



Chesterfield County, Virginia

Purchasing Department

9901 Lori Road – P.O. Box 51 – Chesterfield, VA 23832-0001

Phone: (804) 748-1617 – Fax: (804) 717-6378 – Internet: chesterfield.gov

NOTICE TO BIDDERS

February 20, 2014

Sealed Bids on behalf of Chesterfield County, Virginia, will be received in the Purchasing Department, 9901 Lori Road, Lane B. Ramsey Building, Room 303, Chesterfield, Virginia 23832-0001, until but no later than **2:30 p.m.** local time prevailing, **March 24, 2014** and then publicly opened and read immediately thereafter for the following:

Invitation for Bid #14-0963, Renovation, Technology Education Laboratory

Scope of Work: The project is generally described as all labor, materials and equipment for demolition, patching of concrete floor slabs, masonry wall construction, mechanical and electrical work, and floor and wall finishes to match existing conditions. Chesterfield County Public Schools will renovate a portion of the shop at Swift Creek Middle School, with the plan for converting the space into a Technical Education Laboratory as a separate project.

PRE-BID CONFERENCE

A non-mandatory pre-bid conference will be held on March 4, 2014 at 9:00 a.m. The conference will be held at: Swift Creek Middle School Media Center (Library), 3700 Old Hundred Road, Midlothian, VA 23112. Bidders shall report to the main office to sign in prior to 9:00 a.m. **A valid driver's license for each attendee is required for access to the meeting.** Attendance is encouraged; however, it is not mandatory in order for your bid to be considered for award.

Copies of Invitation for Bid documents and addenda may be obtained from the Purchasing Department website, www.chesterfield.com/purchasing.

Public Inspection of Invitation for Bid Documents will be available at the following locations:

1. MHC/BIZPORT, 9 North Third Street, Richmond, VA 23219
2. Builders' Exchange Association of Virginia, 3207 Hermitage Road, Richmond, VA 23227
3. Valley Construction News, 426 W. Campbell Avenue, S.W., Roanoke, VA 24016
4. Central Virginia Business and Construction Association, 3004 1st Avenue, Richmond, VA 23222
5. Greater Virginia Contractor's Association, 2406 Chamberlayne Avenue, Richmond, VA 23222
6. ARC Richmond, 1400 North Boulevard, Richmond, VA 23230
7. iSqFt, c/o A & E Reprographics, 100 Aragona Boulevard, Suite 103, Virginia Beach, VA 23462

Prepared By: Kimberly H. Mitchell, CPPB, Senior Contract Officer



**CHESTERFIELD COUNTY
PURCHASING DEPARTMENT
CHESTERFIELD, VIRGINIA
Invitation for Bids**



IFB Number:.....14-0963

Title:.....Renovation, Technology Education Laboratory

Issue Date:February 20, 2014

Sealed Bids Due and Opening:..... March 24, 2014 – 2:30 P.M.

Bid Opening Location:..... Chesterfield County Purchasing Department
9901 Lori Road
Lane B. Ramsey Building, 3rd Floor, Room 303
Chesterfield, VA 23832

Inquiries: Questions which may arise as a result of this solicitation may be addressed to Kimberly H. Mitchell, Senior Contract Officer, at (804) 748-1701, or by email to purchasing@chesterfield.gov. Inquiries must be received at least seven (7) business days prior to the due date in order to be considered. Contact initiated by a bidder concerning this solicitation with any other County representative, not expressly authorized elsewhere in this document, is prohibited. Any such unauthorized contact may result in disqualification of the bidder from this transaction.

All prices shall be F.O.B. Destination: Swift Creek Middle School, 3700 Old Hundred Road, Midlothian, VA 23112. Freight, delivery costs, and incidental charges shall be included.

My signature below certifies that:

- I agree to abide by all conditions of this bid and that I am authorized to sign this bid;
 - the accompanying bid is not the result of, or affected by, any unlawful act of collusion with another person or company engaged in the same line of business or commerce, or any act of fraud punishable under § 18.2-498.1, et. seq. of the *Code of Virginia*. Furthermore, I understand that fraud and unlawful collusion are crimes under the Virginia Governmental Frauds Act, the Virginia Government Bid Rigging Act, the Virginia Antitrust Act, and Federal Law, and can result in fines, prison sentences, and civil damage awards;
 - that the accompanying bid is in compliance with applicable provisions of the State and Local Government Conflict of Interests Act (§ 2.2-3100, et. seq. of the *Code of Virginia*). Specifically, without limitation, no County/School Board employee or a member of the employee's immediate family shall have a proscribed personal interest in a contract; and
 - that the accompanying bid is in accordance with applicable provisions of the Virginia Public Procurement Act, Art. 6 Ethics in Public Contracting (§ 2.2-4367, et. seq. of the *Code of Virginia*), and any other applicable law as set forth therein.
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In compliance with this Invitation for Bids and to all conditions imposed therein the undersigned offers and agrees to furnish the goods/services in accordance with this signed bid.

Complete Legal Name of Firm: _____

Order From Address: _____

Remit To Address: _____

Signature: _____ **Email:** _____

Name (type/print): _____ **Title:** _____

Fed ID No.: _____ **Phone:** (____) _____ **Fax:** (____) _____

This page must be returned with the Bid Form.

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ATTACHMENT A – SCOPE OF WORK/SPECIFICATIONS/DRAWINGS

ATTACHMENT B – CHESTERFIELD COUNTY SAMPLE CONTRACT

I. **PURPOSE**

The purpose of this Invitation for Bids (IFB) is to solicit bids for all labor, equipment and materials necessary for renovation work at Swift Creek Middle School. The project includes demolition, patching of concrete floor slabs, masonry wall construction, mechanical and electrical work, and floor and wall finishes matching existing conditions. Chesterfield County Public Schools will renovate a portion of the shop at Swift Creek Middle School, with the plan for converting the space into a Technical Education Laboratory as a separate project.

II. **SCOPE OF WORK/SPECIFICATIONS**

Refer to Attachment A.

DIVISION 01 – GENERAL REQUIREMENTS		
Section	Title	# of Pages
01010	SUMMARY	5
01045	CUTTING AND PATCHING	3
01290	PAYMENT PROCEDURES	5
01310	PROJECT MANAGEMENT AND COORDINATION	6
01330	SUBMITTAL PROCEDURES	8
01730	EXECUTION	2
01770	CLOSEOUT PROCEDURES	5

DIVISION 03 – CONCRETE		
Section	Title	# of Pages
03301	MISCELLANEOUS CAST-IN-PLACE CONCRETE	4

DIVISION 04 – MASONRY		
Section	Title	# of Pages
04100	MORTAR	1
04150	MASONRY ACCESSORIES	2
04200	MASONRY	2

DIVISION 05 – METALS		
Section	Title	# of Pages
05999	MISCELLANEOUS METALS	3

DIVISION 07 – THERMAL AND MOISTURE PROTECTION		
Section	Title	# of Pages
07205	ACOUSTIC BLANKET INSULATION	2
07900	CAULKING AND SEALANTS	2

DIVISION 08 – OPENINGS		
Section	Title	# of Pages
08105	METAL DOOR FRAMES	3
08200	WOOD DOORS	2
08525	ACOUSTIC ALUMINUM WINDOWS	5
08710	FINISH HARDWARE	5
08800	GLASS AND GLAZING	3

DIVISION 09 – FINISHES		
Section	Title	# of Pages
09510	ACOUSTICAL CEILINGS	4
09650	RESILIENT FLOORING	4
09653	RESILIENT WALL BASE AND ACCESSORIES	3
09912	INTERIOR PAINTING	8

DIVISION 10 – SPECIALTIES		
Section	Title	# of Pages
10200	LOUVERS AND VENTS	3

DIVISION 23 – HEATING VENTILATING AND AIR CONDITIONING		
Section	Title	# of Pages
230513	COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT	2
230517	SLEEVES AND SLEEVE SEALS FOR HVAC PIPING	2
230518	ESCUTCHEONS FOR HVAC PIPING	2
230529	HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT	5
230553	IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT	2
230593	TESTING, ADJUSTING AND BALANCING FOR HVAC	11
230713	DUCT INSULATION	9
230719	HVAC PIPING INSULATION	6
232113	HYDRONIC PIPING	4
233113	METAL DUCTS	12
233300	AIR DUCT ACCESSORIES	7

DIVISION 23 – HEATING VENTILATING AND AIR CONDITIONING (continued)		
Section	Title	# of Pages
233713	DIFFUSERS, REGISTERS AND GRILLES	3
237200	AIR-TO-AIR ENERGY RECOVERY EQUIPMENT	5
238126	SPLIT-SYSTEM AIR-CONDITIONERS	5

DIVISION 26 – ELECTRICAL		
Section	Title	# of Pages
260526	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS	4
260529	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS	4
260533	RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS	4
262416	PANELBOARDS	9
262726	WIRING DEVICES	5
262816	ENCLOSED SWITCHES AND CIRCUIT BREAKERS	4
265100	INTERIOR LIGHTING	6

DRAWINGS

Sheet Title	Sheet No.
COVER SHEET	G-001
GENERAL NOTES, ABBREVIATIONS AND SYMBOLS	A-001
DEMOLITION & RENOVATION PLANS	A-101
LIFE SAFETY & REFLECTED CEILING PLANS	A-102
FIRE ALARM WORK, FIRST FLOOR	FA-101
SPRINKLER WORK, FIRST FLOOR	FP-101
LEGEND AND ABBREVIATIONS	M-001
MECHANICAL DEMOLITION AND RENOVATION PLANS	M-101
SCHEDULES AND DETAILS	M-201
ELECTRICAL LEGEND AND ABBREVIATIONS	E-001
ELECTRICAL DEMOLITION AND RENOVATION PLANS	E-101
ELECTRICAL LIGHTING PLAN	E-102

III. INSTRUCTIONS

A. Submission and Receipt of Bids

1. Sealed bids shall be received in the Chesterfield County Purchasing Department, 9901 Lori Road, Lane B. Ramsey Building, 3rd Floor, Room 303, P.O. Box 51, Chesterfield, Virginia, 23832 until, but no later than the specified time and date of opening as designated in the invitation, and then publicly opened and read aloud. Bids shall be submitted in a sealed

envelope with the IFB number and due date and time written on the outside of the envelope. The time of receipt shall be determined by the time clock stamp in the Purchasing Department. Bidders are responsible for ensuring that their bids are stamped by Purchasing Department personnel before the deadline. Late bids shall be rejected.

2. Bids or changes to a bid response shall not be accepted via fax or E-mail.
3. In the event that Chesterfield County government offices are not operating under normal staffing levels or if the location for bid submission, bid opening or a pre-bid conference is inaccessible due to inclement weather or other emergency situations at the published time, the bid submission, bid opening or pre-bid conference will default to the next regular business day at the same time.
4. All bids shall be signed in the space provided for a signature on the cover sheet and returned. If the bidder is a partnership or corporation, the bidder shall show the title of the individual signing the bid, and if the individual is not the president or vice president of the partnership or corporation, if requested, the bidder shall submit proof that the individual has the authority to bind the partnership or corporation.
5. Bids concerning separate bid invitations are not to be combined on the same form or placed in the same envelope. Bids submitted in violation of this provision may not be considered.
6. Unless otherwise specified, bidders are to complete and return the Bid Form furnished by the County.
7. No bid shall be altered or amended after the specified time for opening.
8. If you are an individual with a disability and require a reasonable accommodation in order to participate in this procurement, please notify the Purchasing Department at (804)748-1617 as soon as possible.
9. For information pertaining to the bid tabulation, decision to award and/or award on this procurement transaction, bidders may access public notification electronically at:
www.chesterfield.gov/purchasing.

B. Amendments or Requests to Withdraw Bids by a Bidder Prior to Bid Opening: A bidder may amend and/or withdraw their bid before the due date and time designated for receipt of bids. All requests from a bidder to return their bid shall be in writing, addressed to the Purchasing Department, and signed by a person authorized to represent the person or firm that submitted the bid. The bidder may be contacted by telephone to verify the authorization of the return request and the signature involved if there is doubt as to the document's authenticity. All amendments to the bid are to be initialed by an individual authorized to represent the bidder.

C. Pre-Bid Conference (Non-Mandatory): A **non-mandatory** pre-bid conference will be held on March 4, 2014 at 9:00 a.m. The conference will be held at: Swift Creek Middle School Media Center (Library), 3700 Old Hundred Road, Midlothian, VA 23112. Bidders shall report to the main office to sign in prior to 9:00 a.m. **A valid driver's license for each attendee is required for access to the meeting.**

Attendance is encouraged; however, it is not mandatory in order for your bid to be considered for award.

IV. **GENERAL TERMS AND CONDITIONS**

- A. Addenda:** Any changes or supplemental instructions to this solicitation shall be in the form of written addenda. All addenda are downloadable from the Purchasing Department web site at: www.chesterfield.gov/purchasing. Each bidder is responsible for obtaining all addenda posted at the Purchasing Department website or by calling (804) 748-1617. Acknowledgement of receipt of all addenda shall be in the space provided within the solicitation or by returning a copy of each signed addendum. Failure to do so may result in rejection of the bid. All addenda issued shall become part of the solicitation and all resulting contract documents.
- B. Appropriation of Funds:** The continuation of the terms, conditions, and provisions of a resulting contract beyond June 30 of any year, the end of the County's fiscal year, are subject to approval and ratification by the Chesterfield County Board of Supervisors and appropriation by them of the necessary money to fund said contract for each succeeding year. In the event of non-appropriation of funds, the contract shall be automatically terminated with no recourse for the Contractor.
- C. Assignment of Contract:** The County and Contractor bind themselves and any successors and assigns to the contract. The employees of the Contractor will perform the work necessary to fulfill the contract. The Contractor shall not assign, sublet, subcontract or transfer any of its interest in the contract without written consent of the County. Nothing herein shall be construed as creating any personal liability on the part of any officer or agent of the County, nor shall it be construed as giving any rights or benefits hereunder to anyone other than the County and Contractor.
- D. Audit of Vendor Records:** Contractor shall maintain full and accurate records with respect to all matters covered under the contract including, without limitation, accounting records, written policies and procedures, time records, telephone records, reproduction cost records, travel and living expense records and any other supporting evidence necessary to substantiate charges related to the contract. Contractor's records shall be open to inspection and subject to audit and/or reproduction, during normal working hours by the County and its employees, agents or authorized representatives to the extent necessary to adequately permit evaluation and verification of any invoices, payments or claims submitted by Contractor pursuant to this contract. Such records subject to examination shall also include, without limitation, those allocations as they may apply to costs associated with the contract. The County shall have access to such records from the effective date of the contract, for the duration of the contract, and until two (2) years after the date of final payment by the County to the Contractor pursuant to this contract. The County's employees, agents or authorized representatives shall have access to the Contractor's facilities, shall have access to all necessary records, and shall be provided adequate and appropriate work space, in order to conduct audits in compliance with this paragraph.
- E. Change Orders:** Change orders must be approved by the County prior to work being performed.
- F. Commitment to Diversity and Chesterfield Businesses:** Chesterfield County is a growing progressive community consisting of an increasingly diverse population. This diversity provides for a dynamic and robust community that promotes growth. Chesterfield County believes that all of its citizens should benefit from this economic growth without regard to race, color, religion or economic status. The County is committed to increasing the opportunities for participation of minority-owned businesses, women-owned businesses, and businesses located in Chesterfield County to ensure diversity in its procurement and contract activities. These businesses are encouraged to respond to all solicitations. In addition, the County strongly encourages each

Contractor and/or supplier with which the County contracts to actively solicit minority-owned businesses, women-owned businesses, and businesses located in the County as subcontractors/suppliers for their projects.

Upon award/completion of work, the County will require the Contractor to furnish data regarding subcontractor/supplier activity with minority-owned businesses, women-owned businesses, and businesses located in Chesterfield County on a Certification of Subcontractor/Supplier Activity form. The form will be provided to the Contractor by the Purchasing Department. This information will enable the County to document the dollar level of activity and measure the success of its purchasing and contracting efforts in this endeavor.

Definitions:

Chesterfield Business (CB) - any private business enterprise, located within the jurisdictional boundaries of Chesterfield County.

Minority-Owned Business (MOB) – a business that is at least 51% owned by one or more minority individuals who are U.S. citizens or legal resident aliens, or in the case of a corporation, partnership, or limited liability company or other entity, at least 51% of the equity ownership interest in the corporation, partnership, or limited liability company or other entity is owned by one or more minority individuals who are U.S. citizens or legal resident aliens, and both the management and daily business operations are controlled by one or more minority. (*Code of Virginia 2.2-4310*)

Women-Owned Business (WOB) - a business that is at least 51% owned by one or more women who are U.S. citizens or legal resident aliens, or in the case of a corporation, partnership, or limited liability company or other entity, at least 51% of the equity ownership interest is owned by one or more women who are U.S. citizens or legal resident aliens, and both the management and daily business operations are controlled by one or more women. (*Code of Virginia 2.2-4310*)

- G. Contractor Background Checks:** In order to preserve the integrity and security of County government operations, contract workers may be required to undergo a criminal background check conducted by Chesterfield County. The County will conduct these checks for any worker it believes will have unsupervised access to County designated Security Sensitive areas. Contract workers providing goods, services or construction in these designated areas are required to confine themselves to the area of the work. Based on the results of the background check, the contract worker may be disqualified from providing work/services for Chesterfield County.
- H. Contractor's Authorization To Transact Business:** In accordance with §2.2-4311.2 of the *Code of Virginia*, any bidder organized as a stock or nonstock corporation, limited liability company, business trust, or limited partnership or registered as a registered limited liability partnership shall be authorized to transact business in the Commonwealth as a domestic or foreign business entity if so required by Title 13.1 or Title 50 of the *Code of Virginia*, or as otherwise required by law. Any bidder organized or authorized to transact business in the Commonwealth of Virginia pursuant to Title 13.1 or Title 50 of the *Code of Virginia* shall include in its bid the identification number issued to it by the State Corporation Commission. Any bidder that is not required to be authorized to transact business in the Commonwealth as a foreign business entity under Title 13.1 or Title 50 of the *Code of Virginia*, or as otherwise required by law, shall include in its bid a statement describing why the bidder is not required to be so authorized. This information shall be provided in the section of the Bid Form titled "Virginia State Corporation Commission (SCC) Registration Information". Failure to provide the required

information may result in the rejection of the bid. The Contractor shall not allow its existence to lapse or its certificate of authority or registration to transact business in the Commonwealth of Virginia, if so required under Title 13.1 or Title 50 of the *Code of Virginia*, to be revoked or cancelled at any time during the term of the contract. The County may void any contract with a Contractor if the Contractor fails to remain in compliance with the provisions of this section.

SEE THE BID FORM.

- I. **Copyrights or Patent Rights:** The bidder certifies by submission of a bid that there has been no violation of copyrights or patent rights in manufacturing, producing, or selling the product or services shipped or ordered as a result of this solicitation. The Contractor shall, at his own expense, defend any and all actions or suits charging such infringement, and will save Chesterfield County, its officers, employees, and agents harmless from any and all liability, loss, or expense incurred by any such violation, or alleged violation.
- J. **Default:** In case of failure to deliver goods or services in accordance with the contract terms and conditions, the County may, without prejudice to any other right or remedy, and after giving the Contractor seven (7) calendar days written notice, terminate the employment of the Contractor and procure such goods or services from other sources. In such event, the Contractor shall be liable to the County for any resulting additional purchase and administrative costs. This remedy shall be in addition to any other remedies which the County may have.
- K. **Drug Free Workplace:** (*Code of Virginia 2.2-4312*) This provision only applies to contracts valued in excess of \$10,000.

During the performance of this contract, the Contractor agrees to (i) provide a drug-free workplace for the Contractor's employees; (ii) post in conspicuous places, available to employees and applicants for employment, a statement notifying employees that the unlawful manufacture, sale, distribution, dispensation, possession, or use of a controlled substance or marijuana is prohibited in the Contractor's workplace and specifying the actions that will be taken against employees for violations of such prohibition; (iii) state in all solicitations or advertisements for employees placed by or on behalf of the Contractor that the Contractor maintains a drug-free workplace; and (iv) include the provisions of the foregoing clauses in every subcontract or purchase order of over \$10,000, so that the provisions will be binding upon each subcontractor or vendor.

For the purposes of this section, "drug-free workplace" means a site for the performance of work done in connection with a specific contract awarded to a Contractor in accordance with this chapter, the employees of whom are prohibited from engaging in the unlawful manufacture, sale, distribution, dispensation, possession or use of any controlled substance or marijuana during the performance of the contract.

- L. **Employment Discrimination:** (*Code of Virginia 2.2-4311*) This provision only applies to contracts valued in excess of \$10,000.

1. During the performance of the contract, the Contractor agrees as follows:

- a. The Contractor will not discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin, age, disability, or any other basis prohibited by state law relating to discrimination in employment, except where there is a bona fide occupational qualification reasonably necessary to the normal operation of the Contractor. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause.

- b. The Contractor, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, will state that such Contractor is an equal opportunity employer.
 - c. Notices, advertisements and solicitations placed in accordance with federal law, rule or regulation shall be deemed sufficient for the purpose of meeting the requirements of this section.
 2. The Contractor shall include the provisions of the foregoing paragraphs a, b, and c in every subcontract or purchase order of over \$10,000, so that the provisions will be binding upon each subcontractor or vendor.
- M. Environmental Management Procedures:** The Contractor shall comply with all federal, state and local environmental laws and regulations and any additional requirements that may be included in or attached to the solicitation. For work done for the County, the Contractor must also meet all Chesterfield County Environmental Management System (EMS) requirements. For questions or additional information regarding environmental requirements for the County, please contact Chesterfield County's General Services – Environmental Division at (804) 717-6531. For questions regarding environmental requirements for the Chesterfield County Public Schools, please contact Environmental Health and Safety at (804) 318-8048.
- N. ePayables:** Chesterfield County recognizes the importance of timely payments to our vendors. Therefore, we offer our vendors the opportunity to enroll in our ePayables program. This program allows us to make card payments to our vendors and features an online portal to facilitate payments as well as reduce payment processing times. Our ePayables program is mutually beneficial and is our preferred method of payment. If you choose not to enroll in this program, payments will be made by check and mailed through the postal service which could impact how quickly you receive payments. No action is required for vendors already enrolled in the program. Please contact the Accounting Department at (804) 748-1673 with questions.
- O. Faith-Based Organizations:** (*Code of Virginia 2.2-4343.1*) Chesterfield County does not discriminate against faith-based organizations.
- P. Finance/Interest Charges:** Finance and/or interest charges imposed by the Contractor on any invoice shall not be paid by the County.
- Q. Governing Law:** Contracts shall be governed by the provisions hereof and by the laws of the Commonwealth of Virginia, excepting the law governing conflicts of laws. Disputes arising out of this contract shall be resolved in the Courts of the Commonwealth of Virginia, in and for Chesterfield County.
- R. Illegal Aliens:** (*Code of Virginia 2.2-4311.1*) The Contractor agrees that he does not, and shall not, during the performance of the contract, knowingly employ an unauthorized alien as defined in the federal Immigration Reform and Control Act of 1986.
- S. Indemnification:** The Contractor shall hold harmless and indemnify the County, the School Board, if applicable, and its officers, officials, employees and agents against any and all injury, loss or damage arising out of the Contractor's negligent or intentionally wrongful acts or omissions.
- T. Mistakes in Bids**
1. Mistakes discovered following bid opening but prior to award: If there is a significant and obvious disparity between the prices of the lowest apparent responsive bidder and other

bidders, the low bidder may be contacted by the purchasing authority to confirm the bid price. This does not relieve a bidder from the responsibility for the submission of a correct bid. If the bidder then alleges a mistake in the bid and can provide clear and convincing evidence that supports the existence of a clerical error to the satisfaction of the purchasing authority, the bid may be withdrawn in accordance with the withdrawal procedure provided herein.

2. Mistakes discovered after award: Bids containing mistakes by bidders shall not be withdrawn after award of a contract or issuance of a purchase order.

- U. Modification of the Contract:** The contract shall not be amended, modified, or otherwise changed except by the written consent of the Contractor and the County given in the same manner and form as the original signing of the contract.
- V. Negotiation:** In accordance with 2-47 of the County Code, if the bid from the lowest responsible bidder exceeds available funds, the county may negotiate with the apparent low bidder to obtain a contract price within available funds. Such negotiation may include, but is not necessarily limited to, adjustment of the bid price and changes in the bid scope or requirements in order to bring the bid within the amount of available funds. Negotiation shall be conducted by the purchasing director, or his designee, with assistance from the user department.
- W. Payment:** If the Contractor performs all of the obligations of the contract to the satisfaction of the County, the County shall pay the Contractor for the performance of the work in the manner and within the time specified in the contract documents, which shall be consistent with the provisions of Section 2.2-4352 and 2.2-4354 of the *Code of Virginia*.

Furthermore, the Contractor shall, within seven days after receipt of payment by the County, take the following actions:
 1. Pay the subcontractor for the proportionate share of the total payment received from the County attributable to the work performed by the subcontractor under that contract; or
 2. Notify the County and subcontractor, in writing, of his intention to withhold all or a part of the subcontractor's payment with the reason for nonpayment.
- X. Precedence of Terms:** All Special Conditions contained in this solicitation that may be in variance or conflict with these General Terms and Conditions shall have precedence over these General Terms and Conditions. If no changes or deletions to General Terms and Conditions are made in the Special Conditions, then the General Terms and Conditions shall prevail in their entirety.
- Y. Preferences:** In accordance with Section 2.2-4324 (B) of the *Code of Virginia*, whenever the lowest responsive and responsible bidder is a resident of any other state and such state under its laws allows a resident contractor of that state a percentage preference, a like preference shall be allowed to the lowest responsive and responsible bidder who is a resident of Virginia and is the next lowest bidder. If the lowest responsive and responsible bidder is a resident of any other state and such state under its laws allows a resident contractor of that state a price-matching preference, a like preference shall be allowed to responsive and responsible bidders who are residents of Virginia. If the lowest bidder is a resident contractor of a state with an absolute preference, the bid shall not be considered. The Commonwealth's Department of General Services shall post and maintain an updated list on its website of all states with an absolute preference for their resident contractors and those states that allow their resident contractors a percentage preference, including the respective percentage amounts. For

purposes of compliance with this section, the County will rely upon the accuracy of the information posted on this website. In accordance with Section 2.2-4324 (D) of the *Code of Virginia*, for the purposes of this section, a Virginia person, firm or corporation shall be deemed to be a resident of Virginia if such person, firm or corporation has been organized pursuant to Virginia law or maintains a principal place of business within Virginia.

In accordance with Section 2.2-4328 of the *Code of Virginia* and Article 4, Section 2-47 of the County Code, in the case of a tie bid, the County may give preference to goods, services, and construction produced in the County or provided by persons, firms or corporations having principal places of business in the County. If such choice is not available, preference shall then be given to goods and services produced in the Commonwealth of Virginia pursuant to *Code of Virginia* 2.2-4324 or where goods are being offered, and existing price preferences have already been taken into account, preference shall be given to the bidder whose goods contain the greatest amount of recycled content. If no County or Commonwealth of Virginia preference is applicable, the tie shall be decided by lot.

- Z. Proprietary Information:** Section 2.2-4342(F) of the *Code of Virginia* states: "Trade secrets or proprietary information submitted by a bidder, offeror, or Contractor in connection with a procurement transaction or prequalification application submitted pursuant to subsection B of 2.2-4317 shall not be subject to the Virginia Freedom of Information Act (2.2-3700 et seq.); however, the bidder, offeror, or Contractor shall (i) invoke the protections of this section prior to or upon submission of the data or other materials, (ii) identify the data or other materials to be protected, and (iii) state the reasons why protection is necessary." If the exemption from disclosure provided by Section 2.2-4342(F) of the *Code of Virginia* is not properly invoked then the bids will be subject to disclosure pursuant to applicable law.
- AA. Quality Expectation Statement:** Chesterfield County, through its quality initiative, is a recognized leader in providing quality products and services at the most effective cost possible. Therefore, the County fully expects, requires, and shall hold all Contractors, and all agents, staff, representatives, and subcontractors of the Contractor, responsible for, and accountable to, the highest quality standards of professional workmanship, products and services. In the spirit of the County's quality initiative, the Contractor shall be expected to become a member of the team and perform or provide all work, services and products with a target of "zero defects – zero rework".
- BB. References:** If requested, the bidder shall provide references which substantiate past work performance and experience in the type of work required for the contract. The County may contact all references furnished by bidders. The right is further reserved by the County to contact references other than, and/or in addition to, those furnished by the bidder.
- CC. Schools:** When goods and/or services are for the benefit of Chesterfield County Schools, the contract shall be entered into on behalf of the Chesterfield County Public Schools.
- DD. Sensitive Information Handling:** Any information in the possession of the County/Schools which is specific to an employee, student, citizen, County/School business function, private business entity or other government entity which is not generally available to the public shall be designated Sensitive Information. Contract workers will under no circumstances remove Sensitive Information from County/Schools facilities. Any Sensitive Information which must reside temporarily on a hard drive or portable storage device (USB Key, CD ROM, memory card, etc.) for processing must remain within the County/Schools facility. No Sensitive Information may be remotely accessed by contract workers by dial in, VPN, web interface or other means without expressed consent of the department head and the Information Security Manager (County) or Director of Technology (Schools). Any access to County/Schools

information by contract workers from outside the County/Schools intranet shall be in accordance with existing Information Systems Technology (IST)/Chesterfield County Public Schools (CCPS) Technology department security policies and procedures. Contract worker network connected computer equipment will be subject to all applicable IST/CCPS policies and procedures. Any exception to this application of policies shall be approved by the CCPS Department of Technology/County Information Security Manager and Chief Information Officer or designees.

- EE. Taxes:** Chesterfield County is exempt from payment of Federal Excise Tax and State and Local Sales and Use Tax on all tangible personal property purchased or leased by Chesterfield County for its use or consumption. Tax exemption certification will be furnished upon request. Sales tax, however, is paid by Chesterfield County on materials and supplies that are installed by a Contractor and become a part of real property. Contractors are not exempt from paying taxes on these materials and supplies, as they are considered to be a cost of doing business and should be considered in pricing when preparing a bid.
- FF. Termination:** It shall be the sole right of the County to terminate the contract upon written notification to the Contractor.
- GG. Termination for Breach or Non-Performance:** If the Contractor fails to perform the work promptly and diligently, or if the Contractor breaches the Contract in any other way, the County may:
1. after providing the Contractor with 15 days written notice, supply any workmen, equipment or materials necessary to ensure that the work is performed promptly and diligently. The County may deduct the cost of supplying additional workmen, equipment or materials from payments due to the Contractor;
 2. terminate the contract, enter upon the premises, take possession of all equipment, materials or appurtenances, and employ any person or persons to finish the work.
- If the contract is terminated by the County, the Contractor shall not be entitled to receive any further payment from the County until completion of the work has occurred. After completion of the work, the County shall pay to the Contractor the amount of the unpaid balance due to the Contractor at the time the contract was terminated minus the cost incurred by the County to complete the work. If the cost incurred by the County to complete the work exceeds the unpaid balance due to the Contractor, the Contractor shall be due no money from the County and, instead, the Contractor shall pay to the County the difference between the unpaid balance due and the County's cost to complete the work.
- HH. Vendor Rewards/Gift Programs:** It is the policy of the County not to participate in any rewards programs offered by vendors and not to accept any gifts or gift cards, or other rewards from vendors for purchases made by the County. If you customarily provide, or if you plan to provide, rewards programs, gifts or gift cards, or other rewards to your customers for purchases made by such customers, you must identify this fact in your bid and demonstrate in the bid how you have applied the value of such rewards to a reduction in the price of the goods and/or services being offered to the County.
- II. Waiver of One Breach Not Waiver of Others:** No waiver by the County or its agents or employees of any breach of this contract by the Contractor shall be construed as a waiver of any other or subsequent breach of the contract by the Contractor. All remedies provided by this contract are cumulative, and in addition to each and every other remedy under the law.

JJ. Withdrawal of Bids

1. Withdrawal: Construction (*Code of Virginia* 2.2-4330)

A bidder for a public construction contract, other than a contract for construction or maintenance of public highways, may withdraw his bid from consideration if the price bid was substantially lower than the other bids due solely to a mistake in the bid, provided the bid was submitted in good faith, and the mistake was a clerical mistake as opposed to a judgment mistake, and was actually due to an unintentional arithmetic error or unintentional omission of a quantity of work, labor, or material made directly in the compilation of a bid, which unintentional arithmetic error or unintentional omission can be clearly shown by objective evidence drawn from inspection of original work papers, documents and materials used in the preparation of the bid sought to be withdrawn. If a bid contains both clerical and judgment mistakes, a bidder may withdraw his bid from consideration if the price bid would have been substantially lower than the other bids due solely to the clerical mistake, that was an unintentional arithmetic error or an unintentional omission of a quantity of work, labor or material made directly in the compilation of a bid that shall be clearly shown by objective evidence drawn from inspection of original work papers, documents and materials used in the preparation of the bid sought to be withdrawn.

The bidder shall give notice in writing to the Director of Purchasing of his claim of right to withdraw his bid within two business days after the conclusion of the bid opening procedure and shall submit original work papers with such notice. The work papers, documents and materials shall, at the bidders request, be considered as trade secrets or proprietary information subject to compliance with the provisions of *Code of Virginia* §2.2-4342(F).

Within 5 business days, the County will notify the bidder in writing of its decision. If the County denies the withdrawal of a bid under the provisions of this section, it shall state in such notice the reasons for its decision and award the contract to such bidder at the bid price, provided such bidder is a responsible and responsive bidder. At the same time that the notice is provided, the County will also return all work papers and copies thereof to the bidder.

2. Withdrawal: Other than Construction

A bidder for a public contract may request withdrawal of his bid from consideration if the price bid was substantially lower than the other bids due solely to a mistake therein, provided the bid was submitted in good faith, and the mistake was a clerical mistake as opposed to a judgment mistake, and was actually due to an unintentional arithmetic error or unintentional omission of a quantity of work, labor, or material made directly in the compilation of the bid which unintentional arithmetic error or unintentional omission can be clearly shown by objective evidence drawn from inspection of work papers, documents or materials used in the preparation of the bid sought to be withdrawn. If a bid contains both clerical and judgment mistakes, a bidder may request withdrawal of his bid from consideration if the price bid would have been substantially lower than the other bids due solely to the clerical mistake, that was an unintentional arithmetic error or an unintentional omission of a quantity of work, labor or material made directly in the compilation of a bid which shall be clearly shown by objective evidence drawn from inspection of work papers, documents or materials used in the preparation of the bid sought to be withdrawn. Such notice shall be sent to the Purchasing Department prior to award. The work papers, documents and materials shall, at the bidders request, be considered as trade secrets or proprietary information subject to compliance with the provisions of *Code of Virginia* §2.2-4342(F).

V. **SPECIAL TERMS AND CONDITIONS**

- A. Access to County Property:** Access to the County's property shall be as follows:
1. The Contractor's employees shall report to the main office each day.
 2. The Contractor shall provide identification badges for all employees, which shall be prominently displayed at all times while on the job site.
 3. The Contractor's employees are restricted to those areas to which they have been assigned to work and are not authorized to roam in other areas of the building.
- B. Acceptance Period of Bids:** All bids submitted shall be binding for sixty (60) calendar days following bid opening date. The sixty (60) calendar day acceptance period may be extended by mutual consent of both parties.
- C. Bid Bond:** Each bid shall be accompanied by a bid bond from a Surety company satisfactory to the County Attorney, or his designee, or a Certified or Cashier's Check, made payable to: Treasurer, Chesterfield County, in an amount equal to five percent of the total bid price. Attorneys-in-fact who sign Bid Bonds must file with each bond a certified and effective dated copy of their power of attorney. Each Bid Bond and the accompanying power of attorney should bear the same date. In case of the failure of the bidder to execute the contract within the prescribed time, the County may, at its option consider the bidder in default, in which case the bid bond accompanying the bid shall become the property of the County.
- D. Brand Name or Equal:** In accordance with §2.2-4315 of the *Code of Virginia*, unless otherwise provided in the Invitation for Bid, the name of a certain brand, make or manufacturer shall not restrict bidders to the specific brand, make or manufacturer named and shall be deemed to convey the general style, type, character, and quality of the article desired. Any article that the County in its sole discretion determines to be the equal of that specified, considering quality, workmanship, economy of operation, and suitability for the purpose intended, shall be accepted.

Unless otherwise provided in the Invitation for Bid, no proposed equal will be considered prior to receipt of bids. If bidding a proposed equal, the bidder is responsible to clearly and specifically identify the article being offered and to provide sufficient descriptive literature, catalog cuts and technical detail to enable the County to determine if the article offered meets the requirements of the solicitation. Failure to furnish adequate data for evaluation purposes may result in declaring a bid non-responsive. Unless the bidder clearly indicates in the bid that the article offered is an equal, such bid will be considered to offer the brand name referenced in the solicitation. It shall be understood that the burden of proof for an equal article shall be and remain the sole responsibility of the bidder. The County's failure to object to a manufacturer will not constitute a waiver of any of the requirements of the contract documents, and all products furnished must conform to such requirements.

The Contractor shall be responsible for making all changes in the work necessary to adapt and accommodate "equal" products which are submitted and accepted in lieu of the products whose name and model numbers are specified and around which the drawings, where applicable, were developed. The necessary changes shall be made at the Contractor's expense. The Contractor shall submit sufficient data concerning the proposed equal products and resulting necessary changes to the project to the County documenting that the proposed product(s) can be properly integrated with the project.

