.

10. Recessed Indirect Fixture:

a. Housing shall be made of die-formed 20 gage steel with a minimum depth of 5 ½-inch.

b. Lamp shield shall be made of 22 gage perforated mesh with white acrylic overlay.

c. Fixture shall be Lightolier CFH Series, , LSI 2LLC Series, Focal Point Luna (FLU) Series, or equal.

d. Fixture shall provide the option to be hinged from either side.

11. Wall-Mounted Fixtures:

a. Fully enclosed, with high impact white acrylic diffuser.

b. Die-formed, prime quality 20 gage steel body, 48 inches long with two F32T8 lamps.

c. Provide ballasts and accessories for proper installation.

2.04 .EXIT ILLUMINATION

A. Lighting Fixture:

1. Ceiling or wall-mounted, LED EXIT, consisting of:

a. LED board, red exit lettering and directional arrows as indicated required

b. Face plate and polycarbonate shield.

c. Number of faces, voltage, and emergency power source shall conform to design requirements indicated on drawings.

d. Area of refuge listing is required when fixtures are used in such locations.

e. Utilize a flag mount luminary with additional support from the ceiling or wall for canopy or pendant mounted exit signs. This option shall be exercised only if a wall is not available.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install a lighting fixture for each lighting outlet indicated and mark new ballasts with day of installation.

B. Fixture voltage shall be as indicated on Drawings.

C. Install recessed and surface-mounted fixtures, with plaster frames compatible with ceiling and wall systems employed; secure fixtures mechanically to frames.

D. Align rows of suspended and surface-mounted fluorescent fixtures to form straight lines at uniform elevations.

E. Recessed fixtures shall fit snugly against ceilings to prevent light leakage.

F. Notwithstanding the following paragraphs in Part 3-Execution, fixture installations shall comply with the most current CBSC and Department of State Architect Seismic requirements.

G. Support suspended recessed fixtures in accordance with DSA IR 25-2.10. Support pendant-mounted fixtures in accordance with DSA IR 16-9. Fixture installations shall be coordinated with acoustical and gypsum ceiling installation.

H. Emergency light fixtures shall be labeled “Emergency Fixture” with one inch high letters produced with a P-touch or similar labeling system.

I. Continuous suspended fixtures:

1. Fixture suspension device shall allow vertical adjustment of fixture without the use of tools. Cable shall be minimum seven strand twisted stainless steel capable of supporting minimum four times the fixture weight. For continuous linear suspended fixtures longer than eight feet, provide not less than three suspension points.

2. Top of fixture shall be suspended as shown on the Drawings, typically 24 inches below the ceiling and a minimum of 18 inches from the ceiling.

3. Fixture shall utilize factory furnished or approved hardware and canopy for either hard or T-bar ceilings.

4. White Board Lights shall be suspended 24 inches from the wall unless specifically shown otherwise.

J. Where fixtures with emergency battery packs are installed, these fixtures shall receive constant powered circuits. When powering unit inverter power packs, use the same circuit that powers the switched ballast to power the inverter.

K. Surface mount fixtures shall be attached to structure. Toggle bolts shall NOT be used or permitted. Provide backing supported by structure where required.

L. Low level exit signs shall be installed with the bottom of the sign not less than six inches, or more than eight inches above the floor level and shall indicate the path of exit travel. For exit and exit-access doors, the sign shall be on the door or adjacent to the door with the closest edge of the sign within four inches of the door frame.

3.02 TESTING

A. Check and adjust fixtures for required illumination.

B. Replace defective lamps and ballasts.

C. Test and adjust lighting control equipment for proper operation.

3.03 SPARE PARTS

Provide the following spare parts:

a. Furnish 5% spare lamps with a minimum of one spare lamp of each type.

b. Furnish 5% spare motion detectors of each type with a minimum of one spare detector of each type.

c. Furnish 5% spare ballasts of each type with a minimum one spare ballast of each type.

3.04 HAZARDOUS WASTE DISPOSAL

A. Hazardous waste disposals and recycling shall be handled and disposed of by an approved, licensed CONTRACTOR.

B. Ballasts are assumed to contain PCB unless clearly marked “NO PCBs.”

C. Place ballasts and lamps in appropriate containers provided by hazardous waste or recycling CONTRACTOR. Clearly label containers with:

1. Project Name

2. Quantity of lamps

3. Date lamps became waste

D. Store, remove, transport and dispose of hazardous materials in all accordance with state and federal regulations.

E. Provide OWNER with copy of manifest and certificate of destruction and/or recycling no later than achievement of substantial completion.

3.05 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.06 CLEANUP

A. Remove rubbish, debris, and waste materials from all areas of work each day.

B. Clean fixture surfaces of dirt, cement, plaster and debris. Furnish cleansers compatible with material surfaces being cleaned.

END OF SECTION

SECTION 26 5010 - SOLID STATE (LED) LIGHTING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: LED Luminaires, LED modules, drivers, wiring, and lighting controls.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 26 0500: Common Work Results for Electrical.
3. Section 26 0513: Basic Electrical Materials and Methods.
4. Section 26 0526: Grounding and Bonding.
5. Section 26 0519: Low-Voltage Wires (<600 Volt AC).
6. Section 26 0923: Lighting Controls Systems.
7. Section 26 5200: - Emergency Power Systems.
8. Section 32 1313 - Site Concrete Work.

1.02 REFERENCES

A. American National Standards Institute/American National Standard Lighting Group ANSI/ANSLG – C78.377-2008 Specifications for the Chromaticity of Solid State Lighting Products.

B. American National Standards Institute/American National Standard Lighting Group ANSI/ANSLG – C82.77-2002 Harmonics Emission Limits.

C. Federal Communication Commission (FCC) 47 CFR Part 15 – Radio Frequency Devices.

D. Illuminating Engineering Society of North America (IESNA) LM-79-, LM-80-15, and TM-21.

E. National Electrical Manufacturers Association (NEMA) SSL-1-2010 Electronic Drivers for LED Devices, Arrays, or Systems.

F. SSL-3-2010 Solid State Lighting High Power LED Binning for General Illumination.

G. SSL-4-2012 Solid State Lighting Retrofit Lamps.

H. National Fire Protection Association (NFPA) NEC-70-2011

I. Underwriters Laboratories (UL) 8750-Light Emitting Diode (LED) Equipment for Use in Lighting Products.

J. Underwriters Laboratories (UL) 1598C- Light Emitting Diode (LED) Retrofit Luminaire Conversion Kits.

1.03 SUBMITTALS

A. List of Materials: Submit a complete list of proposed materials.

B. Shop Drawings: Provide detailed and dimensioned Shop Drawings indicating kind, weight and thickness of materials, method of fitting and fastening parts together, location and number of sockets, size of lamps, and complete details of method of fitting suspension and fastening luminaires in place. Provide wiring diagrams for lighting control equipment. Drawings shall contain sufficient information to assemble and install equipment at the Project site without further instructions.

C. Prior to start of construction; provide photometric calculations with graphic of lighting foot-candle levels at work plane, ceiling and walls. Calculations shall comply with IESNA recommendations.

D. Installation Instructions: Submit manufacturer's written installation instructions for luminaires and accessories.

1.04 SUBSTITUTIONS

A. Luminaires that deviate from these requirements shall not be accepted without written approval from OWNER'S Design Standards Section and Maintenance and Operations Technical Unit. When deviating or substituting luminaires, the following information shall be submitted:

1. Substitution request form substantiating reasons and benefits to OWNER.

2. OWNER'S approval shall be obtained for any equipment or materials substitutions.

B. Substitutions: Submittals must comply with contract general provisions.

1.05 QUALITY ASSURANCE

A. Design of lighting luminaires, accessories, supports, and method of luminaire installation shall comply with requirements for earthquake-resistant construction of the State of California.

B. Provide suspension points at no more than two feet from luminaire ends. Spacing between supports shall not exceed eight feet.

C. Components and luminaires shall be listed and approved for the intended application by Underwriter's Laboratories (UL), or other Nationally Recognized Testing

Laboratory (NRTL), and in compliance with applicable industry standards and codes, including those mentioned under article 1.02 – References.

1.06 WARRANTEE

A. Provide a one year labor warranty.

B. Provide material warranty as specified:

1. LED modules: five years minimum.

2. Drivers: five years minimum.

3. Lighting Pole (Standards): five year minimum.

C. Warranty period begins at substantial completion or project acceptance for beneficial occupancy.

D. CONTRACTOR shall warranty Luminaires, including drivers, LED modules and ancillary components via a single warranty source. Multiple warranty sources is not acceptable.

PART 2 - PRODUCTS

2.01 MATERIAL AND FABRICATION

A. Lighting luminaires shall be the type indicated on Drawings and as specified. Luminaires of same type shall be of one manufacturer.

B. Specific manufacturer and model number references are indicated as a standard of performance and quality; other manufacturers' models may be submitted for review, provided the product meets or exceeds the specifications and substantially complies with OWNER'S LED Luminaires Evaluation Requirements Form.

C. Conductors that pass over edges or through metal opening(s) shall be secured from contacting the edges, or be protected from cutting and abrasion. This requirement shall be met through one of the following:

1. Rolling the edge of the metal not less than 120 degrees.

2. A bushing or grommet of a material other than rubber at least 1.2 mm (0.047") thick.

3. Glass sleeving at least 0.025 mm (0.010") thick.

D. Lighting luminaires shall meet the following requirements:

1. Industry standards as indicated under REFERENCES Article.

2. Luminaire shall be from a manufacturer who has been in the business of manufacturing LED lighting luminaires for interior and exterior applications for a minimum of 5 years.

3. Luminaires shall comply with the California Health and Safety Code requirements for products containing substances identified in the California Lighting Efficiency and Toxics Reduction Act, or be in compliance with the European Restriction of Hazardous Substances (RoHS), whichever is more stringent.

4. Luminaires shall be baked-on enamel or powder-coated, unless otherwise specified in this section.

5. The luminaire(s) lens, including end caps shall be 0.187 nominal thickness.

6. Drivers shall be easily accessible without the use of special tools.

7. Wiring cavity shall be field accessible for service or repairs.

8. Luminaires shall be capable of being operated by standard motion/ vacancy sensors, daylight sensors, and dimmers.

9. Luminaires shall be provided with a manufacturer's stencil or permanent legible sticker that states manufacturer business information and date of delivery.

10. Temperature rating; -20 degrees Celsius minimum starting temperature. Luminaire accessories including LEDs and drivers shall be able to withstand temperatures in excess of 110 Fahrenheit degrees.

11. Color Rendering Index (CRI):

    1) Interior Applications: +82 CRI.

    2) Exterior Applications: +70 CRI

12. Power factor: Greater than 0.9 at 120V and 277V.

13. Total Harmonic Distortion: Less than 20% at 120V and 277V.

14. Color Correlated Temperature: 4000K minimum ± 275K degrees.

15. LEDs and drivers life expectancy: 50,000 minimum projected hours at 6,000 hours testing for both LEDs and drivers.

16. Luminaires in contact with insulation materials shall be IC rated.

2.02 DRIVERS and LED MODULES

A. Drivers:

1. Approved Drivers Manufacturers:

a. Osram – Optotronic.

b. Philips – Advance and Xitanium.

c. Universal Lighting Technologies – Everline.

d. General Electric – Lightech.

e. Others only if approved by Owner.

2. Driver Type and Characteristics:

a. Comply with the state of California Health and Safety Code requirements for products containing substances identified in the California Lighting Efficiency and Toxics Reduction Act, or be RoHS compliant, whichever is more stringent.

b. Dimming for 0-10 volt DC control circuits. Drivers shall be specifically compatible with the lighting control system being provided.

c. Comply with applicable state, federal, and industry standards listed under References article.

d. Wattage as stated in Luminaire's LM-79 test report.

e. Driver performance requirements:

DRIVERS PERFORMANCE CHARACTERISTICS		
No.	**Characteristic**	**Minimum Requirements**
1	Input Voltage range	120V, 277V
2	Input Overvoltage	320 VAC for 48 hours, 350 VAC for 2 hours.
3	Frequency	50/60 Hz Nominal
4	Power factor	0.95 Minimum
5	Inrush Current	Less than 30 amps @ 120V, Less than 70A @ 277V
6	Input Current Range	54A @ 120V, 23A @ 277V
7	Output Current	1670 mA Maximum
8	Maximum Power	65 Watts
9	Total Harmonic Distortion	Less than 20%
10	Leakage Current	Less than 500 mA

11	Output Protection	Short and Open Circuit Protection
12	Maximum Case Temperature	90^0 C
13	Minimum Starting Temperature	-20^0 C
14	Storage Temperature	No less than 70^0 C
15	Humidity	Rated for dry and damp locations
16	Cooling	Convection
17	Sound Rating	Class A
18	Life Expectancy	>50,000 hours at $+50^0$ C
19	Dimming, Motion Sensors and Daylight Sensors Controllability	0-10V

B. LEDs:

1. Approved Manufacturers:

   a. General Electric.

   b. Philips.

   c. NICHIA

   d. Samsung LED Co.

   e. CREED

2. LEDs Characteristics:

   a. Color Correlated Temperature (CCT):

      1) Chromaticity target Duv and tolerance 0.001 plus/minus 0.006.

      2) Nominal CCT for 4000K, target CCT 3985K ± 275K.

      3) CCT measurements in compliance with ANSI C78.377-2008.

   b. Lumen Maintenance: Greater than 90% at 50^0 C degrees.

   c. LEDs must be from same manufacturer and batch.

   d. TM-21 and LM-80 reported hours of no less than 50,000.

   e. LM-79 reported CCT and CRI in compliance with articles 2.09.D.9 and 12.

2.03 LUMINAIRES

A. Lighting Luminaire Types:

1. Ceiling Surface-Mounted with wraparound diffusers:

a. Lens shall be extruded of clear acrylic plastic, 12 pattern prismatic with minimum 25 DR meeting the ASTM specifications for methacrylate molding compounds D-788-69A. The overall length of the lens, including end caps shall be 0.187 nominal thickness.

b. Furnish luminaires with number of LED strips as indicated on drawings.

c. Spring-loaded barrel latches shall consist of sliding steel pins or rods operating through spring-loaded steel cylinders tack-welded or pop-riveted to luminaire body. Pins shall be fabricated of solid steel with round cross-sectional areas of sufficient size to prevent bending when operating latches. Latches shall engage when pins are fitted into corresponding catches on diffusers. Latches shall disengage by applying finger pressure to a portion of the pin, turned up at 90 degrees, at operating end. Alternative latches mechanisms are discouraged.

d. Luminaire channels shall be formed as single pieces of 20 gage metal without joints or splices and shall be assembled by means of spot-welding. Metal surfaces of luminaires shall be powder-coat painted after fabrication. Provide two 8-32 screw knockouts for alignment on each end plate.

2. Linear Suspended Indirect:

a. Luminaire shall be minimum 20 gage CRS with die-cast end cap mechanically attached with no exposed fasteners.

b. Housing shall come in three styles perforated, pierced or solid with a clear acrylic dust cover.

c. Cable suspension canopy shall be a minimum of 3 ½-inch diameter with 1/16 inches diameter stainless steel aircraft cable adjustable up to 36 inches.

d. Reflector shall be semi-specular aluminum.

e. Furnish luminaires with LED strips as indicated on drawings.

3. Linear Suspended Direct/Indirect:

a. Luminaire shall be minimum 20 gage steel, cast aluminum end caps. No exposed fasteners or hardware.

b. Cable suspension shall be minimum 3 ½-inch diameter canopy with 1/16 inch diameter stainless steel aircraft cable adjustable up to 36, inches unless otherwise specified.

c. Housing shall be supplied with a clear acrylic dust cover.

d. Reflector shall be highly reflective aluminum.

e. Furnish luminaires with LED strips as indicated on drawings..