- E. Contact with Students:** As required by Section 22.1-296.1 of the *Code of Virginia*, Bidders who will provide services that will place Contractor or Contractor's employees in direct contact with students on school property during regular school hours or during school-sponsored activities, shall certify, by signing and submitting their bid or proposal, that none of the individuals who will perform the work under the contract have been convicted of a felony or any offense involving the sexual molestation or physical or sexual abuse or rape of a child. Any person making a materially false statement regarding any such offense shall be guilty of a Class 1 misdemeanor and, upon conviction, the fact of such conviction shall be grounds for the revocation of the contract to provide such services and, when relevant, the revocation of any license required to provide such services.
- F. Date of Commencement:** The date of commencement shall be established in a written Notice to Proceed issued by the County.
- G. Definitions:**
- Completion of the Work** - The event that occurs when (1) the work has been completed, successfully tested and approved in accordance with the contract, (2) all submittals required by the contract (including operation and maintenance manuals) have been made, and (3) all punch list items and restoration work required by the contract documents has been completed.
- Consultant** – Shall mean a representative designated by the County as consultant for the project, to act as such and designated to be in charge of the work, acting directly through duly authorized representatives of the County.
- Extra Work** - Shall mean work other than that required, either expressed or implied, by the contract in its present form.
- Final Acceptance** - The event that occurs when the Consultant issues to the County or the County issues to the Contractor a written statement that the Contractor has completely performed all punch list items, has made all necessary submittals to the County and/or Consultant and has satisfied all of the Contractor's obligations under the contract documents.
- Final Payment** - Payment by the County to the Contractor after completion of the work so that the Contractor has received all payments due him under the terms of the contract documents for performing and completing the work.
- Inspector** - The person designated and authorized by the County to carry out instructions given by the County and to inspect the work performed and the materials supplied by the Contractor.
- H. Discrepancies:** The Contractor shall immediately report to the County, in writing, any discrepancies found between the contract documents and site conditions or any alleged inconsistencies or ambiguities in the contract documents. The County will promptly address such alleged inconsistencies or ambiguities in writing. Work done by the Contractor after the discovery of such discrepancies, inconsistencies or ambiguities shall be done at the Contractor's risk.
- I. Drawings:**
- The drawings, prepared by Wiley | Wilson, consist of 12 pages and are included in ATTACHMENT A.

- J. Final Inspection:** At the conclusion of the work, the Contractor shall demonstrate to the County's authorized representative that the work is fully operational and in compliance with contract specifications and codes. After the final inspection is conducted, the County shall provide the Contractor with a punch list that the Contractor shall complete. Deficiencies will be promptly and permanently corrected prior to final acceptance of the work, and shall be the full responsibility of the Contractor.
- K. Guarantee of Work:** All materials and workmanship shall be guaranteed for a period of twelve (12) months after final acceptance by the County and repairs necessary shall be made by the Contractor at his expense.
- L. Insurance Requirements:** The Contractor and insurance company should carefully review the insurance requirements set forth below. The Contractor shall furnish a copy of a certificate of insurance in accordance with the requirements before the County will execute a contract. The Contractor shall be responsible for maintaining current certificates of insurance on file with the County. The certificate of insurance does not need to accompany the bid.

The Contractor shall purchase and maintain in force, at his own expense, such insurance as will protect him and the County and Chesterfield County Public Schools from claims which may arise out of or result from the Contractor's execution of the work, whether such execution be by himself, his employees, agents, subcontractors, or by anyone for whose acts any of them may be liable. The insurance coverages shall be such as to fully protect the County and Chesterfield County Public Schools, the Consulting Professional (if applicable) and the general public from any and all claims for injury and damage resulting by any actions on the part of the Contractor or his forces as enumerated above.

The Contractor shall furnish insurance in satisfactory limits, and on forms and of companies that are acceptable to the County's Attorney and/or Risk Management Director and shall require and show evidence of insurance coverages on behalf of any subcontractors (if applicable), before entering into any agreement to sublet any part of the work to be done under this contract.

The Contractor shall maintain during the initial term and any additional terms of this contract the following equivalent coverage and minimum limits:

1. Commercial General Liability: \$1,000,000 Combined Single Limit per occurrence.
2. Automobile Liability: \$1,000,000 Combined Single Limit per occurrence
3. Workers' Compensation Virginia Statutory limits
4. Employers' Liability: \$100,000 each accident

If an insurance certificate is used as evidence of the required insurance the insurance certificate:

- a. Must reflect that the Commercial General Liability policy names the Chesterfield County School Board, Chesterfield County Board of Supervisors, their officers, employees, and agents as an additional insured by endorsement to the policy;
- b. Must reflect that the policies are endorsed to require no less than 30 days notice of cancellation or other change in coverage to the County;

- c. Must have an authorized signature;
- d. The Certificate Holder should be listed as:
Chesterfield County
c/o Purchasing Department
P.O. Box 51
Chesterfield, VA 23832-0001
IFB No _____

- M. Licenses, Permits, and Fees:** All bids submitted shall have included in the price the cost of any business and professional licenses, permits, or fees required by Chesterfield County or the Commonwealth of Virginia.
- N. Materials and Workmanship:** The Invitation for Bid describes the character and features of the best possible materials and workmanship required to perform the work. It is understood that the contract includes any and all work that may be necessary to connect the work done with the adjoining work in a proper and workmanlike manner.
- O. Monthly Estimates and Retainage:** On the 20th day of each month, or at any other regular time agreed upon by the County and Contractor, the Contractor shall prepare and submit to the County a monthly estimate for partial payment. The monthly estimate shall cover items of work for which the Contractor is entitled to be paid since the last previous monthly estimate was submitted, including (1) the value of the work done, (2) major items of equipment or materials delivered to the site of the project to be installed by the Contractor, as substantiated by submitted invoices and as approved by the inspector, and (3) materials incorporated into the work.

The County will pay to the Contractor all sums due under the monthly estimate less five percent (5%) retainage on or before the 15th day of the month following the submission of the monthly estimate, unless the County asserts a right to withhold some or all of the payment under the provisions of the contract documents.

If approved in advance by the County, the Contractor will be paid for materials delivered to and suitably stored on the job site. Payment for materials and equipment stored on site will be conditioned upon compliance by the Contractor with procedures satisfactory to the County to establish the County's title to such materials and equipment or otherwise protect the County's interest payment will be for actual cost of materials as evidenced by receipted invoices, less five percent (5%) retainage. The Contractor shall make a separate accounting of these materials and shall submit an accounting of them along with the monthly estimate for partial payment.

- P. Performance Bond and Labor and Material Payment Bond:** If the bid price is over \$100,000, a labor and material payment bond and a performance bond, each in the amount of 100% of the contract price, with a corporate surety authorized to do business in the Commonwealth of Virginia and otherwise acceptable in all respects to the County Attorney, or his designee will be required for the faithful performance of the contract. (A sample of the contract is included for review in ATTACHMENT B).

The party to whom the contract is awarded will be required to execute the contract and obtain the labor and material payment bond and the performance bond within fifteen calendar days from the date when the Notice of Award together with the contract is delivered to the Contractor for execution.

Attorneys-in-fact who sign labor and material payment bonds and performance bonds must file with each bond a certified and effective dated copy of their power of attorney. Performance bond and the accompanying power of attorney should bear the same date as the date of the contract.

- Q. Pre-Construction Meeting:** A pre-construction meeting, to be arranged by the County, to include representatives of the County, the Consultant (if applicable), and the Contractor shall be mandatory prior to start of construction unless waived by the County.
- R. Responsibility of Bidder:** The bidder should carefully and thoroughly examine the job site and conditions, the quality of materials and workmanship required for the work, and review the entire Invitation for Bid document before submitting a bid. Claims, as a result of failure to inspect the job site and all Invitation for Bid documents, will not be considered by the County.
- S. Special Requirements:**
1. Work hours are Monday through Friday, 7:00 a.m. until 9:00 p.m. Weekend work may be allowed with prior approval by the County. The Contractor shall notify the County no later than Tuesday of the week prior to the weekend they desire to work.
 2. School facilities shall not be used. The Contractor shall provide portable lavatories for use during the project.
 3. Parking for the Contractor's employees will be designated during the pre-construction meeting.
- T. Subcontracts:** No portion of the work shall be subcontracted without prior written consent of the County. In the event that the Contractor desires to subcontract some part of the work specified herein, the Contractor shall furnish the County the names, qualifications and experience of their proposed subcontractors. The Contractor shall, however, remain fully liable and responsible for the work to be done by its subcontractor(s) and shall assure compliance with all requirements of the contract and compliance with applicable General Terms and Conditions (including, without limitation, the non-discrimination and drug-free workplace provisions).
- U. Submittals:** If requested, the bidder shall submit the following information to the County within seven days of notification:
1. a designation of the work to be performed by the bidder with his own forces;
 2. the proprietary names and the suppliers of principal items or systems of materials and equipment proposed for the work;
 3. a list of names of the subcontractors or other persons or entities proposed for the principal portions of the work.

Prior to the award of the contract, the County will notify the bidder in writing if the County, after due investigation, has reasonable objection to any such proposed person or entity. If the County has reasonable objection to such proposed person or entity, the bidder may submit an acceptable substitute person or entity.

The County may, at its discretion, accept the substitution, or may disqualify the bidder. In the event of disqualification under this sub-paragraph, bid security will not be forfeited.

Persons and entities proposed by the bidder and to whom the County has made no reasonable objection under the provisions of sub-paragraph (c) must be used on the work for which they were proposed and shall not be changed except with the written consent of the County.

- V. Supervision and Construction Procedures:** The Contractor shall supervise and direct the work, using their best skill and attention. The Contractor shall be solely responsible for all construction means, methods, techniques, sequences and procedures and for coordinating all portions of the work under the Contract. The Contractor shall be responsible to the County for the acts and omissions of his employees, subcontractors and their agents and employees, and other persons performing any of the work under a contract with the Contractor.
- W. Use of Premises and Removal of Debris:** The Contractor at all times shall keep the premises free from accumulation of waste materials or rubbish caused by the operations. The Contractor shall maintain all access roads and walks clear of debris, materials and equipment during the course of the work. All streets, drives, walks, fences, trees, poles, antennae and the like where disturbed, removed or damaged shall be replaced, returned or repaired such that the facility and its appurtenances are left in the same condition after completion of the work as it was before operations began.
- Debris shall be disposed of by the end of every working day and not stockpiled. Beverage cans, bottles, lunch refuse, cigarette debris, etc. will not be tolerated on the job site except by immediate and proper removal of the same on a daily basis. At the completion of the work, the Contractor shall remove all waste materials and rubbish from and about the project site as well as all tools, construction equipment, machinery and surplus materials. The County does not supply trash containers for debris disposal.
- X. Worksite Damages:** Any damage to existing utilities, equipment or finished surfaces resulting from the performance of the contract shall be repaired, to the County's satisfaction, at the Contractor's expense.

VI. **BID FORM**

A. **BASIS OF AWARD**

Award will be made to the lowest responsive and responsible bidder based on the Lump Sum Bid.

B. **PRICING SCHEDULE**

The bidder agrees to furnish the goods/services as specified herein, and in compliance with the terms and conditions of this Invitation for Bids at the following price(s):

LUMP SUM BID: \$ _____

C. **DELIVERY SCHEDULE**

1. Bidders are required to state the time of project completion. Unless otherwise specified, bid the earliest completion possible.
2. Bidders **MUST** insert a definitive time frame IN CALENDAR DAYS, within which completion will be made after receipt of a written Notice to Proceed. **INDEFINITE TERMS SUCH AS "PROMPTLY", "STOCK", "AS SOON AS POSSIBLE", "APPROXIMATELY", ETC., WILL NOT BE GIVEN CONSIDERATION. THE FAILURE OF A BIDDER TO PROVIDE A DEFINITE COMPLETION TIME WILL RESULT IN THE BID BEING REJECTED AS NONRESPONSIVE IN ITS ENTIRETY OR, WHEN APPLICABLE, FOR THE ITEM SPECIFIED.**

Project completion in calendar days _____ after receipt of a written Notice to Proceed.

D. **ADDENDA**

Bidder hereby acknowledges receipt of and incorporation of all requirements of any addenda issued for this Invitation for Bids:

Addendum No. _____ Dated _____

Addendum No. _____ Dated _____

Addendum No. _____ Dated _____

E. **BUSINESS CLASSIFICATION**

Bidders are requested to provide the following information to Chesterfield County regarding their business. This information is for statistical purposes and, except in the case of tie bids, all firms submitting bids will receive equal consideration (refer to Clause F of the General Terms and Conditions). Bidder shall indicate whether they are classified as a:

Minority-Owned Business: Yes ☐ No ☐

Women-Owned Business: Yes ☐ No ☐

Chesterfield Business: Yes ☐ No ☐

F. BIDDER'S CHECKLIST

This checklist is provided to assist bidders in submitting a responsive bid and may not be inclusive of all solicitation requirements. Bidders are expected to carefully read the entire solicitation and verify that the following issues have been addressed prior to submission of a bid:

- ☐ Provide requested information on cover page: name, address, etc., including signature
- ☐ Bid Bond, in the amount of 5% of the bid price
- ☐ Entire BID FORM, pages 21 through 24
- ☐ Receipt of all addenda issued has been acknowledged on page 21, item D, or if required, signed and submitted with the bid.
- ☐ Virginia State Corporation Commission (SCC) Registration Information
- ☐ Bidder Data Information

G. VIRGINIA CONTRACTOR LICENSE NUMBER (*Code of Virginia 54.1-1100*)

Contractors that for a fixed price, commission, fee, or percentage undertake to bid upon, or accepts, or offers to accept, orders or contracts for performing, managing, or superintending in whole or in part, the construction, removal, repair or improvement of any building or structure permanently annexed to real property owned, controlled, or leased by him or another person or any other improvement to such real property, are required to hold a business license issued by the Virginia Board for Contractors, phone (804)367-8511. If a bidder shall fail to obtain the required license prior to submission of a bid, the bid shall not be considered. **Bidder shall insert Contractor license number and specialty in the space provided below.**

Class of License Definitions:

Class A Contractor – perform or manage construction, removal, repair, or improvements when (i) the total value referred to in a single contract or project is \$120,000 or more, or (ii) the total value of all such construction, removal, repair, or improvements undertaken by such person within any 12-month period is \$750,000 or more.

Bidders are required to possess a Class A Contractor's Business License for this project.

The Contractor license shall have the appropriate specialty classification that is predominant for the respective work.

Provide Contractor license number below:

Class A Virginia Contractor Registration No. _____

Classification/Specialty: _____

H. CONTRACTOR'S REPRESENTATIVE – Project Manager/Supervisor:

Name(s): _____

Address: _____

Phone (voice): _____ Fax: _____

Cell Phone: _____ Email Address: _____

I. PAYMENT TERMS

If discounts for prompt payment are offered by the bidder, it is required that a minimum of twenty (20) days be allowed for payment. Discounts for prompt payment will not be considered in the evaluation of bids. Discounts for prompt payment will be shown on the purchase order/contract and taken if invoices are processed and payment made within the stipulated time frame. If discounts are not offered, payment shall be made thirty (30) days after receipt of an accurate invoice by the County. Our terms are: _____

J. BIDDER DATA

QUALIFICATIONS OF BIDDER: Firms shall have the capability in all respects to perform fully the contract requirements and the experience, integrity, perseverance, reliability, capacity, facilities, equipment, and credit which will assure good faith performance of the contract to the satisfaction of the County.

Indicate the length of time you have been in business as a company providing the type of good(s) and/or service(s) required for this contract.

_____ years _____ months

Provide a minimum of three (3) references that will substantiate past work performance and experience in the type of work required for this contract.

Company Name, Address, Phone Number and Contact Person's Name and Email Address:

1. _____

2. _____

3. _____

K. VIRGINIA STATE CORPORATION COMMISSION (SCC) REGISTRATION INFORMATION

The bidder shall check one of the following. The bidder is:

☐ a corporation or other business entity with the following SCC identification number:
_____ **-OR-**

☐ not a corporation, limited liability company, limited partnership, registered limited liability partnership, or business trust **-OR-**

☐ an out-of-state business entity that does not regularly and continuously maintain as part of its ordinary and customary business any employees, agents, offices, facilities, or inventories in Virginia (not counting any employees or agents in Virginia who merely solicit orders that require acceptance outside Virginia before they become contracts, and not counting any incidental presence of the bidder in Virginia that is needed in order to assemble, maintain, and repair goods in accordance with the contracts by which such goods were sold and shipped into Virginia from bidder's out-of-state location) **-OR-**

☐ an out-of-state business entity that is including with this bid an opinion of legal counsel which accurately and completely discloses the undersigned bidder's current contacts with Virginia and describes why those contacts do not constitute the transaction of business in Virginia within the meaning of § 13.1-757 or other similar provisions in Titles 13.1 or 50 of the *Code of Virginia*.

****NOTE**** >> Check the following box if you have not completed any of the foregoing options but currently have pending before the SCC an application for authority to transact business in the Commonwealth of Virginia and wish to be considered for a waiver to allow you to submit the SCC identification number after the due date for bids. No award shall be issued to a bidder who fails to provide the required information unless a waiver of these requests is granted by the chief executive of the local governing body (the County reserves the right to determine in its sole discretion whether to allow such waivers): ☐

ATTACHMENT A – SCOPE OF WORK/SPECIFICATIONS/DRAWINGS
(total of 216 pages)

**PROJECT MANUAL
FOR
CHESTERFIELD COUNTY PUBLIC SCHOOLS**

Swift Creek Middle School Tech Lab

**WILEY|WILSON
6606 WEST BROAD STREET
SUITE 500
RICHMOND, VIRGINIA 23230**

Commission # 213197.00

DATE: September 30, 2013

Chesterfield County Public Schools
Swift Creek Middle School Tech Lab

Division	Section Title
DIVISION 01 - GENERAL REQUIREMENTS	
01010	SUMMARY OF WORK
01045	CUTTING AND PATCHING
01290	PAYMENT PROCEDURES
01310	PROJECT MANAGEMENT AND COORDINATION
01330	SUBMITTAL PROCEDURES
01730	EXECUTION
01770	CLOSEOUT PROCEDURES
DIVISION 03 - CONCRETE	
03301	MISCELLANEOUS CAST-IN-PLACE CONCRETE
DIVISION 04 - MASONRY	
04100	MORTAR
04150	MASONRY ACCESSORIES
04200	MASONRY
DIVISION 05 - METALS	
05999	MISCELLANEOUS METALS
DIVISION 07 - THERMAL AND MOISTURE PROTECTION	
07205	ACOUSTIC BLANKET INSULATION
07900	CAULKING AND SEALANTS
DIVISION 08 - OPENINGS	
08105	METAL DOOR FRAMES
08200	WOOD DOORS
08525	ACOUSTIC ALUMINUM WINDOWS
08710	FINISH HARDWARE
08800	GLASS AND GLAZING
DIVISION 09 - FINISHES	
09510	ACOUSTICAL CEILINGS
09650	RESILIENT FLOORING

09653 RESILIENT WALL BASE AND ACCESSORIES
09912 INTERIOR PAINTING

DIVISION 10 SPECIALTIES

10200 LOUVERS AND VENTS

DIVISION 23 - HEATING VENTILATING AND AIR CONDITIONING

230513 COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT
230517 SLEEVES AND SLEEVE SEALS FOR HVAC PIPING
230518 ESCUTCHEONS FOR HVAC PIPING
230529 HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT
230553 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT
230593 TESTING, ADJUSTING, AND BALANCING FOR HVAC
230713 DUCT INSULATION
230719 HVAC PIPING INSULATION
232113 HYDRONIC PIPING
233113 METAL DUCTS
233300 AIR DUCT ACCESSORIES
233713 DIFFUSERS, REGISTERS, AND GRILLES
237200 AIR-TO-AIR ENERGY RECOVERY EQUIPMENT
238126 SPLIT-SYSTEM AIR-CONDITIONERS

DIVISION 26 - ELECTRICAL

260526 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
260529 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
260533 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS
262416 PANELBOARDS
262726 WIRING DEVICES
262816 ENCLOSED SWITCHES AND CIRCUIT BREAKERS
265100 INTERIOR LIGHTING

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SECTION 01010 – SUMMARY OF WORK

PART 1 - GENERAL

1.1 WORK COVERED BY CONTRACT DOCUMENT

- A. The work includes demolition, patching of concrete floor slabs, masonry wall construction, mechanical and electrical work, and floor and wall finishes matching existing conditions. Chesterfield County Public Schools will renovate a portion of the Shop at Swift Creek Middle School with the plan for converting the space into a Technical Education Laboratory.
- B. The General Contractor is required to visit the school to determine the “extent of work” per the Contract Documents in preparing his bid. By submitting a bid, the Bidder agrees and warrants that he has examined all the bid documents, and has become familiar with the conditions applicable to the project and, if appropriate, the subject of the bid and where the specifications require a given result to be produced, that the specifications are adequate and the desired results can be produced under the specifications in the bid.

1.2 CONTRACTOR USE OF PREMISES

- A. Use of the Site: Limit use of the premises to work in areas shown on the documents. Confine operations to areas within contract limits. Do not disturb portions of the site beyond the areas in which the Work is indicated. Restore; reseed any portion of the site disturbed by construction activities.

1.3 COORDINATION

- A. Coordinate performance of work with Owner's representative in order to minimize disruption of normal activities during school hours. Operations requiring access to occupied portions of the existing facility that would cause such disruption will be scheduled for evening hours, summer recess or school holidays.
- B. Coordinate the work for the various sections of Specifications to ensure efficient and orderly sequence of installation of construction elements, with provisions for accommodating items installed later.
- C. Verify that the characteristics of elements of interrelated operating equipment are compatible; coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- D. Coordinate space requirements and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduits, as closely as practical; make runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

- E. In finished areas conceal pipes, ducts and wiring in the construction. Coordinate locations of fixtures and outlets with finish elements.

1.4 MISCELLANEOUS PROVISIONS

- A. No later than 300 days after the date of Substantial completion, and after Owner occupancy and use of the Project, return to the site with the Owner's Representative and again inspect, test and adjust the Work in accordance with warranty. Submit a report of results to the Owner.
- B. Instruct the Owner's operating personnel on operational requirements needed to maintain compliance. Provide Owner with all required operation and maintenance manuals prior to any instruction. Report performance of completed installations after adjustment that appears unable to comply with the requirements of the Environmental Impact Statement.
- C. Any cutting of holes in new or existing construction by subcontractors for the installation of their work must be patched and repaired by the General Contractor. All patch work must conform and be in accordance with the Contract Documents.

PART 2 - USE OF PREMISES

2.1 CONTRACTOR'S USE OF PREMISES

- A. Contractor shall coordinate use of premises under direction of Owner's Representative.
 - 1. The possession and/or use of drugs and alcohol are strictly forbidden on school property.
 - 2. Smoking, use of improper language and fraternization by contractor's employees with students and staff are also prohibited.
- B. Contractor shall assume full responsibility for protection and safekeeping of Products under this Contract stored on the site.
- C. Contractor shall move any stored Products, under Contractor's control, which interfere with operations of the Owner.
- D. Contractor shall, at his option, obtain and pay for the use of additional storage or work areas needed for operations.
- F. Contractor shall provide temporary toilet facilities for use by his employees and other workers associated with the project. The use of existing facilities is not permitted.
- G. In order to work overtime, a minimum of five (5) workers, excluding foreman and superintendent, must be available and willing to work. Nor overtime shall be allowed if this minimum crew size cannot be guaranteed.

- H. The Contractor shall provide 24 hour advance notice to the Owner's Representative, when access to the building is needed and when they will vacate the building for coordination with security.

2.2 WORK IN, OR ADJACENT TO, EXISTING OR OCCUPIED AREAS

- A. Maintain the existing building in a secure, weather tight condition.
- B. Repair damage to existing structures, equipment or furnishings resulting from Contractor's use of premises.
- C. No construction materials shall be stored in a corridor at any time, nor shall any materials be stored in such a manner as to restrict emergency egress, both inside and outside the building.
- D. All existing exit lights and exit ways must remain operational. Egress shall be by means of hard surfaced, non-slip walkways, ramps or other platforms, along with temporary handrail, barricade or canopies as required.
- E. No work shall be allowed in the corridor of the existing building during school hours. A minimum clear corridor width of 72" shall be maintained at all corridors for safe egress. No such work such as welding or soldering, which is considered hazardous to the building occupants, shall take place during school hours.
- F. Work in corridors within occupied portions of the building may progress only when the students and teachers are not in the building.
- G. Contractor shall take all necessary safety precautions to clearly delineate the construction areas with cones or other devices, and to isolate the area with temporary barricades, dust partitions and temporary construction fences as appropriate. Use temporary fencing to isolate on-site staging areas, storage yards and construction access ways.
- H. Contractor shall immediately clean and remove construction debris from any work area in an occupied area once the work is completed or halted for a significant period of time.
- I. No pneumatic, gas powered or other noise producing construction equipment shall be allowed in an occupied area during school hours.
- J. No hoisting shall be allowed over the school building during normal school hours or other time when the building is occupied for school related or other activities.
- K. Load construction areas with materials during non-school hours only.
- L. Doors to construction areas must be locked. Temporary doors to construction areas must have closers on them.
- M. Fire extinguishers are required in all construction areas.
- N. Perform existing building survey before work commences.

- O. Wherever temporary partitions are required, they will be dust proof partitions from floor to underside of deck with a self-closing, lockable door.
- P. If existing windows and/or doors are removed and new window/doors are not installed, the Contractor must provide a secure plywood covering over the window or door openings. No wall openings (no matter how small) shall be left uncovered after completion of the work shift.
- Q. Do not locate a masonry saw near any window or door openings, or near a fresh air intake.
- R. Do not perform any work during the school day which could cause the fire alarm to be inadvertently activated.
- S. Change filters often during construction and prior to occupying spaces. Do not occupy any area unless the entire HVAC system is operational, (exhaust system, etc.)
- T. All temporary storage areas and or trailers shall be fenced in by 6 feet high construction fence.
- U. Install proper temporary lighting for all phases of construction.
- V. All painting performed by spray application shall be done only when the building is unoccupied.
- W. Use of school supplies or school equipment by contractor is prohibited.

2.3 OWNER OCCUPANCY

- A. The Contractor shall schedule his operations for completion of portions of the Work, for the Owner's occupancy upon Substantial Completion of those portions of the Work.
- B. Owner will occupy the premises during the normal 10 month school year for the conduct of his normal operations. Cooperate with Owner's Representative in all construction operations to minimize conflict and to facilitate continued owner usage.

PART 4 –PRECAUTIONS AND SAFETY

- A. Fire Protection: Provide and maintain an adequate number of hand fire extinguishers at convenient and appropriate locations during construction. Avoid all accumulations of flammable debris by removing rubbish promptly. Take all other precautions necessary to prevent fire. Supervise closely the storage of paint materials and other combustible products.
 - 1. Existing fire alarm and detection system must remain operable at all times during construction.

2. All existing services and utilities must remain operable during the construction process. In the event that disruption of these services is required for any reason, the contractor must outline the scheduled events and coordinate them with the Owner for his approval prior to the Work being performed.
 3. During the pre-construction meeting, the Owner will designate approved lay down areas that may be used by the contractor.
- B. Accident Prevention and Safety: Comply with all applicable laws, ordinances, rules regulations and orders of governing authorities having jurisdiction for the safety of persons and property to protect them from damage, injury or loss. Erect and safeguards for safety and protection, including fences, railings, barricades, lighting posting of danger signs and other warnings against hazards. Where prevention of construction accidents is not regulated by code or ordinances, comply with AGC's "Manual of Accident Prevention in Construction." Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Project. All scaffolds shall be built in accordance with all requirements of local, state and Federal laws and regulations.

END OF SECTION 01010

SECTION 01045 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 Summary of Work:

- A. This Section specifies requirements for all cutting and patching work on the project, whether existing exposed work or work to be concealed by new work.

1.2 Cutting and Patching Proposal:

- A. Approval of procedures is required before proceeding with cutting and patching of existing exposed surfaces. Submit a proposal describing procedures in advance of the time cutting and patching will be performed. Include the following information, as applicable:

- 1. Describe the extent of cutting and patching required and how it is to be performed; indicate why it cannot be avoided.
- 2. Describe anticipated results; include changes to structural elements and operating components and changes in the building's appearance and other visual elements.
- 3. List products to be used and entities that will perform Work.
- 4. Indicate dates when cutting and patching is to be performed.
- 5. List utilities that will be disturbed, including those that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.
- A. Approval by the Architect to proceed does not waive the Architect's right to later require complete removal and replacement of Work found to be unsatisfactory.

1.3 Other Requirements:

A. Structural Work

- 1. Do not cut and patch structural elements in a manner that would reduce the load-carrying capacity or load deflection ratio. Obtain approval of the cutting and patching proposal before cutting and patching structural elements.

B. Operational and Safety Limitations

- 1. Do not cut and patch operating elements or safety components in a manner that would reduce their capacity to perform as intended, or would increase maintenance, or decrease operational life or safety. Obtain approval of the cutting and patching proposal before cutting and patching operating elements or safety related systems.

C. Visual Requirements

- 1. Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching.

2. Remove and replace Work cut and patched in a visually unsatisfactory manner.
- D. Inspection
 1. Before cutting, examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed. Take corrective action before proceeding if unsafe or unsatisfactory conditions are encountered.
- E. Temporary Support
 1. Provide temporary support of Work to be cut.
- F. Protection
 1. Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions that might be exposed during cutting and patching operations.
 2. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
 3. Take all precautions to avoid cutting existing pipe, conduit or ductwork serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them.
- G. Performance
 1. Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.
 2. Only cut existing construction to provide for the installation of other components or in the performance of other construction activities, and the subsequent patching required to restore surfaces to their original condition.

PART 2 - PRODUCTS

2.1 Materials:

- A. Use materials identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible, subject to the approval of the Architect. Use materials whose performance will equal or that surpass of existing materials.

PART 3 - EXECUTION

3.1 Cutting:

- A. Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review procedures with the original installer; comply with the original installer's recommendations.

- B. Where cutting is required, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces. DO NOT USE IMPACT HAMMERS OR DRILLS.
- C. Cut through concrete and masonry using a cutting machine with a carborundum saw or diamond core drill.
- D. Comply with requirements of applicable sections of Division-2 where cutting and patching requires excavating and backfilling.
- E. Bypass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed, relocated or abandoned. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.

3.2 Patching:

- A. Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
- B. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
- C. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

3.3 Cleaning:

- A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove mortar, oils and similar items.

END OF SECTION 01045

SECTION 01290 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.2 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.3 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
 - 1. Correlate line items in the schedule of values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with continuation sheets.
 - b. Submittal schedule.
 - c. Items required to be indicated as separate activities in Contractor's construction schedule.
 - 2. Submit the schedule of values to Architect at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
- B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
 - 1. Identification: Include the following Project identification on the schedule of values:
 - a. Project name and location.
 - b. Name of Architect.
 - c. Architect's project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
 - 2. Arrange schedule of values consistent with format of AIA Document G703.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of Contract Sum.
4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.
6. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
8. Purchase Contracts: Provide a separate line item in the schedule of values for each purchase contract. Show line-item value of purchase contract. Indicate owner payments or deposits, if any, and balance to be paid by Contractor.
9. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
10. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.4 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

1. Submit draft copy of Application for Payment seven days prior to due date for review by Architect.
- C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
 4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.
- E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 3. Provide summary documentation for stored materials indicating the following:
 - a. Materials previously stored and included in previous Applications for Payment.
 - b. Work completed for this Application utilizing previously stored materials.
 - c. Additional materials stored with this Application.
 - d. Total materials remaining stored, including materials with this Application.
- F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt. One copy shall include waivers of lien and similar attachments if required.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 2. When an application shows completion of an item, submit conditional final or full waivers.
 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.
- H. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 2. When an application shows completion of an item, submit conditional final or full waivers.
 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 5. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.
- I. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of values.
 3. Contractor's construction schedule (preliminary if not final).
 4. Combined Contractor's construction schedule (preliminary if not final) incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor.
 5. Products list (preliminary if not final).
 6. Schedule of unit prices.
 7. Submittal schedule (preliminary if not final).
 8. List of Contractor's staff assignments.
 9. List of Contractor's principal consultants.
 10. Copies of building permits.
 11. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 12. Initial progress report.
 13. Report of preconstruction conference.
 14. Certificates of insurance and insurance policies.
 15. Performance and payment bonds.
 16. Data needed to acquire Owner's insurance.
- J. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- K. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
 5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
 6. AIA Document G707, "Consent of Surety to Final Payment."
 7. Evidence that claims have been settled.
 8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01290

SECTION 01310 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General project coordination procedures.
 - 2. Administrative and supervisory personnel.
 - 3. Coordination drawings.
 - 4. Requests for Information (RFIs).
 - 5. Project meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

1.2 DEFINITIONS

- A. RFI: Request from Owner, Architect, or Contractor seeking information from each other during construction.

1.3 COORDINATION

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
 2. Preparation of the schedule of values.
 3. Installation and removal of temporary facilities and controls.
 4. Delivery and processing of submittals.
 5. Progress meetings.
 6. Project closeout activities.
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1.4 COORDINATION DRAWINGS

- A. Coordination Drawings: Prepare coordination drawings in accordance with requirements in individual Sections, where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1.5 KEY PERSONNEL

- A. Key Personnel Names: Within 10 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and email addresses. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.

1.6 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
 2. Project number.
 3. Date.
 4. Name of Contractor.
 5. Name of Architect.
 6. RFI number, numbered sequentially.

7. RFI subject.
 8. Specification Section number and title and related paragraphs, as appropriate.
 9. Drawing number and detail references, as appropriate.
 10. Field dimensions and conditions, as appropriate.
 11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 12. Contractor's signature.
 13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: AIA Document G716
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
1. The following RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for coordination information already indicated in the Contract Documents.
 - d. Requests for adjustments in the Contract Time or the Contract Sum.
 - e. Requests for interpretation of Architect's actions on submittals.
 - f. Incomplete RFIs or inaccurately prepared RFIs.
 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal.
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.
- E. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.
- F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number.

1.7 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
- B. Preconstruction Conference: Architect will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
1. Conduct the conference to review responsibilities and personnel assignments.
 2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing and long-lead items.
 - d. Designation of key personnel and their duties.
 - e. Lines of communications.
 - f. Procedures for processing field decisions and Change Orders.
 - g. Procedures for RFIs.
 - h. Procedures for testing and inspecting.
 - i. Procedures for processing Applications for Payment.
 - j. Distribution of the Contract Documents.
 - k. Submittal procedures.
 - l. Preparation of record documents.
 - m. Use of the premises.
 - n. Work restrictions.
 - o. Working hours.
 - p. Owner's occupancy requirements.
 - q. Responsibility for temporary facilities and controls.
 - r. Procedures for moisture and mold control.
 - s. Procedures for disruptions and shutdowns.
 - t. Construction waste management and recycling.
 - u. Parking availability.
 - v. Office, work, and storage areas.
 - w. Equipment deliveries and priorities.

- x. First aid.
 - y. Security.
 - z. Progress cleaning.
- C. Project Closeout Conference: Schedule and conduct Project closeout conference, at a time convenient to Owner and Architect, but no later than 10 days prior to the scheduled date of Substantial Completion.
 - 1. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- D. Progress Meetings: Conduct progress meetings at monthly intervals.
 - 1. Coordinate dates of meetings with preparation of payment requests.

Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and controls.
 - 9) Progress cleaning.
 - 10) Quality and work standards.
 - 11) Status of correction of deficient items.
 - 12) Field observations.
 - 13) Status of RFIs.
 - 14) Status of proposal requests.

- 15) Pending changes.
 - 16) Status of Change Orders.
 - 17) Pending claims and disputes.
 - 18) Documentation of information for payment requests.
3. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
 - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01310

SECTION 01330 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as action submittals.
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as informational submittals.
- C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.
- D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.3 ACTION SUBMITTALS

- A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or modifications to submittals noted by the Architect and additional time for handling and reviewing submittals required by those corrections.
 - 1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
 - 2. Initial Submittal: Submit concurrently with start-up construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
 - 3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

- a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic copies of CAD Drawings of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 1. Initial Review: Allow 1 business days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow 15 business days for review of each resubmittal.
 4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 20 business days for initial review of each submittal.
- D. Identification and Information: Place a permanent label or title block on each paper copy submittal item for identification.
 1. Indicate name of firm or entity that prepared each submittal on label or title block.
 2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
 3. Include the following information for processing and recording action taken:
 - a. Project name.

- b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Name of subcontractor.
 - f. Name of supplier.
 - g. Name of manufacturer.
 - h. Submittal number or other unique identifier, including revision identifier.
 - 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).
 - i. Number and title of appropriate Specification Section.
 - j. Drawing number and detail references, as appropriate.
 - k. Location(s) where product is to be installed, as appropriate.
 - l. Other necessary identification.
- E. Identification and Information: Identify and incorporate information in each electronic submittal file as follows:
- 1. Assemble complete submittal package into a single indexed file with links enabling navigation to each item.
 - 2. Name file with submittal number or other unique identifier, including revision identifier.
 - a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).
 - 3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
 - 4. Include the following information on an inserted cover sheet:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name of Contractor.
 - e. Name of firm or entity that prepared submittal.
 - f. Name of subcontractor.
 - g. Name of supplier.
 - h. Name of manufacturer.
 - i. Number and title of appropriate Specification Section.
 - j. Drawing number and detail references, as appropriate.
 - k. Location(s) where product is to be installed, as appropriate.
 - l. Related physical samples submitted directly.
- F. Options: Identify options requiring selection by the Architect.
- G. Deviations: Identify deviations from the Contract Documents on submittals.

- H. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
 - 1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect
- I. Transmittal: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than Contractor.
 - 1. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- J. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 - 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- K. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- L. Use for Construction: Use only final submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 - 1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.

2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 5. Submit Product Data before or concurrent with Samples.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of applicable Specification Section.

3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned.
- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location.
- F. Application for Payment: Comply with requirements specified in Division 01 Section "Payment Procedures."
- G. Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."
- H. Coordination Drawings: Comply with requirements specified in Division 01 Section "Project Management and Coordination."
- I. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- J. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of

Welding Procedure Specification and Procedure Qualification Record on American Welding Society (AWS) forms. Include names of firms and personnel certified.

- K. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- L. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- M. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- N. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- O. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- P. Product Test Reports: Submit written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- Q. Schedule of Tests and Inspections: Comply with requirements as specified.
- R. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- S. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- T. Field Test Reports: Submit reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note

corrections and field dimensions. Mark with approval stamp before submitting to Architect.

- B. Project Closeout and Maintenance/Material Submittals: Refer to requirements in Division 01 Section "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

- A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
- C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- D. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- E. Incomplete submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
- F. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 01330

SECTION 01730 - EXECUTION

1.1 INFORMATIONAL SUBMITTALS

- A. Qualification data.
- B. Cutting and patching plan.

1.2 EXECUTION

- A. Existing Conditions: Existence and location of site improvements, utilities, and other construction affecting the Work must be investigated and verified.
- B. Review of the Contract Documents and field conditions.
- C. Installation: Comply with manufacturer's written instructions.

1.3 CUTTING AND PATCHING

- A. Provide temporary support.
- B. Protect in-place construction.
- C. Protect adjacent occupied areas.
- D. Existing Utility Services and Mechanical/Electrical Systems: Minimize interruption to occupied areas.
- E. Cutting: In general, use hand or small power tools. Cut holes and slots neatly to minimum size required. Temporarily cover openings when not in use.
- F. Patching: Patch with durable seams that are as invisible as practicable. Restore exposed finishes.

1.4 PROGRESS CLEANING

- A. Clean Project site and work areas daily. Dispose of materials lawfully.
- B. Keep installed work clean.
- C. Remove debris from concealed spaces.

1.5 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation.

- B. Adjust equipment for proper operation.

1.6 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure Work is without damage.

END OF SECTION 01730

SECTION 01770 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.

1.2 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete with request.
 - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 - 2. Advise Owner of pending insurance changeover requirements.
 - 3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 5. Prepare and submit Project Record Documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
 - 6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
 - 7. Make final changeover of permanent locks and deliver keys to Owner.
 - 8. Complete startup testing of systems.
 - 9. Submit test/adjust/balance records.
 - 10. Terminate and remove temporary facilities from Project site, along with construction tools, and similar elements.
 - 11. Advise Owner of changeover in heat and other utilities.
 - 12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
 - 13. Complete final cleaning requirements, including touchup painting.
 - 14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

- B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
 - 1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 - 2. Results of completed inspection will form the basis of requirements for final completion.

1.3 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:
 - 1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
 - 2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 - 3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 - 4. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
 - 1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.4 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
 - 1. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 - 2. Include the following information at the top of each page:
 - a. Project name.

- b. Date.
- c. Name of Architect.
- d. Name of Contractor.
- e. Page number.

1.5 WARRANTIES

- A. Submittal Time: Submit properly executed warranties within 15 days of completion of designated Work.
- B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
 - 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
 - 4. Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide table of contents at beginning of document.
- C. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
 - 1. Use cleaning products that meet Green Seal GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Sweep concrete floors broom clean in unoccupied spaces.
 - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
 - j. Clean transparent materials, including glass in windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish glass, taking care not to scratch surfaces.
 - k. Remove labels that are not permanent.
 - l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - 1) Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates.
 - m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

- n. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
- o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
- p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
- q. Leave Project clean and ready for occupancy.

END OF SECTION 01770

SECTION 03301 - MISCELLANEOUS CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 Summary of Work:

- A. Section includes cast-in-place concrete, including reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.2 Action Submittals:

- A. Product Data: For each type of product indicated.
- 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 the following sections of ACI 301, unless modified by requirements in the Contract Documents:
 - 1. "General Requirements."
 - 2. "Formwork and Formwork Accessories."
 - 3. "Reinforcement and Reinforcement Supports."
 - 4. "Concrete Mixtures."
 - 5. "Handling, Placing, and Constructing."
 - 6. "Lightweight Concrete."
- 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.

2.2 Steel Reinforcement:

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.
- B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

2.3 Concrete Materials:

- A. Lightweight Aggregate: ASTM C 330, 1-inch nominal maximum aggregate size.
- B. Water: ASTM C 94/C 94M.

2.4 Curing Materials:

- A. Water: Potable.
- B. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

2.5 Concrete Mixtures:

- A. Comply with ACI 301 requirements for concrete mixtures.
- B. Normal-Weight Concrete: Prepare design mixes, proportioned according to ACI 301, as follows:
 - 1. Minimum Compressive Strength: 4000 psi at 28 days.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.45.
 - 3. Slump Limit: 5 inches plus or minus 1 inch.
 - 4. Air Content: Maintain within range permitted by ACI 301. Do not allow air content of trowel-finished floor slabs to exceed 3 percent.

2.6 Concrete Mixing

- A. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
 - 1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1½ minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
 - 2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
 - 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 Formwork:

- A. Design, construct, erect, brace, and maintain formwork according to ACI 301.

3.2 Items Embedded:

- 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 Steel Reinforcement:

- A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

3.4 Joints:

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Locate and install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

3.5 Concrete Placement:

- A. Comply with ACI 301 for placing concrete
- B. Retain one of first two paragraphs below. Retain first paragraph if adding water after batch mixing is permitted. ACI 301 (ACI 301M) permits water to be added to concrete mix on-site to adjust slump, up to amount allowed in design mixture. Retain second paragraph if adding water is not permitted.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
- D. Consolidate concrete with mechanical vibrating equipment.
- E. Equipment Bases and Foundations:
 - 1. Coordinate sizes and locations of concrete bases with actual equipment provided.
 - 2. Construct concrete bases 8 inches high unless otherwise indicated; and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
 - 3. Minimum Compressive Strength: 4000 psi at 28 days.
 - 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on centers around the full perimeter of concrete base.
 - 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete substrate.
 - 6. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.6 Finishing Unformed Surfaces:

- A. Retain first paragraph below. Some floating and troweling machines have watering attachments. Adding water weakens concrete surface and can cause dusting, blistering, and scaling.
- B. General: Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- C. 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 bleedwater appears on surface.
 - 1. Do not further disturb surfaces before starting finishing operations.
- 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.

3.7 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 for hot-weather protection during curing.
- B. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- C. Curing Methods: Cure formed and unformed concrete for at least seven days by one or a combination of the following methods
 - 1. 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.

3.8 Repairs:

- A. Remove and replace concrete that does not comply with requirements in this Section.

END OF SECTION 03301

SECTION 04100 - MORTAR

PART 1 - GENERAL:

1.1 Description of Work:

- A. Furnish mortar materials, equipment, and labor required for mortar and mortar mixing.

PART 2 - PRODUCTS:

2.1 Materials:

- A. Mortar Materials Shall Conform to The Following Requirements:

1. Cement shall be Portland cement per ASTM C150-84, Type I or II or Type IA or IIA.
2. Hydrated lime shall conform to ASTM C-207-84, Type S.
3. Sand shall conform to ASTM C-144-81.
4. Water shall be taken from local drinking water supply and shall be lean and free from deleterious amounts of acids, alkalis, or organic materials.
5. Additives shall be used only with written approval of the Architect.

- B. Mortar Shall Conform to the Requirements of ASTM C-270-82 with An fin=2000psi. Use Mortar As Follows:

1. Interior Masonry: Type S.

- C. Color: Mortar color shall match existing mortar and be selected by the Architect. Submit samples for selection and approval by the Architect.

PART 3 - EXECUTION:

3.1 Workmanship:

- A. Storage of Materials: All mortar materials shall be stored under cover in a dry place.
- B. Measurement of ingredients shall be accomplished with methods that insure accuracy.
- C. Prevent 'bleeding' of mortar onto masonry which may result in staining or discoloration.

END OF SECTION 04100

SECTION 04150 - MASONRY ACCESSORIES

PART 1 - GENERAL:

1.1 Description of Work:

- A. Furnish masonry accessories, equipment and labor required for a complete job.

PART 2 - PRODUCTS:

2.1 Materials:

A. Joint Reinforcement:

1. General: Provide joint reinforcement complying with requirements of referenced unit masonry standard and this article, formed from galvanized carbon steel wire, coating class as required by referenced unit masonry standard for application indicated.
2. Description: Welded-wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 10 feet, with prefabricated corner and tee units, and complying with requirements indicated below:
 - a. Wire Diameter For Side Rods: 0.1483 inch (9 gages).
 - b. Wire Diameter For Cross Rods: 0.14831 inch (9 gages).
 - c. For Single-Wythe Masonry Provide Type As Follows with Single Pair of Side Rods: Truss design with continuous diagonal cross rods spaced not more than 16 inches o.c.

- B. Nonmetallic Expansion Joint Strips: Pre-molded filler strips complying with ASTM D 1056, Type 2 (closed cell), Class A (cellular rubber and rubber-like materials with specific resistance to petroleum base oils), Grade 1 (compression-deflection range of 2-5 psi.) in compressible up to 35 percent, of width and thickness indicated, formulated from Neoprene.

- C. Performed Control Joints Gaskets: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

1. Styrene-Butadiene Rubber Compound: ASTM D 2000, Designation 2AA-805.
2. Polyvinyl Chloride: ASTM D 2287, General Purpose Grade, Type PVC-65406.

- D. Bond Breaker Strips: Asphalt-saturated organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

- E. Wall Reinforcing: ASTM A615-82, grade 60.

PART 3 - EXECUTION:

3.1 Control and Expansion Joints:

- A. General: Install control and expansion joints in unit masonry where indicated. Build in related items as the masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.
- B. Form Control Joints in Concrete Masonry As Follows: Install performed control joint gaskets designed to fit standard sash block:

END OF SECTION 04150

SECTION 04200 - MASONRY

PART 1 - GENERAL:

1.1 Description of Work:

A. This Section includes unit masonry assemblies consisting of the following:

1. Concrete masonry units (CMUs).

B. Cooperate with other trades in setting items in masonry walls

1.2 Delivery, Storage, and Handling:

A. Deliver, stack masonry on platforms, cover, or store in any approved manner that will protect them from contact with soil and weather exposure. Exercise care in handling masonry units to avoid chipping, breaching; stack immediately upon delivery to job, protect from weather exposure.

PART 2 - PRODUCTS:

2.1 Materials:

A. Concrete Masonry Units (CMU): "Solite" or equal lightweight concrete aggregate conforming to ASTM C331-81: Units shall be free of organic impurities that would cause rusting, staining; pop-up to walls, free from combustible matter. Units shall be either high or low pressure steam cured, hollow or solid load bearing type as required, per the following specifications:

1. Hollow Load Bearing Units: ASTM C90-81, Grade N Type I.

2. Solid Load Bearing Units: ASTM C145-81, Grade N Type I.

3. Hollow Non-Load Bearing Units: ASTM C129-80, Type I.

B. Concrete Masonry Reinforcing for Lintels (Where required): ASTM A615-82 Grade 60. Provide one #4 bar in top and bottom for each 4" (or part thereof) increment of width.

C. Wall Reinforcing: Continuous horizontal wall reinforcing shall be truss type at 16" on center, 9 gauge cold drawn wire conforming to ASTM A-82.

PART 3 - EXECUTION:

3.1 General Requirements:

A. Erect no masonry when air temperature is below or expected to go below 40 degrees F. Protect masonry from freezing when the temperature of the surrounding air is 40 degrees F and falling. Heat materials and provide temporary protection of completed portions of masonry work. Protect completed work as per Structural Clay Products Institute's Technical Notes, Volume I, No. 1. Do not build upon frozen work. Do not lay masonry having water film or frost on its surface. Do not wet CMU.

- B. Lay masonry plumb, true to line, with level, accurately spaced courses as indicated. Keep bond plumb throughout. Lay corners and reveals plumb and true.
- C. Build in work required to be built in with masonry, including flashing, anchors, wall plugs, lintels, joint fillers, packing, and accessories, as erection progresses.
- D. Protect masonry surfaces not being worked on during construction work.
- E. Do cutting of concrete masonry units with motor driven carborundum saw where cut edge is to be exposed. Provide neat openings for electric boxes.

3.2 Bond and Coursing:

- A. Lay CMU in running bond, except where specifically indicated otherwise. Bond shall pass uninterrupted over all openings using lintel blocks as herein specified.
- B. Vertical Coursing for CMU: One course in 8 inches. Horizontal coursing as required to produce joints $\frac{3}{8}$ inches wide.
- C. Lay out horizontal coursing so that no CMU is less than 4 inches (nominal) in length.

3.3 Workmanship for Concrete Masonry Units:

- A. Erect masonry unit walls, partitions where indicated. Bed each course solidly in specified mortar with vertical joints breaking halfway over course below. Butter vertical joints entire height of units.
- B. CMU tooled concave joints.

3.4 Protection:

- A. All installed door and window frames; and sills, ledgers, offsets, etc. shall be protected from droppings of mortar, paint and other staining agents during construction work.

END OF SECTION 04200

SECTION 05999 - MISCELLANEOUS METALS

PART 1 - GENERAL

- 1.1 Scope: Furnish and install all items of miscellaneous metal including but not necessarily limited to:
 - A. Miscellaneous Anchor Bolts, Plates, etc.
 - B. Miscellaneous Metal Sleeves.
 - C. Clip Angles, Shelf Angles, and Bracing Angles.
- 1.2 Delivery, Storage and Handling:
 - A. Deliver materials to the site at such intervals to ensure uninterrupted progress of the work.
 - B. Store materials to permit easy access for inspection and identification. Keep members off the floor, using pallets, platforms, or other supports. Protect members and packaged materials from erosion and deterioration.
 - C. Do not store materials on the structure in a manner that might cause distortion or damage to the members of the supporting structures. Repair or replace damaged materials or structures as directed.
- 1.3 General Requirements:
 - A. Metals: Free from defects impairing strength, durability, appearance, best commercial quality for purposes specified, made with structural properties to withstand safety strains, stresses, to which they will normally be subjected.
 - B. Protect metals from injury at shops, in transit to job, until erected in place, inspected, and accepted.

PART 2 - PRODUCTS

- 2.1 Materials:
 - A. Comply With The Following Standards:
 - 1. Steel Plates, Shapes, Bars and Bar Size Shapes: ASTM A36.
 - 2. Cold-Finish Steel Bars: ASTM A108.
 - 3. Stainless Steel Sheets: A1S1 Type 302 or 304, 24 gage with number 4 finish.
 - B. Fasteners: All fasteners for exterior use and where built into exterior walls shall be zinc-coated; all other fasteners shall be of the type, grade and class required for the particular use.
 - 1. Nuts and Bolts: Provide hexagon-head regular type complying with ASTM A307 Grade A.

2. Lag Bolts: Provide square-head type complying with Fed. Spec. FF-B-561.
 3. Machine Screws: Provide cadmium plated steel type complying with Fed. Spec. FF-2-111.
 4. Toggle Bolts: Provide type, class and style needed complying with Fed. Spec. FF-B-588.
 5. Plain Washers: Provide round, carbon steel type complying with Fed. Spec. FF-W-92.
 6. Lock Washers: Provide carbon steel, helical spring type complying with Fed. Spec. FF-W-84.
 7. Anchorage Devices: Provide expansion shields complying with Fed. Spec. FF-S-325.
- C. Other Materials: Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.
- 2.2 Shop Paint:
- A. Primer: Use "10-99 Themec Primer" or "Rustoleum Number 5769 Primer".
 - B. Galvanizing Repair: Use a high zinc-dust content paint complying with MIL-P-21035.
- 2.3 Fabrication:
- A. Except as otherwise noted on the Construction Drawings or approved Shop Drawings, use materials of size, thickness, and type required to produce reasonable strength and durability in the work of this Section.
 - B. Fabricate with accurate angles and surfaces which are true to the required lines and levels, grinding exposed welds smooth and flush, forming exposed connections with hairline joints and using concealed fasteners wherever possible.
 - C. Prior to shop painting or priming, properly clean metal surfaces as required for the applied finish and for the proposed use of the item.
 - D. On surfaces inaccessible after assembly or erection, apply two coats of the specified primer. Change color of second coat to distinguish it from the first.

PART 3 - EXECUTION

- 3.1 Field Conditions:
- A. Verify measurements in field, as required, for work fabricated to fit job conditions.
 - B. Before starting work, examine adjoining work on which work is in any way dependent, for perfect workmanship, fit.

- C. Surface Conditions: Examine the areas and their condition which the work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected.
- 3.2 Coordination: Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.
- 3.3 Installation:
- A. Set work accurately into position, plumb, level, true, and free from rack and anchor firmly into position.
 - B. Where field welding is required comply with AWS Code for the Procedures of Manual Shielded Metal-arc Welding, the appearance and quality of welds made, and the methods used in correcting welding work.
 - C. Grind exposed welds smooth, and touch-up shop prime coats.
 - D. Do not cut, weld, or abrade surfaces which have been not-dip galvanized after fabrication and which are intended for belted or screwed field connections.
- 3.4 Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of the shop paint, and paint all exposed areas with the same material as used for shop painting. Installation of Manufactured Items: In accordance with the manufacturer's printed instruction.

END OF SECTION 05999

SECTION 07205 - ACOUSTIC BLANKET INSULATION

PART 1 – GENERAL:

1.1 Summary of Work:

- A. Section Includes: Provide glass fiber acoustical blanket insulation above interior ceilings.

1.2 References:

- A. Materials shall meet the property requirements of one or more of the following specifications as applicable to the specific product or end use:

- 1. American Society for Testing of Materials (ASTM):

- a. ASTM C423 Test Method for Sound Absorption Coefficient by the Reverberation Room Method.
 - b. ASTM C518 Test Method for Steady State Thermal Transmission Properties by Means of the Heat Flow Meter.
 - c. ASTM C665 Specification for Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
 - d. ASTM E36 Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C.
 - e. ASTM E84 Test Method for Surface Burning Characteristics of Building Materials.

1.3 Submittals:

- A. Product Data: Submit product characteristics, performance criteria, and limitations, including installation instructions, for each type of product indicated.

1.4 Delivery, Storage and Handling:

- A. Deliver materials in manufacturer's original packaging.
- B. Store and protect products in accordance with manufacturer's instructions, store in a dry indoor location. Protect insulation materials from moisture and soiling.
- C. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.
- D. Do not install insulation that has been damaged or wet. Remove it from jobsite.

PART 2 - PRODUCTS

2.1 Acoustic Blanket Insulation, Non-Fire-Rated:

- A. Type: Kraft faced glass fiber acoustical insulation, complying with ASTM C 665, Type II, Class C.

- B. Surface Burning Characteristics: ASTM E84.
 - 1. Maximum flame spread: Not Rated
 - 2. Maximum smoke developed: Not Rated
- C. Fire Resistance Ratings: Part of ASTM E119 fire tested wall assemblies.
- D. Sound Transmission Class: ASTM C423, STC 45
- E. Dimensional Stability: Linear Shrinkage less than 0.1%

PART 3 - EXECUTION

3.1 Examination:

- A. Examine conditions under which the work of this Section is to be performed. Notify the Architect in writing of any unsatisfactory conditions. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Verify mechanical and electrical services above the ceiling have been tested and inspected.

3.2 Installation:

- A. Comply with manufacturer's installation instructions.
- B. Friction-fit blanket insulation in place, until the interior finish is applied. Install batts to fill entire area, with no gaps, voids, or areas of compression. Ceilings with penetrations require that insulation be carefully cut to fit around junction boxes, and other irregularities.

3.3 PROTECTION

- A. Protect installed insulation as recommended by manufacturer.

END OF SECTION 07205

SECTION 07900 - CAULKING AND SEALANTS

PART 1 - GENERAL:

1.1 Description of Work:

- A. The work shall consist of the complete installation of necessary caulking and sealing of interior and exterior building joints.
- B. Deliver, store, and handle materials to prevent inclusion of foreign materials, damage to materials by water, breakage. Deliver, and store, packaged materials in original packages until ready for use. Do not use packages or materials showing evidence of water or other damage.

PART 2 - PRODUCTS:

2.1 Materials:

A. Sealant:

- 1. Sealant Compound: Used on interior joints where movement is expected (control joints, etc).

B. Caulking:

- 1. Caulking Compound: Used on the interior of the building where no movement is expected (window and door frames, etc.) where caulking is required.

PART 3 - EXECUTION:

3.1 General Requirements:

A. All Spaces to Receive Caulking or Sealant:

- 1. Clean and free of dust, debris, and any coating which might affect the caulking or sealant bond.
- 2. Pack dry joints with backing material and prime joints as recommended by the caulking or sealant manufacturer.

B. It is the intent of this specification that all exterior joints subject to moisture penetration to be filled with sealant and that all interior joints exposed to view to be filled with caulking.

C. The drawings indicate the intent of the contract requirements and similar conditions, even though not specially shown or specified, shall be sealed.

D. Finish joints smooth, neat, of uniform width and completely bonded and clean and free of excess sealant or caulking.

3.2 Caulking:

- A. Install sealant using caulking gun in strict accordance with manufacturer's printed instruction.

- B. Caulking surfaces to be free of wrinkles, uniformly smooth and neat.
- C. Seal joints around all openings in interior walls including doors, louvers, etc. seal interior joints around same openings.
- D. Set all thresholds in a full bed of caulking.

END OF SECTION 07900

SECTION 08105 - METAL DOOR FRAMES

PART 1 - GENERAL:

1.2 Related Work In Other Sections:

Section 08710 - Finish Hardware

1.3 Submittals:

- A. Submit shop drawings indicating materials, finishes, size of members, profiles, and internal construction.
- B. Submit warranty in writing, in duplicate, stating doors have been manufactured in complete accordance with Contract Documents. Warranty: Signed by an officer of the company.
- C. Guarantee: Frames: Guaranteed for a period of not less than two (2) years against any defects which make them unsuitable for use for which intended. Any warp in excess of $\frac{1}{4}$ " in 8 feet: considered a defect under terms of this guarantee. Guarantee: Provide for replacement, as originally furnished.

1.4 Delivery and Storage: Protect frames against physical damage during and after delivery, store undercover and according to written instructions of manufacturer.

1.5 Quality Assurance:

- A. Provide metal frames complying with the Steel Door Institute "Recommended Specifications for Standard Steel Door Frames" (SDI 100), and as herein specified.

PART 2 - PRODUCTS:

2.1 Frames (For Doors) :

- A. Steel: Prime quality, 16 gauge, bonderized and prime painted steel. 14 gauge where specifically noted on the drawings. Exterior frames to be galvanized.
- B. Furnish six (6) jamb anchors and two (2) base anchors per frame. Jamb anchors for masonry jambs: adjustable T-strap.
- C. Furnish three (3) rubber bumpers at each strike jamb and two (2) bumpers at head for double doors.
- D. Fabrication:
 - 1. Frames: Set up, and welded, ground smooth, with heads and jambs mitered, with spreader bar attached. Mitered corners: heavy reinforcing with integral tabs for secure, easy interlocking of jambs to head.
 - 2. Frames: Mortised, reinforced to receive hardware listed on approved hardware schedule. Drill, tap for all mortised hardware. Mortised items: provided with cover to prevent blockage by masonry mortar.

PART 3 - EXECUTION:

3.1 Frame Installation:

- A. Set frames accurately, plumb, true and positioned properly for door swings indicated or for glass where indicated. Brace frames adequately to hold securely in position until built-in and anchored to walls. Set angle floor clips in mortar, and then anchor with expansion bolts let thru angles. All frames adjacent to masonry construction shall be packed full with mortar.

3.2 Inspect frames periodically as they are being built-in to insure accurate positioning.

3.3 Surface Conditions:

- A. Examine the areas and conditions under which work of this section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.
- B. Make measurements as required in the field to assure proper fit.

3.4 Installation:

- A. Install the work of this section in strict accordance with the original design, the approved Shop Drawings, pertinent requirements of governmental agencies having jurisdiction, and the manufacturer's recommended installation procedures as approved by the Architect, anchoring all components firmly into position for long life.
- B. Remove protective coating completely from exposed surfaces as soon as progress of the work will permit with safety.

3.5 Job Conditions:

- A. Coordination: Coordinate hardware with other work. Tag each item or package separately, with identification related to the final hardware schedule and include basic installation instructions in the package. Furnish hardware items of proper design for use in frames of the thickness', profile, swing, security, and similar requirements indicated, as necessary for proper function and installation. Deliver individually packaged hardware items at the proper times to the proper locations (shop or project site) for installation.
- B. Templates: Furnish hardware templates to each fabricator of frames, and other work to be factory-prepared for the installation of hardware. Upon request, check the shop drawing of such other work, to confirm that adequate provisions are made for the proper installation of hardware.
 - 1. Hardware shall be examined for damage, defects and suitability for intended use and shall be made good before installation. Degree of openings for overhead holders, door closures, etc. shall be established by hardware supplier and included in hardware schedule for Architect's approval. Hardware shall be accurately and properly fitted. Exposed parts shall be removed until painting is completed and then re-installed. After hardware has been installed, it shall be examined in place for proper installation and operation.

2. Hardware found defective in materials, installation or operation shall be replaced, reworked, or otherwise made good as required.
 - a. The Following Shall Be Considered As Defective Material:
 - 1) Unauthorized Substitutes.
 - 2) Materials delivered with Missing, Broken, Damaged or Defaced Parts.
 - 3) Incorrect Hand or Function.
 - b. The Following Shall Be Considered As Defective Installation:
 - 1) Materials Broken, Damaged or Defaced after Delivery.
 - 2) Materials Incomplete, Mis-aligned, or Incorrectly Located.

END OF SECTION 08105

SECTION 08200 - WOOD DOORS

PART 1 - GENERAL:

1.2 Related Work In Other Sections:

Section 08710 - Finish Hardware
Section 08800 - Glass and Glazing

1.3 Submittals:

- A. Submit shop drawings indicating materials, finishes, face veneers, glazing, and size of members, profiles, and internal construction.
- B. Submit warranty in writing, in duplicate, stating doors have been manufactured in complete accordance with Contract Documents. Warranty: Signed by an officer of the company.
- C. Guarantee: Doors: Guaranteed for a period of not less than two (2) years against any defects which make them unsuitable for use for which intended. Any warp in excess of $\frac{1}{4}$ " in 8 feet: considered a defect under terms of this guarantee. Guarantee: Provide for replacement, as originally furnished.

1.4 Delivery and Storage: Protect doors against dampness and physical damage during and after delivery. Store under cover in a well-ventilated building, and where not exposed to extreme changes of temperature or humidity. Do not store or install doors in any part of building until concrete, masonry, and plaster work is dry. Store as required by written instruction of door manufacturer.

1.5 Quality Assurance:

- A. Standards as published by Architectural Woodwork Institute (AWI).

1.6 Scope:

- A. All doors to be factory fit and machined for hardware.
- B. All doors to be factory marked with opening number and individually poly-bagged.

PART 2 - PRODUCTS:

2.1 Materials: Manufactured to conform to AWI Standard.B. Glass View Panel: AWI Custom Grade.

- 1. Cores: SLC (Staved Lumber Core). 5-ply.
- 2. Stiles: Stain grade birch.
- 3. Faces: Stain grade birch, plain sliced.
- 4. Adhesives: Type I adhesive all doors.

5. Glazing:

- a. Complete with snap-on-glazing bead and wire glass as shown or scheduled on drawings.
- b. Dimensions of view panel as shown or scheduled on drawings.

2.2 Openings for glazing shall be trimmed with wood bead or veneer wrapped beads at mineral core fire doors.

PART 3 - EXECUTION:

3.1 Installation:

- A. Follow written requirements of door manufacturer; and of standard statement of National Woodwork Manufacturer's "Standard Door Guarantee" for work on doors to maintain guarantee by door manufacturer.
- B. Doors: Have $\frac{1}{16}$ " clearance at sides and top, $\frac{3}{16}$ " at bottom unless otherwise indicated. Where carpet extends through door opening, trim door to provide $\frac{1}{8}$ " clearance above carpet.
- C. Prepare doors to receive hardware required to be rabbeted or mortised into doors.
- D. Handle doors with care; avoid damage to finish. Do trimming required to fit with fine tooth saws, planes or by sanding; do not leave ragged or damaged edges where trimmed. Damaged doors: Restored to original condition at delivery or replaced as directed by the Architect.
- E. Installer shall conform to manufacturer's written specifications, instructions and details.
- F. Center unit in opening, plumb, square and level. Shim around unit as required.
- G. Secure door through jambs with approved fasteners. Shim at masonry anchor locations (Conceal anchors).
- H. If not pre-primed all doors shall be painted with a primer coat on all six sides within ten (10) days of installation.

3.2 Cleaning:

- A. Clean all surfaces to remove soil without using abrasive cleaners or solutions containing corrosive solvents.
- B. Glass and hardware must be protected from acid solutions used to clean masonry surfaces.
- C. Provide both interior and exterior protection of doors until structure is sealed from weather.

END OF SECTION 08200

SECTION 08525 – ACOUSTIC ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 Summary of Work:

- A. Section includes acoustic aluminum windows for interior locations.

1.2 Action Submittals:

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for aluminum windows.
- B. Shop Drawings: Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.
- C. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

1.3 Informational Submittals:

- A. Qualification Data: For manufacturer and Installer.
- B. Sample Warranties: For manufacturer's warranties.

1.4 Quality Assurance:

- A. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by test reports, and calculations.
- B. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

1.5 Performance Requirements:

- A. Sound Transmission
 - 1. Sound Transmission Class (STC). When tested in accordance with ASTM E1425, windows shall perform to a minimum STC-35. Testing shall be performed in a NVLAP Certified Test Laboratory.

1.6 Warranty:

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure to meet performance requirements.

- b. Structural failures including excessive deflection, condensation, and air infiltration.
 - c. Faulty operation of hardware.
 - d. Deterioration of materials and finishes beyond normal.
 - e. Failure of insulating glass.
2. Warranty Period:
- a. Window: 10 years from date of Substantial Completion.
 - b. Glazing Units: Five years from date of Substantial Completion.
 - c. Aluminum Finish: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 Manufacturers:

- A. Basis of Design: Subject to compliance with requirements of Basis of Design: St. Cloud Window, Inc. , 390 Industrial Blvd, Sauk Rapids MN 56379, Phone: 800-383-9311 Fax: 320-255-1513
- B. Source Limitations: Obtain aluminum windows from single source from single manufacturer.

2.2 Window Performance Requirements:

- A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
 - 1. Window Certification: AMMA certified with label attached to each window.
- B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
 - 1. Minimum Performance Class: CW
 - 2. Minimum Performance Grade: 30

2.3 Aluminum Windows:

- A. Operating Types: Provide fixed windows locations indicated on Drawings.
- B. Frames and Sashes: Aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440.
- C. Insulating-Glass Units: ASTM E 2190
 - 1. Glass: ASTM C 1036, Type 1, Class 1, q3.

- a. Thickness: $\frac{1}{4}$ "
- b. Tint: Clear
- c. Kind: Fully tempered
- 2. Filling: Fill space between glass lites with air
- D. Glazing System: Manufacturer's standard factory-glazing system
- E. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907 or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.
 - 1. Exposed Hardware Color and Finish: As indicated by manufacturer's designations
- F. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
 - 1. Exposed Fasteners: Do not use exposed fasteners to the greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.
- 2.4 Accessories:
 - A. Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.
- 2.5 Fabrication:
 - A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.
 - B. Glaze aluminum windows in the factory.
 - C. Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design wind loads of window units.
 - D. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.
- 2.6 General Finish Requirements:
 - A. Comply with NAAMM's "Metal Finishes Manual" 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: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 Aluminum Finishes:

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.
 - 1. Organic Coating: Thermosetting, modified-acrylic or polyester enamel primer/topcoat system complying with AAMA 2603, medium gloss.
 - 2. Color: To match existing windows

PART 3 - EXECUTION

3.1 Examination:

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.
- C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Installation:

- A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.
- B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.
- C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.
- D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 Adjusting, Cleaning, and Protection:

- A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.
- B. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
 - 1. Keep protective films and coverings in place until final cleaning.
- C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
- D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

END OF SECTION 08525

SECTION 08710- FINISH HARDWARE

PART 1 - GENERAL:

1.1 Description of Work:

- A. Definition: "Finish Hardware" includes items known commercially as finish hardware which are required for swing, sliding and folding doors, except special types of unique and non-matching hardware specified in the same section as the door and door frame.
- B. The extent of finish hardware required is indicated on drawings and in schedules.
- C. Types of finish hardware required include the following:
 - Hinges
 - Lock cylinders and keys
 - Closers
 - Miscellaneous door control devices
 - Thresholds
 - Silencers
 - Wall stops

1.3 Quality Assurance:

- A. Supplier: A recognized architectural finish hardware supplier, with warehousing facilities, who has been furnishing hardware in the project's vicinity for a period of not less than 2 years, and who is, or who employs an experienced architectural hardware consultant who is available, at reasonable times during the course of the work, for consultation about project's hardware requirements, to Owner, Interior Designer and Contractor.

1.4 Submittals:

- A. Hardware Schedule: Submit final hardware schedule in manner indicated below. Coordinate hardware with doors, frames and related work to ensure proper size, thickness, hand, function and finish of hardware.
 - 1. Final Hardware Schedule Content: Based on finish hardware indicated, organize hardware schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:
 - a. Type, style, function, size and finish of each hardware item.
 - b. Name and manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of hardware set cross-referenced to indications on Drawings both on floor plans and in door and frame schedule.
 - e. Explanation of all abbreviations, symbols, codes, etc. contained in schedule.
 - f. Mounting locations for hardware.

- g. Door and frame sizes and materials.
- 2. Submittal Sequence: Submit schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work (e.g., hollow metal frames) which is critical in the project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by finish hardware, and other information essential to the coordinated review of hardware schedule.
- B. Samples: Prior to submittal of the final hardware schedule and prior to final ordering of finish hardware, submit one sample of each type of exposed hardware unit, finished as required, and tagged with full description for coordination with schedule.
 - 1. Samples will be returned to the supplier. Units which are acceptable and remain undamaged through submittal, review and field comparison procedures may, after final check of operation, be used in the work, within limitations of keying coordination requirements.
- C. Templates: Furnish hardware templates to each fabricator of doors, frames and other work to be factory-prepared for the installation of hardware. Upon request, check shop drawings of such other work, to confirm that adequate provisions are made for proper location and installation of hardware.

1.5 Product Handling:

- A. Tag each item or package separately, with identification related to final hardware schedule, and include basic installation instructions with each item or package.
- B. Packaging of hardware is the responsibility of the supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Two or more identical sets may be packed in same container.
- C. Inventory hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.
- D. Deliver individually packaged hardware items at the proper times to the proper locations (shop or project site) for installation.
- E. Provide secure lock-up for hardware delivered to the project, but not yet installed. Control handling and installation of hardware items which are not immediately replaceable, so that completion of the work will not be delayed by hardware losses, both before and after installation.

PART 2 - PRODUCTS:

2.1 Scheduled Hardware:

- A. Requirements for design, grade, function, finish, size and other distinctive qualities of each type of finish hardware is indicated in the Finish Hardware Data Sheet and Hardware Schedule on the Construction Drawing.

2.2 Materials and Fabrication (General):

- A. Hand of door: Drawings show direction of slide, swing or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.
- B. Manufacturer's Name Plate: Do not use manufacturer's products which have manufacturer's name or trade name displayed in visible location (omit removable nameplates), except in conjunction with required UL labels and as otherwise acceptable to Architect.
- C. Base Metals: Produce hardware units of basic metal and forming method indicated, using manufacturer's standard metal alloy, composition, temper and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units by applicable ANSI A 156 series standard for each type hardware item and with ANSI A 156.18 for finish designations indicated. Do not furnish "optional" materials or forming methods for those indicated, except as otherwise specified.
- D. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation. Do not provide hardware which has been prepared for self-tapping sheet metal screws, except as specifically indicated.
- E. Furnish screws for installation, with each hardware item. Provide Phillips flat-head screws except as otherwise indicated.

Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of such other work as closely as possible, including "prepared for paint" in surfaces to receive painted finish.

- F. Provide concealed fasteners for hardware units which are exposed when door is closed, except to extent no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work, except where it is not feasible to adequately reinforce the work. In such cases, provide sleeves for each thru-bolt or use sex screw fasteners.
- G. Tools and Maintenance Instructions for Maintenance: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of finish hardware.

2.03 Hinges, Butts and Pivots:

- A. Templates: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames. Provide only template-produced units.
- B. Screws: Furnish Phillips flat-head or machine screws for installation of units, except furnish Phillips flat-head or wood screws for installation of units into wood. Finish screw heads to match surface of hinges or pivots.
- C. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 - 1. Out-swing Corridor Doors: Non-irremovable pins.
 - 2. Interior Doors: Non-rising pins.
 - 3. Tips: Flat button and matching plug, finished to match leaves, except where hospital tip (HT) indicated.