4. Ceiling Recessed Troffer Luminaires:

a. Luminaire shall be 20 gage cold rolled steel housing with no exposed fasteners or hardware.

b. Approximately 4 ½-inch maximum depth housing with full length die-formed stiffeners, and contoured ballast wireway cover.

c. Positive cam action steel latches and safety lock T-hinges to allow hinging and latching on either side.

d. Baked white enamel finish.

e. Trim shall be painted to match ceiling color.

f. Reflector reflectance shall equal or exceed 89 percent.

g. Flat non-glare acrylic panel.

h. Minimum lens thickness 0.187 inch.

i. Furnish luminaires with LED strips as indicated on drawings. Mounting shall be compatible with standard or slot T-grid systems.

j. Furnish mounting frames on recessed luminaires in plaster and tile surfaces.

5. Ceiling Recessed Troffer-Retrofit Luminaires:

a. Retrofit kits shall comply with all requirements sets forth in parts 2.01 and 2.02

b. Provide proof of even distribution on lighting with max/min foot-candle ratios of 2.5.

c. Approved luminaires: LED Living technology G2CLA-30-6-D-40-1K-24, Orion MKLDRTLX42551com-40, or equal.

6. Linear Suspended AV Mode Indirect/Direct:

a. Luminaire shall be minimum 20 gage perforated steel, cast aluminum end caps. No exposed fasteners or hardware.

b. Cable suspension shall be minimum 3 ½-inch diameter canopy with 1/16 inch diameter stainless steel aircraft cable adjustable up to 36, inches unless otherwise specified.

c. Housing shall be supplied with a clear acrylic dust cover.

d. Reflector shall be highly reflective aluminum.

e. Furnish luminaires with LED strips as indicated on drawings.

f. Approved luminaires: Hubbell-Alera Lighting LP7-OA-4/8-40-HL-40-CM-48-EDU; Lidalite Boldplay, Corelite J3-WM-3L-40-1D-UNV-AC48-XX-4'-E34-L34, or equal.

7. Linear Suspended 100 percent Direct:

a. Luminaire shall be minimum 20 gage steel housing with steel ends.

b. Luminaire shall have a top reflector for 100 percent down light.

c. Lens shall be high impact vandal resistant acrylic hinging from either side of housing.

8. Recessed Linear Wall Washer:

a. Luminaire shall be minimum 20 gage steel with integral adjustable hanger clamps.

b. High performance luminaire with low iridescent specular aluminum reflector.

c. One piece body with integral hungers.

9. Linear Suspended or Wall Mounted Wall Washer:

a. Luminaire shall be 20 gage die formed steel.

b. Reflector shall be die-formed white and/or semi specular.

c. Luminaire shall be an asymmetric distribution.

d. Luminaire shall come with the option for prismatic lens or louver.

e. Luminaire shall have an option to be wall mounted or suspended.

10. Ceiling Surface-mounted or Recessed Troffer Luminaires:

a. 22 gage extruded aluminum doorframes, white baked enamel finish. Spring loaded and half recessed with flush latches and T-handle hinge, accessible from bottom to drivers and wiring. Clear prismatic 100 percent pure virgin acrylic Pattern 12.

b. Recessed Troffer Housing minimum depth shall be 4 ½-inch to eliminate lamp images in lens.

c. Minimum lens thickness 0.187 inch.

d. Furnish mounting frames on recessed luminaires in plaster and tile surfaces.

e. Manufacturers and catalog numbers: Modify catalog numbers for mounting in gypsum drywall ceilings, as required.

11. Recessed Indirect Luminaire:

a. Housing shall be made of die-formed 20 gage steel with a minimum depth of 5 ½-inch.

b. Lamp shield shall be made of 22 gage perforated mesh with white acrylic overlay.

c. Luminaire shall provide the option to be hinged from either side.

12. Wall-Mounted Luminaires:

a. Fully enclosed, with high impact white acrylic diffuser.

b. Die-formed, prime quality 20 gage steel body, 48 inches long.

13. Surface-Mounted Industrial Luminaires:

a. Approximately 48-inch or 96-inch long by 16-inch wide by 7 ½-inch deep.

b. Provide couplings, clips and end caps for continuous row installation.

c. Furnish luminaires with screw-on wire guards. Design guards to accommodate luminaire, provided by same manufacturer as luminaire.

d. Exposed LED strips are not allowed.

e. Housing shall be made of die formed 20 gage cold rolled steel.

14. Recessed two-foot by four-foot Static Troffer Luminaires with Parabolic Louvers:

a. Approximately 5 ½-inch maximum depth housing fabricated of 22 gage, prime cold-rolled steel, with full length die-formed stiffeners. Contoured driver wireway cover.

b. Provide positive cam action steel latches and safety lock T-hinges to allow hinging and latching on either side.

c. Baked white enamel finish. Trim shall be painted white to match ceiling color.

d. Louvers shall be three inches deep, die-formed of semi-specular anodized aluminum with anodic oxide coating. Parabolic cells shall be fastened with interlocking feature. Provide 12-cell louvers for two-lamp luminaires and 18-cell louvers for three-lamp luminaires.

e. Voltage shall be as indicated on Drawings.

f. Approved luminaires: Hubbell Columbia Lighting LCAT24-40-HL-EDU, or equal.

15. Surface Mounted Strip Light:

a. Luminaire shall be made of 20 gage die formed steel and have the ability for continuous row mounting.

b. Furnish luminaires with LED strips as indicated on drawings. Luminaire shall have the option to have narrow or wider housing channels depending on the application.

16. Surface/Pendant Mounted:

a. Luminaire shall be 20 gage cold rolled steel precision formed housing.

b. Luminaire shall be supplied with diffuser lens and 11 gage wire guard.

c. Furnish luminaires with LED strips as indicated on drawings.

d. Luminaires shall be glare free.

17. Enclosed, Gasketed Luminaire:

a. Luminaire shall be 20 gage steel.

b. Lens enclosure shall be heavy duty vapor tight enclosed gasketed with closed–cell foam gasketing permanently attached to luminaire housing.

c. Luminaire shall have tamperproof latches.

d. Luminaire shall be furnished with minimum one watertight hub kit for top or end conduit entry.

e. Luminaire shall have option for cable mount and safety strap

f. Wet Location listed.

18. Surface, Wall or Recess Mounted fixtures

a. Luminaire shall be 20 gage extruded aluminum with die cast end caps.

b. Opal polycarbonate lens.

c. Furnish luminaires with LED strips as indicated on drawings.

d. Luminaire mounting as indicated on drawings.

e. Luminaire shall be listed for damp and wet location.

19. Display Case/Under Counter Luminaires:

a. Ribbed, white opal acrylic lens.

b. Chassis parts shall be die-formed cold rolled steel.

c. Finish shall be white baked enamel.

d. Furnish luminaires with LED strips as indicated on drawings. .

e. Luminaire shall be supplied without switches or receptacles.

f. Approved luminaires: Kenall AUCLED-IMW-20L40K-48, or equal.

20. Down Lights:

a. 4 to 6 inch round LED downlight.

b. Color trim as specified in construction drawings.

c. Trim attachment to frame-in kit via push-in connector on frame.

d. Removable cover for access.

e. Complete luminaire including all peripheral devices including frame-in kit, light engine, trim kit, etc. shall be provided.

f. Approved luminaires: Lightolier C4LDL40K, C6LDL40K, or equal.

21. High Abuse Surface Luminaires:

a. Lens shall be extruded polycarbonate, clear prismatic refractor, nominal thickness 0.125 inch, UV stabilized.

b. Base-plate shall be 18 gage prime cold-rolled steel with corrosion-resistant, 92 percent reflective, white polymer finish.

c. End caps shall be 16 gage prime cold roll steel with corrosion-resistant, white polymer finish and shall be spot welded to the base-plate.

d. Lens/housing shall be furnished with a minimum of two large or four small stainless steel fasteners to secure lens/housing to base plate.

e. Listed for wet and damp locations.

22. Wall Mounted Vaportite Luminaire:

a. Luminaire housing shall be die cast aluminum with corrosion resistant polyester powder coated finish.

b. Luminaire shall be heat and shock resistant, with prismatic glass optical chamber with neoprene gasketing.

c. Luminaire shall be 15 or 20 watt LED; LEDs and drivers as indicated on drawings.

d. Luminaire shall be equipped with lens guard.

23. Ceiling-Mounted Luminaires:

a. Separate ceiling and reflector pans with foil-backed fiberglass between pans and 1/8 inch thick neoprene gasketing between ceiling pan and ceiling.

b. White polyester finished 18 gage cold-rolled steel back-plate with clear prismatic injection molded polycarbonate lens, UV stabilized heavy gage aluminum back-plate and four tamper-proof screws.

c. Provide luminaire wattage as indicated on drawings.

d. Luminaire shall be listed for damp locations.

24. Ceiling / Wall Mounted Luminaires:

a. Luminaire shall be die-cast aluminum.

b. Luminaire shall have reinforced four-point mounting system construction to resist breakage from impact and prying.

c. Luminaire finish shall be as indicated on drawings.

d. Lens shall be Injection molded UV stabilized, high impact resistant opal polycarbonate.

e. Luminaire shall have option trim ring to fit between housing and inside lip of trim ring for a smooth transitional look.

f. Provide luminaire with input watts as indicated on drawings.

g. Ceiling luminaires shall be supplied without eye lid option, wall mounted luminaires shall be supplied with eye lid option.

2.04 EXIT ILLUMINATION

A. Lighting Luminaire:

1. Ceiling or wall-mounted, glass edge, LED EXIT, consisting of:

a. LED board, red exit lettering and directional arrows as indicated on drawings.

b. Face plate glass and polycarbonate shield.

c. Number of faces, voltage, and emergency power source shall conform to design requirements indicated on drawings.

d. Area of refuge listing is required when luminaires are used in such locations.

e. Utilize a flag mount luminary with additional support from the ceiling or wall for canopy or pendant mounted exit signs. This option shall be exercised only if a wall is not available.

1) Area of refuge listing is required when luminaires are used in such locations.

a. Emergency battery pack operation shall be as indicated on Drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install a lighting luminaire for each lighting outlet indicated and label with day of installation.

B. Luminaire voltage shall be as indicated on Drawings.

C. Install recessed and surface-mounted luminaires, with plaster frames compatible with ceiling and wall systems employed; secure luminaires mechanically to frames.

D. Align rows of suspended and surface-mounted luminaires to form straight lines at uniform elevations.

E. Recessed luminaires shall fit snugly against ceilings to prevent light leakage.

F. Luminaire installations shall comply with CBC Seismic requirements

G. Support suspended recessed luminaires in T-bar ceilings as follows: Luminaires shall be attached to ceiling grid to resist a horizontal force equal to weight of luminaires. For heavy-duty grid systems, luminaires weighing less than 56 pounds must also have two 12 gage slack safety wires from diagonal corners to the structure above; luminaires weighing more than 56 pounds shall be independently supported by not less than four taut 12 gage wires capable of supporting four times the load. For intermediate duty grid systems, luminaires shall be independently supported by not less than four taut 12 gage wires capable of supporting four times the load.

Luminaire hanger wire ends shall be twisted three tight turns within a 1 ½ -inch distance. Provide positive point of attachment to T-bar ceiling with four, #8 wafer head tek screws (one at each corner), avoiding conflict with operation of the lens. Luminaire installation shall be coordinated with acoustical ceiling installation.

H. Emergency light luminaires shall be labeled “Emergency Luminaire” with one inch high letters produced with a P-touch or similar labeling system.

I. Continuous suspended luminaires:

1. Luminaire suspension device shall allow vertical adjustment of luminaire without the use of tools. Cable shall be minimum seven strand twisted stainless steel capable of supporting minimum four times the luminaire weight. For continuous linear suspended luminaires longer than eight feet, provide not less than three suspension points.

2. Top of luminaire shall be suspended as shown on the Drawings, typically 24 inches below the ceiling and a minimum of 18 inches from the ceiling.

3. Luminaire shall utilize factory furnished or approved hardware and canopy for either hard or T-bar ceilings.

4. White Board Lights shall be suspended 24 inches from the wall unless specifically shown otherwise.

J. Surface mount luminaires shall be attached to structure. Toggle bolts are NOT permitted. Provide backing where required.

K. Low level exit signs shall be installed with the bottom of the sign not less than six inches, or more than eight inches above the floor level and shall indicate the path of exit travel. For exit and exit-access doors, the sign shall be on the door or adjacent to the door with the closest edge of the sign within four inches of the door frame.

3.02 TESTING

A. Check and adjust luminaires for required illumination.

B. Replace defective LED strips and drivers.

C. Test and adjust lighting control equipment for proper operation.

3.03 SPARE PARTS

A. Furnish ten percent spare LED strips with a minimum of one spare strip of each type.

B. Furnish ten percent spare motion detectors of each type with a minimum of one spare detector of each type.

C. Furnish ten percent spare drivers of each type with a minimum one spare driver of each type.

3.04 HAZARDOUS WASTE DISPOSAL

A. Hazardous waste disposals shall be handled and disposed of by an approved, licensed contractor.

B. Products with PCBs are not acceptable. Hazardous waste shall be placed in appropriate containers provided by hazardous waste contractor labeled clearly with:

1. Project Name

2. Quantity of materials

3. Date materials became waste

C. Store, remove, transport and dispose of hazardous materials in accordance with state and federal regulations.

D. Provide Owner with copy of manifest and certificate of destruction.

3.05 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.06 CLEANUP

A. Remove rubbish, debris, and waste materials from all areas of work each day.

B. Clean luminaire surfaces of dirt, cement, plaster and debris. Furnish cleansers compatible with material surfaces being cleaned.

END OF SECTION

SECTION 283111 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Nonsystem smoke detectors.
5. Heat detectors.
6. Notification appliances.
7. Magnetic door holders.
8. Remote annunciator.
9. Addressable interface device.
10. Digital alarm communicator transmitter.

1.2 SYSTEM DESCRIPTION

A. Noncoded, addressable system, with multiplexed signal transmission, dedicated to fire-alarm service only. The existing system to be extended as required for a complete system with all necessary initiating systems and notification systems.

1.3 SUBMITTALS

A. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:

    a. Trained and certified by manufacturer in fire-alarm system design.
    b. NICET-certified fire-alarm technician, Level IV minimum.

B. Product Data: For each type of product indicated.

C. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.

1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
2. Include voltage drop calculations for notification appliance circuits.
3. Include battery-size calculations.

4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
6. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

D. Delegated-Design Submittal: For smoke and heat detectors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Drawings showing the location of each smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the detector.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72.

E. Qualification Data: For qualified Installer.

F. Seismic Qualification Certificates: For fire-alarm control unit, accessories, and components, from manufacturer.

G. Field quality-control reports.

H. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
3. Record copy of site-specific software.
4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:

    a. Frequency of testing of installed components.
    b. Frequency of inspection of installed components.
    c. Requirements and recommendations related to results of maintenance.
    d. Manufacturer's user training manuals.

5. Manufacturer's required maintenance related to system warranty requirements.
6. Abbreviated operating instructions for mounting at fire-alarm control unit.
7. Copy of NFPA 25.
8. Printout of software application and graphic screens.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

Honeywell Company, Silent Night, Model # SK5208

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices:

1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Duct smoke detectors.
5. Automatic sprinkler system water flow.
6. Ansul Hood systems

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm-notification appliances.
2. Identify alarm at the fire-alarm control unit
3. Transmit an alarm signal to the remote alarm receiving station.
4. Unlock electric door locks in designated egress paths.
5. Release fire and smoke doors held open by magnetic door holders.
6. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
7. Activate emergency lighting control.

Activate emergency shutoffs for gas and fuel supplies.

C. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of primary power at fire-alarm control unit.
4. Ground or a single break in fire-alarm control unit internal circuits.

5. Abnormal ac voltage at fire-alarm control unit.
6. Break in standby battery circuitry.
7. Failure of battery charging.
8. Abnormal position of any switch at fire-alarm control unit or annunciator.
9. Fire-pump power failure, including a dead-phase or phase-reversal condition.
10. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system.

D. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit.

2.3 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:

1. Existing to be expanded as required.

2.4 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.

2. In first subparagraph below, retain first option for additions to existing four-wire systems or if detector auxiliary contacts are used for critical control functions such as air-handler shutdowns. Otherwise, retain type based on class of initiating device circuit.

3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

a. Primary status.
b. Device type.
c. Present average value.
d. Present sensitivity selected.
e. Sensor range (normal, dirty, etc.).

C. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

a. Primary status.
b. Device type.
c. Present average value.
d. Present sensitivity selected.
e. Sensor range (normal, dirty, etc.).

3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.5 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections. The existing speaker and visual system to be extended as required into the renovated space as shown and required by code..

2.6 ADDRESSABLE INTERFACE DEVICE

A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Comply with NFPA 72 for installation of fire-alarm equipment.

B. Equipment Mounting: Install fire-alarm control unit on concrete base with tops of cabinets not more than 72 inches (1830 mm) above the finished floor. Comply with requirements for concrete base specified in Division 03 Section. Retain first subparagraph below if Project requires seismic bracing. Coordinate with Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

1. Install seismic bracing. Comply with requirements in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.

C. Equipment Mounting: Install fire-alarm control unit on finished floor with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

1. Comply with requirements for seismic-restraint devices specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
2. Comply with requirements for seismic-restraint devices specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

D. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.

1. Connect new equipment to existing control panel in existing part of the building.
2. Connect new equipment to existing monitoring equipment at the supervising station.
3. Expand, modify, and supplement existing control, monitoring equipment as necessary to extend existing control, monitoring functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.

E. Smoke- or Heat-Detector Spacing:

1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.

F. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.

G. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.

H. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.

I. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.

J. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

K. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling.

L. Device Location-Indicating Lights: Locate in public space near the device they monitor.

M. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

N. Annunciator: Install with top of panel not more than 72 inches (1830 mm) above the finished floor.

3.2 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Division 08 Section "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet (1 m) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Alarm-initiating connection to smoke-control system (smoke management) at firefighter smoke-control system panel.
2. Alarm-initiating connection to elevator recall system and components.
3. Alarm-initiating connection to activate emergency lighting control.
4. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals.

B. Install framed instructions in a location visible from fire-alarm control unit.

3.4 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.5 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by Architect, Engineer. Project Manager, and authorities having jurisdiction.

B. Tests and Inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.

    a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
    b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

C. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

D. Fire-alarm system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

F. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

G. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

END OF SECTION 283111

FIRE PROTECTION SPECIFICATIONS

PART 1- GENERAL

1.1 SCOPE OF WORK

A. Provide all labor, materials and equipment necessary for the installation of a complete fire protection systems as indicated on drawings.

1.2 REGULATIONS

A. Entire installation, including materials, equipment and workmanship, shall conform with all applicable laws, codes and regulations of municipal, state and federal authorities.

A. The contractor shall make tests for acceptance and approval as required by the code and the Owner’s representative.

1.3 PERMITS

A. The contractor shall obtain all necessary permits, approvals and pay all related fees as required by the local municipality.

1.4 PROTECTION

A. Effectively protect all materials and equipment from dust, dirt and damage until final acceptance.

1.5 SAFETY

A. During construction, the contractor shall be responsible for providing all his employees with safe and healthful working conditions as prescribed in the "Safety and Health Regulations for Construction" of the occupational safety and health administration of the U.S. Department of Labor.

1.6 GUARANTEE

A. All materials, equipment and workmanship shall be guaranteed in writing for one (1) year after final acceptance by owner.

1.7 COORDINATION

A. It shall be the responsibility of the fire protection contractors to verify field conditions at the site and notify the Owner's representative of any discrepancies.

B. Any changes and/or modifications must be reviewed and approved by Owner's representative prior to construction.

1.8 SHOP DRAWINGS

A. The contractor shall submit the required copies of shop drawings for all system components to owner's representative for approval.

1.9 DRAWINGS

A. The drawings indicate diagrammatically the extent, general character and location of the work included.

Offsets or changes in direction to avoid structural or other interferences, and work indicated but having minor details obviously omitted shall be provided without extra cost.

B. Final piping connections to existing piping or branches, etc., where not specifically shown, shall be included at no additional cost.

1.10 RECORD DRAWINGS

A. During construction, the contractor shall maintain a record set of installation prints. He will record on these prints all deviations from the contract drawings in sizes, locations and details.

B. At the completion of the work, the contractor shall forward these prints to owner.

1.11 GENERAL REQUIREMENTS

A. The contractor shall field coordinate with mechanical, plumbing and electrical contractors.

B. All equipment and devices shall be installed in strict accordance with manufacturer's instructions.

C. Furnish and install suitable and substantial hangers and supports for all horizontal and vertical piping. Hangers may be directly mounted to beams of building construction. The intention is to provide supports which in each case shall be amply strong and rigid for the load but which shall not weaken or unduly stress the building construction.

D. The fire protection contractor shall be responsible for all cutting and patching required for the installation of their work.

F. Demolition shall include complete removal of existing fire protection systems or branch piping where it is no longer needed.

PART 2 - SYSTEMS

2.5 FIRE PROTECTION

A. The sprinkler system installation and any standpipe modifications shall conform to the requirements of NFPA 13 and 14 the Owners insurance underwriters and the local authority having jurisdiction.

B. Sprinkler piping shall be schedule 40 black steel pipe with threaded joints and wrought or cast iron fittings. Schedule 10 or other light wall piping is permitted on piping 3" and larger. Pipe joints for schedule 10 pipe shall be mechanical type couplings. Valves and accessories shall be UL listed and FM approved.

C. Sprinklers shall be as scheduled and permitted by NFPA 13. Spare heads (5) of each type used shall be furnished to the owner after the system is accepted.

D. Hydraulic calculations must be submitted (if significant piping changes are made that effect the characteristics of the existing system) and approved by the engineer and the Owners insurance underwriter. Calculations must include a recent flow test and test elevations and pressures from an authorized agency. Hydraulic calculations must prove the hydraulically most remote area of the sprinkler zone submitted. A ten percent safety factor must be included in the calculation below the available city water pressure. Limit the water velocity to 20 feet per second in all sprinkler pipes.

G. Verify all field conditions and coordinate piping locations with other contractors on the project. Shut down of the existing system shall be coordinated with the building management or owner before beginning work.

END OF FIRE PROTECTION SPECIFICATIONS.

WHITMAN

Creating Solutions. Exceeding Expectations.

PROJECT DOCUMENTATION

FOR

LIMITED HAZARDOUS MATERIALS ENVIRONMENTAL INSPECTION ACTIVITIES

AT

CAPE MAY ARMORY
600 GARDEN STATE PARKWAY
CAPE MAY, NEW JERSEY 08210

PREPARED FOR

TJD ARCHITECTS
135 AMERICAN AVENUE
BRIDGETON, NEW JERSEY

PREPARED BY

WHITMAN

FEBRUARY 2018

7 Pleasant Hill Road, Cranbury, NJ 08512
www.whitmanco.com

PROJECT DOCUMENTATION FOR
LIMITED HAZARDOUS MATERIALS
ENVIRONMENTAL INSPECTION ACTIVITIES
CAPE MAY ARMORY
600 GARDEN STATE PARKWAY
CAPE MAY, NEW JERSEY

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PROJECT DOCUMENTATION FOR
LIMITED HAZARDOUS MATERIALS
ENVIRONMENTAL INSPECTION ACTIVITIES
CAPE MAY ARMORY
600 GARDEN STATE PARKWAY
CAPE MAY, NEW JERSEY

1.0 INTRODUCTION

Whitman was retained by TJD Architects of Bridgeton, New Jersey, to conduct a limited destructive asbestos, lead-based paint, and PCBs in caulk and ballasts inspection of two latrines and associated shower rooms in the Cape May Armory located in Cape May, New Jersey. The inspection and collection of bulk samples was conducted on January 23 and 24, 2018, by Whitman's USEPA-accredited inspection team, Ms. Elizabeth Casterlin and Lindsey Aceto. The lead-based paint sampling was conducted by Mr. Brett Iwicki on February 8, 2018. In addition, a visual microbiological (mold) inspection was conducted by Mr. Kevin Lovely.

2.0 INSPECTION AND SAMPLING PROCEDURES

Each structure was visually inspected and bulk samples collected of all suspect asbestos-containing materials which included both friable and non-friable materials. All suspect materials were visually examined and the condition and quantity of all suspect materials were recorded. Building materials similar in appearance, function, and installation date are considered homogenous, and the minimum required number of bulk samples was collected per homogenous material.

A total of 50 bulk samples of suspect friable and non-friable asbestos-containing materials were collected which included ceiling plaster, wall board with joint compound, pipe insulation with associated elbows, ceramic tile and grout, ceiling tile, and floor tile with associated mastics from within the two latrines and shower rooms being renovated. Approximately 10% of the light fixtures located in the latrines were disassembled and visually inspected for PCBs. In addition, a bulk sample of window caulk was collected from the windows associated with the latrines and tested for the presence of PCBs in the caulk.

Upon completion of the inspection and collection of the bulk samples, all samples were transported to EMSL Analytical, Inc. (EMSL), located in Cinnaminson, New Jersey, for analysis.

All suspect friable asbestos-containing materials were analyzed by Polarized Light Microscopy (PLM) per EPA Method 600/R-93/116. Additionally, in accordance with the current State of New Jersey Department of Labor and the Department of Health and Senior Services regulations, all suspect non-friable materials were analyzed by Transmission Electron Microscopy Non-Friable Organically Bound (TEM NOB) protocol.

The light ballasts in the men's bathroom of the original light fixtures were visually inspected and found to be labeled as "No PCB" ballasts. Fluorescent light bulbs were identified in all light fixtures located in both latrines. In the women's latrine, the light ballasts did not have labels stating they did not contain PCB's. Therefore, we are presuming that the ballasts contain PCB's.

Whitman's inspection team did not identify any thermostats or mercury switches in the latrines or shower rooms being renovated.

Whitman's inspection team did not identify any containers or equipment that could contain ozone-depleting gases in the latrines and shower room work areas.

Whitman's inspection team did not identify any visual evidence of mold growth at the time of the inspection.

Whitman's New Jersey Lead Risk Accessor/Inspector, Mr. Brett Iwicki, conducted a limited lead-based paint assessment of the latrines and associated storerooms on February 3, 2017. Mr. Iwicki collected paint chip samples of painted surfaces and ceramic tiles located in the two latrines with associated shower room work areas.

3.0 LABORATORY CERTIFICATIONS

EMSL performed the analysis of all bulk samples. EMSL is accredited under the National Voluntary Laboratory Accreditation Program (NVLAP #101048-0). Bulk sample logs with identification numbers, material descriptions, analytical results, and corresponding laboratory analysis certificates are included in this report as Attachment 1.

4.0 FINDINGS

4.1 Asbestos-Containing Materials

The following table lists the locations, quantities, and conditions of confirmed asbestos-containing materials.

Material Description	Location	Approx. Quantity	Condition
Pipe Insulation	Outside of Men's and Women's Latrines in Hallway and Above the Ceiling and Inside Pipe Chases of Both Latrines	1,500 LF	Poor
Dark Red Floor Tile and Mastics	Hallway Outside of Men's and Women's Latrines and in Office Space	1,000 SF	Good
Ceiling Plaster Debris	Men's Latrine	500 SF	Poor

Good = No Damage Fair = <10% Damage Poor = >10% Damage

4.2 Lead-Based Paint

The following painted surfaces were tested for the presence of lead in paint as identified in the table below. Samples that are above .5% by wt are considered positive for the presence of lead in paint.

Location	Color	Structure	Positive	Concentration
Men's Latrine	White	Floor	No	.044% wt.
Office	White	Wall	No	.012% wt.

4.3 PCBs in Caulk and Light Ballasts and Fluorescent Bulbs

All samples collected from the window caulk in the latrines and on the exterior of the office area of the windows were found to contain PCBs (4.2mg/kg). Approximately 10% percent of the light ballasts were disassembled and visually inspected. The ballasts in the men's latrines were found to contain no PCB's. The women's latrines were not labeled with "No PCB" and must be treated as PCB-contaminated. Fluorescent light bulbs were observed inside of the light fixtures in the latrines and shower rooms.

4.4 Mercury-Containing Thermostats and Switches

The inspection team did not identify any thermostats or switches that contain mercury in either the basement latrines or associated shower rooms.

4.6 Ozone-Depleting Chemicals or Gases

The inspection team also conducted a visual inspection for ozone-depleting chemicals or gases in the renovation areas. No containers or vessels of ozone-depleting chemicals or gases were observed at the time of inspection.

5.0 SUMMARY/RECOMMENDATIONS

The latrines located in the Cape May Armory will be undergoing renovations in the near future. Whitman performed a limited hazardous materials investigation which included a visual inspection for the presence of mold, PCBs in light ballasts and fluorescent light bulbs, and mercury in switches and thermostats. In addition, Whitman's inspection team collected bulk samples of suspect friable and non-friable asbestos-containing materials. Whitman's Lead Risk Assessor/Inspector collected paint chips from the painted surfaces and bulk samples of the ceramic tiles. The samples were tested for the presence of lead-based paint. The sample analysis revealed that the paint did not contain lead.

Asbestos-containing pipe insulation was identified in the pipe chases and above the ceilings located in the latrine renovation area. In addition, asbestos-containing pipe insulation was also identified in the office (Room 132 and corridor adjacent to the latrines) being renovated. No other asbestos-containing materials were identified in the bulk samples collected. Whitman recommends that an asbestos abatement be conducted which will include cleanup of asbestos-containing debris and removal of the asbestos-containing pipe insulation located above the ceilings and in the pipe chases of the latrine renovation areas.

In the State of New Jersey, all asbestos abatement must be completed by a licensed State of New Jersey Asbestos Contractor with properly licensed asbestos workers. Asbestos abatement projects are required to be designed by an EPA-accredited Project Designer and the work monitored by a New Jersey-licensed Asbestos Safety Control Monitoring (ASCM) firm using a licensed Asbestos Safety Technician (AST).

Lead-based paint was not identified in the latrine renovation areas. The locations of the paint chip samples are listed in Table 4.3 and in the attached Lead-Based Paint Laboratory Analysis Report.

Approximately 10% of the light fixtures were disassembled and the light ballasts were visually inspected for labels stating “No PCB.” At the time of the inspection, the light fixtures did contain fluorescent light bulbs. Whitman recommends that the fluorescent lights and light ballasts be carefully removed and stored in a safe location until the contractor can recycle the materials in accordance with current universal waste stream requirements and regulations.

The window caulk and glazing tested positive for the presence of PCB’s. Whitman recommends that the caulk be removed, if being impacted during the renovations, by workers that have completed the OSHA HAZWOPER 40-hour training course.