4. Number of Hinges: Provide number of hinges indicated but not less than 3 hinges for door leaf for doors 90" or less in height and one additional hinge for each 30" of additional height.
- 2.4 Lock Cylinders and Keying:
- A. General: Supplier will meet with Owner to finalize keying requirements and obtain final instructions in writing.
 - B. Review the keying system with the Owner and provide the type required (master, grandmaster, great-grandmaster).
 - C. All lock cores shall be by Best, no exceptions.
 - D. Metals: Construct lock cylinder parts from brass/bronze, stainless steel or nickel silver.
 - E. Comply with Owner's instructions for master keying and, except otherwise indicated, provide individual change key for each lock which is not designated to be keyed alike with a group of related locks.
 - 1. Permanently inscribe each key with number or lock that identifies cylinder manufacturer key symbol.
 - F. Key Quantity: Furnish 3 change keys for each lock; 5 master keys for each master system; and 5 grandmaster keys for each grandmaster system.
- 2.5 Locks, Latches and Bolts:
- A. Strikes: Provide manufacturer's standard strike for each latch or lock bolt, with curved lip extended to protect frame, finished to match hardware set.
- 2.6 Closers and Door Control Devices:
- A. Size of Units: Except as otherwise specifically indicated, comply with the manufacturer's recommendations for size of door control unit, depending upon size of door and anticipated frequency of use.
 - B. Access-Free Manual Closers: Where manual closers are indicated for doors required to be accessible to the physically handicapped, provide adjustable units complying with ANSI A117.1 provisions for door opening force and delayed action closing.
 - C. Provide black resilient parts for exposed bumpers.
- 2.7 Door Trim Units:
- A. Fasteners: Provide manufacturer's standard exposed fasteners for door trim units (kick plates, armor plates, etc.); either machine screws or self-tapping screws.
- 2.8 Hardware Finishes:
- A. Provide matching finishes for hardware units at each door or opening, to the greatest extent possible, and except as otherwise indicated. Reduce differences in color and textures as much as commercially possible where the base metal or metal forming process is different for

- individual units of hardware exposed at the same door or opening. In general, match items to the manufacturer's standard finish for the latch and lock set (or push-pull units if no latch-lock sets) for color and texture.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness and other qualities complying with manufacturer's standards, but in no case less than specified for the applicable units of hardware by referenced standards.
 - C. The designations used in schedules and elsewhere to indicate hardware finishes are the industry-recognized standard commercial finishes, except as otherwise noted.

PART 3 - EXECUTION:

3.1 Installation:

- A. Mount hardware units at heights indicated in "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute, except as specifically indicated or required to comply with governing regulation.
- B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, coordinate removal, storage and reinstallation or application of surface protections with finishing work specified in the Division-9 sections. Do not install surface-mounted items until finishes have been completed on the substrate.
- C. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- D. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

3.2 Adjust and Clean:

- A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.
- B. Clean adjacent surfaces soiled by hardware installation.
- C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance of occupancy, and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
- D. Instruct Owner's Personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.

END OF SECTION 08710

SECTION 08800 - GLASS AND GLAZING

PART 1 - GENERAL:

1.2 Scope of Work:

- A. Glass and Glazing for door lights and interior glass as indicated on the Construction Drawings are to be furnished and installed under this section as specified herein.

1.3 Standard Specification:

- A. "Glazing Manual" of the Flat Glass Jobbers Association shall be considered a part of this Specification.

1.4 Shop Drawings:

- A. Product Data: Submit manufacturer's technical data for each glazing material required, including installation and maintenance instructions.
- B. Certificates of compliance from glass and glazing materials manufacturers attesting that glass and glazing materials furnished for project comply with requirements. Separate certification will not be required for glazing materials bearing manufacturer's permanent label designating type and thickness of glass, provided labels represent a quality control program involving a recognized certification agency or independent testing laboratory acceptable to authority having jurisdiction.

PART 2 - PRODUCTS:

2.1 Manufacturer's Labels:

- A. Labels showing strength, grade, thickness, type and quality are required on each piece of glass. Label must remain on glass until it has been set and inspected.
- B. Furnish manufacturer's written warranties in duplicate.

2.2 Insulating Glass:

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.
 - 1. Sealing System: Dual seal, with manufacturer's standard polyisobutylene and hot-melt butyl primary and secondary.
 - 2. Spacer: Aluminum with mill or clear anodic finish; Non-metallic tube.
 - 3. Desiccant: Molecular sieve or silica gel, or blend of both.

2.3 Glass Locations:

- A. Interior Doors: Glazing: $\frac{1}{4}$ " fixed, tempered, insulating glass, double sealed edges, by door supplier, coordinate.
- B. Interior Windows: Factory glazed, insulating glass units, double sealed.

PART 3 - EXECUTION:

3.1 Preparation:

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.2 Glazing, General:

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide $\frac{1}{8}$ inch minimum bite of spacers on glass and use thickness equal to sealant width.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics

- 3.3 Installation: Install glass in strict accordance with glazing manufacturer's printed installation instructions and as recommended by storefront systems manufacturer's specifications and the "Glazing Manual" of the Flat Glass Jobbers Association.
- 3.4 Cleaning and Protection:
- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.
 - B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
 - C. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
 - D. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 08800

SECTION 09510 - ACOUSTICAL CEILINGS

PART 1 – GENERAL:

1.1 Description of Work:

- A. Extent of each type of acoustical ceiling is shown and scheduled on drawings.
- B. Types of acoustical ceilings specified in this section include the following:
 - 1. Acoustical panel ceilings, exposed suspension system.

1.2 Closeout Submittals:

- A. Maintenance Data: For finishes to include in maintenance manuals.

1.3 Maintenance Material Submittals:

- A. Furnish extra materials 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 percent of quantity installed.
 - 2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
 - 3. Hold-Down Clips: Equal to 2 percent of quantity installed.

1.4 Delivery, Storage, and Handling:

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

PART 2 – PRODUCTS:

2.01 Acoustical Ceiling Units:

- A. Standard for Acoustical Ceiling Units: Provide manufacturer's standard units of configuration indicated which are prepared for mounting method designated and which comply with FS SS-S-118 requirements, including those indicated by reference to type, form, pattern, grade, light reflectance coefficient, edge detail, and joint detail.
- B. Colors, Textures, and Patterns: Provide products as indicated in Finish Schedule.

2.2 Metal Suspension System:

- A. Standard for Metal Suspension Systems: Provide metal suspension systems of type, structural classification and finish indicated which comply with applicable ASTM C 635 requirements. Suspension system shall be Prelude 15/16" exposed Tee Systems by Armstrong or equal.
- B. Finishes and Colors: Provide manufacturer's standard finish for type of system indicated, unless otherwise required. For exposed suspension members and accessories with painted finish, provide color indicated in Finish Schedule.
- C. Hanger Wire: Galvanized carbon steel wire, ASTM A 641, soft temper, pre-stretched, Class 1 coating, sized so that 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 12 gage, wire shall be at 4'-0" o.c. Install wire hangers on ceiling runners within 6 inches of each corner of light fixtures.
- D. Edge Moldings and Trim: Provide manufacturer's standard metal molding for edges and penetrations of ceiling which fits with type of edge detail and suspension system indicated.
 - 1. For lay-in panels with reveal edge details, provide stepped edge molding which forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
 - 2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

PART 3 - EXECUTION

3.1 Preparation:

- A. 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, and comply with layout shown on reflected ceiling plans.

3.2 Installation:

- A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.
 - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.

4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 5. 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.
 6. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
 7. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post-installed anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of $\frac{1}{8}$ inch in 12 feet. Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- 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.
1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
 2. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

3.3 Field Quality Control:

- A. Perform the following tests and inspections of completed installations of acoustical panel ceiling hangers and anchors and fasteners in successive stages. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations show compliance with requirements.

1. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed.
 - a. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.
 - B. Acoustical panel ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.
 - C. Prepare test and inspection reports.
- 3.4 Cleaning:
- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09510

SECTION 09650 - RESILIENT FLOORING**PART 1 – GENERAL:****1.1 Scope of Work:**

- A. Provide resilient tile flooring where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.2 Quality Assurance:

- A. Manufacturer: Provide each type of resilient flooring and accessories as produced by a single manufacturer, including recommended primers, adhesives, sealants, and leveling compounds.
- B. Installer's Qualifications: Engage Installer who is certified in writing by resilient flooring manufacturer as qualified for installation of vinyl composition tile.

1.3 Submittals:

- A. Samples for Verification Purposes: Submit the following sample of each type, color, and pattern of resilient flooring required, showing full-range of color and pattern variations.
 - 1. Full size tile samples.
 - 2. 6" long samples of resilient flooring accessories.
- B. Certification for Fire test Performance: Submit certification from an independent testing laboratory acceptable to authorities having jurisdiction that resilient flooring complies with fire test.
- C. Maintenance Instructions: Submit 2 copies of manufacturer's recommended maintenance practices for each type of resilient flooring and accessory required.

1.4 Project Conditions:

- A. Maintain minimum temperature of 65° F. In spaces to receive resilient flooring for at least 48 hours prior to installation, during installation, and for not less than 48 hours after installation. Store resilient flooring materials in spaces where they will be installed for at least 48 hours before beginning installation. Subsequently, maintain minimum temperature of 55° F in areas where work is completed.
- B. Install resilient flooring and accessories after other finishing operations, including painting, have been completed. Do not install resilient flooring over concrete slabs until the latter have been cured and are sufficiently dry to achieve bond with adhesive as determined by resilient flooring manufacturer's recommended bond and moisture test.

PART 2 – PRODUCTS:**2.1 Materials:**

- A. Resilient flooring types and colors and vinyl base shall be as specified on finish schedule and finish legend.

- B. Vinyl Reducer Edge Strips: of width shown and of required thickness to protect exposed edge of resilient flooring. Provide units of maximum available length, to minimize number of joints.
- C. Adhesive (Cements): Waterproof, stabilized type as recommended by flooring manufacturer to suit material and substrate conditions.
- D. Concrete Slab Primer: Non-staining type as recommended by flooring manufacturer.
- E. Leveling and Patching Compounds: Latex types as recommended by flooring manufacturer.

PART 3 – EXECUTION:

3.1 Inspection:

- A. Require Installer to inspect subfloor surfaces to determine that they are satisfactory. A satisfactory subfloor surface is defined as one that is smooth and free from cracks, holes, ridges, coatings preventing adhesive bond, and other defects impairing performance or appearance.
- B. Do not allow resilient flooring work to proceed until subfloor surfaces satisfactory.

3.2 Preparation:

- A. Prepare subfloor surfaces as follows:
 - 1. Use leveling and patching compounds as recommended by resilient flooring manufacturer for refilling small cracks, holes and depressions in subfloors.
 - 2. Remove coatings from subfloor surfaces that would prevent adhesive bond, including curing compounds incompatible with resilient flooring adhesives, paint, oils, waxes and sealers.
- B. Broom clean or vacuum surfaces to be covered, and inspect subfloor.
- C. Apply concrete slab primer, if recommended by flooring manufacturer, prior to application of adhesive. Apply in compliance with manufacturer's directions.

3.3 Installation, General:

- A. Where movable partitions are shown, install resilient flooring before partitions are erected.
- B. Install resilient flooring use method indicated in strict compliance with manufacturer's printed instructions. Extend resilient flooring into toe spaces, door reveals, and into closets and similar openings.
- C. Scribe, cut, and fit, resilient flooring to permanent fixtures, built-in furniture and cabinets, pipes, outlets, and permanent columns, walls and partitions.
- D. Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other non-permanent marking devise.
- E. Install resilient flooring on covers for telephone and electric ducts, and similar items occurring within finished floor areas. Maintain overall continuity of color and pattern with pieces of

flooring installed on these covers. Tightly cement edges to perimeter of floor around covers and to covers.

- F. Tightly cement resilient flooring to subbase without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections. Hand roll resilient flooring at perimeter of each covered area to assure adhesion.

3.4 Installation of Tile Floors:

- A. Lay tile from center marks established with principal walls, discounting minor offsets, so that tile at opposite edges of room area of equal width adjust as necessary to avoid use of cut widths less than $\frac{1}{2}$ tile at room perimeters; lay tile square to room axis, unless otherwise shown.
- B. Match tiles for color and pattern by using tile from cartons in same sequence as manufactured and packaged if so numbered. Cut tile neatly around all fixtures. Broken, cracked, chipped, or deformed tiles are not acceptable.
- C. Adhere tile flooring to substrates using full spread of adhesive applied in compliance with flooring manufacturer's directions.

3.5 Installation of Accessories:

- A. Apply vinyl reducer edge strips where shown on drawings, and after installation of resilient flooring. Secure units to substrate with adhesive, complying with manufacturer's recommendations.

3.6 Cleaning and Protection:

- A. Perform following operations immediately upon completion of resilient flooring:
 - 1. Sweep or vacuum floor thoroughly.
 - 2. Do not wash floor until time period recommended by resilient flooring manufacturer has elapsed to allow resilient flooring to become well-sealed in adhesive.
 - 3. Damp-mop floor being careful to remove black marks and excessive soil.
 - 4. Remove any excess adhesive or other surface blemishes, using appropriate cleaner recommended by resilient flooring.
- B. Protect flooring against damage during construction period to comply with resilient flooring manufacturer's directions.
- C. Clean resilient flooring not more than 4 days prior to date scheduled for inspections intended to establish date of substantial completion in each area of project. Clean resilient flooring by method recommended by resilient flooring manufacturer.

3.7 Extra Stock:

- A. Deliver stock of maintenance materials to Owner. Furnish maintenance materials from same

manufactured lot as materials installed and enclosed in protective packaging with appropriate identifying labels.

1. Tile Flooring: Furnish not less than one box for each 50 boxes of fraction thereof, for each type, color, pattern, and size installed.

END OF SECTION 09650

SECTION 09653 - RESILIENT WALL BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 Description of Work:

A. Section Includes:

1. Resilient base.

1.2 Maintenance Material Submittals:

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.3 Delivery, Storage, and Handling:

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.4 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 Performance Requirements:

- A. FloorScore Compliance: Resilient base shall comply with requirements of FloorScore certification.

2.2 Vinyl Base:

- A. Product Standard: ASTM F 1861, Type TV (vinyl, thermoplastic).

1. Group: I (solid, homogeneous)
 2. Style and Location:
 - a. Style B, Cove:
 - B. Minimum Thickness: 0.125 inch.
 - C. Height: 4 inches
 - D. Outside Corners: Preformed
 - E. Inside Corners: Preformed.
 - F. Colors and Patterns: To match existing.
- 2.3 Installation Materials:
- A. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
 1. Adhesives shall have a VOC content of 50 g/L or less.

PART 3 - EXECUTION

- 3.1 Examination:
- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
 - B. Proceed with installation only after unsatisfactory conditions have been corrected.
 1. Installation of resilient products indicates acceptance of surfaces and conditions.
- 3.2 Preparation:
- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
 - B. Do not install resilient products until they are the same temperature as the space where they are to be installed.
 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
 - C. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.

3.3 Cleaning and Protection:

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 09653

SECTION 09912 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 Summary of Work:

- A. Section includes surface preparation and the application of paint systems on the following interior substrates:
 - 1. Concrete masonry units (CMU).
 - 2. Steel.
 - 3. Wood.

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. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.
 - 3. VOC content.

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 1 gal. (3.8 L) of each material and color applied.

1.5 Delivery, Storage, and Handling:

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
 1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.6 Field Conditions:

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 Manufactures:

- A. Manufacturers: Subject to compliance with requirements, basis of design is around Sherwin Williams Promar 200 Zero VOC paint systems, other acceptable products may be provided by one of the following:
 1. Behr Process Corporation.
 2. Benjamin Moore & Co.
 3. Bennette Paint Manufacturing Company, Inc.
 4. Dunn-Edwards Corporation.
 5. Duron, Inc.
 6. ICI Paints.
 7. Parker Paint Mfg. Co. Inc.
 8. PPG Architectural Finishes, Inc.
 9. Pratt & Lambert.
 10. Sherwin-Williams Company (The).
 11. Sico, Inc.
 12. Southern Diversified Products, LLC.
 13. Vista Paint.
 14. Zinsser.
- B. 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. Flat Paints and Coatings: 50 g/L.
2. Non-flat Paints and Coatings: 150 g/L.
3. Primers, Sealers, and Undercoaters: 200 g/L.
4. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.

2.3 Block Fillers:**A. Block Filler, Latex, Interior:**

1. Equal to Sherwin Williams ProMar Block filler & Finish, Semi-Gloss #B25W0035.

2.4 Primers/Sealers:**A. Primer Sealer, Interior, Institutional Low Odor/VOC: MPI #149.**

1. Equal to Sherwin Williams Promar 200 Zero VOC interior Latex Primer, #B28W02600.

B. Primer, Latex, for Interior Wood: MPI #39.

1. Equal to Sherwin Williams Multi-Purpose Water-Based Acrylic-Alkyd Prime #B79W0045.

C. Primer Sealer, Alkyd, Interior: MPI #45.

1. Equal to Sherwin Williams Multi-Purpose Water-Based Acrylic-Alkyd Prime #B79W0045.

D. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint systems indicated.

1. Equal to Sherwin Williams Multi-Purpose Water-Based Acrylic-Alkyd Prime #B79W0045.

2.5 Metal Primers:

A. Primer, Alkyd, Anti-Corrosive, for Metal:

B. Primer, Alkyd, Quick Dry, for Metal:

1. Equal to KEM Aqua 70P Water Reducible Metal Primer, #361B571

2.6 Water-Based Paints:

A. Latex, Interior, Flat, (Gloss Level 1):

1. Equal to Sherwin Williams ProMar 200 Zero VOC Interior Latex Flat, #B30-4600.

B. Latex, Interior, Institutional Low Odor/VOC, Flat (Gloss Level 1):

1. Equal to Sherwin Williams ProMar 200 Zero VOC Interior Latex Flat, #B30-4600.

C. Latex, Interior, Institutional Low Odor/VOC, (Gloss Level 2):

1. Equal to Sherwin Williams ProMar 200 Zero VOC Interior Latex low-Sheen #B24-2600.

D. Latex, Interior, Institutional Low Odor/VOC, (Gloss Level 3):

1. Equal to Sherwin Williams ProMar 200 Zero VOC Interior Latex Egg-shell, #B33-8251.

E. Latex, Interior, Institutional Low Odor/VOC, Semi-Gloss (Gloss Level 5):

1. Equal to Sherwin Williams ProMar 200 Zero VOC Interior Latex Semi-Gloss, #B34-8251.

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.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

- E. 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 encapsulates.
 - 1. Remove incompatible primers and re-prime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.
- E. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.
 - 1. SSPC-SP 2, "Hand Tool Cleaning."
 - 2. SSPC-SP 3, "Power Tool Cleaning."
- F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- G. Wood Substrates:
 - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 Application:

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. 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.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed in equipment rooms:
 - a. Equipment, including panelboards.
 - b. Metal conduit.
 - 2. Paint the following work where exposed in occupied spaces:
 - a. Metal conduit.
 - b. Other items as directed by Architect.
 - 3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 Field Quality Control:

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 Cleaning and Protection:

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. 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.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 Interior Painting Schedule:

A. Substrates:

1. Institutional Low-Odor/VOC Latex System:

- a. Block Filler: Block filler, latex, interior MPI #4.
- 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.

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. Topcoat: Alkyd, interior, gloss (Gloss Level 6), MPI #48.

C. Wood Substrates: Including wood trim, architectural woodwork and doors

1. Institutional Low-Odor/VOC Latex System:

- a. Prime Coat: Primer, latex, for interior wood, MPI #39.
- b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.

- c. Topcoat: Latex, interior, institutional low odor/VOC, flat (Gloss Level 1), MPI #143.
 - d. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 2), MPI #144.
 - e. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 3), MPI #145.
 - f. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (Gloss Level 5), MPI #147.
2. Alkyd System:
- a. Prime Coat: Primer sealer, alkyd, interior, MPI #45.
 - b. Intermediate Coat: Alkyd, interior, matching topcoat.
 - c. Topcoat: Alkyd, interior, gloss (Gloss Level 6), MPI #48.
- D. Gypsum Board Substrates:
1. Institutional Low-Odor/VOC Latex System:
- a. Prime Coat: Primer sealer, interior, institutional low odor/VOC, MPI #149.
 - 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.

END OF SECTION 09912

SECTION 10200 - LOUVERS AND VENTS

PART 1 - GENERAL

1.1 Summary of Work:

A. Section Includes:

1. Fixed, extruded-aluminum louvers.

B. See Division 23 Sections for louvers that are a part of mechanical equipment.

1.2 Performance Requirements:

- ##### A. 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. Product Test Reports: Based on tests performed according to AMCA 500-L.

PART 2 - PRODUCTS

2.1 Materials:

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B 209, 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, Drainable-Blade Louver:

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
- 2. Louver Depth: 4 inches.
- 3. Frame and Blade Nominal Thickness: Not less than 0.060 inch for blades and 0.080 inch for frames.
- 4. Louver Performance Ratings:
 - a. As indicated on Drawings
- 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, $\frac{1}{2}$ inch square mesh, 0.063-inch wire.

2.5 Aluminum Finishes:

- A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
 - 1. Color: Medium bronze

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 weathertight 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 10200

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 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.

1.2 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 NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet 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 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: Prelubricated, 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 230517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves.
2. Grout.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

2.2 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, 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 1-inch 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. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. 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 above finished floor level.
3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

3.2 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: Galvanized-steel-pipe sleeves.

END OF SECTION 230517

SECTION 230518 - ESCUTCHEONS FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Escutcheons.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.
- D. Split-Casting Brass Type: With polished, chrome-plated finish and with concealed hinge and setscrew.
- E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed and exposed-rivet hinge, and spring-clip 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 or split-casting brass type with polished, chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.

- d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
- e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
- f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
- g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
- h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
- i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
- j. Bare Piping in Equipment Rooms: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
- k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.

3.2 FIELD QUALITY CONTROL

- A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 230518

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. Equipment supports.

B. Related Sections:

1. Section 233113 "Metal Ducts" for duct hangers and supports.

1.2 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.3 INFORMATIONAL SUBMITTALS

- A. 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: Pregalvanized 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.

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 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.4 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, 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. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- D. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- E. 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.

- F. Install lateral bracing with pipe hangers and supports to prevent swaying.
- G. 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 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.
- H. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- I. 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.
- J. 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 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - 3. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

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.

3.5 PAINTING

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 attachments for general service applications.
- F. Use padded hangers for piping that is subject to scratching.
- G. Use thermal-hanger shield inserts for insulated piping and tubing.
- H. 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.
- I. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
- J. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 4. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 5. C-Clamps (MSS Type 23): For structural shapes.
 6. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 7. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 8. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 9. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 10. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 11. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 12. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- K. 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.
- L. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- M. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- N. Use powder-actuated fasteners instead of building attachments where required in concrete construction.

END OF SECTION 230529

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Brimar Industries, Inc.
 - c. Carlton Industries, LP.
 - d. Champion America.
 - e. Craftmark Pipe Markers.
 - f. emedco.
 - g. Kolbi Pipe Marker Co.
 - h. LEM Products Inc.
 - i. Marking Services, Inc.
 - j. Seton Identification Products.
2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
3. Letter Color: Black.
4. Background Color: White.
5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
7. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
8. Fasteners: Stainless-steel rivets or self-tapping screws.
9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

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 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

END OF SECTION 230553

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Balancing Air Systems:
 - a. Constant-volume air 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 ACTION SUBMITTALS

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
- C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- D. Certified TAB reports.
- E. Sample report forms.
- F. Instrument calibration reports, to include the following:
 - 1. Instrument type and make.

2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.5 QUALITY ASSURANCE

- A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC NEBB or TABB.
 1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC NEBB or TABB.
 2. TAB Technician: Employee of the TAB contractor and who is certified by AABC 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.
- D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."
- E. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- F. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.6 PROJECT CONDITIONS

- A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

- A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- B. Perform TAB after leakage and pressure tests on air distribution systems have been satisfactorily completed.

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 and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Section 233113 "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 operating safety interlocks and controls on HVAC equipment.
- K. 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. Automatic temperature-control systems are operational.
 - 3. Equipment and duct access doors are securely closed.
 - 4. Balance, smoke, and fire dampers are open.
 - 5. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
 - 6. 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, 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. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
 - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," and Section 230719 "HVAC Piping 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 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. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

- D. 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.
- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check dampers for proper position to achieve desired airflow path.
- H. Check for airflow blockages.
- I. Check condensate drains for proper connections and functioning.
- J. Check for proper sealing of air-handling-unit components.
- K. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.5 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 HVAC 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, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
1. Measure airflow of submain and branch ducts.
 - a. Where sufficient space in submain 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. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain 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.

3.6 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.

3.7 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.

3.8 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.

3.9 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. Fan curves.
 2. Manufacturers' test data.
 3. Field test reports prepared by system and equipment installers.
 4. Other information relative to equipment performance; do not include Shop Drawings and product data.
- C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
 2. Name and address of the TAB contractor.
 3. Project name.

4. Project location.
 5. Architect's name and address.
 6. Engineer's name and address.
 7. Contractor's name and address.
 8. Report date.
 9. Signature of TAB supervisor who certifies the report.
 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 12. Nomenclature sheets for each item of equipment.
 13. Data for terminal units, including manufacturer's name, type, size, and fittings.
 14. Notes to explain why certain final data in the body of reports vary from indicated values.
 15. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Fan drive settings including settings and percentage of maximum pitch diameter.
 - e. Settings for supply-air, static-pressure controller.
 - f. Other system operating conditions that affect performance.
- D. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Sheave make, size in inches, and bore.
 - i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 - j. Number, make, and size of belts.
 - k. Number, type, and size of filters.
 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.

- d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
- 3. Test Data (Indicated and Actual Values):
 - a. Total air flow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Filter static-pressure differential in inches wg.
 - f. Preheat-coil static-pressure differential in inches wg.
 - g. Cooling-coil static-pressure differential in inches wg.
 - h. Heating-coil static-pressure differential in inches wg.
 - i. Outdoor airflow in cfm.
 - j. Return airflow in cfm.
 - k. Outdoor-air damper position.
 - l. Return-air damper position.
 - m. Vortex damper position.
- E. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
 - 1. Report Data:
 - a. System and air-handling-unit number.
 - b. Location and zone.
 - c. Traverse air temperature in deg F.
 - d. Duct static pressure in inches wg.
 - e. Duct size in inches.
 - f. Duct area in sq. ft..
 - g. Indicated air flow rate in cfm.
 - h. Indicated velocity in fpm.
 - i. Actual air flow rate in cfm.
 - j. Actual average velocity in fpm.
 - k. Barometric pressure in psig.
- F. Air-Terminal-Device Reports:
 - 1. Unit Data:
 - a. System and air-handling unit identification.
 - b. Location and zone.
 - c. Apparatus used for test.
 - d. Area served.
 - e. Make.
 - f. Number from system diagram.
 - g. Type and model number.
 - h. Size.
 - i. Effective area in sq. ft..

2. Test Data (Indicated and Actual Values):

- a. Air flow rate in cfm.
- b. Air velocity in fpm.
- c. Preliminary air flow rate as needed in cfm.
- d. Preliminary velocity as needed in fpm.
- e. Final air flow rate in cfm.
- f. Final velocity in fpm.
- g. Space temperature in deg F.

3.10 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:
 - a. Measure airflow of air outlets.
 - b. Measure water flow of terminals.
 - c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
 - d. Verify that balancing devices are marked with final balance position.
 - e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
2. Architect shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
3. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
4. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract

Documents and deduct the cost of the services from the original TAB contractor's final payment.

- D. Prepare test and inspection reports.

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.
- B. Related Sections:
 - 1. Section 230719 "HVAC Piping Insulation."
 - 2. Section 233113 "Metal Ducts" for duct liners.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. 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.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.5 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.6 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," on plans.
- 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 III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in 2.5 "Factory-Applied Jackets".
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Knauf Insulation.
 - d. Manson Insulation Inc.
 - e. Owens Corning.

2.2 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. Mon-Eco Industries, Inc.
 - 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. 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."
- 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. Mon-Eco Industries, Inc.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. 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."

2.3 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. 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. Foster Brand; H. B. Fuller Construction Products.
 - b. Vimasco Corporation.
2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

2.4 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. Mon-Eco Industries, Inc.
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.
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants 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."

2.5 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. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.6 TAPES

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division.
 - b. Compac Corporation.
 - c. Ideal Tape Co., Inc.; an American Biltrite company.
 - d. Venture Tape.
2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.7 SECUREMENTS

A. 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. 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) AGM Industries, Inc.
 - 2) Gemco.
 - 3) Midwest Fasteners, Inc.
 - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch- 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-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) AGM Industries, Inc.
 - 2) Gemco.
 - 3) Hardcast, Inc.

- 4) Midwest Fasteners, Inc.
- 5) Nelson Stud Welding.

- b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 - 1. Verify that systems to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 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- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches 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 beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 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.
 4. Seal jacket to wall flashing with flashing sealant.

3.5 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 100 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 and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches 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 overcompress 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 from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch 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 at 18-foot 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.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. 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.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.6 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. See schedule on plans.

B. Items Not Insulated:

1. See schedule on plans.

END OF SECTION 230713

SECTION 230719 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes insulating the following HVAC piping systems:
 - 1. Condensate drain piping, indoors.
 - 2. Refrigerant suction and hot-gas piping, indoors and outdoors.
- B. Related Sections:
 - 1. Section 230713 "Duct Insulation."

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting 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.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.5 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.6 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. See schedule on plans.
- 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. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Aeroflex USA, Inc.
 - b. Armacell LLC.
 - c. K-Flex USA.

2.2 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. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Aeroflex USA, Inc.
 - b. Armacell LLC.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. K-Flex USA.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. 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."

2.3 SEALANTS

- A. Joint Sealants:
 - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 2. Permanently flexible, elastomeric sealant.
 - 3. Service Temperature Range: Minus 100 to plus 300 deg F.
 - 4. Color: White or gray.
 - 5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 6. Sealants 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."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 - 1. Verify that systems to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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.

3.3 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. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- L. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- M. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

N. 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. Manholes.
5. Handholes.
6. Cleanouts.

3.4 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.
4. Seal jacket to wall flashing with flashing sealant.

3.5 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 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.
5. 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.
6. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

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 PIPING INSULATION SCHEDULE, GENERAL

- A. See schedule on plans.

END OF SECTION 230719

SECTION 232113 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes pipe and fitting materials and joining methods for the following:
 - 1. Condensate-drain piping.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:
 - 1. Condensate-Drain Piping: 150 deg F.

2.2 PLASTIC PIPE AND FITTINGS

- A. PVC Plastic Pipe: ASTM D 1785, with wall thickness as indicated in "Piping Applications" Article.
 - 1. PVC Plastic Pipe Fittings: Socket-type pipe fittings, ASTM D 2466 for Schedule 40 pipe; ASTM D 2467 for Schedule 80 pipe.

2.3 JOINING MATERIALS

- A. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.
- B. Solvent Cements for Joining Plastic Piping:
 - 1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - a. PVC solvent cement shall have a VOC content of 510 g/L or less.
 - b. Adhesive primer shall have a VOC content of 550 g/L or less.
 - c. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

- C. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

2.4 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Charlotte Pipe and Foundry Company.
 - b. IPEX USA LLC.
 - c. KBI (King Bros. Industries).
2. One-piece fitting with one threaded brass or copper insert and one solvent-cement-joint end of material and wall thickness to match plastic pipe material.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Condensate-Drain Piping: Schedule 40 PVC plastic pipe and fittings and solvent-welded joints.

3.2 PIPING INSTALLATIONS

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. 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 piping to allow application of insulation.

- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- K. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for identifying piping.
- L. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- M. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- N. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.3 HANGERS AND SUPPORTS

- A. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hanger, support, and anchor devices. Comply with the following requirements for maximum spacing of supports.
- B. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
 - 2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
 - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet 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.
- C. Plastic Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.
- D. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.4 PIPE 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 pipe and fittings before assembly.
- C. Plastic Piping Solvent-Cemented 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. PVC Pressure Piping: Join ASTM D 1785 schedule number, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule number PVC pipe and socket fittings according to ASTM D 2855.
 - 3. PVC Nonpressure Piping: Join according to ASTM D 2855.

END OF SECTION 232113

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Sealants and gaskets.
5. Hangers and supports.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.

1.3 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 SINGLE-WALL 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 SINGLE-WALL 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.
- 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."
- 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."
- 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.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Factory- or Shop-Applied Antimicrobial Coating:

1. Apply to the surface of sheet metal that will form the interior surface of the duct. An untreated clear coating shall be applied to the exterior surface.
2. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
3. Coating containing the antimicrobial compound shall have a hardness of 2H, minimum, when tested according to ASTM D 3363.
4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
5. Shop-Applied Coating Color: Black.
6. Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.

D. 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.

E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

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: 3 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.

8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. For indoor applications, sealant shall have 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, 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. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Base: Synthetic rubber resin.
3. Solvent: Toluene and heptane.
4. Solids Content: Minimum 60 percent.
5. Shore A Hardness: Minimum 60.
6. Water resistant.
7. Mold and mildew resistant.
8. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
9. VOC: Maximum 395 g/L.
10. 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."
11. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
12. Service: Indoor or outdoor.
13. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

E. 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, sealant shall have 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."
- F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- G. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg 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: Electrogalvanized, 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, "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.

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, 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.
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "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. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- D. 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."
 - 2. See schedule on plans.

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 thick.
 - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches 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, "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 of each elbow and within 48 inches 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 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Leakage Tests:
 - 1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
 - 2. Test the following systems:
 - a. Supply Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections totaling no less than 100 percent of total installed duct area for each designated pressure class.
 - b. Return Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections totaling no less than 100 percent of total installed duct area for each designated pressure class.
 - c. Exhaust Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections totaling no less than 100 percent of total installed duct area for each designated pressure class.
 - d. Outdoor Air Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections totaling no less than 100 percent of total installed duct area for each designated pressure class.
 - 3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
 - 4. Test for leaks before applying external insulation.
 - 5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
 - 6. Give seven days' advance notice for testing.
- C. Duct System Cleanliness Tests:
 - 1. Visually inspect duct system to ensure that no visible contaminants are present.
 - 2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
 - a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

- D. Duct system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.7 DUCT CLEANING

- A. Clean new duct system(s) before testing, adjusting, and balancing.
- B. Use service openings for entry and inspection.
 - 1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
 - 2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
 - 3. Remove and reinstall ceiling to gain access during the cleaning process.
- C. Particulate Collection and Odor Control:
 - 1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
 - 2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.
- D. Clean the following components by removing surface contaminants and deposits:
 - 1. Air outlets and inlets (registers, grilles, and diffusers).
 - 2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
 - 3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
 - 4. Coils and related components.
 - 5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
 - 6. Supply-air ducts, dampers, actuators, and turning vanes.
 - 7. Dedicated exhaust and ventilation components and makeup air systems.

3.8 START UP

- A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.9 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel.
- B. Supply Ducts:
 - 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
 - 2. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
- C. Return Ducts:
 - 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - 2. Ducts Connected to Energy Recovery Ventilator:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 12.
- D. Exhaust Ducts:
 - 1. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - 2. Ducts Connected to Energy Recovery Ventilator:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 24.
- E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Energy Recovery Ventilator:

- a. Pressure Class: Positive or negative 2-inch wg.
- b. Minimum SMACNA Seal Class: A.
- c. SMACNA Leakage Class for Rectangular: 24.

F. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.

G. 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 or Lower:

- 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
- 2) Mitered Type RE 4 without vanes.

b. Velocity 1000 to 1500 fpm:

- 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
- 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
- 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

c. Velocity 1500 fpm or Higher:

- 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
- 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
- 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

- a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
- b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
- c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
 - 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
 - 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
 - 4) Radius-to Diameter Ratio: 1.5.
 - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
 - c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

H. 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 and Flat Oval: 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 or Lower: 90-degree tap.
 - b. Velocity 1000 to 1500 fpm: Conical tap.
 - c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 233113

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manual volume dampers.
2. Flange connectors.
3. Turning vanes.
4. Duct-mounted access doors.
5. Flexible connectors.
6. Flexible ducts.
7. Duct accessory hardware.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. 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.

2.2 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60.
 2. Exposed-Surface Finish: Mill phosphatized.
- B. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- C. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Warming and Ventilating; a Mestek Architectural Group company.
 - b. Flexmaster U.S.A., Inc.
 - c. Flex-Tek Group.
 - d. McGill AirFlow LLC.
 - e. Nailor Industries Inc.
 - f. Ruskin Company.
2. Standard leakage rating, with linkage outside airstream.
3. Suitable for horizontal or vertical applications.
4. Frames:
 - a. Frame: Hat-shaped, 0.094-inch- thick, galvanized sheet steel.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized-steel, 0.064 inch thick.
6. Blade Axles: Galvanized steel.
7. Bearings:
 - a. Oil-impregnated bronze.
 - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
8. Tie Bars and Brackets: Galvanized steel.

2.4 FLANGE CONNECTORS

- A. If permitted by authorities having jurisdiction, flange connectors can substitute for slip-and-drive connections for smoke and combination fire and smoke dampers.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Hardcast, Inc.
 - 3. Nexus PDQ.
 - 4. Ward Industries, Inc.
- C. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- D. Material: Galvanized steel.
- E. Gage and Shape: Match connecting ductwork.

2.5 TURNING VANES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Aero-Dyne Sound Control Co.
 - 2. Ductmate Industries, Inc.
 - 3. Duro Dyne Inc.
 - 4. Elgen Manufacturing.
 - 5. Hardcast, Inc.
 - 6. METALAIRE, Inc.
 - 7. SEMCO Incorporated.
 - 8. Ward Industries, Inc.
- B. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."
- C. Vane Construction: Single wall.
- D. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.6 DUCT-MOUNTED ACCESS DOORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Warming and Ventilating; a Mestek Architectural Group company.
 - 2. Cesco Products; a division of MESTEK, Inc.

3. Ductmate Industries, Inc.
 4. Elgen Manufacturing.
 5. Flexmaster U.S.A., Inc.
 6. Greenheck Fan Corporation.
 7. McGill AirFlow LLC.
 8. Nailor Industries Inc.
 9. Pottorff.
 10. Ventfabrics, Inc.
 11. Ward Industries, Inc.
- B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."
1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Vision panel.
 - d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
 - e. Fabricate doors airtight and suitable for duct pressure class.
 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
 3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
 - c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches.

2.7 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ductmate Industries, Inc.
 2. Duro Dyne Inc.
 3. Elgen Manufacturing.
 4. Hardcast, Inc.
 5. Ventfabrics, Inc.
 6. Ward Industries, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.

- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 26 oz./sq. yd..
 - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - 3. Service Temperature: Minus 40 to plus 200 deg F.
- F. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.
 - 1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
 - 2. Outdoor 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.
 - 7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

2.8 FLEXIBLE DUCTS

- A. UL 181 defines two categories of flexible ducts. Ducts listed according to UL 181 must pass all UL 181 tests. Air connectors listed according to UL 181 must pass most, but not all, UL 181 tests and are limited to lengths of 6 feet or less.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Flexmaster U.S.A., Inc.
 - 2. Flex-Tek Group.
 - 3. McGill AirFlow LLC.
 - 4. Ward Industries, Inc.
- C. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.
 - 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 - 2. Maximum Air Velocity: 4000 fpm.
 - 3. Temperature Range: Minus 10 to plus 160 deg F.
 - 4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.
- D. Flexible Duct Connectors:
 - 1. Clamps: Nylon strap in sizes 3 through 18 inches, to suit duct size.

2.9 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 - 1. Install steel volume dampers in steel ducts.
- D. Set dampers to fully open position before testing, adjusting, and balancing.
- E. Install test holes at fan inlets and outlets and elsewhere as indicated.
- F. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. On both sides of duct coils.
 - 2. Upstream from duct filters.
 - 3. At outdoor-air intakes and mixed-air plenums.
 - 4. At drain pans and seals.
 - 5. Elsewhere as indicated.
- G. Install access doors with swing against duct static pressure.
- H. Access Door Sizes:
 - 1. One-Hand or Inspection Access: 8 by 5 inches.
 - 2. Two-Hand Access: 12 by 6 inches.
 - 3. Head and Hand Access: 18 by 10 inches.
 - 4. Head and Shoulders Access: 21 by 14 inches.
 - 5. Body Access: 25 by 14 inches.

6. Body plus Ladder Access: 25 by 17 inches.

- I. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- J. Install flexible connectors to connect ducts to equipment.
- K. Connect terminal units to supply ducts directly or with maximum 6-inch lengths of flexible duct. Do not use flexible ducts to change directions.
- L. Connect diffusers or light troffer boots to ducts directly or with maximum 72-inch lengths of flexible duct clamped or strapped in place.
- M. Connect flexible ducts to metal ducts with draw bands.
- N. Install duct test holes where required for testing and balancing purposes.
- O. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Operate dampers to verify full range of movement.
 - 2. Inspect locations of access doors and verify that purpose of access door can be performed.
 - 3. Inspect turning vanes for proper and secure installation.

END OF SECTION 233300

SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rectangular and square ceiling diffusers.
2. Adjustable bar grilles.
3. Fixed face grilles.

B. Related Sections:

1. Section 10200 "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
2. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS

A. Rectangular and Square Ceiling Diffusers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Krueger.
 - b. Price Industries.
 - c. Titus.
 - d. Tuttle & Bailey.
2. Material: Steel.
3. Finish: Baked enamel, white.
4. Face Size: 24 by 24 inches.

5. Face Style: Three cone.
6. Mounting: T-bar.
7. Pattern: Fixed.
8. Accessories:
 - a. Equalizing grid.
 - b. Plaster ring.
 - c. Safety chain.
 - d. Wire guard.
 - e. Sectorizing baffles.
 - f. Operating rod extension.

2.2 REGISTERS AND GRILLES

A. Fixed Face Grille:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Krueger.
 - b. Price Industries.
 - c. Titus.
 - d. Tuttle & Bailey.
2. Material: Steel.
3. Finish: Baked enamel, white.
4. Face Arrangement: 1/2-by-1/2-by-1/2-inch grid core.
5. Core Construction: Integral.
6. Frame: 1 inch wide.
7. Mounting: Lay in.

B. Adjustable Bar Grille:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Krueger.
 - b. Price Industries.
 - c. Titus.
 - d. Tuttle & Bailey.
2. Material: Steel.
3. Finish: Baked enamel, white.
4. Face Blade Arrangement: Horizontal spaced 1/2 inch apart.
5. Core Construction: Removable.
6. Rear-Blade Arrangement: Vertical spaced 1/2 inch apart.
7. Frame: 1 inch wide.
8. Mounting: Countersunk screw.

2.3 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

SECTION 237200 - AIR-TO-AIR ENERGY RECOVERY EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Heat wheels.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air-to-air energy recovery equipment to include in maintenance manuals.

1.4 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. ARI Compliance:
 1. Capacity ratings for air-to-air energy recovery equipment shall comply with ARI 1060, "Performance Rating of Air-to-Air Heat Exchangers for Energy Recovery Ventilation Equipment."
 2. Capacity ratings for air coils shall comply with ARI 410, "Forced-Circulation Air-Cooling and Air-Heating Coils."
- C. ASHRAE Compliance:
 1. Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
 2. Capacity ratings for air-to-air energy recovery equipment shall comply with ASHRAE 84, "Method of Testing Air-to-Air Heat Exchangers."
- D. NRCA Compliance: Roof curbs for roof-mounted equipment shall be constructed according to recommendations of NRCA.
- E. UL Compliance:

1. Packaged heat recovery ventilators shall comply with requirements in UL 1812, "Ducted Heat Recovery Ventilators"; or UL 1815, "Nonducted Heat Recovery Ventilators."
2. Electric coils shall comply with requirements in UL 1995, "Heating and Cooling Equipment."

1.5 COORDINATION

- A. Coordinate layout and installation of air-to-air energy recovery equipment and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided.
- C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of air-to-air energy recovery equipment that fail in materials or workmanship within specified warranty period.
 1. Warranty Period for Packaged Energy Recovery Units: Two years.

PART 2 - PRODUCTS

2.1 HEAT WHEELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Loren Cook Company.
 2. Greeheck.
 3. Trane.
- B. Casing:
 1. Steel with standard factory-painted finish.
 2. Integral purge section limiting carryover of exhaust air to between 0.05 percent at 1.6-inch wg and 0.20 percent at 4-inch wg differential pressure.
 3. Casing seals on periphery of rotor and on duct divider and purge section.
 4. Support vertical rotors on grease-lubricated ball bearings having extended grease fittings or permanently lubricated bearings. Support horizontal rotors on tapered roller bearing.

- C. Rotor: Aluminum segmented wheel strengthened with radial spokes, with nontoxic, noncorrosive, silica-gel desiccant coating.
 - 1. Maximum Solid Size for Media to Pass: 800 micrometer.
- D. Rotor: Polymer segmented wheel strengthened with radial spokes impregnated with nonmigrating, water-selective, molecular-sieve desiccant coating.
 - 1. Maximum Solid Size for Media to Pass: 800 micrometer.
- E. Drive: Fractional horsepower motor and gear reducer and self-adjusting multilink belt around outside of rotor.
 - 1. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - 2. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
- F. Controls:
 - 1. Starting relay, factory mounted and wired, and manual motor starter for field wiring.
- G. Disposable Panel Filters:
 - 1. Comply with NFPA 90A.
 - 2. 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 lift out from access plenum.
 - 3. Factory-fabricated, viscous-coated, flat-panel type.
 - 4. Thickness: 1 inch.
 - 5. Minimum Arrestance: 80, according to ASHRAE 52.1.
 - 6. MERV: 5, according to ASHRAE 52.2.
 - 7. Media: Interlaced glass fibers sprayed with nonflammable adhesive and antimicrobial agent.
 - 8. Frame: Galvanized steel with metal grid on outlet side, steel rod grid on inlet side, hinged, and with pull and retaining handles.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine casing insulation materials and filter media before air-to-air energy recovery equipment installation. Reject insulation materials and filter media that are wet, moisture damaged, or mold damaged.

- C. Examine roughing-in for electrical services to verify actual locations of connections before installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install heat wheels so supply and exhaust airstreams flow in opposite directions and rotation is away from exhaust side to purge section to supply side.
 - 1. Install access doors in both supply and exhaust ducts, both upstream and downstream, for access to wheel surfaces, drive motor, and seals.
 - 2. Install removable panels or access doors between supply and exhaust ducts on building side for bypass during startup.
 - 3. Access doors and panels are specified in Section 233300 "Air Duct Accessories."
- B. Unit Support: Install unit level and plumb. Coordinate wall penetrations and flashing with wall construction. Secure air-to-air energy recovery equipment to structural support with anchor bolts.
- C. Install wind and seismic restraints according to manufacturers' written instructions.
- D. Suspended Units: Suspend and brace units from structural-steel support frame using threaded steel rods and spring hangers.
- E. Install units with clearances for service and maintenance.
- F. Install new filters at completion of equipment installation and before testing, adjusting, and balancing.

3.3 CONNECTIONS

- A. Comply with requirements for ductwork specified in Section 233113 "Metal Ducts."
- B. Install electrical devices furnished with units but not factory mounted.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 2. Adjust seals and purge.
 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 4. Set initial temperature and humidity set points.
 5. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- D. Air-to-air energy recovery equipment will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

END OF SECTION 237200

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SECTION 238126 - SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

1.4 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. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, 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.

1.5 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases.
- B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.6 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: One year(s) from date of Substantial Completion.
- b. For Parts: One year(s) from date of Substantial Completion.
- c. For Labor: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carrier Corporation; a unit of United Technologies Corp.
2. Lennox Industries, Inc.; Lennox International.
3. Mitsubishi Electric & Electronics USA, Inc.
4. SANYO North America Corporation.
5. Trane.
6. YORK; a Johnson Controls company.

2.2 INDOOR UNITS (5 TONS 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 206/110.
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: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.
6. Fan Motors:
 - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - b. Multitapped, multispeed with internal thermal protection and permanent lubrication.

- c. Wiring Terminations: Connect motor to chassis wiring with plug connection.
- 7. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- 8. Filters: Permanent, cleanable.
- 9. Condensate Drain Pans:
 - a. Fabricated with one 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.
 - 2) Depth: A minimum of 2 inches deep.
 - b. Single-wall, galvanized-steel sheet.
 - 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 3/4.
 - d. Pan-Top Surface Coating: Asphaltic waterproofing compound.
 - e. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

2.3 OUTDOOR UNITS (5 TONS 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-410A.
 - d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.
- 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. Mounting Base: Polyethylene.

2.4 ACCESSORIES

- A. Combined Thermostat and Humidistat: Low voltage with subbase to control compressor and evaporator fan.
- B. Combined Thermostat and Humidistat: 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.
 5. Humidity control to integrate with heat pump controller to reduce fan speed to increase latent performance and reduce indoor air humidity.
- C. Automatic-reset timer to prevent rapid cycling of compressor.
- D. 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.
- E. Drain Hose: For condensate.
- F. Additional Monitoring:
 1. Monitor cooling load.
 2. Monitor air distribution static pressure and ventilation air volumes.

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. Equipment Mounting:
 1. Install ground-mounted, compressor-condenser components on cast-in-place concrete equipment base(s).
 2. Install ground-mounted, compressor-condenser components on polyethylene mounting base.
- D. Install and connect pre-charged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

- A. Duct Connections: Duct installation requirements are specified in Section 233113 "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Section 233300 "Air Duct Accessories."

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. 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.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Prepare test and inspection reports.

3.4 STARTUP SERVICE

- A. Perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.

3.5 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 238126

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Grounding systems and equipment.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.3 INFORMATIONAL SUBMITTALS

- A. Informational Submittals: Plans showing dimensioned as-built locations of grounding features - including the following:
 - 1. Ground rods.
- B. Qualification Data: For qualified testing agency and testing agency's field supervisor.
- C. Field quality-control reports.

1.4 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. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
 - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.2 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Bus-bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.3 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet in diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.
 - 1. Bury at least 24 inches below grade.
- C. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Connections to Ground Rods: Bolted connectors.
 - 3. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.
 - 3. Receptacle circuits.
 - 4. Single-phase motor and appliance branch circuits.
 - 5. Three-phase motor and appliance branch circuits.
 - 6. Flexible raceway runs.
 - 7. Armored and metal-clad cable runs.
- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
 - 2. For grounding electrode system, install at least two rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- D. Grounding and Bonding for Piping:
 - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Hangers and supports for electrical equipment and systems.

1.2 DEFINITIONS

- A. EMT: Electrical metallic tubing.

1.3 PERFORMANCE REQUIREMENTS

- A. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- B. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel slotted support systems.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze hangers. Include Product Data for components.
 - 2. Steel slotted channel systems. Include Product Data for components.
 - 3. Equipment supports.

1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 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. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut; Tyco International, Ltd.
 - g. Wesanco, Inc.
 - 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 3. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - 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) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti Inc.
 - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
 - 2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.

3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
5. Toggle Bolts: All-steel springhead type.
6. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 1. To Wood: Fasten with lag screws or through bolts.
 2. To New Concrete: Bolt to concrete inserts.
 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 4. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
 5. To Light Steel: Sheet metal screws.

6. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

END OF SECTION 260529

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.2 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. ENT: Electrical nonmetallic tubing.
- C. FMC: Flexible metal conduit.
- D. LFMC: Liquidtight flexible metal conduit.

1.3 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Structural members in the paths of conduit groups with common supports.
 - 2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.
- C. Qualification Data: For professional engineer and testing agency.
- D. Source quality-control test reports.

1.4 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. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- 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. AFC Cable Systems, Inc.
 2. Alflec Inc.
 3. Allied Tube & Conduit; a Tyco International Ltd. Co.
 4. Anamet Electrical, Inc.; Anaconda Metal Hose.
 5. Electri-Flex Co.
 6. Manhattan/CDT/Cole-Flex.
 7. Maverick Tube Corporation.
 8. O-Z Gedney; a unit of General Signal.
 9. Wheatland Tube Company.
- B. EMT: ANSI C80.3.
- C. LFMC: Flexible steel conduit with PVC jacket.
- D. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
 2. Fittings for EMT: Steel compression set-screw or compression type.

2.2 NONMETALLIC CONDUIT AND TUBING

- 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. AFC Cable Systems, Inc.
 2. Anamet Electrical, Inc.; Anaconda Metal Hose.
 3. Arnco Corporation.
 4. CANTEX Inc.
 5. CertainTeed Corp.; Pipe & Plastics Group.
 6. Condux International, Inc.
 7. ElecSYS, Inc.
 8. Electri-Flex Co.
 9. Lamson & Sessions; Carlon Electrical Products.
 10. Manhattan/CDT/Cole-Flex.
 11. RACO; a Hubbell Company.
 12. Thomas & Betts Corporation.
- B. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.

- C. LFNC: UL 1660.
- D. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.
- E. Fittings for LFNC: UL 514B.

2.3 BOXES, ENCLOSURES, AND CABINETS

- 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. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
 - 2. EGS/Appleton Electric.
 - 3. Erickson Electrical Equipment Company.
 - 4. Hoffman.
 - 5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
 - 6. O-Z/Gedney; a unit of General Signal.
 - 7. RACO; a Hubbell Company.
 - 8. Robroy Industries, Inc.; Enclosure Division.
 - 9. Scott Fetzer Co.; Adalet Division.
 - 10. Spring City Electrical Manufacturing Company.
 - 11. Thomas & Betts Corporation.
 - 12. Walker Systems, Inc.; Wiremold Company (The).
 - 13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
- B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, [ferrous alloy] [aluminum], Type FD, with gasketed cover.
- D. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
 - 1. Exposed Conduit: RNC, Type EPC-80-PVC.
 - 2. Concealed Conduit, Aboveground: [RNC, Type EPC-40-PVC.
 - 3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
 - 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 - 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

- B. Minimum Raceway Size: 3/4-inch trade size.
- C. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- D. Do not install aluminum conduits in contact with concrete.

3.2 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- E. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- F. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 1. Use LFMC in damp or wet locations subject to severe physical damage.
 - 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

3.3 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 262416 -PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Lighting and appliance branch-circuit panelboards.

1.2 DEFINITIONS

- A. TVSS: Transient voltage surge suppressor.

1.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.4 SUBMITTALS

- A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

- B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Include evidence of NRTL listing for series rating of installed devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.
8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

- C. Qualification Data: For qualified testing agency.

- D. Seismic Qualification Certificates: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces. Include the following:
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- E. Field Quality-Control Reports:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- F. Panelboard Schedules: For installation in panelboards.
- G. Operation and Maintenance Data: For panelboards and components include the following:
 - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 - 2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- D. 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.
- E. Comply with NEMA PB 1.
- F. Comply with NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
- B. Handle and prepare panelboards for installation according to NECA 407.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations:
 - 1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry.
 - 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding minus 22 deg F to plus 104 deg F.
 - b. Altitude: Not exceeding 6600 feet.
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
 - 1. Ambient temperatures within limits specified.
 - 2. Altitude not exceeding 6600 feet.

1.8 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

1.10 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Keys: Two spares for each type of panelboard cabinet lock.
 - 2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two spares for each panelboard.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Enclosures: Surface-mounted cabinets.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
 - 3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
 - 4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
 - 5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
 - 6. Finishes:
 - a. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - b. Back Boxes: Galvanized steel.
 - c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.
 - 7. Directory Card: Inside panelboard door, mounted in transparent card holder.
- B. Incoming Mains Location: Top.
- C. Phase, Neutral, and Ground Buses:
 - 1. Material: [Hard-drawn copper, 98 percent conductivity.
 - 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
 - 3. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
- D. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Main and Neutral Lugs: Mechanical type.
 - 3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
- E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

- F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- G. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, listed and labeled for series-connected short-circuit rating by an NRTL.
- H. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- 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 on Drawings or comparable product by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- C. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- D. Mains: Circuit breaker.
- E. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- F. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- 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 on Drawings or comparable product by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.

2.4 PANELBOARD SUPPRESSORS

- 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 on Drawings or comparable product by one of the following:
 - 1. Current Technology; a subsidiary of Danahar Corporation.
 - 2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 4. Liebert Corporation.
 - 5. Siemens Energy & Automation, Inc.
 - 6. Square D; a brand of Schneider Electric.
- C. Surge Protection Device: IEEE C62.41-compliant, integrally mounted, wired-in, solid-state, parallel-connected, modular (with field-replaceable modules) type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the panelboard short-circuit rating, and with the following features and accessories:
 - 1. Accessories:
 - a. Fuses rated at 200-kA interrupting capacity.
 - b. Fabrication using bolted compression lugs for internal wiring.
 - c. Integral disconnect switch.
 - d. Redundant suppression circuits.
 - e. Redundant replaceable modules.
 - f. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
 - g. LED indicator lights for power and protection status.
 - h. Audible alarm, with silencing switch, to indicate when protection has failed.
 - i. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of system operation. Contacts shall reverse position on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
 - j. Four-digit, transient-event counter set to totalize transient surges.
 - 2. Peak Single-Impulse Surge Current Rating: 120 kA per mode/240 kA per phase.
 - 3. Minimum single-impulse current ratings, using 8-by-20-mic.sec. waveform described in IEEE C62.41.2.
 - a. Line to Neutral: 70,000 A.
 - b. Line to Ground: 70,000 A.
 - c. Neutral to Ground: 50,000 A.
 - 4. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.

5. Protection modes and UL 1449 SVR for 240/120-V, three-phase, four-wire circuits with high leg shall be as follows:
 - a. Line to Neutral: 400 V, 800 V from high leg.
 - b. Line to Ground: 400 V.
 - c. Neutral to Ground: 400 V.

2.5 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Receive, inspect, handle, and store panelboards according to NECA 407.
- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install panelboards and accessories according to NECA 407.
- B. Mount top of trim 90 inches above finished floor unless otherwise indicated.
- C. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- D. Install overcurrent protective devices and controllers not already factory installed.
 1. Set field-adjustable, circuit-breaker trip ranges.
- E. Install filler plates in unused spaces.
- F. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- E. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 3. Perform the following infrared scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
 - c. Instruments and Equipment:
 - 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
- F. Panelboards will be considered defective if they do not pass tests and inspections.

- G. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

- A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Twist-locking receptacles.
 - 3. Snap switches and wall-box dimmers.
 - 4. Wall-switch and exterior occupancy sensors.

1.2 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- C. TVSS: Transient voltage surge suppressor.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 3. Leviton Mfg. Company Inc. (Leviton).
 4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; 5351 (single), 5352 (duplex).
 - b. Hubbell; HBL5351 (single), CR5352 (duplex).
 - c. Leviton; 5891 (single), 5352 (duplex).
 - d. Pass & Seymour; 5381 (single), 5352 (duplex).

2.3 GFCI RECEPTACLES

- A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; GF20.
 - b. Pass & Seymour; 2084.

2.4 TWIST-LOCKING RECEPTACLES

- A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; L520R.

- b. Hubbell; HBL2310.
- c. Leviton; 2310.
- d. Pass & Seymour; L520-R.

2.5 SNAP SWITCHES

- A. Comply with NEMA WD 1 and UL 20.
- B. Switches, 120/277 V, 20 A:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
 - b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
 - c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
 - d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

2.6 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Unfinished Spaces: Galvanized steel.
 - 3. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.

2.7 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color.
 - 1. Wiring Devices Connected to Normal Power System: Ivory, unless otherwise indicated or required by NFPA 70 or device listing.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailing existing conductors is permitted provided the outlet box is large enough.
5. Wire sizes #12 and #10 AWG shall be solid. Larger sizes may be stranded.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

3.2 FIELD QUALITY CONTROL

A. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION 262726

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nonfusible switches.
2. Enclosures.

1.2 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.4 SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
 1. Enclosure types and details for types other than NEMA 250, Type 1.
 2. Current and voltage ratings.
 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
 4. Include evidence of NRTL listing for series rating of installed devices.
 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
 6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.
- B. Qualification Data: For qualified testing agency.

- C. Seismic Qualification Certificates: For enclosed switches and circuit breakers, 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. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Field quality-control reports.
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- E. Manufacturer's field service report.
- F. Operation and Maintenance Data: Enclosed switches and circuit breakers are to be included in emergency, operation, and maintenance manuals.
 - 1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
 - 2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- D. 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.
- E. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - 1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
 - 2. Altitude: Not exceeding 6600 feet.

1.7 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 NONFUSIBLE SWITCHES

- 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 on Drawings or comparable product by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- C. Type GD, General Duty, Single Throw, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- D. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.2 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
 - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 - 2. Outdoor Locations: NEMA 250, Type 3R.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- C. Comply with NECA 1.

3.3 FIELD QUALITY CONTROL

- A. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- B. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

END OF SECTION 262816

SECTION 265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Interior lighting fixtures, lamps, and ballasts.
 - 2. Emergency lighting units.
 - 3. Exit signs.
 - 4. Lighting fixture supports.

1.2 DEFINITIONS

- A. BF: Ballast factor.
- B. CRI: Color-rendering index.
- C. CU: Coefficient of utilization.
- D. HID: High-intensity discharge.
- E. LER: Luminaire efficacy rating.
- F. Luminaire: Complete lighting fixture, including ballast housing if provided.
- G. RCR: Room cavity ratio.

1.3 SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
 - 1. Physical description of lighting fixture including dimensions.
 - 2. Emergency lighting units including battery and charger.
 - 3. Ballast.
 - 4. Energy-efficiency data.
 - 5. Life, output, and energy-efficiency data for lamps.
 - 6. Photometric data, in IESNA format, based on laboratory tests of each lighting fixture type, outfitted with lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
 - a. Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program (NVLAP) for Energy Efficient Lighting Products.

- B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.
 - 1. Wiring Diagrams: Power wiring.
- C. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Lighting fixtures.
 - 2. Structural members to which suspension systems for lighting fixtures will be attached.
 - 3. Other items in finished ceiling including the following:
 - a. Duct work.
- D. Qualification Data: For agencies providing photometric data for lighting fixtures.
- E. Field quality-control test reports.
- F. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
- G. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

1.5 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.6 WARRANTY

- A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or

replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Lighting Unit Batteries: 1 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
 2. Warranty Period for Emergency Fluorescent Ballast and Self-Powered Exit Sign Batteries: 1 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.
- B. Special Warranty for Ballasts: Manufacturer's standard form in which ballast manufacturer agrees to repair or replace ballasts that fail in materials or workmanship within specified warranty period.
1. Warranty Period for Electronic Ballasts: 2 years from date of Substantial Completion.
- C. Special Warranty for T8 Fluorescent Lamps: Manufacturer's standard form, made out to Owner and signed by lamp manufacturer agreeing to replace lamps that fail in materials or workmanship, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
1. Warranty Period: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
- B. In Interior Lighting Fixture Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:
 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

- A. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
- B. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.
- C. Metal Parts: Free of burrs and sharp corners and edges.

- D. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
- E. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- F. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
 - 1. Laminated Silver Metallized Film: 90 percent.
- G. Plastic Diffusers, Covers, and Globes:
 - 1. Glass: Annealed crystal glass, unless otherwise indicated.

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

- A. Electronic Ballasts: Comply with ANSI C82.11; instant-start type, unless otherwise indicated, and designed for type and quantity of lamps served. Ballasts shall be designed for full light output unless dimmer or bi-level control is indicated.
 - 1. Sound Rating: A.
 - 2. Total Harmonic Distortion Rating: Less than 10 percent.
 - 3. Transient Voltage Protection: IEEE C62.41, Category A or better.
 - 4. Operating Frequency: 42 kHz or higher.
 - 5. Lamp Current Crest Factor: 1.7 or less.
 - 6. BF: 0.85 or higher.
 - 7. Power Factor: 0.95 or higher.
 - 8. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C 82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.

2.4 BALLASTS FOR HID LAMPS

- A. Electromagnetic Ballast for Metal-Halide Lamps: Comply with ANSI C82.4 and UL 1029. Include the following features, unless otherwise indicated:
 - 1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
 - 2. Minimum Starting Temperature: Minus 22 deg F for single-lamp ballasts.
 - 3. Normal Ambient Operating Temperature: 104 deg F.
 - 4. Open-circuit operation that will not reduce average life.
 - 5. Low-Noise Ballasts: Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise.

2.5 EXIT SIGNS

- A. Description: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
 - 1. Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life.
 - 2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 - a. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - b. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - f. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

2.6 EMERGENCY LIGHTING UNITS

- A. Description: Self-contained units complying with UL 924.
 - 1. Battery: Sealed, maintenance-free, lead-acid type.
 - 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - 3. Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - 4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - 5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

2.7 FLUORESCENT LAMPS

- A. T8 rapid-start low-mercury lamps, rated 32 W maximum, nominal length of 48 inches, 2800 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life 20,000 hours, unless otherwise indicated.

2.8 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

2.9 REQUIREMENTS FOR INDIVIDUAL LIGHTING FIXTURES

- A. Fixture Type as indicated on drawings:
 - 1. Basis-of-Design Product: See sheet E-101 Fixture Schedule or a comparable product.

PART 3 - EXECUTION

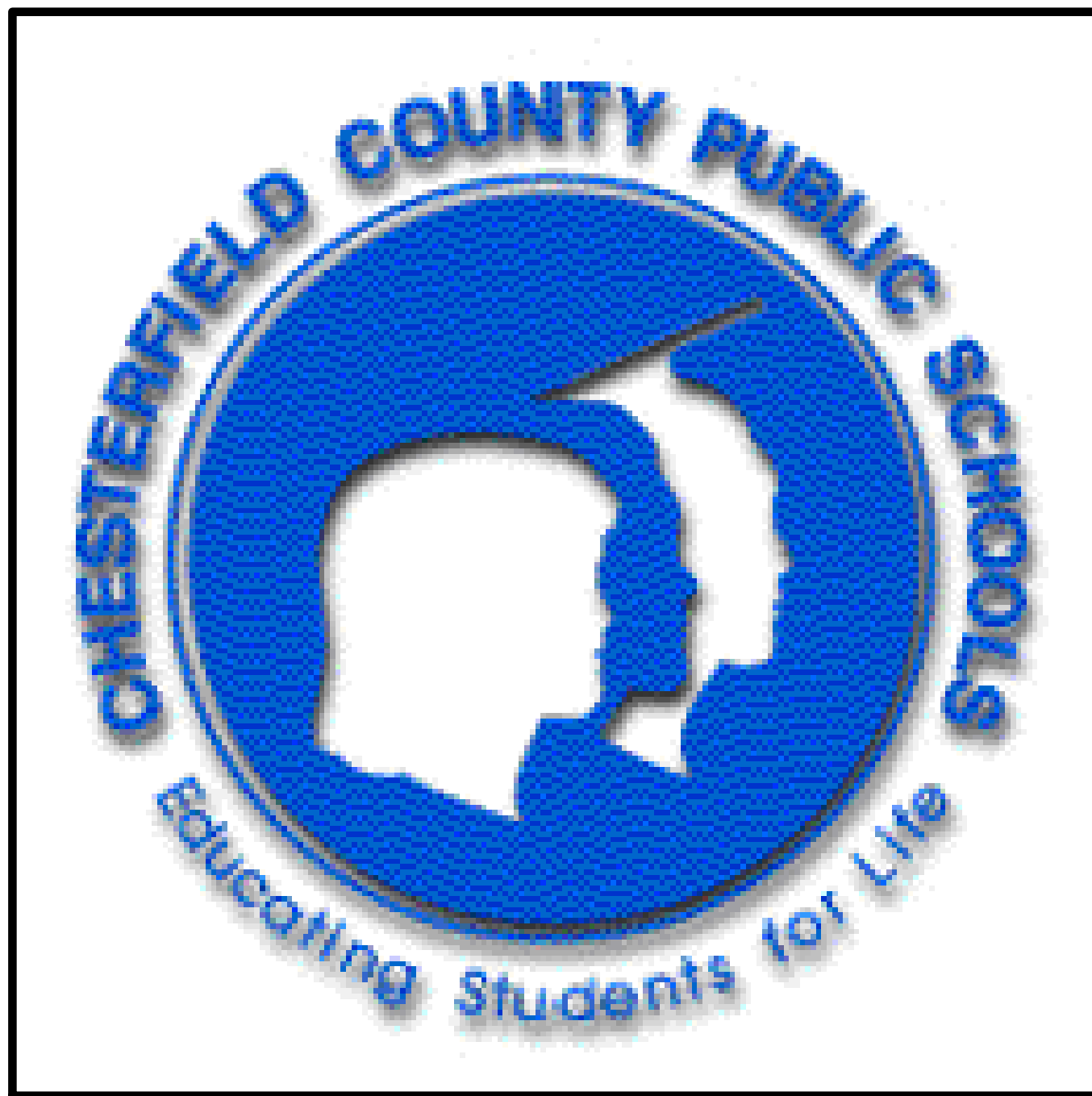
3.1 INSTALLATION

- A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.
- B. Install wire hangers on all four corners of lay-in light fixtures.

3.2 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.
- B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 265100

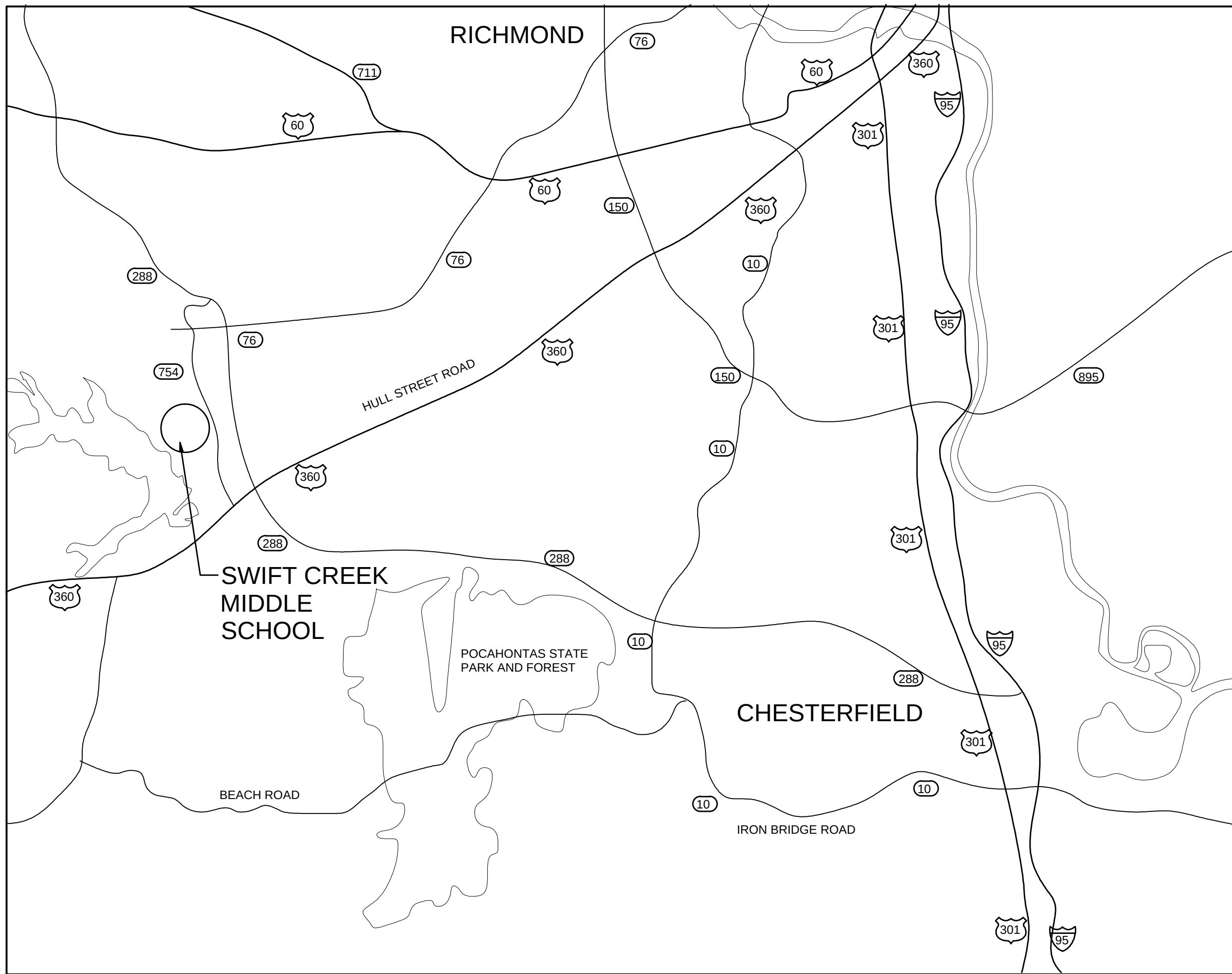


CHESTERFIELD COUNTY PUBLIC SCHOOLS

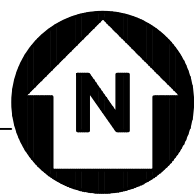
SWIFT CREEK MIDDLE SCHOOL TECH LAB

SWIFT CREEK MIDDLE SCHOOL
CHESTERFIELD COUNTY, VIRGINIA

SEPTEMBER 30, 2013



VICINITY MAP



DRAWING LIST			
DATE	REV.	SHT. NO.	SHEET TITLE
GENERAL			
09-06-2013		G-001	COVER SHEET
ARCHITECTURAL			
09-06-2013		A-001	GENERAL NOTES, ABBREVIATIONS, AND SYMBOLS
09-06-2013		A-101	DEMOLITION & RENOVATION PLANS
09-06-2013		A-102	LIFE SAFETY & REFLECTED CEILING PLANS
FIRE ALARM AND PROTECTION			
09-06-2013		FA-101	FIRE ALARM WORK FIRST FLOOR
09-06-2013		FP-101	SPRINKLER WORK FIRST FLOOR
MECHANICAL			
09-06-2013		M-001	LEGEND AND ABBREVIATIONS
09-06-2013		M-101	MECHANICAL DEMOLITION AND RENOVATION PLAN
09-06-2013		M-102	SCHEDULES AND DETAILS
ELECTRICAL			
09-06-2013		E-001	ELECTRICAL LEGEND AND ABBREVIATIONS
09-06-2013		E-101	ELECTRICAL DEMOLITION AND RENOVATION PLAN
09-06-2013		E-102	ELECTRICAL LIGHTING PLAN

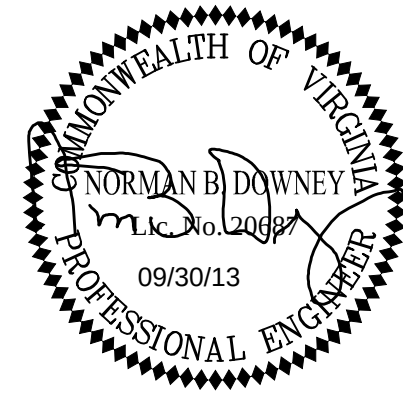
BUILDING CODE INFORMATION

REFERENCES

VIRGINIA UNIFORM STATEWIDE BUILDING CODE (VUSBC) 2009
VIRGINIA CONSTRUCTION CODE (VCC) 2009

BUILDING INFORMATION

BUILDING CONSTRUCTION TYPE: 2B (EXISTING, CONSTRUCTED IN 1977; BOCA CONSTRUCTION TYPE 3C)
OCCUPANCY USE GROUP: E, EDUCATIONAL (BOCA USE GROUP E, EDUCATIONAL)
AREA OF NEW CLASSROOM: 1,373 SF - NO NEW AREA ADDED
OCCUPANCY OF NEW CLASSROOM: 27 PEOPLE
AREA OF EXISTING BUILDING: EXISTING TO REMAIN UNCHANGED
OCCUPANCY LOAD ENTIRE BUILDING: OCCUPANCY UNCHANGED BY RENOVATION
FIRE PROTECTION: EXIST BUILDING SPRINKLED