Hazardous Materials Abatement Cost Estimate

Asbestos Abatement of the Basement Latrine Renovation Area

1. Removal and cleanup of asbestos-containing pipe insulation and debris from the pipe chases and above the ceilings of the two latrines by wrap and cut procedures:
   1,500 linear feet @ $25 per square foot – $37,500

Removal of Light Ballasts

2. Removal and disposal of PCB-contaminated ballasts:
   Two (2) 50-gallon drums @ $1,000 per drum – $2,000

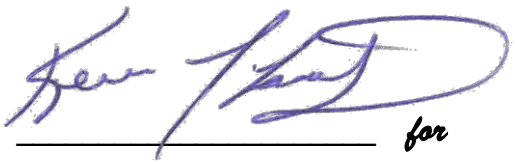
Removal and Disposal of Fluorescent Light Bulbs

3. Removal and disposal of fluorescent light bulbs: Two (2) cases @ $500 per case – $1,000

Estimated Total for Hazardous Materials Abatement: $40,500

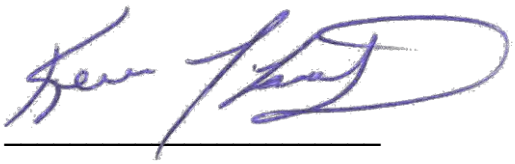
Should you have questions regarding this report, please feel free to contact the undersigned at your convenience.

Report Prepared by,



Elizabeth Casterlin
USEPA-Accredited Building Inspector

Report Reviewed by,



Kevin T. Lovely
Senior Project Manager

ATTACHMENT 1

ASBESTOS SAMPLE COLLECTION AND LABORATORY ANALYSIS DATA

EMSL Analytical, Inc.
200 Route 130 North Cinnaminson, NJ 08077
Tel/Fax: (800) 220-3675 / (856) 786-5974
http://www.EMSL.com / cinnasblab@EMSL.com

EMSL Order: 041802394
Customer ID: WHIT53
Customer PO:
Project ID:

Attention: Kevin Lovely
Whitman Companies, Inc.
7 Pleasant Hill Rd
Cranbury, NJ 08512

Project: Cape May Armory, NJ

Phone: (732) 644-5418
Fax: (732) 390-9496
Received Date: 01/24/2018 1:25 PM
Analysis Date: 01/24/2018 - 01/25/2018
Collected Date: 01/23/2018

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
1 *041802394-0001*	Outside Women's Bathroom - Elbow	Gray Fibrous Homogeneous	40% Min. Wool	60% Non-fibrous (Other)	None Detected
2 *041802394-0002*	Outside Women's Bathroom - Elbow	Gray Fibrous Homogeneous	40% Min. Wool	60% Non-fibrous (Other)	None Detected
3 *041802394-0003*	Outside Women's Bathroom - Elbow	Gray Fibrous Homogeneous	40% Min. Wool	60% Non-fibrous (Other)	None Detected
4 *041802394-0004*	Outside Office - Possible Old Ceiling Tile above Drop Ceiling	Brown/White Fibrous Homogeneous	90% Cellulose	10% Non-fibrous (Other)	None Detected
5 *041802394-0005*	Outside Office - Possible Old Ceiling Tile above Drop Ceiling	Brown/White Fibrous Homogeneous	90% Cellulose	10% Non-fibrous (Other)	None Detected
6 *041802394-0006*	Outside Women's Bathroom - Pipe Insulation	White Fibrous Homogeneous		30% Non-fibrous (Other)	40% Amosite 30% Chrysotile
7 *041802394-0007*	Outside Women's Bathroom - Pipe Insulation				Positive Stop (Not Analyzed)
8 *041802394-0008*	Outside Women's Bathroom - Pipe Insulation				Positive Stop (Not Analyzed)
9 *041802394-0009*	Hallway - Ceiling Tile	Gray/White Fibrous Homogeneous	60% Cellulose 30% Min. Wool	10% Non-fibrous (Other)	None Detected
10 *041802394-0010*	Hallway - Ceiling Tile	Gray/White Fibrous Homogeneous	60% Cellulose 30% Min. Wool	10% Non-fibrous (Other)	None Detected
11-Ceramic Wall *041802394-0011*	Women's Bathroom - Black Ceramic Wall	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
11-Grout *041802394-0011A*	Women's Bathroom - Grout	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
12-Ceramic Wall *041802394-0012*	Men's Bathroom - Black Ceramic Wall	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
12-Grout *041802394-0012A*	Men's Bathroom - Grout	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
13-Ceramic Flooring *041802394-0013*	Men's Bathroom - Ceramic Flooring	Brown Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected

Initial report from: 01/25/2018 07:19:21

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EMSL Order: 041802394
Customer ID: WHIT53
Customer PO:
Project ID:

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos % Fibrous	Non-Asbestos % Non-Fibrous	Asbestos % Type
13-Grout *041802394-0013A*	Men's Bathroom - Grout	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
14-Ceramic Flooring *041802394-0014*	Women's Bathroom - Ceramic Flooring	Brown Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
14-Grout *041802394-0014A*	Women's Bathroom - Grout	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
15 *041802394-0015*	Outside Men's Bathroom - Pipe Insulation	White Fibrous Homogeneous	15% Cellulose	20% Non-fibrous (Other)	40% Amosite 25% Chrysotile
16 *041802394-0016*	Outside Men's Bathroom - Pipe Insulation				Positive Stop (Not Analyzed)
17 *041802394-0017*	Outside Men's Bathroom - Pipe Insulation				Positive Stop (Not Analyzed)
18-Sheetrock *041802394-0018*	Women's Bathroom - Sheetrock	Brown/White Fibrous Homogeneous	15% Cellulose	85% Non-fibrous (Other)	None Detected
18-Joint Compound *041802394-0018A*	Women's Bathroom - Joint Compound	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
18-Texture *041802394-0018B*	Women's Bathroom - Texture	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
19-Sheetrock *041802394-0019*	Women's Bathroom - Sheetrock	Brown/White Fibrous Homogeneous	15% Cellulose	85% Non-fibrous (Other)	None Detected
19-Joint Compound *041802394-0019A*	Women's Bathroom - Joint Compound	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
19-Texture *041802394-0019B*	Women's Bathroom - Texture	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
20 *041802394-0020*	Hallway associated with Office - Sheetrock	Brown/White Non-Fibrous Homogeneous	15% Cellulose	85% Non-fibrous (Other)	None Detected
21-Skim Coat *041802394-0021*	Men's Bathroom - Ceiling Plaster	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
21-Base Coat *041802394-0021A*	Men's Bathroom - Ceiling Plaster	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
22-Skim Coat *041802394-0022*	Men's Bathroom - Ceiling Plaster	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
22-Base Coat *041802394-0022A*	Men's Bathroom - Ceiling Plaster	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
23-Skim Coat *041802394-0023* *The sample group is not homogeneous*	Men's Bathroom - Ceiling Plaster	White Fibrous Homogeneous		98% Non-fibrous (Other)	<1% Amosite 2% Chrysotile

Initial report from: 01/25/2018 07:19:21

EMSL Analytical, Inc.
200 Route 130 North Cinnaminson, NJ 08077
Tel/Fax: (800) 220-3675 / (856) 786-5974
http://www.EMSL.com / cinnasblab@EMSL.com

EMSL Order: 041802394
Customer ID: WHIT53
Customer PO:
Project ID:

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
23-Base Coat *041802394-0023A*	Men's Bathroom - Ceiling Plaster	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
24-Skim Coat *041802394-0024*	Women's Bathroom - Ceiling Plaster	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
24-Base Coat *041802394-0024A*	Women's Bathroom - Ceiling Plaster	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
25-Skim Coat *041802394-0025*	Women's Bathroom - Ceiling Plaster	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
25-Base Coat *041802394-0025A*	Women's Bathroom - Ceiling Plaster	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
26-Skim Coat *041802394-0026*	Women's Bathroom - Ceiling Plaster	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
26-Base Coat *041802394-0026A*	Women's Bathroom - Ceiling Plaster	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
27-Skim Coat *041802394-0027*	Women's Bathroom - Ceiling Plaster	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
27-Base Coat *041802394-0027A*	Women's Bathroom - Ceiling Plaster	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
28-Skim Coat *041802394-0028*	Women's Bathroom - Ceiling Plaster	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
28-Base Coat *041802394-0028A*	Women's Bathroom - Ceiling Plaster	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected

Analyst(s)
Andrew Burke (16)
Gregory Barry (10)
Nancy Stalter (14)

Benjamin Ellis, Laboratory Manager
or Other Approved Signatory

Initial report from: 01/25/2018 07:19:21

OrderID: 041802394

041802394

WHITMAN

7 Pleasant Hill Road
Cranbury, NJ 08512
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Fax: 732-390-9496
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ASBESTOS BULK SAMPLE CHAIN OF CUSTODY

CLIENT: IID — Collected By: ID Castellon — Date: 1-23-17

PROJECT No.: _____ — Transported By: ID Castellon — Date: 1-24-17

PROJECT NAME: Cape May Armory, NJ — Received By: [signature] — Date: 1-24-17 1:25pm

FACILITY: Cape May Armory — Analyzed By: _____ — Date: _____

SAMPLE TURNAROUND: Rush @ ____ Hour ☐ 24 hour ☐ 3 days ☐ 5 days

TYPE OF ANALYSIS: (1= PLM) 2= PLM/NOB 3= TEM/NOB 4 = TEM 5=Other Method _____

LAB ID #	SAMPLE NUMBER	FRIABLE Y / N	SAMPLE LOCATION & MATERIAL DESCRIPTION	MATERIAL TYPE*	ANALYSIS TYPE	RESULT
	1		Elbow, outside womens Bathroom			
	2		Elbow, outside womens Bathroom			
	3		Elbow, outside womens Bathroom			
	4		Posible old ceiling tile Above drop ceiling outside office			
	5		Possible old ceiling tile, above drop ceiling Outside Office			
	6		Pipe Insul., outside womens Bathroom			
	7		Pipe Insul, outside womens Bathroom			
	8		Pipe Insul., outside womens Bathroom			
	9,10		Ceiling tile, Hallway			
	11		Black ceramic wall w/ Grout, womens Bathroom			
	12		Black ceramic wall w/ Grout, mens Bathroom			
	13		Ceramic flooring w/ Grout, mens Bathroom			
	14		Ceramic flooring w/ Grout, womens Bathroom			
	15,16,17		Pipe Insul., Outside mens Bathroom			
	18,19		SheetRock, womens Bathroom			
	20		SheetRock, Above drop ceiling In hallway associated w/ office			
	21,22,23		Ceiling Plaster, mens Bathroom			
	24,25,26,27,28		Ceiling Plaster, womens Bathroom			

RECEIVED EMSL CINNAMINSON, N.J. 2010 JAN 24 P 4:25

* T=THERMAL, S=SURFACING, M=MISCELLANEOUS

28

PLEASE CONTACT Kevin Caseley WITH RESULTS

Phone: 732-390-5858 Fax: 732-390-9496

Please Stop First Positive!

OrderID: 041802392

041802392

WHITMAN

7 Pleasant Hill Road
Cranbury, NJ 08512
Tel: 732-390-5858
Fax: 732-390-9496
www.whitmanco.com

ASBESTOS BULK SAMPLE CHAIN OF CUSTODY

CLIENT: TDD

Collected By: Liz Astelen Date: 1-23-18

PROJECT No.:

Transported By: Liz Astelen Date: 1-24-17

PROJECT NAME: Cape May Armory, NJ

Received By: [signature] Date: 1/24/18 1:25pm

FACILITY: Cape May Armory

Analyzed By: [signature] Date:

SAMPLE TURNAROUND: Rush @ 48 Hour ☐ 24 hour ☐ 3 days ☐ 5 days

TYPE OF ANALYSIS: 1= PLM 2= PLM/NOB 3= TEM/NOB 4 = TEM 5=Other Method

LAB ID #	SAMPLE NUMBER	FRIABLE Y / N	SAMPLE LOCATION & MATERIAL DESCRIPTION	MATERIAL TYPE*	ANALYSIS TYPE	RESULT
	1A		9x9 floor tile w/ mastic, Hallway			
	1B		9x9 floor tile w/ mastic, Hallway			
	2		window caulk, Office			
	3		window caulk, Office			

RECEIVED
EMSL
CINNAMINSON, N.J.
2018 JAN 24 P 1:25

* T=THERMAL, S=SURFACING, M=MISCELLANEOUS

PLEASE CONTACT Kevin Lovelly WITH RESULTS

Phone: 732-390-5858 Fax: 732-390-9496

4RP

Please Stop@First Positive!

EMSL ANALYTICAL, INC.
LABORATORY · PRODUCTS · TRAINING

Environmental Chemistry
Chain of Custody

EMSL Order Number (*Lab Use Only*): 011800500

PHONE:
FAX:

Report To Contact Name: Kevin Lovely			**Bill To Company:**		
Company Name: Cranbury			**Attention To:**		
Street: 7 Pleasant Hill Rd			**Street:**		
City: Cranbury	**State/Province:** NJ	**Zip/Postal Code:**	**City:**	**State/Province:**	**Zip/Postal Code:**
Phone : 732-396-5858 **Fax :**			**Phone:**	**Fax:**	
Project Name: Cape May Armory, NJ		**Email Results To:** klovely@whitmanco.com		**Purchase Order:**	
U.S. State where Samples Collected:		**Number of Samples in Shipment:**		**Date of Shipment:**	

Sample for Compliance? Yes ☐ No ☐ If yes, NPDES? ☐ **Other (Specify):**

Samples Collected by: EMSL ☐ Client ☐ check one — **Sampled By (Signature):** — **Samples Received Chilled (Y/N)** ____

Standard Turnaround Time: ☐ 2 Weeks — **The following TATs are subject to lab approval:** ☒ 1 Week ☐ 4 Days ☐ 3 Days ☐ 2 Days ☐ 1 Day

Failure to complete will hinder processing of samples

Client Sample ID	Comp	Grab	Collect Date/Time	Matrix (W=Water S=Soil A=Air SL=Sludge O=Other)	Preservative (1=HCL 2=HNO3 3=H2SO4 4=ICE 5=Other)	List Test(s) Needed: PCB				Field pH	Field pH Test Time	Field Temp. Deg C	Field Temp. Test Time	Comments
1	☐	☐	1-24-18			✓								PCB test
	☐	☐												
	☐	☐												
	☐	☐												
	☐	☐												

Released By (Signature)	Date & Time	Received By	Date & Time
	1-24-18	21.9	1/24/18 1:25p
			1/24/18 1:25pm

Please indicate reporting requirements: ☐ Results Only ☐ Results and QC ☐ Reduced Deliverables ☐ Disk Deliverable ☐ Other ____

Instructions or Comments: Please email Kevin Lovely w/ Results Thank you! PCB test.

Note:Field pH and Field Temperature are tested on the same day as the date of sample collection.

(Lab) Received Temperature: ____ °C

OrderID: 011800500

1/24

EMSL Analytical, Inc.