CCPS SWIFT CREEK MIDDLE
SCHOOL TECH LAB
SWIFT CREEK MIDDLE SCHOOL
3700 OLD HUNDRED RD, MIDLOTHIAN, VA 23112
CHESTERFIELD COUNTY PUBLIC SCHOOLS
CHESTERFIELD COUNTY, VIRGINIA

REVISION DESCRIPTION		DATE
1	DRAWING REVISIONS PER REVIEW COMMENTS	1-29-14

COMM NO: 213197
DATE: SEPTEMBER 30, 2013
DRAWN: ACM
DESIGN: JRS
CHECK: NBD
CAD FILE: G-001 COVER SHEET.dwg

SHEET TITLE

COVER SHEET

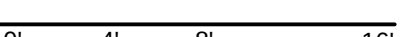
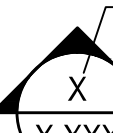
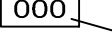
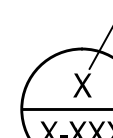
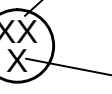
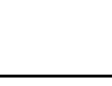
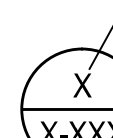
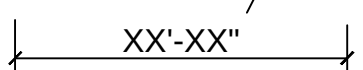
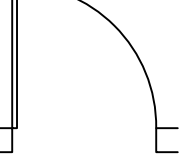
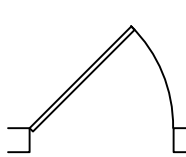
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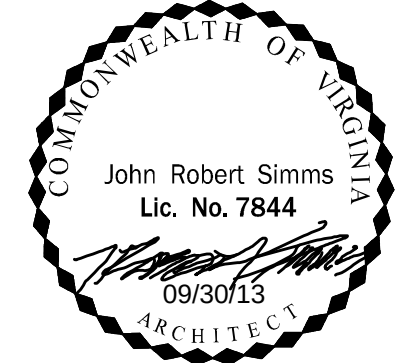
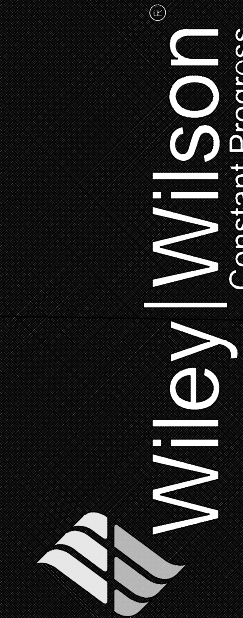
(OFFICE STANDARDS - SOME MAY NOT BE APPLICABLE)

ABCT	AIR BARRIER OR ANCHOR BOLT	IN.	INCHES
AC	ACOUSTICAL CEILING TILE	INFO	INFORMATION
ACC	ACoustical	INSUL	INSULATION
AED	AUTOMATIC EXTERNAL DEFIBRILLATOR	JAN	JANITOR
AFF	ABOVE FINISH FLOOR	LB	POUND (#)
ALUM	ALUMINUM	LAM	LAMINATED
APPROX	APPROXIMATE(LY)	LENS	LENS
BD	BOARD	LF	LINEAR FEET (FOOT)
BULDO	BUILDING	LLV	LONG LEG VERTICAL
BM	BEAM	M	MALE
B-U	BUILT-UP	MAINT	MAINTENANCE
CAB	CABINET	MAS	MASONRY
CALC	CALCULATED	MAT	MATERIAL
CFS	COLD FORMED STEEL	MAX	MAXIMUM
CJ	CONTROL JOINT	MECH	MECHANICAL
CLG	CEILING	MFR	MANUFACTURER
CLR	CLEAR	MTL	METAL
COMM	CONCRETE MASONRY UNIT	MIN	MINIMUM
CORR	CORRIDOR	MISC	MISCELLANEOUS
CONTR	CONCRETE	MO	MASONRY OPENING
CONT	CONTINUOUS	NOM	NOMINAL
CORR	CORRIDOR	NO (#)	NO. (#)
COUNS	COUNSELOR	NIC	NOT IN CONTRACT
CT	CERAMIC TILE	NTS	NOT TO SCALE
D	DEPTH	OC	ON CENTER
DEMO	DEMOLISH (DEMOLITION)	OCC	OCCUPANT
DIA(M)	DIAMETER	OH	OVERHEAD
DN	DOWN	OPNG	OPENING
DWS	DOWNSPOUT	OPP	OPPOSITE
DWG(S)	DRAWING(S)	PCF	POUNDS PER CUBIC FOOT
EA	EACH	PR	PAIR
ELEC	ELECTRICAL	PSF	POUNDS PER SQUARE FOOT
ELEV	ELEVATION	PT	PRESSURE TREATED
ELEV	ELEVATOR	R	RISE/R
EL EQ	ELEVATOR EQUIPMENT	RCP	REFLECTED CEILING PLAN
EPDM	ETHYLENE PROPYLENE DIENE MONOMER	REC	RECOMMENDED
EQ	EQUAL	REINF	REINFORCING
EQUIP	EQUIPMENT	REQ	REQUIRED
ETC	ETCETERA	RO	ROUGH OPENING
EXIST(EX)	EXISTING	SC	SOIL CORE
EJ	EXPANSION JOINT	SCH	SCHEDULE
EXP	EXPOSED	SECT	SECTION
EXT	EXTERIOR	SIM	SIMILAR
EXT	EXTENSION	SF	SQUARE FOOT (FEET)
FCU	FAN COIL UNIT	SQ	SQUARE
FDD	FLOOR DRAIN	STC	SOUND TRANSMISSION COEFFICIENT
FE	FIRE EXTINGUISHER	STD	STANDARD
FEC	FIRE EXTINGUISHER CABINET	STD(NT)	STUDENT
FIN	FINISH	STL	STEEL
FL(FLR)	FLOOR	STOR	STORAGE
FLUOR	FLUORESCENT	T	TREAD
FT	FEET (FOOT)	TBD	TO BE DETERMINED
GA	GALVANIZED	THRU	THROUGH
GALV	GALVANIZED	TRANS	TRANSLUCENT
GC	GENERAL CONTRACTOR	TRYP	TYPICAL
GFG	GOVERNMENT FURNISHED, GOVERNMENT INSTALLED	UL	UNDERWRITER LABORATORIES
GVT	GOVERNMENT	UNC	UNLESS NOTED OTHERWISE
GYSUM	GYP SUM	VCT	VINYL COMPOSITION TILE
GWB	GYP SUM WALL BOARD	VIF	VERIFY IN FIELD
H	HIGH	W	WIDE
HDW	HARDWARE	W	WITH
HZ	HEIGHT	W/O	WITHOUT
HORIZ	HORIZONTAL	WD	WOOD
HR	HOUR	&	AND
HM	HOLLOW METAL	@	AT
HVAC	HEATING VENTILATING AIR	¢	CENTERLINE
CONDITIONING		§	STEEL LINE

1. THE CONTRACTOR SHALL FAMILIARIZE HIMSELF WITH THE DRAWINGS FOR DISCREPANCIES OR OMISSIONS BEFORE ANY WORK IS BEGUN. ANY DISCREPANCIES OR OMISSIONS THAT WOULD AFFECT THE WORK, ITS COST, OR THE WELFARE OF THE GENERAL PUBLIC SHALL BE BROUGHT TO THE ATTENTION OF THE ARCHITECT BEFORE ANY WORK IS BEGUN.
2. THE CONTRACTOR SHALL VISIT THE JOB SITE AND FAMILIARIZE HIMSELF WITH CONDITIONS BEFORE ANY WORK IS BEGUN. ANY UNUSUAL SITE CONDITIONS THAT COULD AFFECT THE WORK, ITS COST, OR THE WELFARE OF THE GENERAL PUBLIC SHALL BE BROUGHT TO THE ATTENTION OF THE ARCHITECT BEFORE ANY WORK IS BEGUN.
3. THE CONTRACTOR SHALL SAFEGUARD THE COUNTY'S PROPERTY AND ADJACENT PROPERTIES DURING CONSTRUCTION AND SHALL REPLACE ANY DAMAGED PROPERTY OR MATERIALS TO THE ORIGINAL CONDITION AT NO COST TO THE COUNTY.
4. THE CONTRACTOR SHALL COMPLY WITH THE INTERNATIONAL BUILDING CODE (2009 EDITION) AND ALL APPLICABLE AND GOVERNING CODES AND REGULATIONS; AND SHALL COMPLY WITH ALL LIFE SAFETY REQUIREMENTS OF ALL APPLICABLE JURISDICTIONS. ALL WORK SHALL BE PERFORMED IN STRICT ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE AND LOCAL CODES AND ORDINANCES.
5. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND CLEARANCES PRIOR TO THE COMMENCEMENT OF WORK OR ORDERING OF MATERIALS. ANY DEVIATIONS FROM THE CONTRACT DOCUMENTS SHALL BE REPORTED TO THE ARCHITECT IN WRITING PRIOR TO PROCEEDING WITH THAT PORTION OF WORK.
6. THE CONTRACTOR OR ANY OF HIS EMPLOYEES, OR SUB-CONTRACTORS SHALL NOT SCALE THESE DRAWINGS FOR DIMENSIONS. IF THERE IS ANY QUESTION CONCERNING THE DIMENSIONS THE CONTRACTOR SHALL CONTACT THE ARCHITECT TO CLARIFY THE DIMENSIONS.
7. THE CONTRACTOR SHALL NOT PROCEED WITH ANY WORK THAT DEVIATES FROM WHAT IS INDICATED IN THE CONTRACT DOCUMENTS OR THAT MAY RESULT IN ADDITIONAL COST OR TIME TO THE PROJECT WITHOUT WRITTEN PERMISSION FROM THE ARCHITECT.
8. THE CONTRACTOR SHALL CONFIRM AND VERIFY WITH THE OWNER PRIOR TO STARTING WORK ANY RULES OR REGULATIONS FOR THE USE OF AND CONSTRUCTION ON THE PROPERTY WITH RESPECT TO BUT NOT LIMITED TO HOURS OF CONSTRUCTION, LIMITS OF WORK, OPERATIONS OF THE BUILDING, SAFETY OF THE OWNERS EMPLOYEES OR GENERAL PUBLIC, PLACEMENT OF SAFETY BARRIERS, NOISE, DUST OR VIBRATION RESTRICTIONS, LOCATIONS OF DUMPSTERS, USE OF THE OWNERS UTILITIES AND FACILITIES, SCHEDULING OF DELIVERIES ETC. THE CONTRACTOR SHALL COORDINATE WITH THE OWNER ALL WORK SO TO AVOID DISRUPTION TO THE NORMAL OPERATIONS AND WORK OF THE OWNER.
9. THE CONTRACTOR SHALL REMOVE ALL CONSTRUCTION OR DEMOLITION DEBRIS FROM THE JOB SITE TO MAINTAIN A CLEAN AND SAFE ENVIRONMENT AND TO PREVENT THE POSSIBILITY OF A FIRE OR LIFE SAFETY HAZARD.
10. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR THE MEANS, METHODS, TECHNIQUES AND PROCEDURES OF CONSTRUCTION.
11. ALL LABOR, EQUIPMENT, MATERIALS, TEST AND SERVICES TO BE INSTALLED AND PREFORMED SHALL BE DONE IN A WORKMANLIKE MANNER, AND IN ACCORDANCE WITH ALL LOCAL AND NATIONAL CODES AND REGULATIONS.

(OFFICE STANDARDS - SOME MAY NOT BE APPLICABLE)

 0.00  0.00	FLOOR/CEILINGS ELEVATIONS SECTION/DETAIL ELEVATIONS	 TAG  NAME OF DETAIL/SECTION/PLAN  SCALE SCALE OF DETAIL/SECTION/PLAN
 NUMBER DENOTES WALL TYPE  LETTER DENOTES HEAD TYPE (IF APP)	WALL TAGS	 ELEVATION TAG  WHERE ELEVATION IS SHOWN
 	WINDOW FRAME TAG (NUMBER-EXTERIOR) WINDOW FRAME TAG (NUMBER-INTERIOR)	 SECTION DESIGNATION  WHERE SECTION IS DRAWN
 ROOM NAME  ROOM NUMBER DESIGNATION	ROOM TAG	 SECTION/DETAIL DESIGNATION  WHERE SECTION/DETAIL IS DRAWN
 ROOM DESIGNATION  DOOR/NUMBER DESIGNATION	DOOR TAG	 SECTION/DETAIL DESIGNATION  WHERE SECTION/DETAIL IS DRAWN
 ELEVATION TAG  WHERE ELEVATION IS SHOWN	ELEVATION TAG (INTERIOR)	 DIMENSIONS IN FEET/INCHES DIMENSIONS
 QUANTITY	CORNER GUARD TAG	 TRANSITION STRIP TAG (LETTER)
	BUILDING ELEVATION MATERIAL TAG (LETTER)	 SIGNAGE TAG (LETTER)
	TOILET ACCESSORIES TAGS (LETTERS)	 REVISION TAG
	INTERIOR FINISH TAG (LETTER/NUMBER)	 NEW DOOR
	KEYNOTE	 EXISTING DOOR TO REMAIN



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SCHOOL TECH LAB
SWIFT CREEK MIDDLE SCHOOL
373700 OLD HUNDRED RD, MIDLOTHIAN, VA 23112
CHESTERFIELD COUNTY PUBLIC SCHOOLS

REVISION DESCRIPTION

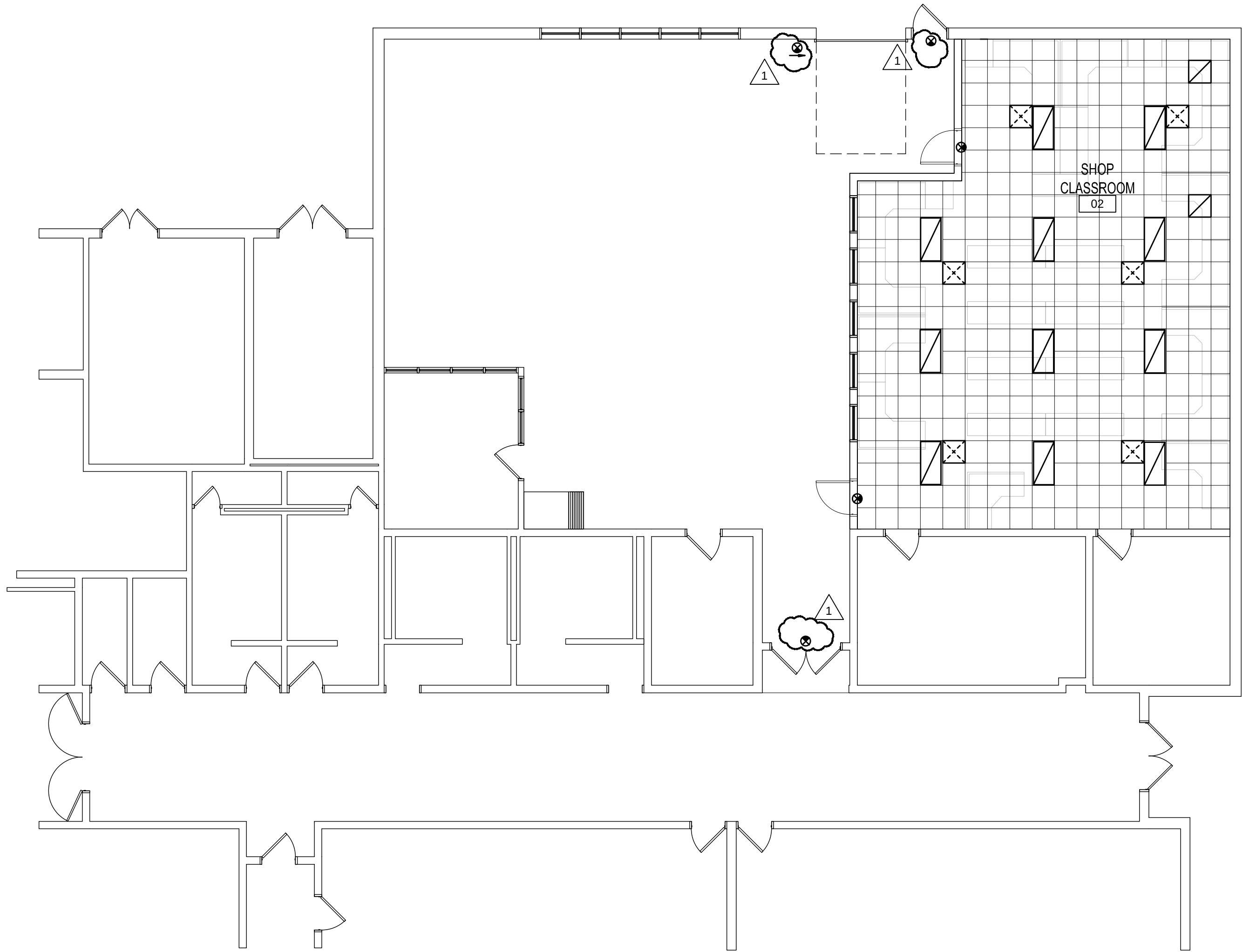
MRK	DATE

COMM NO: 213197	
DATE: SEPTEMBER 30, 2013	
DRAWN: ACM	DESIGN: JRS
CHECK: NBD	
CAD FILE: A-01 GENERAL NOTES, ABBREVIATIONS, AND SYMBOLS	

SHEET TITLE

GENERAL NOTES,
ABBREVIATIONS, AND
SYMBOLS

SHT. NO.	REV. NO.
A-001	0



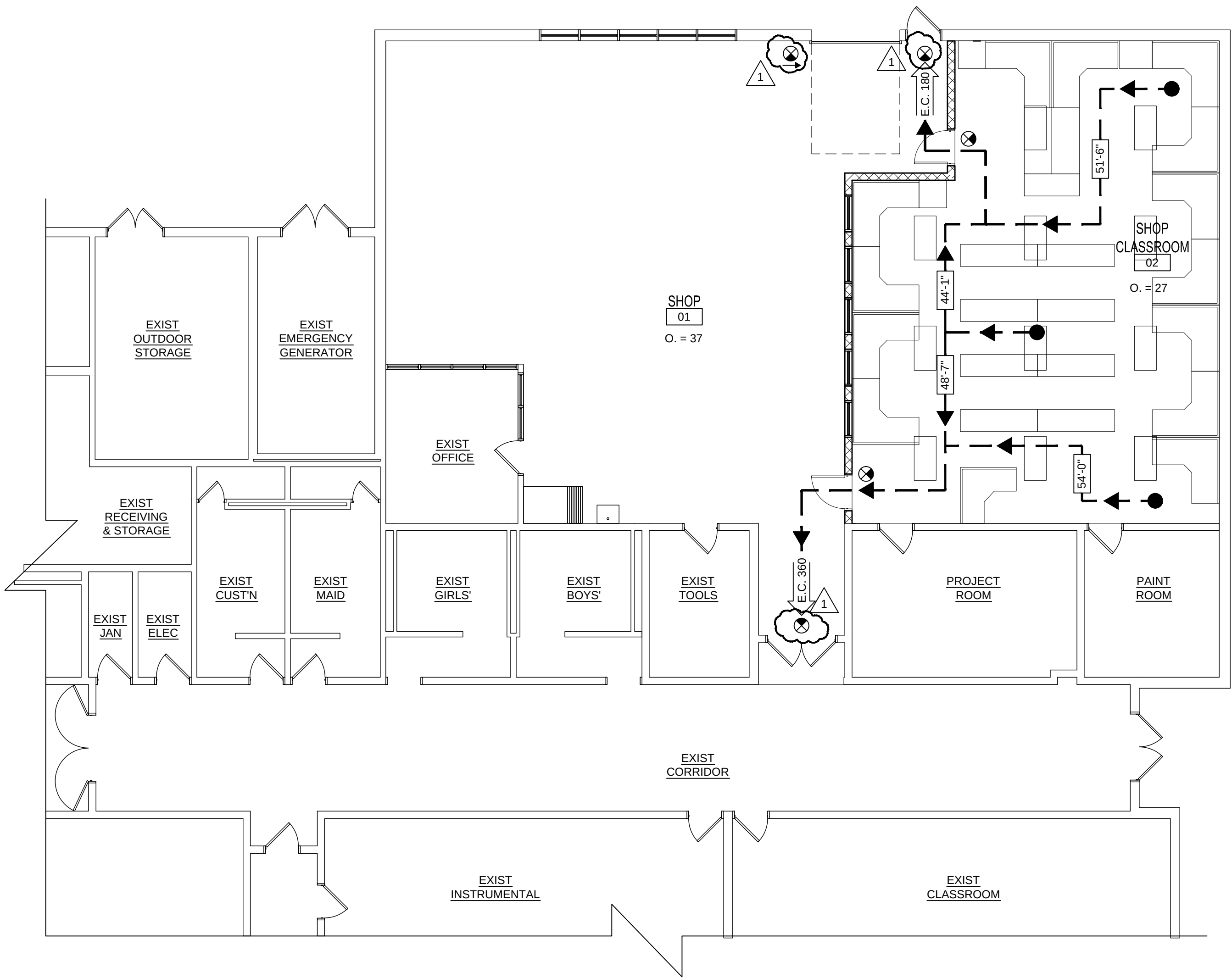
1 REFLECTED CEILING PLAN
1/8"=1'-0"

0' 4' 8' 16'

CEILING LEGEND			
	ACOUSTICAL LAY-IN CEILING		HVAC DIFFUSERS
	LIGHT FIXTURES		HVAC RETURN AIR GRILLS
			EXIT LIGHT

GENERAL CEILING NOTES

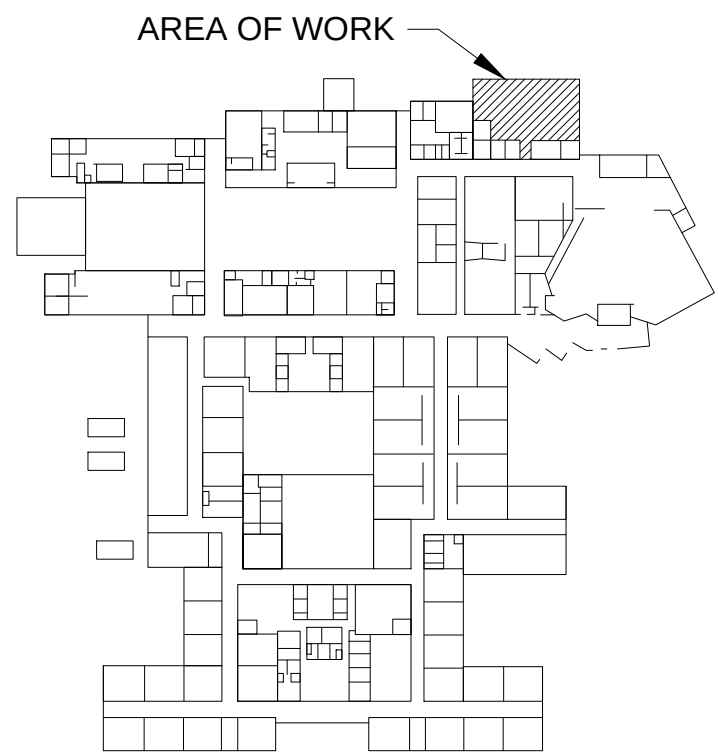
- FOLLOW MANUFACTURER'S RECOMMENDATIONS AND INSTRUCTIONS FOR THE INSTALLATION OF ALL CEILING SYSTEMS.
- COORDINATE ALL CEILING SYSTEMS WITH ALL WORK SHOWN ON MECHANICAL AND ELECTRICAL DRAWINGS FOR ALL CEILING MOUNTED EQUIPMENT, FIXTURES, DIFFUSERS, ETC.



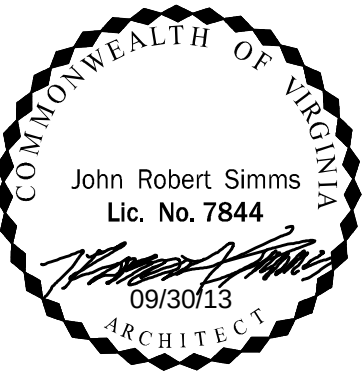
2 LIFE SAFETY PLAN
1/8"=1'-0"

0' 4' 8' 16'

LEGEND	
PATH OF EGRESS	
TRAVEL DISTANCE	
EXIT CAPACITY	
OCCUPANT LOAD	
EXIT LIGHT	



KEY PLAN



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CHESTERFIELD COUNTY, VIRGINIA

DRAWING REVISIONS PER REVIEW COMMENTS		DATE	DESCRIPTION
1	1-29-14	DATE	MRK

COMM NO: 213197	DATE: SEPTEMBER 30, 2013
DRAWN: ACM	DESIGN: JRS
CHECK: NBD	CAD FILE: A-102 LIFE SAFETY & REFLECTED CEILING PLANS
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LIFE SAFETY & REFLECTED CEILING PLANS	
SHT. NO. A-102	REV. NO. 0

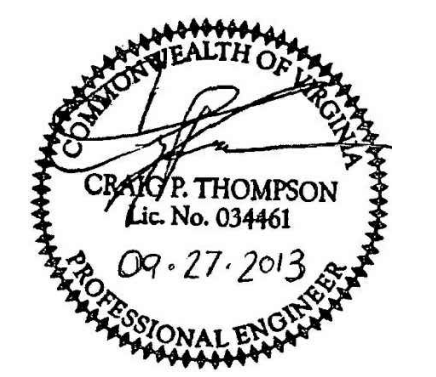
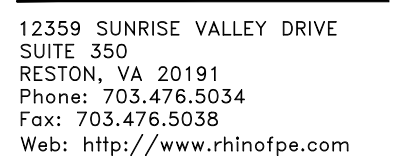
M

FPS

FIRE ALARM POWER SUPPLY

2

VERIFY THAT THE EXISTING CIRCUIT AND POWER SUPPLY HAS SUFFICIENT CAPACITY TO ADD THE TWO ADDITIONAL STROBES. IF NOT, PROVIDE A NEW CIRCUIT AND AN ADDITIONAL POWER SUPPLY PANEL ADJACENT TO THE EXISTING PANELS.



CHESTERFIELD COUNTY, VIRGINIA



1/8"=1'-0"



COMM NO: 213197	
DATE: AUGUST 23, 2013	
DRAWN:PAM	DESIGN:CPT
CHECK: CPT	
CAD FILE: FA-101.DWG	
SHEET TITLE	

HT. NO. FA-101	REV. NO. 0
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SPRINKLER NOTES

1. SCOPE OF WORK: PROVIDE A COMPLETE AUTOMATIC WET PIPE SPRINKLER SYSTEM THROUGHOUT THE AREA OF WORK. ALL WORK AND INSTALLATION SHALL CONFORM TO THE IBC 2009 EDITION AND NFPA 13 2007 EDITION, EXCEPT AS MODIFIED BY THE APPLICABLE PROVISIONS OF THE 2009 UNIFORM STATEWIDE BUILDING CODE. INSTALL FIRE SUPPRESSION SPRINKLER SYSTEM AS INDICATED ON THE DRAWINGS. PROVIDE ALL EQUIPMENT, LABOR AND MATERIAL FOR AN ACCEPTED AUTOMATIC SPRINKLER SYSTEM, INCLUDING PIPING, HANGERS, SPRINKLER, AND ALL ASSOCIATED EQUIPMENT. IN AREAS WITH CEILINGS ALL SPRINKLERS SHALL BE CHROME RECESSED PENDANTS.
2. THE SPRINKLER PIPE AS SHOWN ON THESE CONTRACT DRAWINGS ARE TO BE FIELD VERIFIED. UPON INSPECTION, CONTRACTOR IS TO VERIFY WITH RHINO FIRE PROTECTION THE ACTUAL PIPE SIZES. THE INSTALLING CONTRACTOR SHALL COORDINATE WITH ALL OBSTRUCTION AND INSTALL THE SPRINKLER SYSTEM PER NFPA 13.
3. ALL NEW SPRINKLERS SHALL BE NEW QUICK RESPONSE SPRINKLERS IN ALL AREAS WITH FINISHED CEILINGS AS PERMITTED BY NFPA 13. IF ANY EXISTING CEILING LEVEL SPRINKLERS ARE TO BE REPLACED, THE NEW SPRINKLERS SHALL MATCH THE EXISTING TEMPERATURE AND RESPONSE.
4. ALL SPRINKLERS SHALL BE REPLACED WITH ORDINARY TEMPERATURE SPRINKLERS UNO ON THE FLOOR PLAN DRAWINGS.
5. PIPE SIZES ON CONTRACT DRAWINGS IS SHOWN FOR REFERENCE ONLY. THE INSTALLING SPRINKLER CONTRACTOR MAY REDUCE THE PIPE SIZES WITH SUBMITTAL OF SHOP DRAWINGS.
6. PROVIDE ADDITIONAL HANGERS ON ALL ARMOVERS LONGER THAN 12-INCHES PER NFPA 13 FOR SPRINKLER SYSTEMS THAT EXCEED 100 PSI.
7. ON PIPE TO PENDENT SPRINKLERS: PROVIDE SURGE CLIPS OR RESTRAIN PIPE FROM UPWARD MOVEMENT. THE HANGER CLOSEST TO THE SPRINKLER SHALL ALSO BE RESTRAINED FROM UPWARD MOVEMENT, PER NFPA 13 FOR SPRINKLER SYSTEMS EXCEEDING 100PSI.
8. DEMOLISH ALL SPRINKLER SYSTEM COMPONENTS THAT ARE NOT REUSED. PROVIDE NEW CAP/PLUGS ON ENDS OF ALL REMAINING OUTLETS NOT REUSED FOR SPRINKLERS.
9. ANY INFORMATION CONFLICTS BETWEEN THE SPECIFICATIONS AND DRAWINGS SHALL BE BROUGHT TO THE ENGINEER'S ATTENTION. THE CONTRACTOR(S) SHALL NOT PROCEED WITH ANY WORK, EXCEPT AT THEIR OWN RISK, UNTIL CLARIFICATIONS OF THE CONFLICTS ARE ISSUED TO THE CONTRACTOR(S) BY THE ENGINEER.
10. THE CONTRACTOR SHALL FIELD VERIFY ALL CONDITIONS AND DIMENSIONS ON THE DRAWINGS PRIOR TO THE EXECUTION OF THIS CONTRACT. LOCATION AND SIZES OF PIPING AND LIGHTING FIXTURES ARE APPROXIMATE. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE LOCATION OF ALL SYSTEM COMPONENTS. CONTRACTOR SHALL REPORT ANY DISCREPANCIES WITH THESE DRAWINGS TO THE ENGINEER IMMEDIATELY.

1. CONTRACTOR SHALL BE RESPONSIBLE FOR AVOIDING ALL CONFLICTS WITH LIGHTING FIXTURES, DIFFUSERS, GRILLS, DUCTS, STRUCTURAL MEMBERS, PIPES AND OTHER OBSTRUCTIONS ENCOUNTERED.
12. CONTRACTOR SHALL MAINTAIN AS MUCH HEAD ROOM CLEARANCE AS PRACTICAL BETWEEN BOTTOM OF SPRINKLER PIPE, FITTINGS, VALVES, AND SPRINKLER HEADS WITH THE FINISHED FLOOR IN ALL AREAS OF EXPOSED PIPE, IN NO CASE PROVIDE LESS THAN 6'-8" OF HEAD ROOM CLEARANCE.
13. SPRINKLER PIPING INDICATED ON THE DRAWINGS IS SHOWN FOR PURPOSES OF DESIGN INTENT AND LIMITED FIELD VERIFICATION. CONTRACTOR SHALL VERIFY ALL PIPE SIZES AND LOCATIONS. PIPE SIZES AS SHOWN MAY NOT BE AS INSTALLED. CONTRACTOR SHALL BE RESPONSIBLE FOR FIELD VERIFICATION.
14. ALL AREAS ARE CONSIDERED ORDINARY HAZARD OCCUPANCIES PER NFPA. AREAS TO BE CONSIDERED ORDINARY HAZARD GROUP 1 OCCUPANCIES UNO ON THE FLOOR PLAN DRAWINGS.
15. ALL ELEVATIONS AFF INDICATED FOR STRUCTURAL MEMBERS AND CEILINGS ARE APPROXIMATE. VARIANCES OF +/- 1" CAN BE EXPECTED DUE TO SLOPING FLOORS AND STRUCTURAL MEMBERS.
16. THE TERM "PROVIDE" SHALL MEAN THE CONTRACTOR SHALL FURNISH, INSTALL AND CONNECT FOR A COMPLETE AND OPERATIONAL SYSTEM.
17. THE TERM "REMOVE" SHALL MEAN THE CONTRACTOR SHALL DISCONNECT AND CLEAR FROM SITE.
18. ALL EQUIPMENT SHALL BE TESTED/APPROVED BY A NATIONAL TESTING LABORATORY AND INSTALLED PER THE LISTING AND MANUFACTURERS INSTALLATION INSTRUCTIONS.
19. PIPING: ALL PIPE 1.5" AND SMALLER SHALL BE STEEL PIPE SCHEDULE 40 WITH THREADED FITTINGS. ALL PIPE 2" AND LARGER SHALL BE STEEL PIPE SCHEDULE 40 OR SCHEDULE 10.
20. REFLECTED CEILING PLAN IS PROVIDE FOR REFERENCE ONLY SEE ARCHITECTURAL CEILING PLAN SCHEDULE FOR CEILING HEIGHTS. SPRINKLER CONTRACTOR SHALL COORDINATE WITH ALL TRADES.
21. HYDROSTATIC TESTING OF THE FIRE SUPPRESSION SYSTEMS SHALL BE WITNESSED BY THE AUTHORITY HAVING JURISDICTION, BEFORE CEILING CLOSE IN. INSTALLING CONTRACTOR SHALL COORDINATE WITH THE AUTHORITY HAVING JURISDICTION AND PROVIDE 14 WORKING DAY NOTICE FOR SCHEDULING.

ABBREVIATIONS

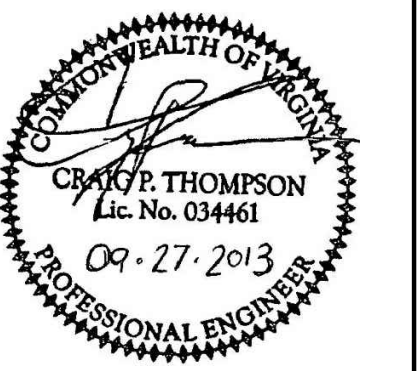
A AMP
ABV ABOVE
A/E ARCHITECT/ENGINEER (OF RECORD)
AFF ABOVE FINISHED FLOOR
ANSI AMERICAN NATIONAL STANDARDS INSTITUTE
A/S AUTOMATIC SPRINKLER
AWG AMERICAN WIRE GAGE
BLDG BUILDING
BOB BOTTOM OF BEAM
BOJ BOTTOM OF JOIST
C CEILING
CANDELA CANDELA
CLO CLOSET
CMU CONCRETE MASONRY UNIT
COM COMMUNICATIONS
CONT CONTINUED
CORR CORRIDOR
DS DRY SPRINKLER
E EXISTING DEVICE
EC EXTENDED COVERAGE SPRINKLER
ELEC ELECTRIC
EOLR END OF LINE RESISTOR
EXIST EXISTING
FACP FIRE ALARM CONTROL PANEL
FDC FIRE DEPARTMENT CONNECTION
GPM GALLONS PER MINUTE
INCH INCH
J.C. JANITOR'S CLOSET
LAT LAY-IN ACOUSTICAL TILE
LED LIGHT EMITTING DIODE
MACH MACHINE
MI MINERAL INSULATED
MNS MASS NOTIFICATION SYSTEM
MPS MANUAL PULL STATION
MR MACHINE ROOM
NAC NOTIFICATION APPLIANCE CIRCUIT
NFPA NATIONAL FIRE PROTECTION ASSOCIATION
NO. NUMBER
NOS. NUMBERS
NPT NATIONAL PIPE THREAD
NTS NOT TO SCALE
OPG OPENING
OS&Y OUTSIDE STEM AND YOKE
P PHASE
P.S. PIPE SHAFT
PSI POUNDS PER SQUARE INCH
QR QUICK RESPONSE
RM ROOM
SPKLR SPRINKLER
SSU STANDARD SPRAY UPRIGHT
STDP STANDPIPE
SF SQUARE FOOT
SUERGE SURGE PROTECTION DEVICE
STO STORAGE
TQJ TERMINAL CABINET
TOJ TOP OF JOIST
UNO UNLESS NOTED OTHERWISE
VAC VOLTS ALTERNATING CIRCUIT
WP WEATHER PROOF
W/ WITH

LEGEND

- | | |
|---|---|
|  | SPRINKLER — EXISTING UPRIGHT |
|  | SPRINKLER — NEW CHROME RECESSED PENDANT |
|  | PIPE — SECTION |
|  | PIPE — EXISTING |
|  | PIPE — NEW |
|  | PIPE ELBOW, 90° |
|  | PIPE TEE, TURNED AWAY |
|  | PIPE TOWARDS VIEWER |
|  | PIPE CONTINUATION |
|  | RISER |
|  | START OF WORK |

NOTES

- 1 PROVIDE RECESSED PENDANTS BELOW THE NEW CEILING IN THE SHOP CLASSROOM.
- 2 THE AREA BELOW THE CEILING IS NOT REQUIRED TO BE CALCULATED PER NFPA 13 SECTION 22.4 AS THE CLASSROOM CEILING IS AN OBSTRUCTION.



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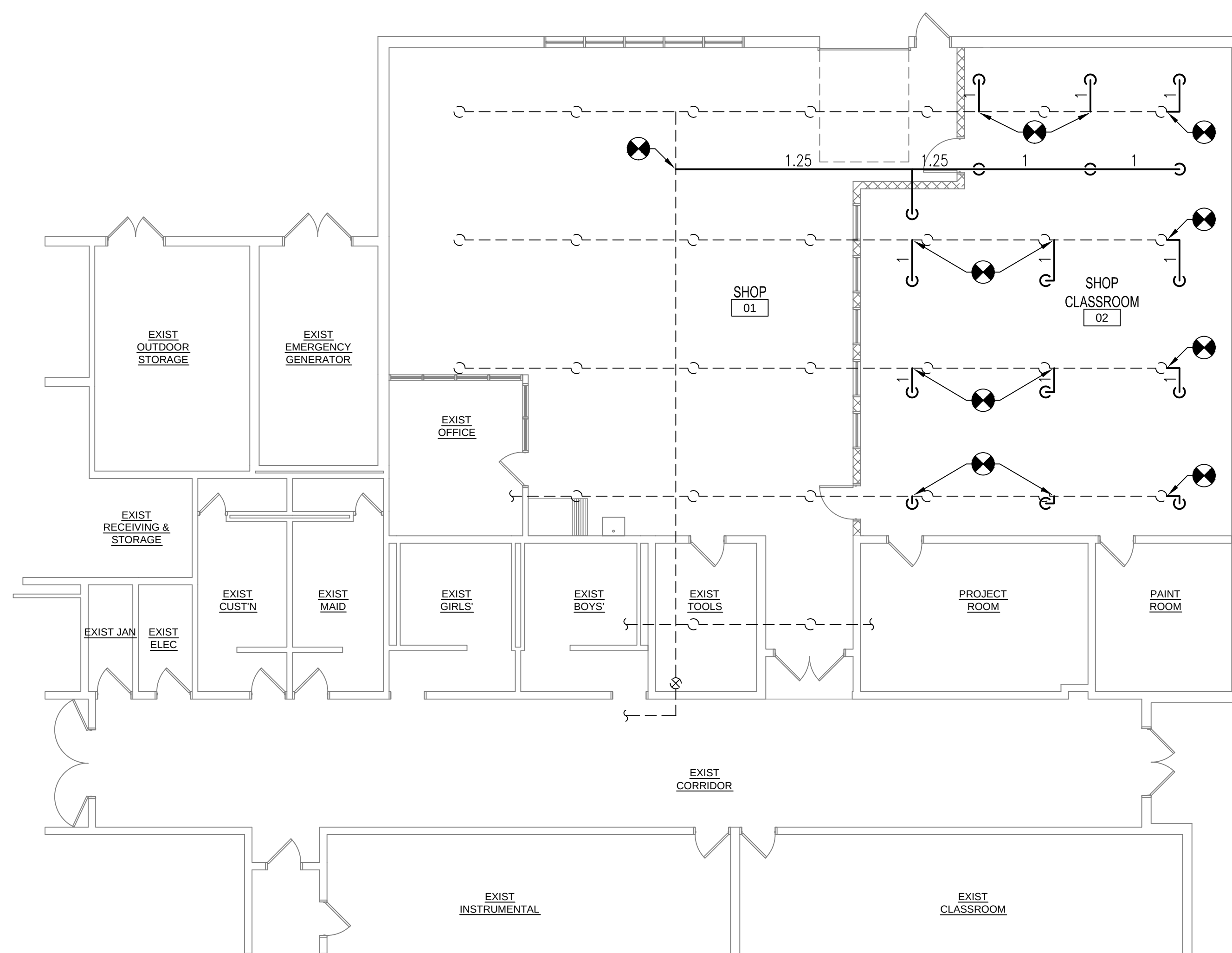
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DATE	
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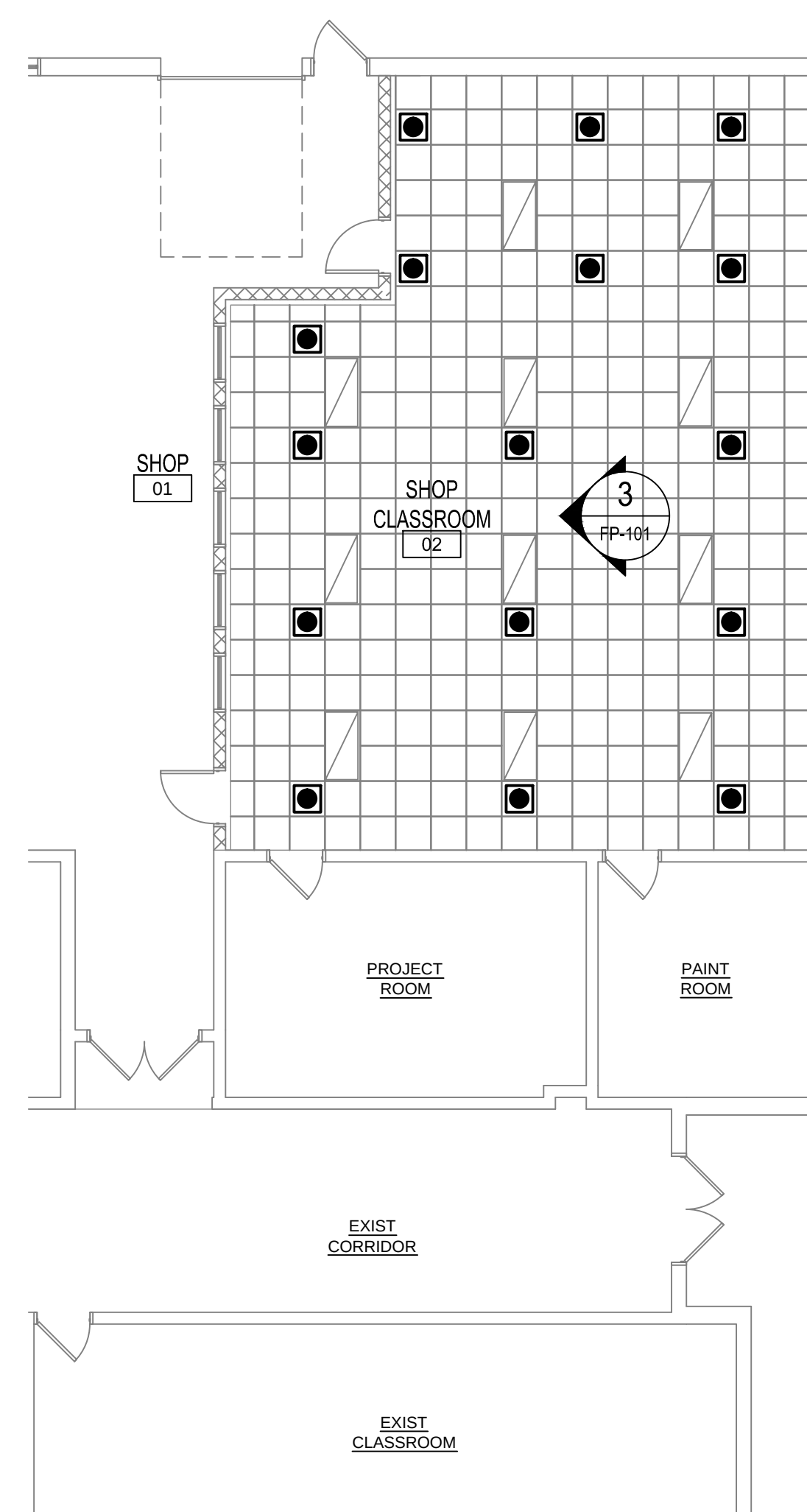
COMM NO: 213197	
DATE: AUGUST 23, 2013	
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SHEET TITLE	

SPRINKLER WORK
FIRST FLOOR

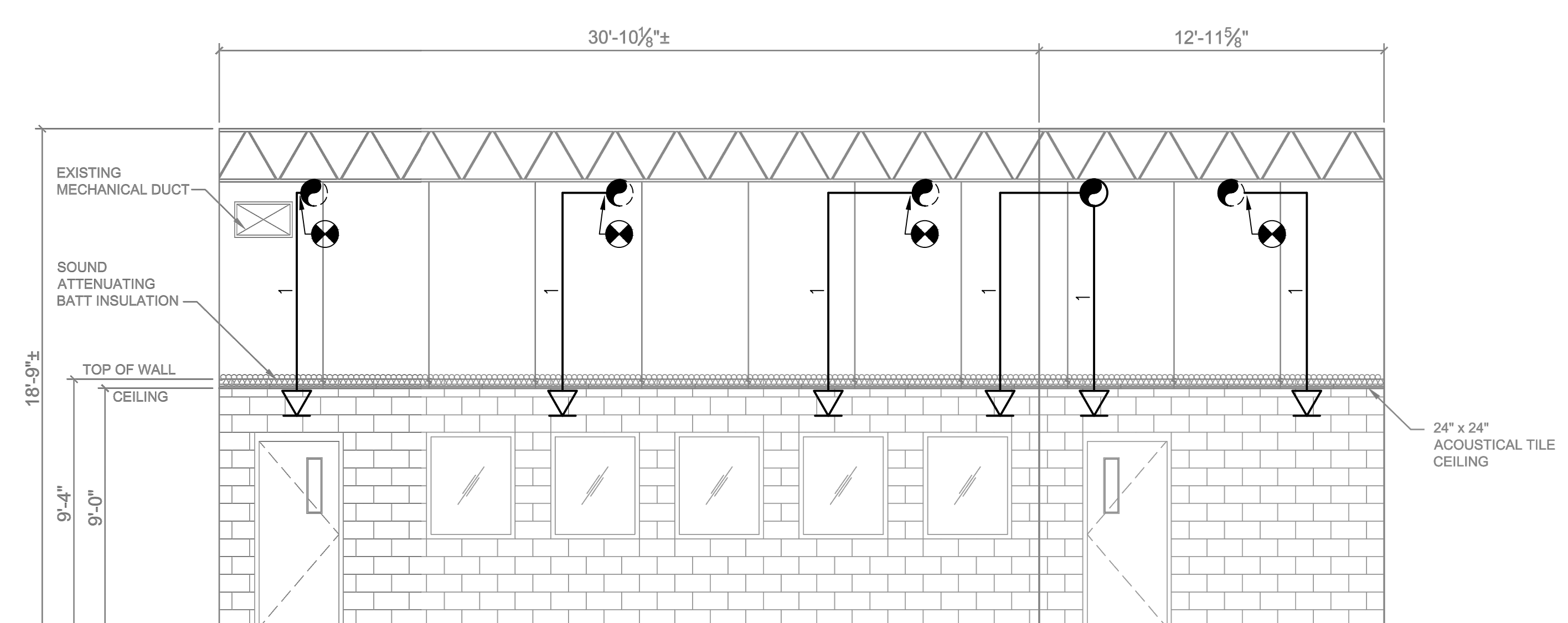
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FP-101	0



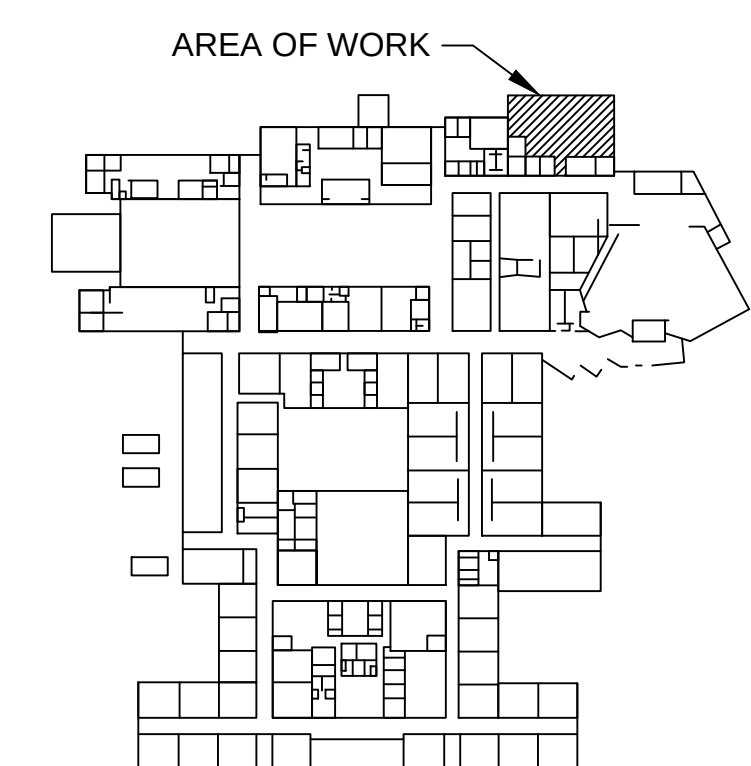
1 SPRINKLER PLAN SHOP CEILING LEVEL
1/8"=1'-0"



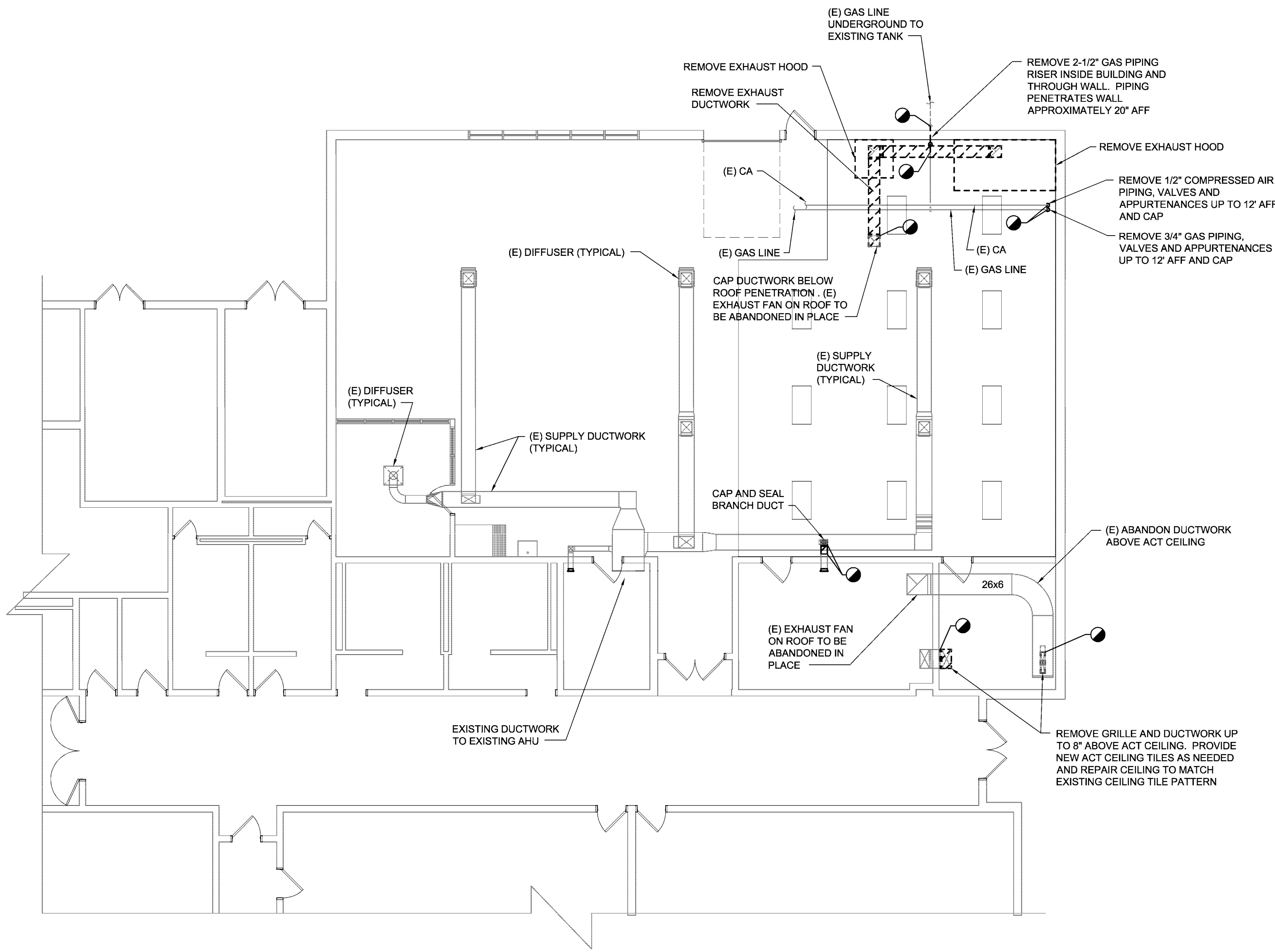
2 SPRINKLER PLAN - SHOP CLASSROOM CEILING LEVEL



3 SPRINKLER - SECTION



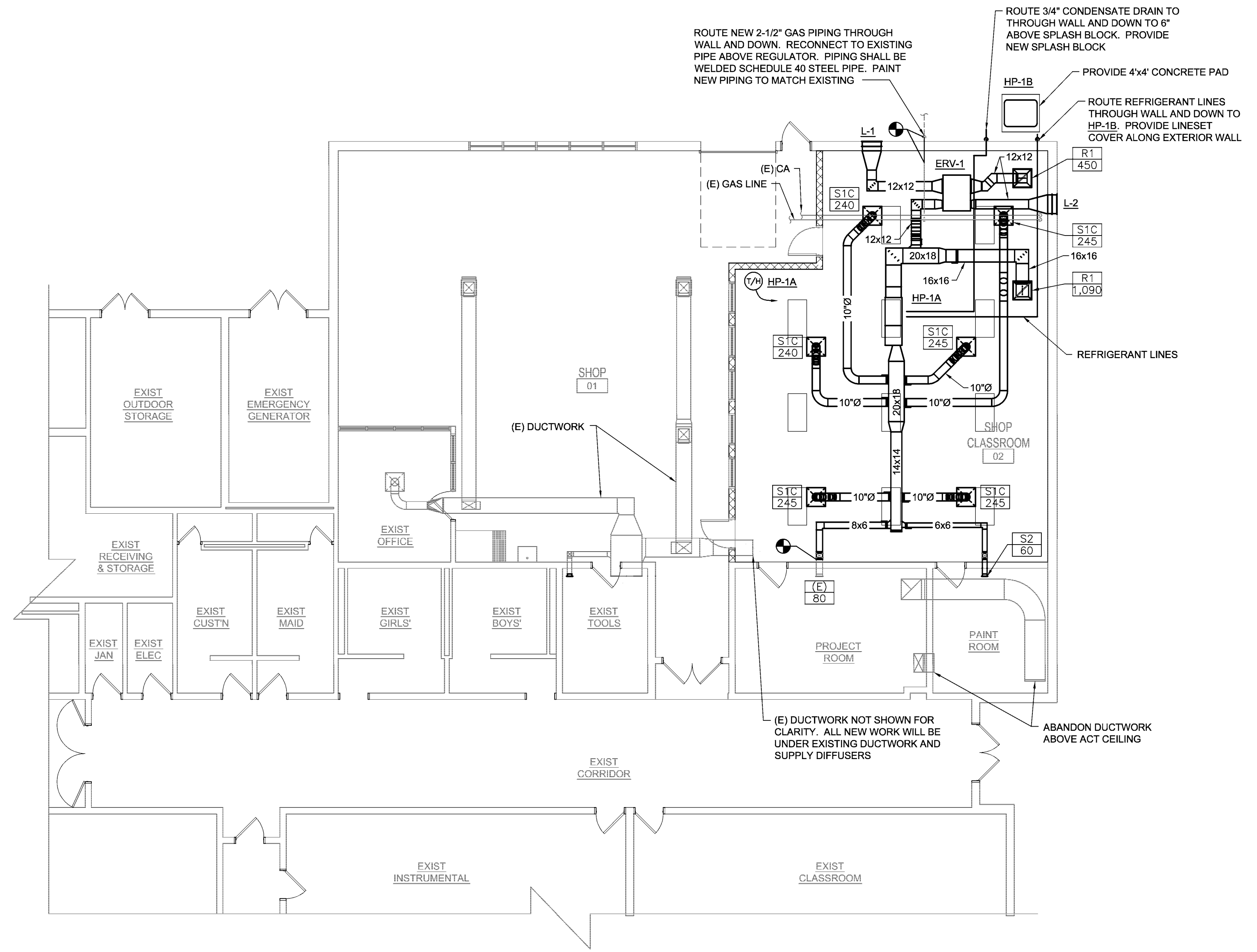
KEY PLAN



1 MECHANICAL DEMOLITION PLAN
1/8"=1'-0"

DEMOLITION NOTES:

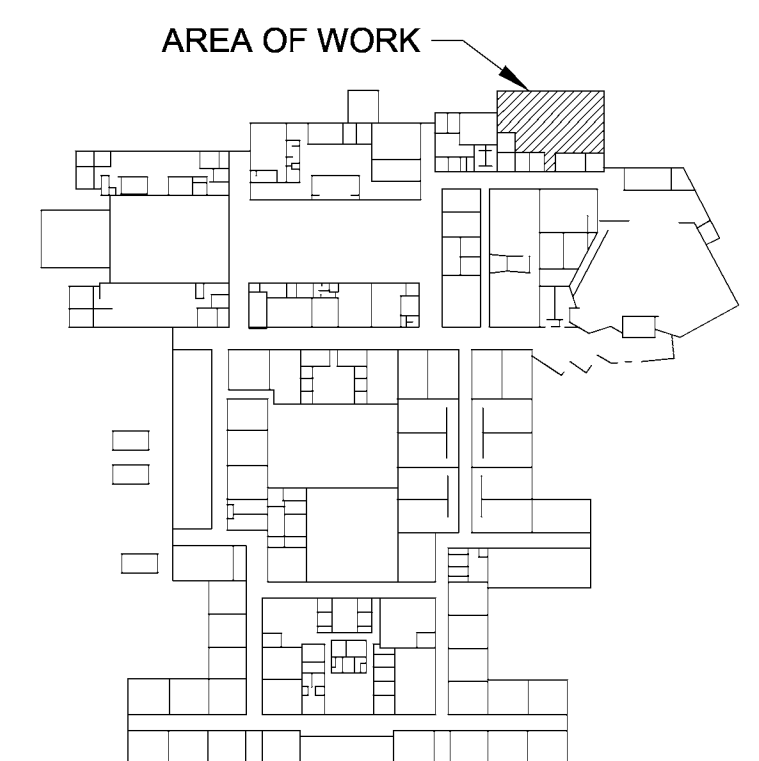
1. DUCT, PIPING AND EQUIPMENT LOCATIONS ARE APPROXIMATE, CONTRACTOR TO VERIFY AS NECESSARY.
2. SEAL ALL BUILDING PENETRATIONS CREATED DURING DEMOLITION AND NOT RE-USED TO INCLUDE PLASTER CEILING PENETRATIONS. SEE ARCHITECTURAL PLANS.
3. REMOVE ALL EQUIPMENT, DUCTWORK, PIPING, HANGERS AND INSULATION AS SHOWN.



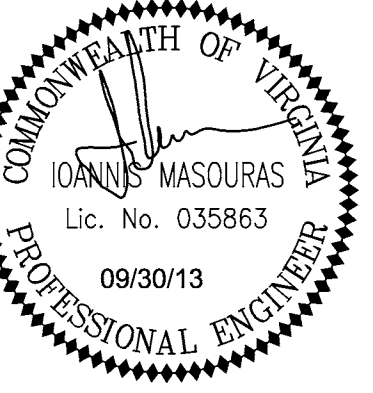
2 MECHANICAL RENOVATION PLAN
1/8"=1'-0"

RENOVATION NOTES:

1. THE LOCATION OF ALL DUCT, PIPING AND EQUIPMENT SHALL BE ADJUSTED TO ACCOMMODATE ANTICIPATED OR ENCOUNTERED INTERFERENCES. THESE PLANS ARE PARTIALLY DIAGRAMMATIC AND MAY NOT SHOW MINOR DETAILS AND LOCATIONS.
2. PROVIDE BALANCING DAMPER FOR EACH SUPPLY, RETURN AND EXHAUST BRANCH. BALANCE SYSTEM WITH PROJECT ROOM AND PAINT ROOM DOORS OPEN.
3. PROVIDE BALANCING DAMPER FOR OUTSIDE AIR DUCT THAT CONNECTS TO THE RETURN DUCT OF THE AIR HANDLER AND BALANCE TO AIRFLOW INDICATED ON SCHEDULE.
4. MAXIMUM LENGTH OF ALLOWABLE FLEX DUCT IS 6 FEET. DO NOT MAKE TURNS WITH FLEXIBLE DUCT. USE HARD ELBOWS.
5. PROVIDE 2" MERV 6 FILTER ASSEMBLY IN RETURN DUCT DOWNSTREAM OF THE OUTSIDE AIR CONNECTION.
6. MAINTAIN MANUFACTURER RECOMMENDED CLEARANCE AROUND ALL EQUIPMENT.
7. ALL RUN-OUTS TO TERMINALS ARE NECK SIZE UNLESS OTHERWISE NOTED.
8. DUCT SIZE REFERS TO AIR SIZE.
9. ALL RECTANGULAR AND ROUND DUCT TAPS SHALL HAVE A 45 DEGREE DUCT HEEL.
10. ENSURE HEAT PUMP IS INSTALLED LEVEL AND PLUMBS.



KEY PLAN



CCPS SWIFT CREEK MIDDLE SCHOOL TECH LAB
SWIFT CREEK MIDDLE SCHOOL
3700 OLD HUNDRED RD, MIDLOTHIAN, VA 23112
CHESTERFIELD COUNTY PUBLIC SCHOOLS
CHESTERFIELD COUNTY, VIRGINIA

REVISION DESCRIPTION	DATE	BY

COMM NO: 213197	DATE: SEPTEMBER 30, 2013
DRAWN: SWL	DESIGN: SWL
CHECK: IM	CAD FILE: 18" MECH DEMOLITION RENOVATION PLAN
SHEET TITLE: MECHANICAL DEMOLITION AND RENOVATION PLANS	SHT. NO. M-101
REV. NO. 0	

SPLIT SYSTEM HEAT PUMP SCHEDULE			
INDOOR UNIT DESIGNATION			HP-1A
OUTDOOR UNIT DESIGNATION			HP-1B
LOCATION			SHOP CLASSROOM - 02
INDOOR UNIT	EVAPORATOR	TOTAL AIRFLOW (CFM)	1,600
		OUTSIDE AIRFLOW (CFM)	515
		EXTERNAL STATIC PRESSURE (IN-WC)	0.78
		TOTAL COOLING CAPACITY (MBH)	48.1
		SENSIBLE COOLING CAPACITY (MBH)	34.2
		ENTERING AIR TEMPERATURE DBWB/ (DEG F)	76.3/64.2
	ELECTRICAL	LEAVING AIR TEMPERATURE DBWB/ (DEG F)	56.5/54.1
		HEAT PUMP HEATING CAPACITY AT 17° F (MBH)	30.6
		CONFIGURATION	HORIZONTAL
		ELECTRIC HEATING CAPACITY (KW)	5.0
		MINIMUM CIRCUIT AMPACITY (A)	14.3
		MAXIMUM OVERCURRENT PROTECTION (A)	15
BASED ON	VOLTAGE	115	
	PHASE	1	
	FREQUENCY (Hz)	60	
	YORK		
BLOWER UNIT MODEL		MA20D	
CASED COIL UNIT MODEL		MC62D	
REFRIGERANT		R-410A	
OUTDOOR UNIT	ELECTRICAL	AMBIENT DESIGN TEMPERATURE (DEG F)	95
		MINIMUM HEATING COP AT 17° F	3
		MINIMUM CIRCUIT AMPACITY (A)	29.2
		MAXIMUM OVERCURRENT PROTECTION (A)	50
		VOLTAGE (V)	208
		PHASE	1
FREQUENCY (Hz)		60	
MINIMUM COMBINED SEER RATING PER ARI		13	
YORK			
OUTDOOR SYSTEM MODEL		YZH046	
REMARKS		1, 2 & 3	
REMARKS LEGEND:			

ENERGY RECOVERY VENTILATOR SCHEDULE		
DESIGNATION		ERV-1
LOCATION		SHOP CLASSROOM - 02
SUPPLY FAN	TOTAL FAN AIRFLOW (CFM)	515
	EXTERNAL STATIC PRESSURE (IN. WG)	0.25
EXHAUST FAN	TOTAL FAN AIRFLOW (CFM)	450
	EXTERNAL STATIC PRESSURE (IN. WG)	0.25
ENTHALPY WHEEL	OPERATING OUTSIDE AIRFLOW	515
	OPERATING EXHAUST AIRFLOW	450
	OUTDOOR EAT DB/WB (COOLING)	89.07/8.0
	OUTDOOR EAT DB (HEATING)	17.8
	EXHAUST EAT DB/WB (COOLING)	75.0/62.6
	EXHAUST EAT DB (HEATING)	70
	DELIVERED CONDITIONS DB/WB (COOLING)	78.9/67.5
	DELIVERED CONDITIONS DB (HEATING)	55.6
FILTERS	SUPPLY (MERV)	5
	EXHAUST (MERV)	5
ELECTRICAL	MCA (A)	16.3
	MCCP (A)	25
	VOLTS (V)	115
	PHASE	1
	FREQUENCY (Hz)	60
BASED ON		GREENHECK
MODEL		MINVENT-750
REMARKS:		1 & 2

AIR TERMINAL DEVICE SCHEDULE				
TAG NUMBER	S1	S2	R1	
DESCRIPTION	SUPPLY	SUPPLY	RETURN	
TYPE	DIFFUSER	SIDEWALL	EGGCRATE	
NECK SIZE	A=6"	6x6	24 x 24	
	B=8"			
	C=10"			
	D=12"			
AIR PATTERN	4 WAY	2-WAY	--	
MAX NC RATING	20	20	20	
MATERIAL	STEEL	STEEL	STEEL	
FINISH	BAKED ENAMEL	BAKED ENAMEL	BAKED ENAMEL	
BASED ON	PRICE	PRICE	PRICE	
MODEL	24x24 SCD	500 SERIES	81 SERIES	
REMARKS	--	--	--	

LOUVER SCHEDULE		
DESIGNATION	L-1	L-2
USAGE	INTAKE	EXHAUST
SERVES ROOM	SHOP CLASSROOM - 02	SHOP CLASSROOM - 02
DESCRIPTION	SIDEWALL	SIDEWALL
DEPTH (IN)	4	4
FRAME TYPE	DRAINABLE	DRAINABLE
WIDTH (IN)	24	24
HEIGHT (IN)	16	16
AIRFLOW (CFM)	515	450
FREE AREA (SF)	1.06	1.06
FREE AREA VELOCITY (FPM)	487	426
PRESSURE DROP (IN H ₂ O)	0.041	0.031
SELECTION BASED ON	GREENHECK	GREENHECK
MODEL	ESD-403	ESD-403
REMARKS	1 & 2	1 & 2

REMARKS LEGEND:

1. PROVIDE BIRD SCREEN.

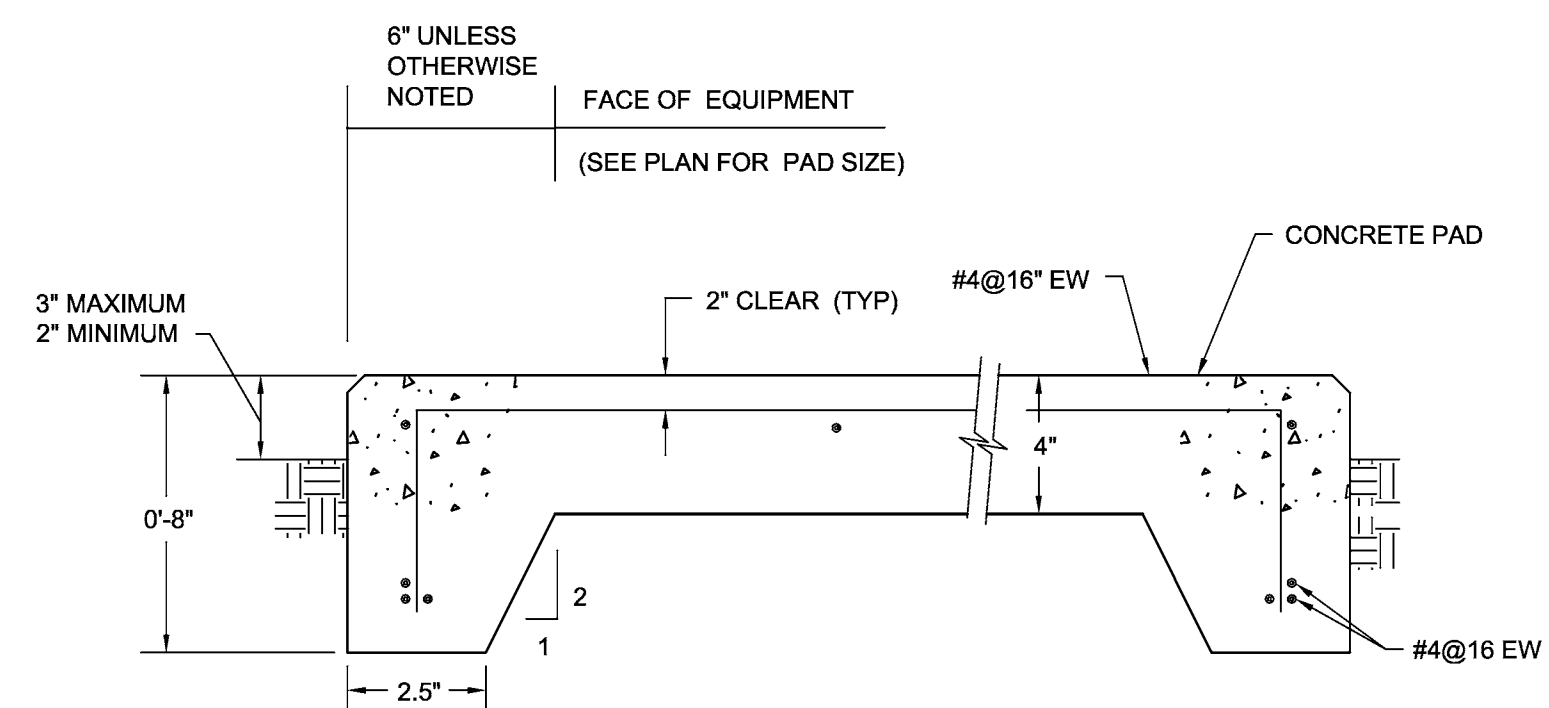
1. SUBMIT COLOR CHART. COLOR TO MATCH WINDOW FRAMES, TO BE CHOSEN BY THE ARCHITECT.

MECHANICAL PIPE AND DUCT INSULATION AND CONSTRUCTION SCHEDULE									
SERVICE	CONFIGURATION	INSULATION	THICKNESS	INSULATION DENSITY (LB/CSQ-FT)	FINISH	DUCT/PIPE MATERIAL	PRESSURE CLASSIFICATION	SMACNA SEAL CLASSIFICATION	REMARKS
SUPPLY DUCT	ALL	FIBERGLASS BLANKET FOR SQUARE DUCT, BLANKET FOR ROUND	1-1/2"	0.75	FSK	GALV. STEEL	≥2.0 H2O	A	1
RETURN AIR DUCT	ALL	--	--	--	--	GALV. STEEL	≥2.0 H2O	A	--
EXHAUST AIR FROM BUILDING TO ERV	ALL	--	--	--	--	GALV. STEEL	≥2.0 H2O	A	--
OUTSIDE AIR INTAKE DUCT TO ERV	ALL	--	--	--	--	GALV. STEEL	≥2.0 H2O	A	--
OUTSIDE AIR SUPPLY TO HEAT PUMP RETURN DUCT	ALL	FIBERGLASS BOARD FOR SQUARE DUCT, BLANKET FOR ROUND	1-1/2"	0.75	FSK	GALV. STEEL	≥2.0 H2O	A	1
CONDENSATE PIPING	WITHIN BUILDING ENVELOPE	FLEXIBLE ELASTOMERIC	1"	--	--	PVC	--	--	--
REFRIGERANT SUCTION AND HOT-GAS PIPING	ALL	FLEXIBLE ELASTOMERIC	1"	--	--	COPPER	--	--	--

REMARKS LEGEND:

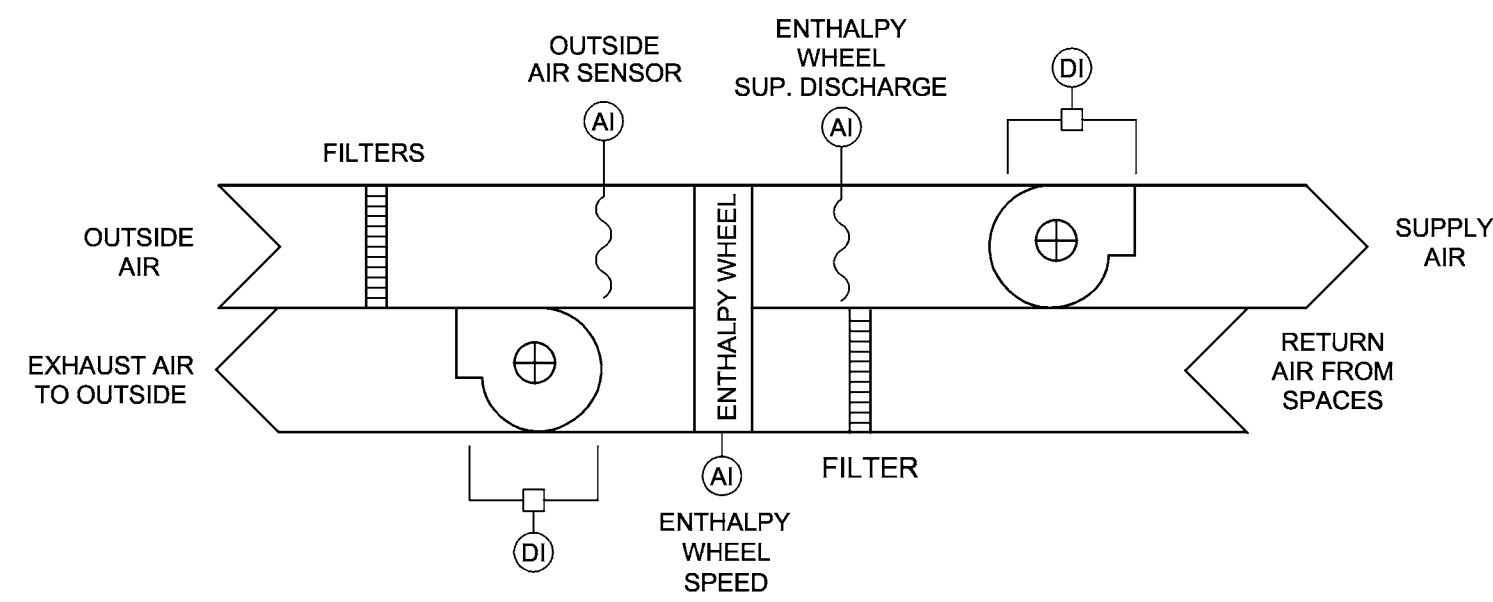
1. DUCT WRAP INSULATION WILL BE INSTALLED ACCORDING TO MANUFACTURERS RECOMMENDATION. THE MANUFACTURER INSTRUCTIONS INCLUDE STAPLES 6" O.C. PRESSURE SENSITIVE TAPE. MECHANICAL FASTENERS AND SPEED CLIPS ARE TO BE USED ON THE BOTTOMS 18" O.C. FOR DUCT 24" OR GREATER. NO ADDITIONAL ADHESIVE IS REQUIRED.