200 Route 130 North Cinnaminson, NJ 08077
Phone/Fax: (800) 220-3675 / (856) 786-5974
http://www.EMSL.com / cinnasblab@EMSL.com

EMSL Order ID:	041802392
Customer ID:	WHIT53
Customer PO:	
Project ID:	

Attn:	Kevin Lovely Whitman Companies, Inc. 7 Pleasant Hill Rd Cranbury, NJ 08512	Phone: Fax: Collected: Received: Analyzed:	(732) 390-5858 (732) 390-9496 1/23/2018 1/24/2018 1/25/2018
Proj:	Cape May Armory, NJ		

Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: 1A-Floor Tile **Lab Sample ID:** 041802392-0001
Sample Description: Hallway/9x9 Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
TEM Grav. Reduction	1/25/2018	Red	0.0%	54.1%	45.9% Chrysotile	

Client Sample ID: 1A-Mastic **Lab Sample ID:** 041802392-0001A
Sample Description: Hallway/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
TEM Grav. Reduction	1/25/2018	Black	0.0%	80.7%	19.3% Chrysotile	

Client Sample ID: 1B-Floor Tile **Lab Sample ID:** 041802392-0002
Sample Description: Hallway/9x9 Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
TEM Grav. Reduction	1/25/2018				Positive Stop (Not Analyzed)	

Client Sample ID: 1B-Mastic **Lab Sample ID:** 041802392-0002A
Sample Description: Hallway/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
TEM Grav. Reduction	1/25/2018				Positive Stop (Not Analyzed)	

Client Sample ID: 2 **Lab Sample ID:** 041802392-0003
Sample Description: Office/Window Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
TEM Grav. Reduction	1/25/2018	Black	0.0%	100%	<0.1% Chrysotile	

Client Sample ID: 3 **Lab Sample ID:** 041802392-0004
Sample Description: Office/Window Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
TEM Grav. Reduction	1/25/2018	Black	0.0%	100%	None Detected	

EMSL Analytical, Inc.
200 Route 130 North Cinnaminson, NJ 08077
Phone/Fax: (800) 220-3675 / (856) 786-5974
http://www.EMSL.com / cinnasblab@EMSL.com

EMSL Order ID:	041802392
Customer ID:	WHIT53
Customer PO:	
Project ID:	

Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Analyst(s):

Matthew Dare TEM Grav. Reduction (4)

Reviewed and approved by:

Benjamin Ellis, Laboratory Manager
or Other Approved Signatory

Samples analyzed by EMSL Analytical, Inc. Cinnaminson, NJ NVLAP Lab Code 101048-0, AIHA-LAP, LLC-IHLAP Lab 100194, NYS ELAP 10872, NJ DEP 03036

Initial report from: 01/25/201812:32:12

ATTACHMENT 2

LEAD-BASED PAINT LABORATORY ANALYSIS REPORT

EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856) 303-2500 / (856) 786-5974
http://www.EMSL.com cinnaminsonleadlab@emsl.com

EMSL Order:	201801326
CustomerID:	WHIT53
CustomerPO:	
ProjectID:	

Attn: **Kevin Lovely**
Whitman Companies, Inc.
7 Pleasant Hill Rd
Cranbury, NJ 08512

Phone:	(732) 390-5858
Fax:	(732) 390-9496
Received:	02/08/18 3:40 PM
Collected:	2/8/2018

Project: **Cape May Armory**

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

Client Sample Description	*Lab ID*	*Collected*	*Analyzed*	*Lead Concentration*
1	*201801326-0001*	2/8/2018	2/9/2018	0.044 % wt
	Site: Men's - White Paint			
6	*201801326-0006*	2/8/2018	2/9/2018	<0.012 % wt
	Site: White Paint Office			

Phillip Worby, Lead Laboratory Manager
or other approved signatory

*Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.008 % wt based on the minimum sample weight per our SOP. Unless noted, results in this report are not blank corrected. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. The QC data associated with the sample results included in this report meet the recovery and precision requirements unless specifically indicated otherwise. Definitions of modifications are available upon request.

Samples analyzed by EMSL Analytical, Inc. Cinnaminson, NJ NELAP Certifications: NJ 03036, NY 10872, PA 68-00367, AIHA-LAP, LLC ELLAP 100194, A2LA 2845.01

Initial report from 02/12/2018 11:24:58

OrderID: 201801326

EMSL ANALYTICAL, INC.
LABORATORY • PRODUCTS • TRAINING

Lead (Pb) Chain of Custody

EMSL Order ID *(Lab Use Only)*: 201801326

PHONE: ( )
FAX: ( )

Company: Whitman		**EMSL-Bill to:** ☒ Same ☐ Different If Bill to is Different note instructions in Comments** *Third Party Billing requires written authorization from third party*	
Street: 7 Pleasant Hill Rd			
City: Cranbury	**State/Province:** NJ	**Zip/Postal Code:** 08512	**Country:** USA
Report To (Name): Kevin Lovely		**Telephone #:** 732 390 5858	
Email Address: Klovely@whitmanco.com		**Fax #:** 732 390 9496	**Purchase Order:**
Project Name/Number: Cape May Armory		**Please Provide Results:** ☐ Fax ☒ Email	
U.S. State Samples Taken:		**CT Samples:** ☐ Commercial/Taxable ☐ Residential/Tax Exempt	

Turnaround Time (TAT) Options* - Please Check

☐ 3 Hour | ☐ 6 Hour | ☐ 24 Hour | ☒ 48 Hour | ☐ 72 Hour | ☐ 96 Hour | ☐ 1 Week | ☐ 2 Week

**Analysis completed in accordance with EMSL's Terms and Conditions located in the Price Guide*

Matrix	Method	Instrument	Reporting Limit	Check
Chips ☒ % by wt. ☐ mg/cm² ☒ ppm (mg/kg)	SW846-7000B	Flame Atomic Absorption	0.01%	☒
Air	NIOSH 7082	Flame Atomic Absorption	4 µg/filter	☐
	NIOSH 7105	Graphite Furnace AA	0.03 µg/filter	☐
	NIOSH 7300M/NIOSH 7303	ICP-OES	0.5 µg/filter	☐
Wipe* ASTM ☐ non ASTM ☐ *If no box checked, non-ASTM Wipe assumed	SW846-7000B	Flame Atomic Absorption	10 µg/wipe	☐
	SW846-6010B or C	ICP-OES	1.0 µg/wipe	☐
TCLP	SW846-1311/7000B/SM 3111B	Flame Atomic Absorption	0.4 mg/L (ppm)	☐
	SW846-1311/SW846-6010B or C	ICP-OES	0.1 mg/L (ppm)	☐
SPLP	SW846-1312/7000B/SM 3111B	Flame Atomic Absorption	0.4 mg/L (ppm)	☐
	SW846-1312/SW846-6010B or C	ICP-OES	0.1 mg/L (ppm)	☐
TTLC	22 CCR App. II, 7000B/7420	Flame Atomic Absorption	40 mg/kg (ppm)	☐
	22 CCR App. II, SW846-6010B or C	ICP-OES	2 mg/kg (ppm)	☐
STLC	22 CCR App. II, 7000B/7420	Flame Atomic Absorption	0.4 mg/L (ppm)	☐
	22 CCR App. II, SW846-6010B or C	ICP-OES	0.1 mg/L (ppm)	☐
Soil	SW846-7000B	Flame Atomic Absorption	40 mg/kg (ppm)	☐
	SW846-6010B or C	ICP-OES	2 mg/kg (ppm)	☐
Wastewater Unpreserved ☐ Preserved with HNO_3 pH < 2 ☐	SM3111B/SW846-7000B	Flame Atomic Absorption	0.4 mg/L (ppm)	☐
	EPA 200.9	Graphite Furnace AA	0.003 mg/L (ppm)	☐
	EPA 200.7	ICP-OES	0.020 mg/L (ppm)	☐
Drinking Water Unpreserved ☐ Preserved with HNO_3 pH < 2 ☐	EPA 200.8	ICP-MS	0.001 mg/L (ppm)	☐
	EPA 200.9	Graphite Furnace AA	0.003 mg/L (ppm)	☐
	EPA 200.5	ICP-OES	0.003 mg/L (ppm)	☐
TSP/SPM Filter	40 CFR Part 50	ICP-OES	12 µg/filter	☐
	40 CFR Part 50	Graphite Furnace AA	3.6 µg/filter	☐
Other:				☐

Name of Sampler: Brett Iwicki **Signature of Sampler:**

	Sample #	Location	Volume/Area	Date/Time Sampled
1-	1	Men's - White Paint	1 Chip	2-8-18 11:15
2-	2	Brown Paint Rubber Framing - Men's	1 Chip	2-8-18 11:20

Client Sample #s - **Total # of Samples:**

Relinquished (Client):		**Date:** 2-8-18	**Time:** 3:40		
Received (Lab):		**Date:** 2-8-18	**Time:** 3:40p		

Comments: o/o wt for chips, ppm for ceramics / flame ok for glaze + rubber

*Rubber/paint analyzed as solid - ok per Kevin 2/8/18, KMS

Page 1 of 2 pages

(6)

OrderID: 201801326

EMSL ANALYTICAL, INC.

LEAD (Pb) CHAIN OF CUSTODY

EMSL ORDER ID *(Lab Use Only):* 201801326

PHONE: ( )
FAX: ( )

Additional Pages of the Chain of Custody are only necessary if needed for additional sample information

	Sample #	Location	Volume/Area	Date/Time Sampled
3.	3	Beige/Brown Floor Tile Ceramic - Mens	1 Chip	2-8-18 11:25
4.	4	Beige Block Wall Ceramic - Mens	1 Chip	2-8-18 11:30
5.	5	Beige/brown Floor tile - Womens	1 Chip	2-8-18 11:35
1.	6	White Paint office	1 Chip	2-8-18 11:45

Comments/Special Instructions:

Page 2 of 2 pages

Controlled Document — COC-25 Lead (Pb) - R8 7/19/2017

EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077
Phone: (856) 303-2500 Fax: (856) 858-4571 Email: EnvChemistry2@emsl.com

Attn: **Kevin Lovely**
Whitman Companies, Inc.
7 Pleasant Hill Rd
Cranbury, NJ 08512
Phone: (732) 390-5858
Fax: (732) 390-9496

1/31/2018

The following analytical report covers the analysis performed on samples submitted to EMSL Analytical, Inc. on 1/24/2018. The results are tabulated on the attached data pages for the following client designated project:

Cape May Armory, NJ

The reference number for these samples is EMSL Order #011800500. Please use this reference when calling about these samples. If you have any questions, please do not hesitate to contact me at (856) 303-2500.

Approved By:

Phillip Worby, Environmental Chemistry
Laboratory Director

The test results contained within this report meet the requirements of NELAP and/or the specific certification program that is applicable, unless otherwise noted.
NELAP Certifications: NJ 03036, NY 10872, PA 68-00367, CA ELAP 1877

EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856) 303-2500 / (856) 858-4571
http://www.EMSL.com EnvChemistry2@emsl.com

EMSL Order:	011800500
CustomerID:	WHIT53
CustomerPO:	
ProjectID:	

Attn: **Kevin Lovely**
Whitman Companies, Inc.
7 Pleasant Hill Rd
Cranbury, NJ 08512

Phone: (732) 390-5858
Fax: (732) 390-9496
Received: 01/24/18 1:25 PM

Project: **Cape May Armory, NJ**

Analytical Results

Client Sample Description 1 ***Collected:*** 1/24/2018 ***Lab ID:*** *011800500-0001*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
3540C/8082A	Aroclor-1016	ND	0.54	mg/Kg	1/26/2018	SD	1/29/2018	EH
3540C/8082A	Aroclor-1221	ND	0.54	mg/Kg	1/26/2018	SD	1/29/2018	EH
3540C/8082A	Aroclor-1232	ND	0.54	mg/Kg	1/26/2018	SD	1/29/2018	EH
3540C/8082A	Aroclor-1242	ND	0.54	mg/Kg	1/26/2018	SD	1/29/2018	EH
3540C/8082A	Aroclor-1248	ND	0.54	mg/Kg	1/26/2018	SD	1/29/2018	EH
3540C/8082A	Aroclor-1254	4.2	0.54	mg/Kg	1/26/2018	SD	1/29/2018	EH
3540C/8082A	Aroclor-1260	ND	0.54	mg/Kg	1/26/2018	SD	1/29/2018	EH
3540C/8082A	Aroclor-1262	ND	0.54	mg/Kg	1/26/2018	SD	1/29/2018	EH
3540C/8082A	Aroclor-1268	ND	0.54	mg/Kg	1/26/2018	SD	1/29/2018	EH

Definitions:
ND - indicates that the analyte was not detected at the reporting limit
RL - Reporting Limit (Analytical)

ATTACHMENT 3

ACCREDITATION INFORMATION

47685

National Asbestos & Environmental Training Institute

CERTIFICATE OF COMPLETION

AHERA/EPA Accredited Per 40 CFR Part 763
Asbestos Accreditation under TSCA Title II

This is to certify that

Elizabeth Casterlin

Successfully completed the course entitled

1/2-Day EPA/AHERA Asbestos Building Inspector Annual Refresher on September 1, 2016

Expiration Date on September 1, 2017

Doris L. Adler
President, NAETI

Per 10 NYCRR Part 73.2 (L) (1), DOH 2832 Certificate of Completion of Asbestos Safety Training is the only official record of training for N.Y.S. students.

Language: English

ABIH 1/2 CM POINT

3321 Doris Avenue, Building B, Ocean, NJ 07712 Phone (732) 531-5571 Fax (732) 531-5956 www.naeti.com

49981

National Asbestos & Environmental Training Institute

CERTIFICATE OF COMPLETION

AHERA/EPA Accredited Per 40 CFR Part 763
Asbestos Accreditation under TSCA Title II

This is to certify that

Lindsey Aceto

Successfully completed the course entitled

3-Day New York State/EPA/AHERA Asbestos Building Inspector Program on June 27-29, 2017

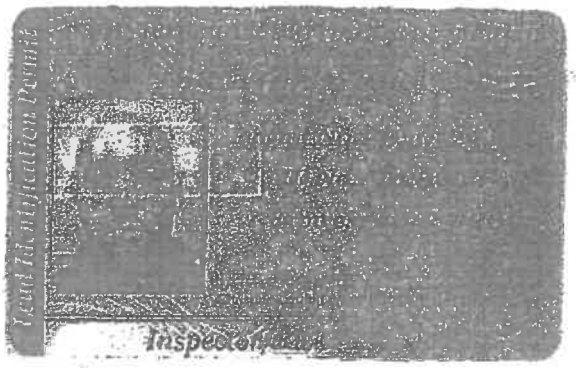
Examination passed on June 29, 2017 *Expiration Date on June 29, 2018*

Doris L. Adler
President, NAETI

Per 10 NYCRR Part 73.2 (L) (1), DOH 2832 Certificate of Completion of Asbestos Safety Training is the only official record of training for N.Y.S. students.

Language: English ABIH 3 CM POINTS

3321 Doris Avenue, Building B, Ocean, NJ 07712 Phone (732) 531-5571 Fax (732) 531-5956 www.naeti.com


Yard Activity Permit
Inspector

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

EMSL ANALYTICAL, INC.
200 Route 130 North
Cinnaminson, NJ 08077
Daycia Scotton Phone: 856 858 4800 x 2546

ENVIRONMENTAL

Valid To: May 31, 2017 Certificate Number: 2845.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform recognized EPA methods using the following testing technologies and in the analyte categories identified below; for the test methods applicable to the National Environmental Lead Laboratory Accreditation Program (NLLAP) and tests on children's products:

ENVIRONMENTAL LEAD	
Test	**Test Method(s)**
Total Lead (Pb) in Soil	EMSL Analytical, Inc. LM-007A (Modified EPA 7000B – (FLAA), 3050 Hotblock Digestion)
Total Lead (Pb) in Paint Chips	EMSL Analytical, Inc. LM-007B (Modified EPA 7000B – (FLAA), 3050 Hotblock Digestion)
Total Lead (Pb) in Dust Wipes	EMSL Analytical, Inc. LM-007C (Modified EPA 7000B – (FLAA), 3050 Hotblock Digestion)

AIR MATRIX	
Test	**Test Method(s)**
Total Lead (Pb) in Air	NIOSH 7082 – (FLAA)
Total Lead (Pb) in Air	NIOSH 7105 – (GFAA)
Total Metals in Air	EMSL Analytical, Inc. LM-003 (Modified NIOSH 7300 for ICP/ICP-MS)
Inorganic Fibrous Particles by SEM	German VDI 3492
Inorganic Fibrous Particles by SEM	ISO 14966
Combustion-by-Products (black carbon/soot, char and ash	ASTM D6602

BULK MATRIX	
Determination of Asbestos in Technical Products by SEM method	German VDI 3866 Part 5
Combustion-by-Products (black carbon/soot, char and ash	ASTM D6602

5202 Presidents Court, Suite 220 | Frederick, MD 21703-8398 | Phone: 301 644 3248 | Fax: 240 454 9449 | www.A2LA.org

Accreditation is also granted to this laboratory to perform the following tests on children's products:

CHEMICAL	
Test	**Test Method(s)**
Lead in Paint and Surface Coatings	16 CFR 1303 (using ASTM E1613 and E1645); CPSC-CH-E1003-09.1
Total Lead in Children's Metal Jewelry	CPSC-CH-E1001-08.1
Total Lead in Children's Metal Products	CPSC-CH-E1001-08.1
Total Lead in Children's Non-Metal Products	CPSC-CH-E1002-08
Phthalates	CPSC-CH-C1001-09.3 (using EPA SW-846 8270)
Soluble Heavy Metals Content (As, Ba, Cd, Cr, Pb, Hg, Sb, Se)	ASTM F 963-11 Section 4.3.5.1 & Section 4.3.5.2
Total Cadmium in Children's Metal Products Including Children's Metal Jewelry	EMSL Analytical, Inc. LM-016, (Modified CPSC-CH-E1001-08.1)
Total Cadmium in Children's Non Metal Products	EMSL Analytical, Inc. LM-016, (Modified CPSC-CH-E1002-08)

Accreditation is also granted to this laboratory to perform the following tests on brake friction materials:

ASBESTOS ANALYSIS	
Test	**Test Method(s)**
Sample Preparation by Drilling	SAE J2975
Polarized Light Microscopy	SAE J2975, EPA 600/R-93/116
Transmission Electron Microscopy	ISO 10312 (direct method)
Transmission Electron Microscopy	ISO 13794 (indirect method)

Accredited Laboratory

A2LA has accredited

EMSL ANALYTICAL, INC.

Cinnaminson, NJ

for technical competence in the field of

Environmental Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system *(refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009)*.

Presented this 17th of August 2015.

President & CEO
For the Accreditation Council
Certificate Number 2845.01
Valid to May 31, 2017

For the tests to which this accreditation applies, please refer to the laboratory's Environmental Scope of Accreditation.

August 31, 2016

Laboratory ID: 100194

Oommen Kappil
EMSL Analytical, Inc.
200 Route 130 North
Cinnaminson, NJ 08077

Dear Mr. Kappil:

Congratulations! The AIHA Laboratory Accreditation Programs (AIHA-LAP), LLC's Analytical Accreditation Board (AAB) has approved EMSL Analytical, Inc. as an accredited Industrial Hygiene, Environmental Lead and Environmental Microbiology laboratory.

Accreditation documentation includes the IHLAP, ELLAP and EMLAP accreditation certificate, scope of accreditation document and a copy of the current AIHA-LAP, LLC license agreement (if your completed agreement is not on file at AIHA-LAP, LLC). The accreditation symbol has been designed for use by all AIHA-LAP, LLC accredited laboratories. If your laboratory chooses to use the symbol in its advertising the laboratory's accreditation, you must complete and return the AIHA-LAP, LLC license agreement to a Laboratory Accreditation Specialist. Once submitted, an electronic copy of the accreditation symbol will be sent to you. Please inform us if your laboratory does not wish to use the symbol in advertising.

Laboratory accreditation shall be maintained by continued compliance with IHLAP, ELLAP and EMLAP requirements *(see Policy Modules 2B, 2C, 2D, and 6)*, which includes proficient participation in AIHA-LAP, LLC approved proficiency testing, demonstration of competency, or round robin program as indicated on the AIHA-LAP "Approved PT and Round Robin" webpage, its associated Scope/PT table, and as required in Policy Module 6, for all Fields of Testing (FoTs) for which the laboratory is accredited. An accredited laboratory that wishes to expand into a new FoT must submit an updated accreditation application to AIHA-LAP, LLC for review by the AAB.

Any changes in ownership, laboratory location, personnel, FoTs/Methods, or significant procedural changes shall be reported to AIHA-LAP, LLC in writing within twenty (20) business days of the change.

The accreditation certificate is the property of AIHA-LAP, LLC and must be returned to us should your laboratory withdraw or be removed from the IHLAP, ELLAP and EMLAP.

Again, congratulations. If you have any questions, please contact Lauren Schnack, Laboratory Accreditation Specialist, at (703) 846-0716.

Sincerely,

Cheryl O. Morton

Cheryl O. Morton
Managing Director
AIHA Laboratory Accreditation Programs, LLC

AIHA Laboratory Accreditation Programs, LLC

acknowledges that

EMSL Analytical, Inc.

200 Route 130 North, Cinnaminson, NJ 08077

Laboratory ID: 100194

along with all premises from which key activities are performed, as listed above, has fulfilled the requirements of the AIHA Laboratory Accreditation Programs (AIHA-LAP), LLC accreditation to the ISO/IEC 17025:2005 international standard, *General Requirements for the Competence of Testing and Calibration Laboratories* in the following:

LABORATORY ACCREDITATION PROGRAMS

✓	**INDUSTRIAL HYGIENE**	Accreditation Expires: September 01, 2018
✓	**ENVIRONMENTAL LEAD**	Accreditation Expires: September 01, 2018
✓	**ENVIRONMENTAL MICROBIOLOGY**	Accreditation Expires: September 01, 2018
☐	**FOOD**	Accreditation Expires:
☐	**UNIQUE SCOPES**	Accreditation Expires:

Specific Field(s) of Testing (FoT)/Method(s) within each Accreditation Program for which the above named laboratory maintains accreditation is outlined on the attached **Scope of Accreditation.** Continued accreditation is contingent upon successful on-going compliance with ISO/IEC 17025:2005 and AIHA-LAP, LLC requirements. This certificate is not valid without the attached Scope of Accreditation. Please review the AIHA-LAP, LLC website (www.aihaaccreditedlabs.org) for the most current Scope.

William Walsh, CIH
Chairperson, Analytical Accreditation Board

Cheryl O. Morton
Managing Director, AIHA Laboratory Accreditation Programs, LLC

Revision 15: 03/30/2016

Date Issued: 08/31/2016

AIHA Laboratory Accreditation Programs, LLC
SCOPE OF ACCREDITATION

EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077

Laboratory ID: **100194**
Issue Date: 08/31/2016

The laboratory is approved for those specific field(s) of testing/methods listed in the table below. Clients are urged to verify the laboratory's current accreditation status for the particular field(s) of testing/Methods, since these can change due to proficiency status, suspension and/or withdrawal of accreditation.

Industrial Hygiene Laboratory Accreditation Program (IHLAP)

Initial Accreditation Date: 02/01/1989

IHLAP Scope Category	Field of Testing (FoT) (FoTs cover all relevant IH matrices)	Technology sub-type/ Detector	Published Reference Method/Title of In-house Method	Method Description or Analyte *(for internal methods only)*
Chromatography Core	Gas Chromatography	GC/FID	NIOSH 1003 Modified	
			NIOSH 1005	
			NIOSH 1400 Modified	
			NIOSH 1500 Modified	
			NIOSH 1501 Modified	
			NIOSH 1550 Modified	
			NIOSH 1603 Modified	
			NIOSH 2000 Modified	
		GC/ECD	NIOSH 5502 Modified	
			NIOSH 5503 Modified	
			NIOSH 5510 Modified	
			OSHA 1010 Modified	
	GC/MS	GC/MS	EPA TO-15	
	Gas Chromatography (Diffusive Samplers)		NIOSH 1501 Modified	
	Ion Chromatography (IC)		NIOSH 6004 Modified	
			NIOSH 6011	
			NIOSH 7903	
			OSHA ID-165SG	
			OSHA ID-214	
			OSHA ID-215 Modified	
	Liquid Chromatography	HPLC/FL	NIOSH 2016 Modified	
		HPLC/UV	NIOSH 5506 Modified	
Spectrometry Core	Atomic Absorption	CVAA	NIOSH 6009 Modified	
			OSHA ID-140 Modified	
			OSHA ID-145	

AIHA
Laboratory Accreditation Programs, LLC

IHLAP Scope Category	Field of Testing (FoT) (FoTs cover all relevant IH matrices)	Technology sub-type/ Detector	Published Reference Method/Title of In-house Method	Method Description or Analyte *(for internal methods only)*
Spectrometry Core	Atomic Absorption	FAA	NIOSH 7082	
		GFAA	NIOSH 7105	
	Inductively-Coupled Plasma	ICP/MS	NIOSH 7300 Modified	
		ICP/AES	NIOSH 7300 Modified	
	X-ray Diffraction (XRD)		NIOSH 7500 Modified	
			OSHA ID-142 Modified	
	UV/VIS (Colorimetric)		NIOSH 6010 Modified	
Asbestos/Fiber Microscopy Core	Polarized Light Microscopy (PLM)		EPA 600/R-93/116	
	Phase Contrast Microscopy (PCM)		NIOSH 7400	
	Transmission Electron Microscopy (TEM)		EPA AHERA - 40 CFR Part 763	EPA AHERA Method (40 CFR 763, Subpart E, Appendix A, Mandatory Method
Miscellaneous Core	Gravimetric		NIOSH 0500	
			NIOSH 0600	
			NIOSH 5524	
	Thermo-optical Analysis (TOA)		NIOSH 5040	
Beryllium Testing	Inductively-Coupled Plasma	ICP/MS	NIOSH 7300	
			NIOSH 7303	

A complete listing of currently accredited Industrial Hygiene laboratories is available on the AIHA-LAP, LLC website at: http://www.aihaaccreditedlabs.org

AIHA Laboratory Accreditation Programs, LLC
SCOPE OF ACCREDITATION

EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077

Laboratory ID: **100194**
Issue Date: 08/31/2016

The laboratory is approved for those specific field(s) of testing/methods listed in the table below. Clients are urged to verify the laboratory's current accreditation status for the particular field(s) of testing/Methods, since these can change due to proficiency status, suspension and/or withdrawal of accreditation.

The EPA recognizes the AIHA-LAP, LLC ELLAP program as meeting the requirements of the National Lead Laboratory Accreditation Program (NLLAP) established under Title X of the Residential Lead-Based Paint Hazard Reduction Act of 1992 and includes paint, soil and dust wipe analysis. Air analysis is not included as part of the NLLAP.

Environmental Lead Laboratory Accreditation Program (ELLAP)

Initial Accreditation Date: 01/18/1995

Field of Testing (FoT)	Technology sub-type/ Detector	Method	Method Description *(for internal methods only)*
Paint		EPA SW-846 3050B	
		EPA SW-846 7000B	
Soil		EPA SW-846 3050B	
		EPA SW-846 7000B	
Settled Dust by Wipe		EPA SW-846 3050B	
		EPA SW-846 7000B	
Airborne Dust		NIOSH 7082	
Composited Wipes		EPA SW-846 3050B	
		EPA SW-846 7000B	

A complete listing of currently accredited Environmental Lead laboratories is available on the AIHA-LAP, LLC website at: http://www.aihaaccreditedlabs.org

AIHA Laboratory Accreditation Programs, LLC
SCOPE OF ACCREDITATION

EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077

Laboratory ID: **100194**
Issue Date: 08/31/2016

The laboratory is approved for those specific field(s) of testing/methods listed in the table below. Clients are urged to verify the laboratory's current accreditation status for the particular field(s) of testing/Methods, since these can change due to proficiency status, suspension and/or withdrawal of accreditation.

Environmental Microbiology Laboratory Accreditation Program (EMLAP)

Initial Accreditation Date: 09/01/2002

EMLAP Category	Field of Testing (FoT)	Method	Method Description *(for internal methods only)*
Fungal	Air - Culturable	M005	Detection and Enumeration of Culturable Fungi from Environmental Samples
	Bulk - Culturable	M005	Detection and Enumeration of Culturable Fungi from Environmental Samples
	Surface - Culturable	M005	Detection and Enumeration of Culturable Fungi from Environmental Samples
	Air - Direct Examination	05-TP-003.7	Standard Operating Procedure for the Analysis of Airborne Fungal Spores, Hyphal Fragments, Pollen, Insect Fragments, Skin Fragments and Fibrous Particulate by Optical Microscopy of Spore Trap Samples
	Bulk - Direct Examination	M041	Standard Operating Procedure for the Microscopic Examination of Fungal Spores, Fungal Structures, Hyphae, Pollen, Insect Fragments, and Fibrous Material from Surface Samples
	Surface - Direct Examination	M041	Standard Operating Procedure for the Microscopic Examination of Fungal Spores, Fungal Structures, Hyphae, Pollen, Insect Fragments, and Fibrous Material from Surface Samples
Bacterial	Air - Culturable	M009	Detection and Enumeration of Culturable Bacteria from Environmental Samples
	Bulk - Culturable	M009	Detection and Enumeration of Culturable Bacteria from Environmental Samples
	Surface - Culturable	M009	Detection and Enumeration of Culturable Bacteria from Environmental Samples

AIHA
Laboratory Accreditation Programs, LLC

EMLAP Category	Field of Testing (FoT)	Method	Method Description *(for internal methods only)*
Bacterial	Legionella	05-TP-002	Recovery of Legionella from the Environment Using the Center for Disease Control and Prevention's Culture Method

A complete listing of currently accredited Environmental Microbiology laboratories is available on the AIHA-LAP, LLC website at: http://www.aihaaccreditedlabs.org

United States Department of Commerce
National Institute of Standards and Technology

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 101048-0

EMSL Analytical, Inc.

Cinnaminson, NJ

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

Asbestos Fiber Analysis

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2016-07-01 through 2017-06-30

Effective Dates

For the National Voluntary Laboratory Accreditation Program

NVLAP® National Voluntary Laboratory Accreditation Program

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

EMSL Analytical, Inc.
200 Route 130 North
Cinnaminson, NJ 08077
Mr. Ben Ellis
Phone: 800-220-3675 Fax: 856-786-5973
Email: bellis@emsl.com
http://www.emsl.com

ASBESTOS FIBER ANALYSIS

NVLAP LAB CODE 101048-0

Bulk Asbestos Analysis

Code	*Description*
18/A01	EPA 600/M4-82-020: Interim Method for the Determination of Asbestos in Bulk Insulation Samples
18/A03	EPA 600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials

Airborne Asbestos Analysis

Code	*Description*
18/A02	U.S. EPA's "Interim Transmission Electron Microscopy Analytical Methods-Mandatory and Nonmandatory-and Mandatory Section to Determine Completion of Response Actions" as found in 40 CFR, Part 763, Subpart E, Appendix A.

For the National Voluntary Laboratory Accreditation Program

August 31, 2016

Laboratory ID: 100194

Oommen Kappil
EMSL Analytical, Inc.
200 Route 130 North
Cinnaminson, NJ 08077

Dear Mr. Kappil:

Congratulations! The AIHA Laboratory Accreditation Programs (AIHA-LAP), LLC's Analytical Accreditation Board (AAB) has approved EMSL Analytical, Inc. as an accredited Industrial Hygiene, Environmental Lead and Environmental Microbiology laboratory.

Accreditation documentation includes the IHLAP, ELLAP and EMLAP accreditation certificate, scope of accreditation document and a copy of the current AIHA-LAP, LLC license agreement (if your completed agreement is not on file at AIHA-LAP, LLC). The accreditation symbol has been designed for use by all AIHA-LAP, LLC accredited laboratories. If your laboratory chooses to use the symbol in its advertising the laboratory's accreditation, you must complete and return the AIHA-LAP, LLC license agreement to a Laboratory Accreditation Specialist. Once submitted, an electronic copy of the accreditation symbol will be sent to you. Please inform us if your laboratory does not wish to use the symbol in advertising.

Laboratory accreditation shall be maintained by continued compliance with IHLAP, ELLAP and EMLAP requirements *(see Policy Modules 2B, 2C, 2D, and 6)*, which includes proficient participation in AIHA-LAP, LLC approved proficiency testing, demonstration of competency, or round robin program as indicated on the AIHA-LAP "Approved PT and Round Robin" webpage, its associated Scope/PT table, and as required in Policy Module 6, for all Fields of Testing (FoTs) for which the laboratory is accredited. An accredited laboratory that wishes to expand into a new FoT must submit an updated accreditation application to AIHA-LAP, LLC for review by the AAB.

Any changes in ownership, laboratory location, personnel, FoTs/Methods, or significant procedural changes shall be reported to AIHA-LAP, LLC in writing within twenty (20) business days of the change.

The accreditation certificate is the property of AIHA-LAP, LLC and must be returned to us should your laboratory withdraw or be removed from the IHLAP, ELLAP and EMLAP.

Again, congratulations. If you have any questions, please contact Lauren Schnack, Laboratory Accreditation Specialist, at (703) 846-0716.

Sincerely,

Cheryl O. Morton

Cheryl O. Morton
Managing Director
AIHA Laboratory Accreditation Programs, LLC

AIHA Laboratory Accreditation Programs, LLC

acknowledges that

EMSL Analytical, Inc.

200 Route 130 North, Cinnaminson, NJ 08077

Laboratory ID: 100194

along with all premises from which key activities are performed, as listed above, has fulfilled the requirements of the AIHA Laboratory Accreditation Programs (AIHA-LAP), LLC accreditation to the ISO/IEC 17025:2005 international standard, *General Requirements for the Competence of Testing and Calibration Laboratories* in the following:

LABORATORY ACCREDITATION PROGRAMS

✓	**INDUSTRIAL HYGIENE**	Accreditation Expires: September 01, 2018
✓	**ENVIRONMENTAL LEAD**	Accreditation Expires: September 01, 2018
✓	**ENVIRONMENTAL MICROBIOLOGY**	Accreditation Expires: September 01, 2018
☐	**FOOD**	Accreditation Expires:
☐	**UNIQUE SCOPES**	Accreditation Expires:

Specific Field(s) of Testing (FoT)/Method(s) within each Accreditation Program for which the above named laboratory maintains accreditation is outlined on the attached **Scope of Accreditation.** Continued accreditation is contingent upon successful on-going compliance with ISO/IEC 17025:2005 and AIHA-LAP, LLC requirements. This certificate is not valid without the attached **Scope of Accreditation.** Please review the AIHA-LAP, LLC website (www.aihaaccreditedlabs.org) for the most current Scope.

William Walsh, CIH
Chairperson, Analytical Accreditation Board

Cheryl O. Morton
Managing Director, AIHA Laboratory Accreditation Programs, LLC

Revision 15: 03/30/2016

Date Issued: 08/31/2016

AIHA Laboratory Accreditation Programs, LLC
SCOPE OF ACCREDITATION

EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077

Laboratory ID: **100194**
Issue Date: 08/31/2016

The laboratory is approved for those specific field(s) of testing/methods listed in the table below. Clients are urged to verify the laboratory's current accreditation status for the particular field(s) of testing/Methods, since these can change due to proficiency status, suspension and/or withdrawal of accreditation.

Industrial Hygiene Laboratory Accreditation Program (IHLAP)

Initial Accreditation Date: 02/01/1989

IHLAP Scope Category	Field of Testing (FoT) (FoTs cover all relevant IH matrices)	Technology sub-type/ Detector	Published Reference Method/Title of In-house Method	Method Description or Analyte *(for internal methods only)*
Chromatography Core	Gas Chromatography	GC/FID	NIOSH 1003 Modified	
			NIOSH 1005	
			NIOSH 1400 Modified	
			NIOSH 1500 Modified	
			NIOSH 1501 Modified	
			NIOSH 1550 Modified	
			NIOSH 1603 Modified	
			NIOSH 2000 Modified	
		GC/ECD	NIOSH 5502 Modified	
			NIOSH 5503 Modified	
			NIOSH 5510 Modified	
			OSHA 1010 Modified	
	GC/MS	GC/MS	EPA TO-15	
	Gas Chromatography (Diffusive Samplers)		NIOSH 1501 Modified	
	Ion Chromatography (IC)		NIOSH 6004 Modified	
			NIOSH 6011	
			NIOSH 7903	
			OSHA ID-165SG	
			OSHA ID-214	
			OSHA ID-215 Modified	
	Liquid Chromatography	HPLC/FL	NIOSH 2016 Modified	
		HPLC/UV	NIOSH 5506 Modified	
Spectrometry Core	Atomic Absorption	CVAA	NIOSH 6009 Modified	
			OSHA ID-140 Modified	
			OSHA ID-145	

AIHA Laboratory Accreditation Programs, LLC

IHLAP Scope Category	Field of Testing (FoT) (FoTs cover all relevant IH matrices)	Technology sub-type/ Detector	Published Reference Method/Title of In-house Method	Method Description or Analyte *(for internal methods only)*
Spectrometry Core	Atomic Absorption	FAA	NIOSH 7082	
		GFAA	NIOSH 7105	
	Inductively-Coupled Plasma	ICP/MS	NIOSH 7300 Modified	
		ICP/AES	NIOSH 7300 Modified	
	X-ray Diffraction (XRD)		NIOSH 7500 Modified	
			OSHA ID-142 Modified	
	UV/VIS (Colorimetric)		NIOSH 6010 Modified	
Asbestos/Fiber Microscopy Core	Polarized Light Microscopy (PLM)		EPA 600/R-93/116	
	Phase Contrast Microscopy (PCM)		NIOSH 7400	
	Transmission Electron Microscopy (TEM)		EPA AHERA - 40 CFR Part 763	EPA AHERA Method (40 CFR 763, Subpart E, Appendix A, Mandatory Method
Miscellaneous Core	Gravimetric		NIOSH 0500	
			NIOSH 0600	
			NIOSH 5524	
	Thermo-optical Analysis (TOA)		NIOSH 5040	
Beryllium Testing	Inductively-Coupled Plasma	ICP/MS	NIOSH 7300	
			NIOSH 7303	

A complete listing of currently accredited Industrial Hygiene laboratories is available on the AIHA-LAP, LLC website at: http://www.aihaaccreditedlabs.org

AIHA Laboratory Accreditation Programs, LLC
SCOPE OF ACCREDITATION

EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077

Laboratory ID: **100194**
Issue Date: 08/31/2016

The laboratory is approved for those specific field(s) of testing/methods listed in the table below. Clients are urged to verify the laboratory's current accreditation status for the particular field(s) of testing/Methods, since these can change due to proficiency status, suspension and/or withdrawal of accreditation.

The EPA recognizes the AIHA-LAP, LLC ELLAP program as meeting the requirements of the National Lead Laboratory Accreditation Program (NLLAP) established under Title X of the Residential Lead-Based Paint Hazard Reduction Act of 1992 and includes paint, soil and dust wipe analysis. Air analysis is not included as part of the NLLAP.

Environmental Lead Laboratory Accreditation Program (ELLAP)

Initial Accreditation Date: 01/18/1995

Field of Testing (FoT)	Technology sub-type/ Detector	Method	Method Description *(for internal methods only)*
Paint		EPA SW-846 3050B	
		EPA SW-846 7000B	
Soil		EPA SW-846 3050B	
		EPA SW-846 7000B	
Settled Dust by Wipe		EPA SW-846 3050B	
		EPA SW-846 7000B	
Airborne Dust		NIOSH 7082	
Composited Wipes		EPA SW-846 3050B	
		EPA SW-846 7000B	

A complete listing of currently accredited Environmental Lead laboratories is available on the AIHA-LAP, LLC website at: http://www.aihaaccreditedlabs.org

AIHA Laboratory Accreditation Programs, LLC
SCOPE OF ACCREDITATION

EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077

Laboratory ID: **100194**
Issue Date: 08/31/2016

The laboratory is approved for those specific field(s) of testing/methods listed in the table below. Clients are urged to verify the laboratory's current accreditation status for the particular field(s) of testing/Methods, since these can change due to proficiency status, suspension and/or withdrawal of accreditation.

Environmental Microbiology Laboratory Accreditation Program (EMLAP)

Initial Accreditation Date: 09/01/2002

EMLAP Category	Field of Testing (FoT)	Method	Method Description (*for internal methods only*)
Fungal	Air - Culturable	M005	Detection and Enumeration of Culturable Fungi from Environmental Samples
	Bulk - Culturable	M005	Detection and Enumeration of Culturable Fungi from Environmental Samples
	Surface - Culturable	M005	Detection and Enumeration of Culturable Fungi from Environmental Samples
	Air - Direct Examination	05-TP-003.7	Standard Operating Procedure for the Analysis of Airborne Fungal Spores, Hyphal Fragments, Pollen, Insect Fragments, Skin Fragments and Fibrous Particulate by Optical Microscopy of Spore Trap Samples
	Bulk - Direct Examination	M041	Standard Operating Procedure for the Microscopic Examination of Fungal Spores, Fungal Structures, Hyphae, Pollen, Insect Fragments, and Fibrous Material from Surface Samples
	Surface - Direct Examination	M041	Standard Operating Procedure for the Microscopic Examination of Fungal Spores, Fungal Structures, Hyphae, Pollen, Insect Fragments, and Fibrous Material from Surface Samples
Bacterial	Air - Culturable	M009	Detection and Enumeration of Culturable Bacteria from Environmental Samples
	Bulk - Culturable	M009	Detection and Enumeration of Culturable Bacteria from Environmental Samples
	Surface - Culturable	M009	Detection and Enumeration of Culturable Bacteria from Environmental Samples

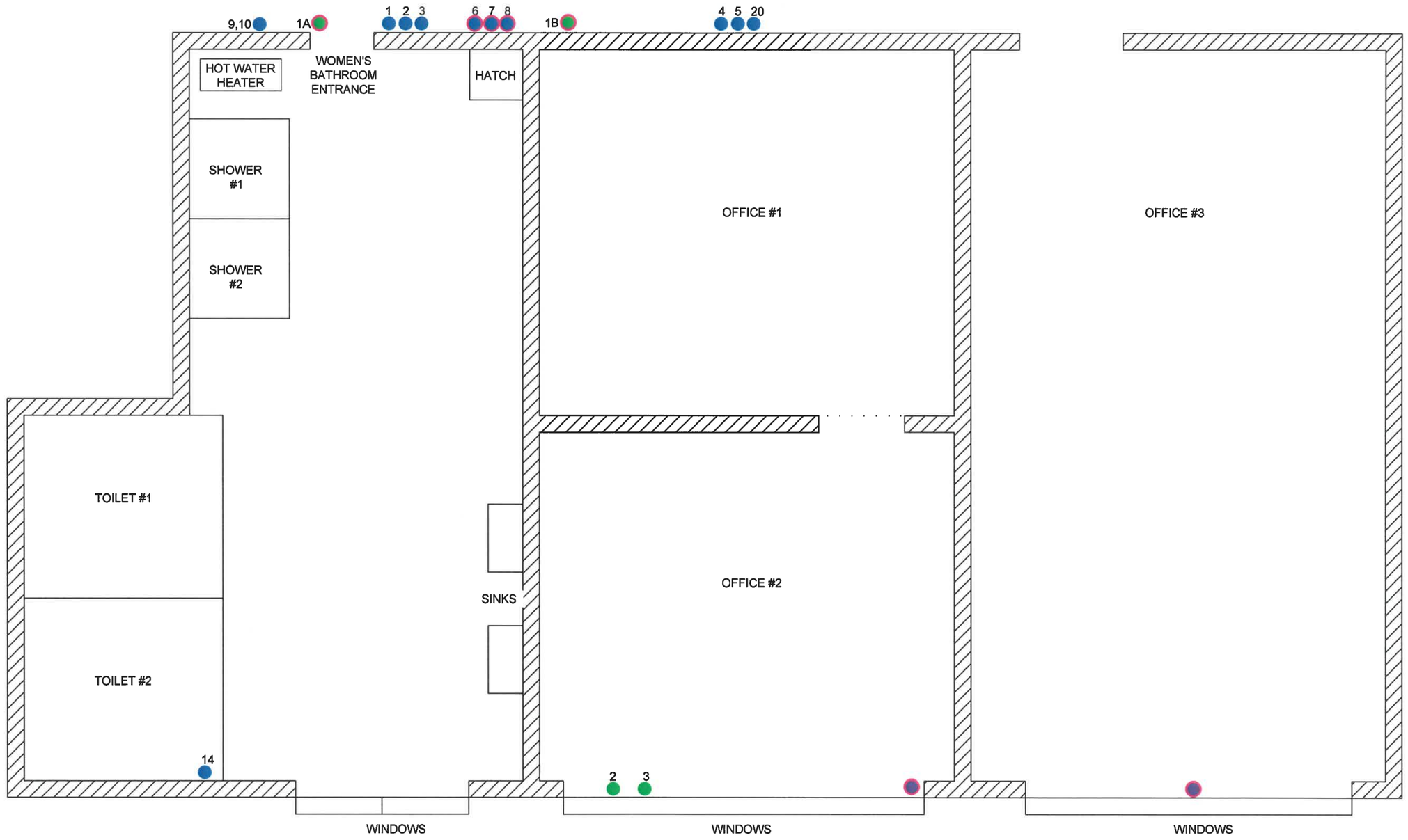
AIHA
Laboratory Accreditation Programs, LLC

EMLAP Category	Field of Testing (FoT)	Method	Method Description *(for internal methods only)*
Bacterial	Legionella	05-TP-002	Recovery of Legionella from the Environment Using the Center for Disease Control and Prevention's Culture Method

A complete listing of currently accredited Environmental Microbiology laboratories is available on the AIHA-LAP, LLC website at: http://www.aihaaccreditedlabs.org

ATTACHMENT 4

BULK SAMPLE LOCATION DRAWINGS



NOT TO SCALE

LEGEND

- PCB SAMPLE LOCATION
- 2 NEGATIVE PLM SAMPLE LOCATION
- 3 POSITIVE PLM SAMPLE LOCATION
- 4 NEGATIVE TEM SAMPLE LOCATION
- 5 POSITIVE TEM SAMPLE LOCATION

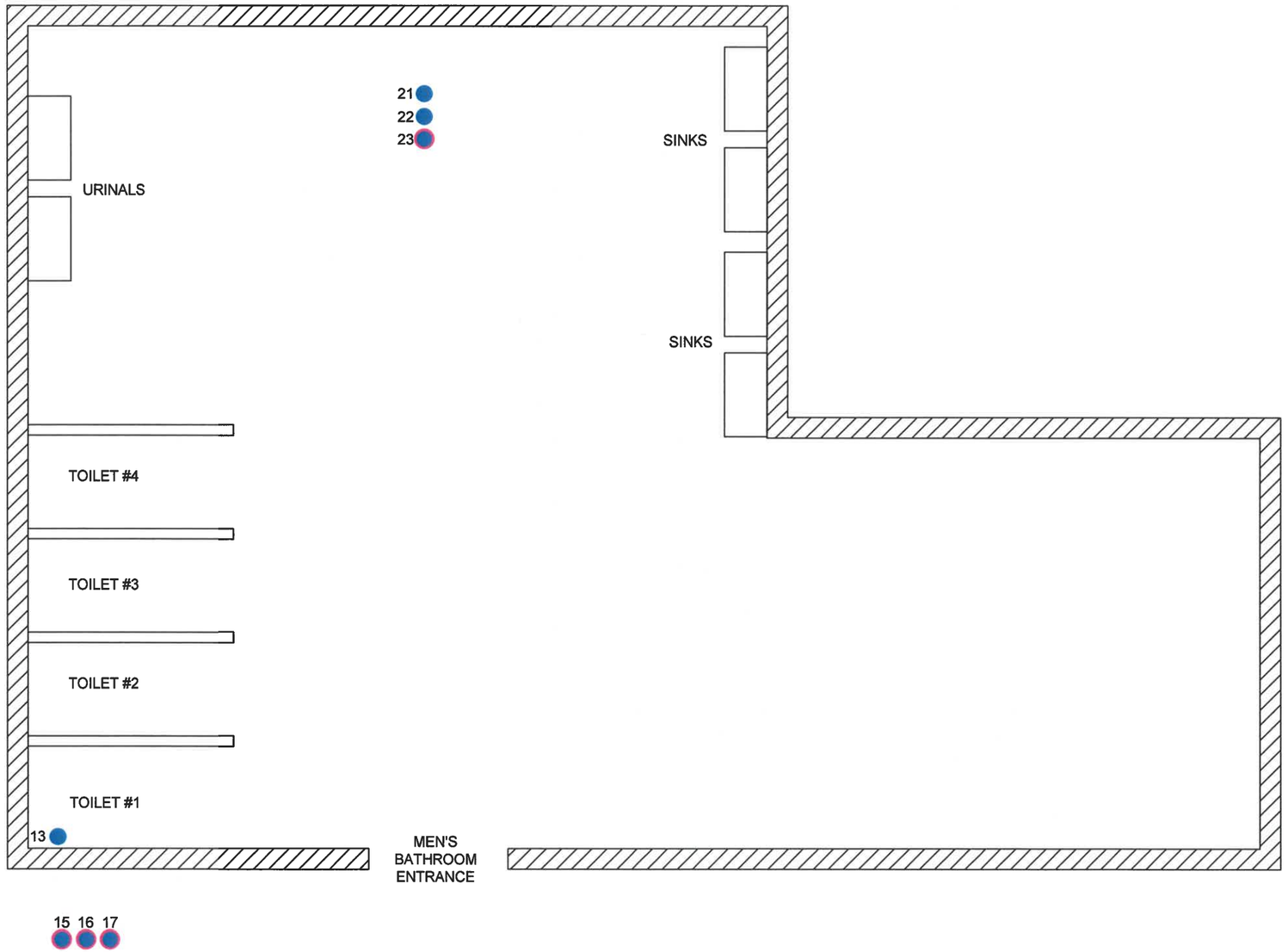
WHITMAN
CERTIFICATE OF AUTHORIZATION No. 24GA28009600

TJD ARCHITECTS
CAPE MAP ARMORY
600 GARDEN STATE PARKWAY
CAPE MAY COURT HOUSE, NEW JERSEY

WOMEN'S BATHROOM AND OFFICE AREA

PROJECT MANAGER:	DRAWN BY:	PROJECT NO:
KL	MED	171002T
CHECKED BY:	DATE:	FIGURE NO:
KL	FEB 2018	1

W:\2017\17-10-02T TJD Architects - Cape May Armory\011 Environmental CAD\171002 - CAPE MAY ARMORY - ASBESTOS SAMPLING INVESTIGATION.dwg 2/10/18



NOT TO SCALE

LEGEND

2 NEGATIVE PLM SAMPLE LOCATION

3 POSITIVE PLM SAMPLE LOCATION

WHITMAN

CERTIFICATE OF AUTHORIZATION No. 24GA28009600

TJD ARCHITECTS
CAPE MAP ARMORY
600 GARDEN STATE PARKWAY
CAPE MAY COURT HOUSE, NEW JERSEY

MEN'S BATHROOM

PROJECT MANAGER:	DRAWN BY:	PROJECT NO:
KL	MED	171002T
CHECKED BY:	DATE:	FIGURE NO:
KL	FEB 2018	2

W:\2017\17-10-02T TJD Architects - Cape May Armory\011 Environmental CAD\171002 - CAPE MAY ARMORY - ASBESTOS SAMPLING INVESTIGATION.dwg 2/10/18

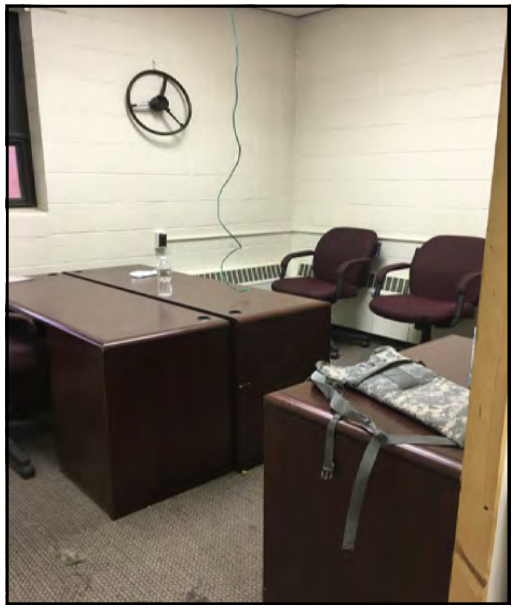
ATTACHMENT 5

PHOTOGRAPHS

Above Ceiling - Hallway Outside of Women's Bathroom

Above Ceiling - Office Adjacent to Women's Bathroom

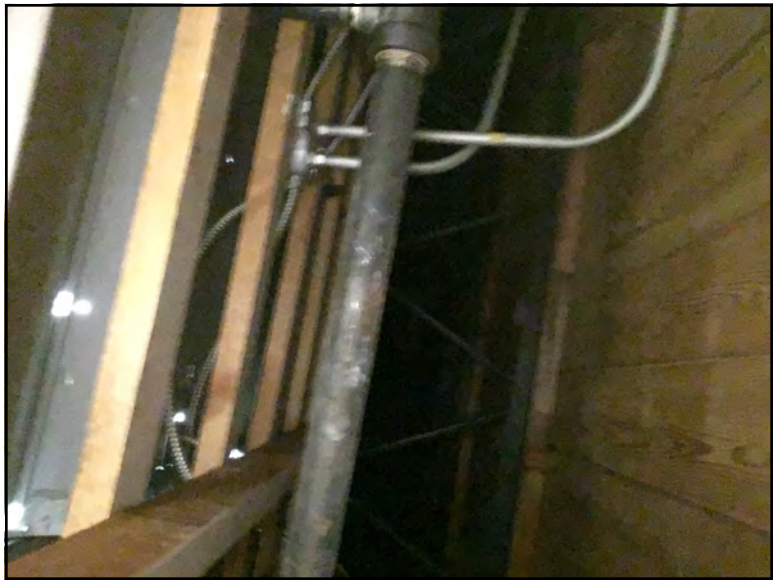
Above Ceiling - Women's Bathroom



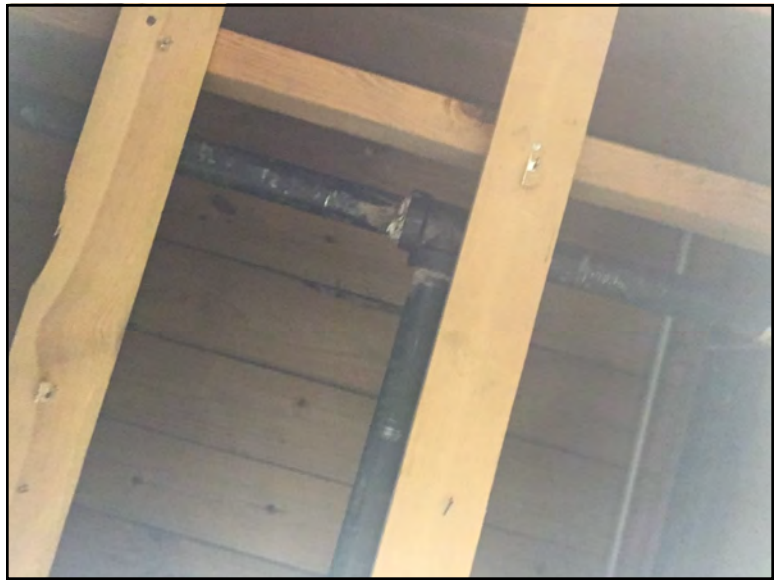
Adjacent Office

Adjacent Office

Ballast in Women's Bathroom



Bare Pipe Above Ceiling - Adjacent Office

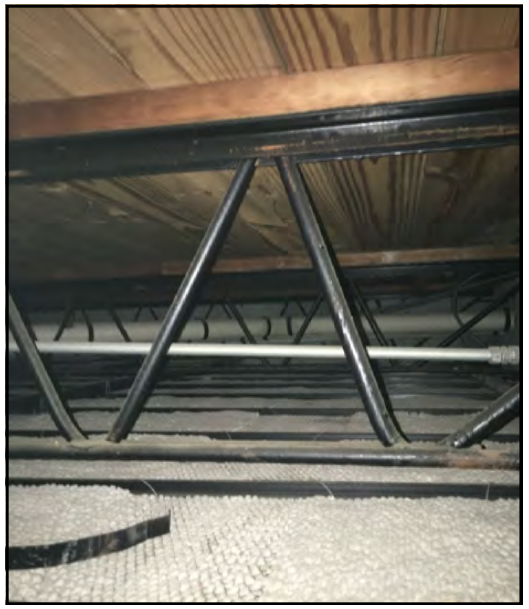


Bare Pipe Above Ceiling - Adjacent Office

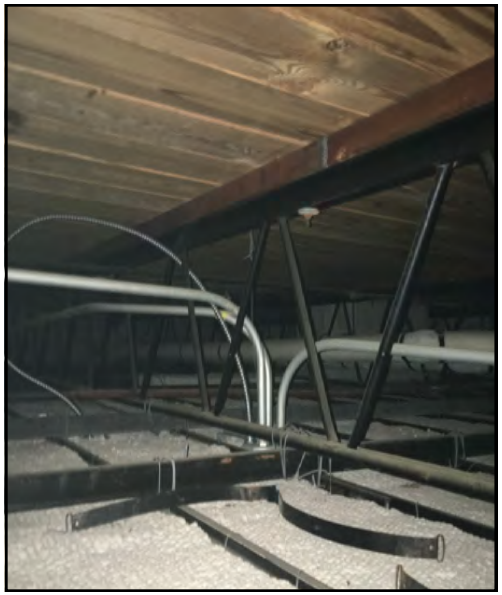
Hallway Outside Men's Bathroom

Hallway Outside Women's Bathroom

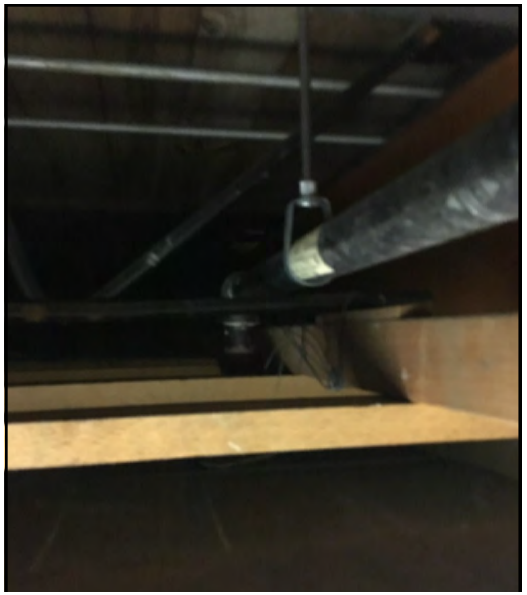
Hot Water Heater in Women's Bathroom



Inside Hatch - Women's Bathroom



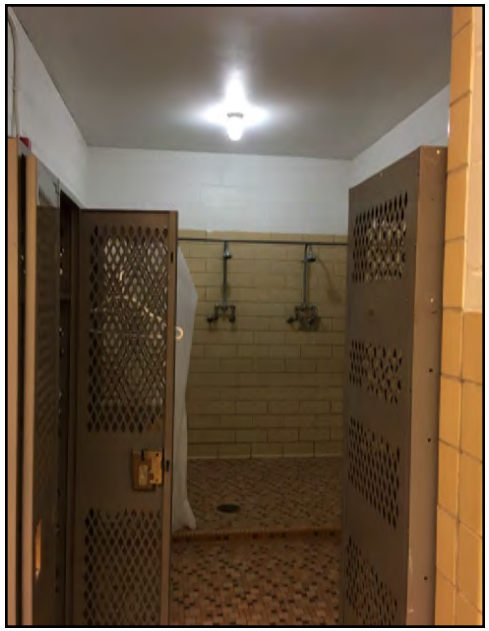
Inside Hatch - Women's Bathroom



Inside Hatch - Women's Bathroom

Men's Bathroom Ballast

Men's Bathroom



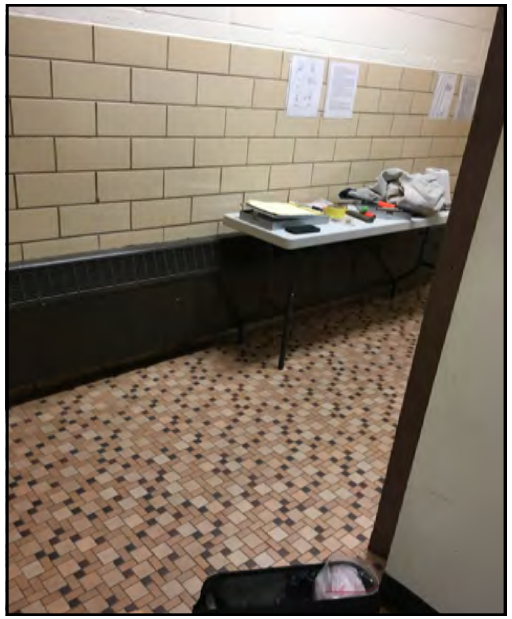
Men’s Shower Area

Men’s Bathroom - Toilet Stalls

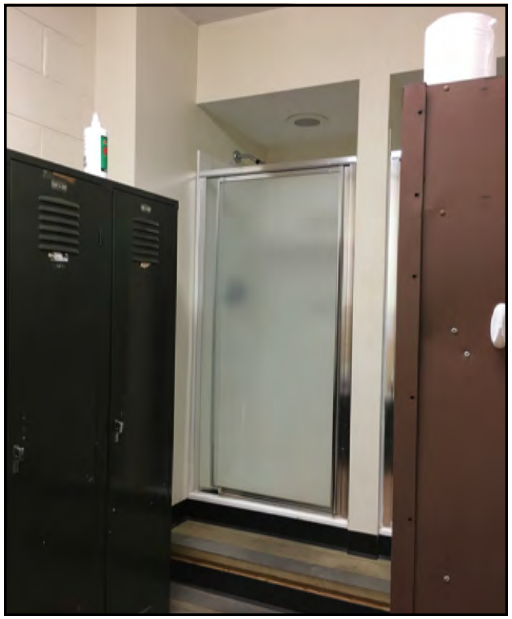
Pipes Above Ceiling Outside Women’s Bathroom

Women’s Bathroom - Toilet Stalls and Window

Water Stains from Ceiling in Men's Bathroom



Women's Bathroom



Women's Shower Area