NOTE:
1. EQUIPMENT MAY BE SCHEDULE AS BASIS OF DESIGN.
OTHER MANUFACTURERS MAY BE ACCEPTED.



EXTERIOR EQUIPMENT PAD DETAIL

SCALE: NONE



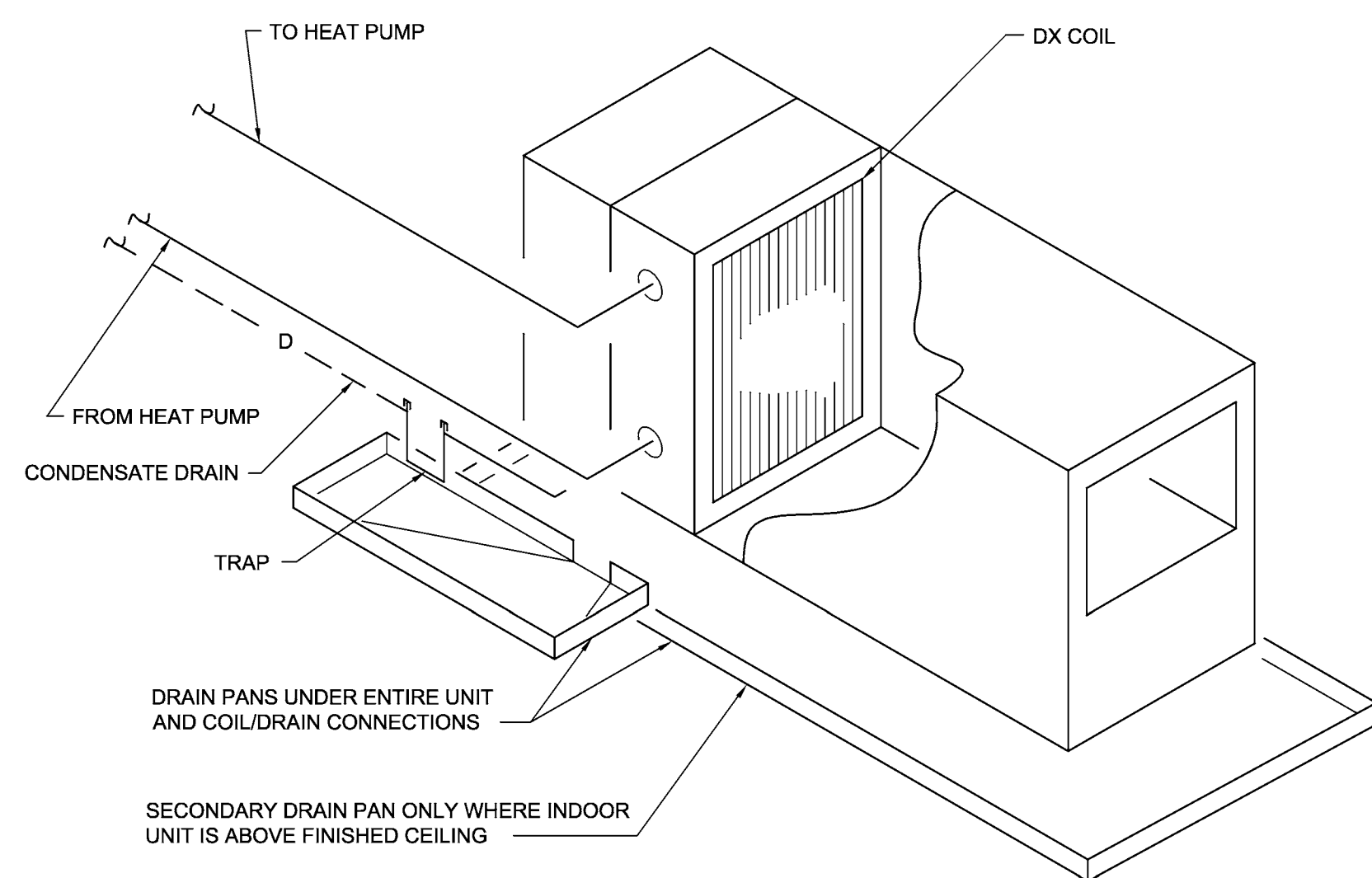
ENERGY RECOVERY VENTILATOR CONTROL DIAGRAM

SCALE: NONE

SEQUENCE OF OPERATION:

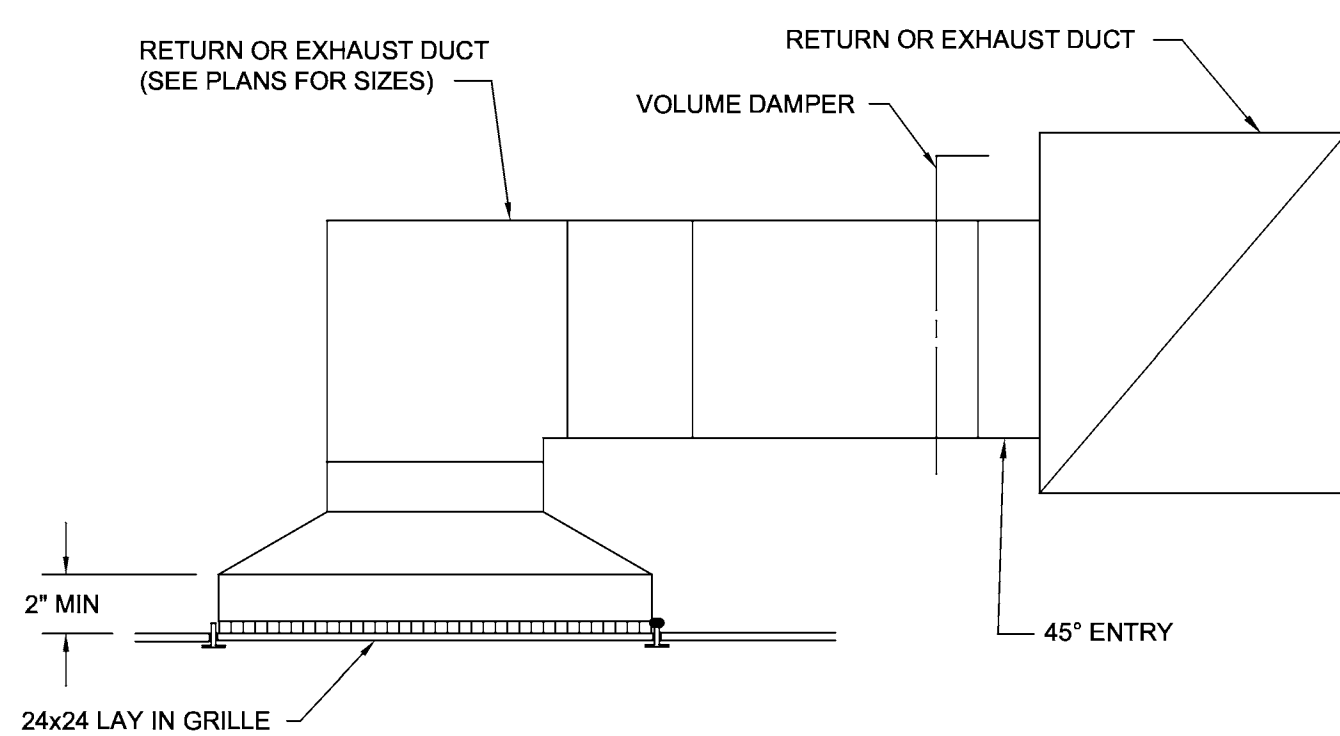
DURING THE OCCUPIED MODE, THE ENERGY RECOVERY VENTILATOR SHALL RUN CONTINUOUSLY. DURING UNOCCUPIED MODE, THE UNIT WILL BE DISABLED WHERE THE SUPPLY AND EXHAUST FANS ARE OFF AND THE WHEEL DOES NOT ROTATE.

DURING OPERATION, DIFFERENTIAL PRESSURE SENSORS SHALL BE USED TO CONFIRM STATUS OF SUPPLY AND EXHAUST FANS. A TACHOMETER SHALL BE USED TO VERIFY WHEEL OPERATION. IF AT ANY TIME THE UNIT IS COMMANDED ON AND EITHER OF THESE THREE OPERATIONAL PIECES OF THE UNIT ARE NOT FUNCTIONING, THE ENTIRE UNIT SHALL BE SHUT DOWN AND AN ALARM SENT.



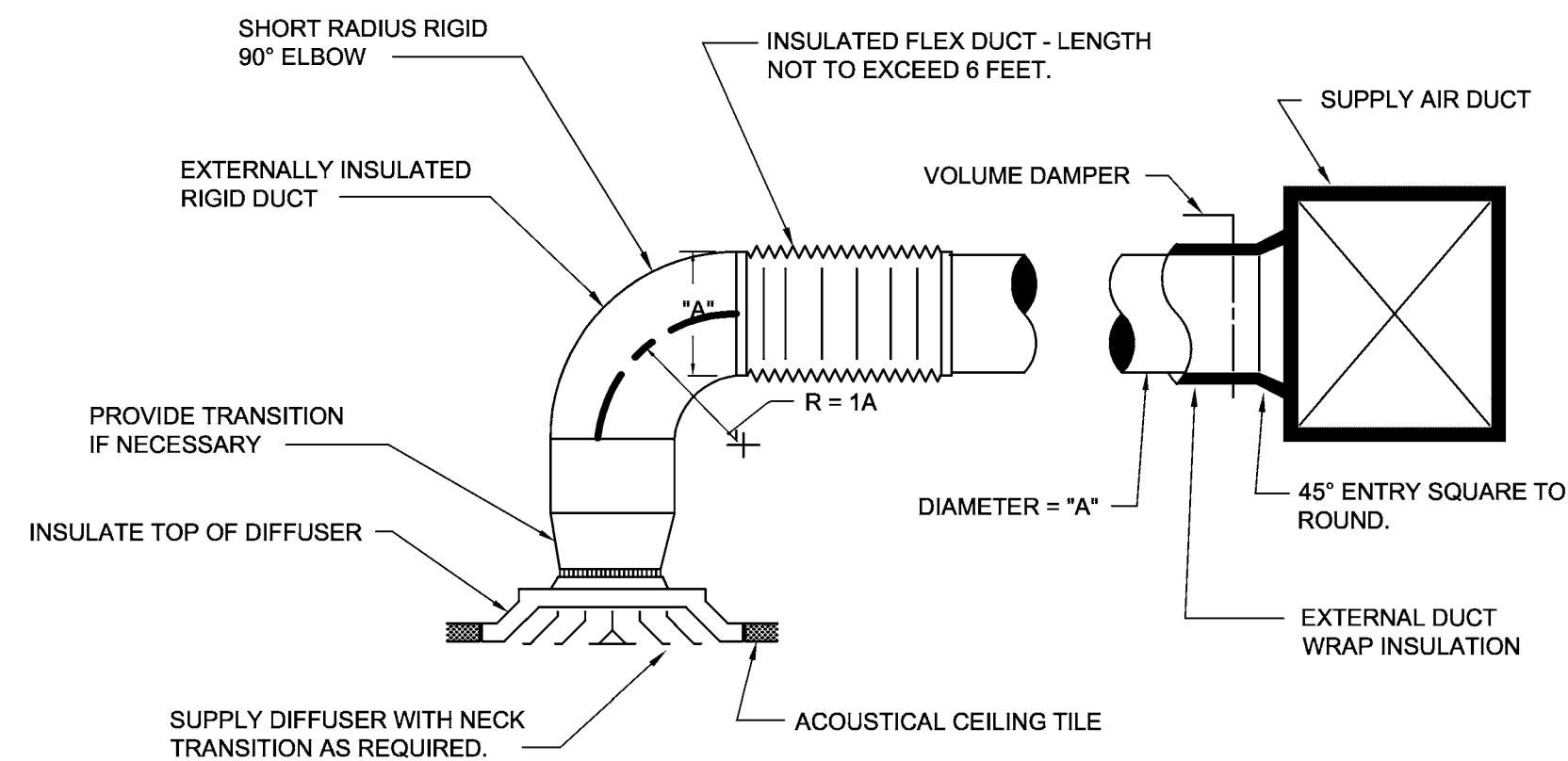
HEAT PUMP INDOOR UNIT DETAIL

SCALE: NONE



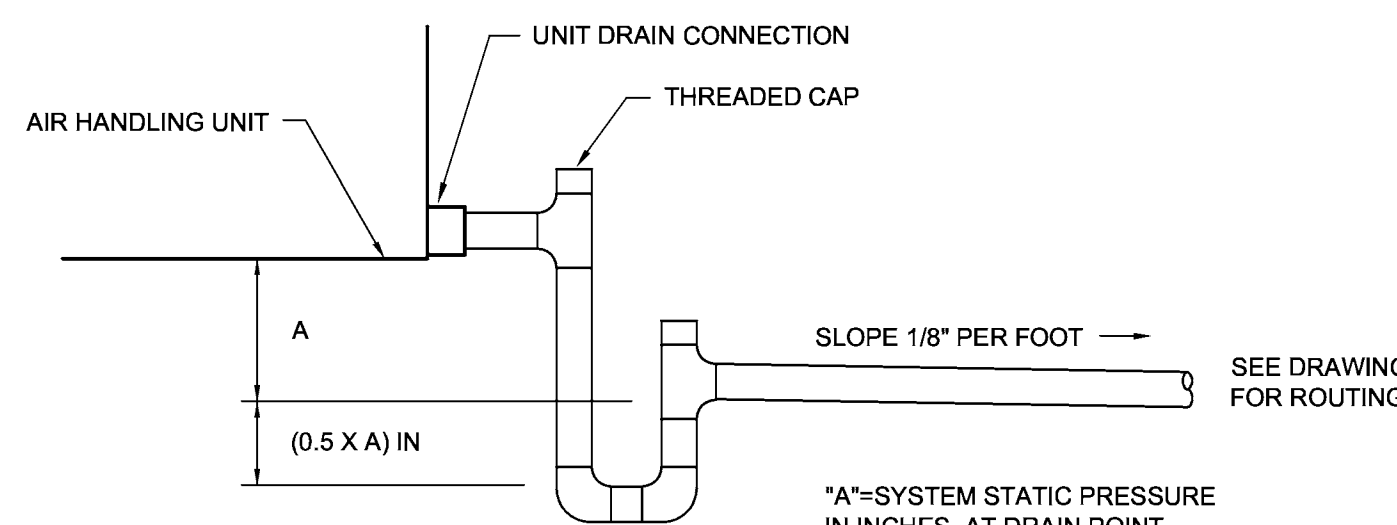
CEILING RETURN/EXHAUST GRILLE

SCALE: NONE



TYPICAL CEILING SUPPLY DIFFUSER CONNECTION

SCALE: NONE



NOTES:

1. CONDENSATE DRAIN PIPE SIZE SHALL BE UNIT DRAIN CONNECTION SIZE (MINIMUM 3/4")
2. THIS DETAIL IS PROVIDED FOR REFERENCE. INSTALL PER MANUFACTURER INSTALLATION INSTRUCTIONS.

AIR HANDLING UNIT DRAIN FOR NEGATIVE PRESSURE DRAIN PAN

SCALE: NONE

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CHESTERFIELD COUNTY PUBLIC SCHOOLS

[illegible]

COMM NO: 213197	
DATE: SEPTEMBER 30, 2013	
DRAWN: SWL	DESIGN: SWL
CHECK: JM	
CAD FILE: M-201 SCHEDULES AND DETAILS	
SHEET TITLE	

SCHEDULES AND DETAILS

SHT. NO.	REV. NO.
M-201	0

	RACEWAY RUN SURFACE MOUNTED. WITH PHASE, NEUTRAL AND GROUND CONDUCTOR UNLESS NOTED OTHERWISE. TIC MARKS INDICATE WIRES IN RACEWAY.
	HOMERUN RACEWAY RUN SURFACE MOUNTED UNLESS OTHERWISE NOTED.
	480 VOLT BRANCH CIRCUIT PANELBOARD, NEMA 1 PANEL IN CABINET. SIZE AND DESCRIPTION AS SCHEDULED. TOP: +6"-0" AFF.
	208 VOLT BRANCH CIRCUIT PANELBOARD, NEMA 1 PANEL IN CABINET. SIZE AND DESCRIPTION AS NOTED. TOP: +6"-0" AFF.
	DRY TYPE SECONDARY TRANSFORMER. SIZE AS INDICATED.
	ELECTRIC MOTOR. SIZE IN HORSEPOWER AS INDICATED OR SCHEDULED. SEE MECHANICAL SCHEDULE.
	DISCONNECT SWITCH. POLES, AMPS, VOLTS, NON-FUSED WITH ENCLOSURE TYPE INDICATED. TOP: +5"-0" AFF.
	DISCONNECT SWITCH. POLES, AMPS, VOLTS, FUSED WITH ENCLOSURE TYPE INDICATED. TOP: +5"-0" AFF.
	120 VOLT, 20 AMP, 3-WIRE, NEMA 5-20 DUPLEX RECEPTACLE. MOUNTING HEIGHT: CENTER +18" AFF UNO. NEW DEVICES SHALL BE SURFACE MOUNTED UNO.
	JUNCTION BOX
	SWITCH, SINGLE POLE SWITCH. MOUNTING HEIGHT: CENTER +48" AFF, UNO.
	SWITCH, THREE POLE SWITCH. MOUNTING HEIGHT CENTER +48" AFF, UNO.
	2' X 4' FLUORESCENT CEILING LIGHTING FIXTURE OF TYPE INDICATED. VERIFY CEILING TYPE BEFORE ORDERING RECESSED LIGHTING FIXTURES. VERIFY CEILING HEIGHT WITH FINISH SCHEDULE.

	AMPERES	FACP	FIRE ALARM CONTROL PANEL
ACSR	ALUMINUM CONDUCTOR STEEL REINFORCED	FAA	FIRE ALARM GRAPHIC ANNUNCIATOR
AF	AMPERE FRAME OR AMPERE FUSE	FD	UNDERFLOOR DUCT
AFD	ADJUSTABLE FREQUENCY MOTOR DRIVE UNIT	FDS	FIRE ALARM REMOTE POWER SUPPLY
AFF	ABOVE FINISHED FLOOR	FS	FLOW SWITCH
AFG	ABOVE FINISHED GRADE	FUS	FUSE
AHU	AIR HANDLING UNIT	FVNR	FULL VOLTAGE NON-REVERSING
AS	AMPERE SWITCH	G	GROUND
AT	AMPERE TRIP OR AIR TERMINAL	GFGI	GOVERNMENT FURNISHED GOVERNMENT INSTALLED
ATC	AUTOMATIC TEMPERATURE CONTROL	GFI	GROUND FAULT INTERRUPTING
AW	AGAINST WALL	GP	GENERAL PURPOSE
AWG	AMERICAN WIRE GAUGE	HP	HORSE POWER
B	BOILER	HT	HEAT TRACE
BAS	BUILDING AUTOMATION SYSTEM	HWRP	HOT WATER RECIRCULATING PUMP
C	CONDUIT	HWP	HOT WATER PUMP
CHR	CHILLED WATER RETURN	HWUH	HOT WATER UNIT HEATER
CHS	CHILLED WATER SUPPLY	IPC	SQUARE D INTEGRATED POWER CENTER
CHWP	CHILLED WATER PUMP	JB	JUNCTION BOX
CKT	CIRCUIT	JV	KILOVOLTS
CKT BKR	CIRCUIT BREAKER	KVA	KILOVOLT AMPERES
CO	CARBON MONOXIDE	KW	KILOWATTS
COMM	COMMUNICATIONS	M	MAIN OR METER
CR	CONTROL RELAY OR CARD READER	MB	MAIN CIRCUIT BREAKER
CT	CURRENT TRANSFORMER OR CABLE TRAY	MH	METAL HALIDE, MANHOLE, OR MOUNTING HEIGHT
DB	DECIBEL		TO CENTER OF DEVICE
DDC	DIRECT DIGITAL CONTROLS	MLO	MAIN LUGS ONLY
DISC SW	DISCONNECT SWITCH	MNS	MASS NOTIFICATION SYSTEM
DHWG	DOMESTIC HOT WATER GENERATOR	MP SW	MOTOR PROTECTIVE SWITCH
DHPW	DOMESTIC HOT WATER RECIRC. PUMP	MS	MAGNETIC STARTER
DPDB	DATA PUNCH DOWN BLOCK	MSB	MAIN SWITCHBOARD
DTPW	DUAL TEMP WATER PUMP	MTD	MOUNTED
DN	DOWN	N	NEUTRAL
DOIM	DIRECTORATE OF INFORMATION MANAGEMENT	NC	NORMALLY CLOSED
DVP	DOMINION VIRGINIA POWER	NEC	NATIONAL ELECTRICAL CODE
E OR EXIST.	EXISTING	NETA	NATIONAL ELECTRICAL TESTING ASSOCIATION
EA	EACH	NF	NON-FUSED
EF	EXHAUST FAN	NIC	NOT IN CONTRACT
EMR	EMERGENCY	NO	NORMALLY OPEN
ENCL	ENCLOSURE	O.C.	ON CENTER
EPI	EXTERNAL PORT NETWORK SWITCH	OS	OCCUPANCY SENSOR
ERU	ENERGY RECOVERY UNIT	P	POLE OR PRIMARY
EUEP	EXISTING UNDERGROUND ELECTRIC POWER		
EUTC	EXISTING UNDERGROUND COMMUNICATIONS		
EWC	ELECTRIC WATER COOLER		
EWH	ELECTRIC WALL HEATER		
F	FLUSH MOUNTED IN WALL		
FA	FIRE ALARM		

PBX	PULLBOX
PH	PHASE
PIV	POST INDICATING VALVE
PNL	PANEL
PT	POTENTIAL TRANSFORMER
PVC	POLYVINYL CHLORIDE
PWR	POWER
RA	RETURN AIR
RCPT	RECEPTACLE
RF	RETURN AIR FAN
SC	SECONDARY OR SURFACE WALL MOUNTED
SCC	SHORT CIRCUIT CURRENT
SHT	SHEET
S/O	SPACE ONLY
STCB	SHUNT TRIP CIRCUIT BREAKER
SW	SWITCH
SYM	SYMMETRICAL
T	THICK
TB	TERMINAL BOX
TS	TAMPER SWITCH
TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSOR
TYPE	TYPICAL
UG	UNDERGROUND ELECTRIC
UH	UNIT HEATER
UNO	UNLESS NOTED OTHERWISE
V	VOLTS
VFD	VARIABLE FREQUENCY DRIVE
VTC	VIDEO TELECONFERENCE
W	WIRE OR WATT
WP	WEATHERPROOF
WS	WORKSTATION
XFMR	TRANSFORMER
Y	WYE CONNECTED
YDCT	WYE DELTA CLOSED TRANSITION



1. HOUSING - DIE-FORMED, COLD-ROLLED STEEL, WITH REINFORCEMENT RIBS FOR RIGIDITY. ENDCAPS SECURED WITH TABS, SCREWS OR RIVETS. FIXTURE SHALL NOT PERMANENTLY DEFORM OUT OF "SQUARE" WHEN PICKED UP FROM ANY CORNER. DEPTH AS INDICATED UNLESS SPECIFICALLY MANUFACTURED FOR OPTIMAL USE WITH T8 LAMPS.
2. FINISH - MULTI-STAGE PHOSPHATE BONDING TREATMENT FINISHED WITH HIGH REFLECTANCE (MINIMUM 85%), BAKED WHITE ENAMEL FINISH.
3. LENS - 100% ACRYLIC, CLEAR PRISMATIC, PATTERN #12 WITH MINIMUM 0.125" THICKNESS.
4. LAMPS -(2) LINEAR FLUORESCENT T8, 34 WATT/41K
5. BALLAST - CLASS P, THERMALLY-PROTECTED, HIGH POWER FACTOR (.95), ELECTRONIC TYPE WITH SOUND RATING A.
6. CERTIFICATION - UL LISTED AND LABELED.



1. HOUSING/TRIM - UV STABLE, FLAME-RATED, HIGH-IMPACT THERMOPLASTIC IN WHITE TEXTURED FINISH
2. LETTERS/CHEVRONS - MINIMUM 6" HIGH WITH 3/4" STROKE. RED OR GREEN LETTERS AS INDICATED. PROVIDE CHEVRONS AS INDICATED EITHER LEFT, RIGHT OR BOTH DIRECTIONS AS INDICATED.
3. EMERGENCY PACK - SOLID-STATE, CONSTANT-CURRENT TYPE BATTERY CHARGER WITH MAINTENANCE-FREE, NICKEL-CADMIUM BATTERY, AC-ON INDICATOR LAMP AND TEST SWITCH.
4. MOUNTING - UNIVERSAL MOUNTING KIT FOR CEILING.
5. ILLUMINATION - PROVIDED BY RED OR GREEN HIGH-OUTPUT LEDS IN HOUSING. RATED LIFE SHALL BE IN EXCESS OF 20 YEARS.
6. LAMP HEADS - UV STABLE, FLAME RATED, POLYCARBONATE THERMOPLASTIC. MR16 HALOGEN LAMPS SHALL BE 5 WATTS, HIGH-OUTPUT OR AS INDICATED IN LIGHTING FIXTURE SCHEDULE.
7. CERTIFICATION - UL LISTED AND LABELED.
- *8. PROVIDE 90 MINUTE BATTERY TO POWER TYPE Z FIXTURE AT EXIT DOORS WHERE INDICATED.

EXIT EGRESS UNIT

REVISÉ

NI - 64



COMMONWEALTH OF VIRGINIA
C. B. Reynolds
 C. B. REYNOLDS
 Lic. No. 005701
 09/30/13
 PROFESSIONAL ENGINEER

CCPS SWIFT CREEK MIDDLE
SCHOOL TECH LAB
SWIFT CREEK MIDDLE SCHOOL
3700 OLD HUNDRED RD, MIDLOTHIAN, VA 23112
CHESTERFIELD COUNTY PUBLIC SCHOOLS

DRAWING REVISIONS PER REVIEW COMMENTS

							1-29-14
							1
COMM NO: 213197							
DATE: SEPTEMBER 30, 2013							
DRAWN: CMM				DESIGN: CMM			
CHECK: CDH							
CAD FILE: 6-01 ELECTRICAL LEGEND AND ABBREVIATION							
SHEET TITLE							
ELECTRICAL LEGEND AND ABBREVIATION							
SHT. NO.						REV. I	
E-001						0	



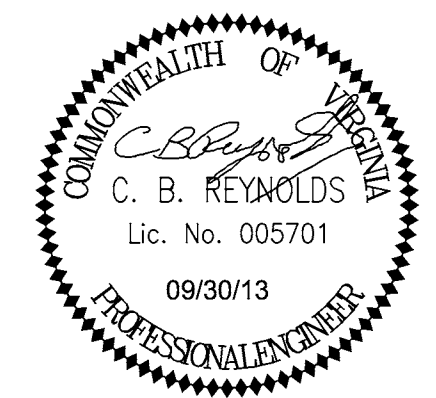
- NOTES:**
1. REMOVE LIGHTS, REUSE CIRCUIT FOR NEW LIGHTS
 2. REMOVE (5) RETRACTABLE RECEPTACLES FROM CEILING, REMOVE CIRCUITS BACK TO PANEL. SAVE CONDUIT RACEWAY FOR NEW WORK
 3. DISCONNECT EXISTING EXHAUST FAN. REMOVE CIRCUITS BACK TO PANEL, SAVE CONDUIT RACEWAY FOR NEW WIRE TO BE USED FOR HP1.



- NOTES:
1. 1. ALL WORK STATIONS CIRCUITS SHALL HAVE DEDICATED NEUTRAL AND GROUND WIRES.

A detailed floor plan of a building, showing various rooms and corridors. A specific area in the upper right portion of the plan is shaded with diagonal lines. An arrow points from the text 'AREA OF WORK' to this shaded region.

KEY PLAN



CCPS SWIFT CREEK MIDDLE
SCHOOL TECH LAB
SWIFT CREEK MIDDLE SCHOOL
13700 OLD HUNDRED RD, MIDLOTHIAN, VA 23112
CHESTERFIELD COUNTY PUBLIC SCHOOLS

[illegible]

[illegible]

ATTACHMENT B – CHESTERFIELD COUNTY SAMPLE CONTRACT
(total of 4 pages)

SAMPLE CONTRACT

THIS AGREEMENT, made and entered into this «day» day of «month», «year», between THE COUNTY OF CHESTERFIELD AND CHESTERFIELD COUNTY SCHOOL BOARD, as party of the first part (hereinafter called the Owner), and «Company», «Address1», «City», «State» «PostalCode», party of the second part (hereinafter called the Contractor).

WITNESSETH: In consideration for the mutual covenants hereinafter stated, the parties agree for themselves, their personal representatives, successors, assigns, as follows:

1. The Contractor promises and agrees:

A. To furnish all materials, equipment, tools, skill, and labor of every description necessary or reasonably incidental to carrying forth and completing in a good and workmanlike manner in accordance with the highest industry standards and in strict conformity with the Plans and Specifications entitled IFB #«number» - «subject» which are incorporated herein by reference.

B. To commence work under this contract not later than «commence» days following the date to be specified in the written "Notice to Proceed" by the Owner, and to fully complete all work hereunder within «complete» calendar days from and including said date.

2. The Owner promises and agrees:

A. To pay the Contractor for said work when completed in accordance with the provisions of these Contract Documents, the Contract Sum as set forth in said Proposal amounting to «dollars» («amount»), subject to additions and accepted by the County and School Board or its authorized representatives.

3. During the performance of this contract, the contractor agrees as follows:

A. The Contractor will not discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin, age, disability, or any other basis prohibited by state law relating to discrimination in employment, except where there is a bona fide occupational qualification reasonably necessary to the normal operation of the Contractor. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause.

B. The contractor, in all solicitations or advertisements for employees placed by or on behalf of the contractor, will state that such contractor is an equal opportunity employer.

C. Notices, advertisements and solicitations placed in accordance with federal law, rule or regulation shall be deemed sufficient for the purpose of meeting the requirements of this section.

D. The contractor shall include the provisions of Section 3, the foregoing paragraphs A, B, and C in every subcontract or purchase order of over \$10,000 so that the provisions will be binding upon each subcontractor or vendor.

4. During the performance of this contract, the contractor agrees to:

A. Provide a drug-free workplace for the contractor's employees.

B. Post in conspicuous places, available to employees and applicants for employment, a statement notifying employees that the unlawful manufacture, sale, distribution, dispensation,

possession, or use of a controlled substance or marijuana is prohibited in the contractor's workplace and specifying the actions that will be taken against employees for violations of such prohibition.

C. State in all solicitations or advertisements for employees placed by or on behalf of the contractor that the contractor maintains a drug-free workplace.

D. Include the provisions of the foregoing clauses in every subcontract or purchase order over \$10,000, so that the provisions will be binding upon each subcontractor or vendor.

For the purposes of this section, "drug-free workplace" means a site for the performance of work done in connection with a specific contract awarded to a contractor in accordance with this chapter, the employees of whom are prohibited from engaging in the unlawful manufacture, sale, distribution, dispensation, possession or use of any controlled substance or marijuana during the performance of the contract.

5. It is further understood and agreed between the parties hereto as follows:

A. The said work is to be done in accordance with the laws of the State of Virginia, excepting the law governing conflicts of laws, to the entire satisfaction of the Owner, subject at all times to the inspection and approval of the Owner. Disputes arising out of this contract shall be resolved in the Courts of the Commonwealth of Virginia, in and for Chesterfield County.

B. The decision of said County and School Board upon any questions connected with the execution of this agreement or any failure or delay in the prosecution of the work by said Contractor shall be final and conclusive.

C. The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to the other party hereto and to partners, successors, assigns and legal representatives of such other party in respect to covenants, agreements and obligations contained in the Contract Documents. Neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

D. If at any time after the execution of this Contract and the Performance Bond, the Owner shall deem the Surety or Sureties then upon said bond to be unsatisfactory, or if for any reason said bond shall cease to be adequate security for the performance of the work, the Contractor shall at his expense, within five (5) days after receipt of written notice to do so, furnish an additional bond or bonds in such form and amount and with such surety or sureties as shall be satisfactory to the Owner. In such event no further payment to the Contractor shall be deemed to be due under this Contract until such new or additional security for the faithful performance of the work shall be furnished in manner and form satisfactory to the Owner.

6. The contractor's records, which shall include but not be limited to accounting records, written policies and procedures, subcontract files (including proposals of successful and unsuccessful bidders), original estimates, estimating worksheets, correspondence, change order files (including documentation covering negotiated settlements), and any other supporting evidence necessary to substantiate charges related to the Contract (all the foregoing hereinafter referred to as "records") shall be open to inspection and subject to audit and/or reproduction, during normal working hours, by the Owner's agent or its authorized representative to the extent necessary to adequately permit evaluation and verification of any invoices, payments, change orders or claims submitted by the Contractor or any of its payees pursuant to the execution of the Contract. Such records subject to examination shall also include, but not be limited to, those records necessary to evaluate and verify direct and indirect costs (including overhead allocations) as they may apply to costs associated with the Contract.

For the purpose of such audits, inspections, examinations and evaluations, the Owner's agent or authorized representative shall have access to said records from the effective date of the Contract, for the duration of the Work, and until three (3) years after the date of final payment by the Owner to the Contractor pursuant to the Contract.

The Owner's agent or its authorized representative shall have access to the Contractor's facilities, shall have access to all necessary records, and shall be provided adequate and appropriate work space, in order to conduct audits as required. The Owner's agent or its authorized representative shall give any auditee reasonable advance notice of intended audits.

The Contractor shall require all subcontractors, insurance agents, and material suppliers (payees) to comply with the provisions of set forth by insertion of the requirements hereof in a written contract agreement between the Contractor and payee. Failure to obtain such written contracts, which include such provisions, shall be reason to exclude some or all of the related payees' costs from amounts payable to the Contractor pursuant to the Contract.

7. It is further understood and agreed as follows:

A. The undersigned Contractor/Vendor will indemnify and hold the County of Chesterfield, Virginia (the "County") and the School Board of the County of Chesterfield, Virginia (the "School Board"), and its officers, agents, and employees harmless from and against all claims, damages, and losses arising out of or resulting from the Contractor/Vendor's providing or failure to provide any construction, product, goods, or services required, including but not limited to any such claim, damage, loss or expense, that is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property, including the loss of use resulting therefrom, or to economic loss; provided, however, that the Contractor/Vendor's indemnification obligation under this agreement shall be limited to claims, damages, losses, and expenses to the extent caused by any act or omission of the Contractor/Vendor, or any subcontractor (a "Subcontractor") performing work required by the Contractor/Vendor's contract with the School Board, or anyone directly or indirectly employed by any of them or anyone for whose acts the Contractor/Vendor or his Subcontractor may be liable.

B. The Contractor/Vendor's indemnification obligation hereunder with respect to any and all claims against the County and School Board or any of its officers, agents or employees, by any employee or statutory employee of the Contractor/Vendor, or any Subcontractor, anyone directly or indirectly employed by any of them, or anyone for whose acts the Contractor/Vendor or Subcontractor may be liable, shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the Contractor/Vendor or any Subcontractor under Worker's Compensation Acts, Disability Benefit Acts or other Employee Benefit Acts unless otherwise provided by law.

C. When a consulting architect (the "Architect") has been retained by the County and School Board, the Contractor/Vendor's indemnification obligation hereunder shall not extend to the liability of the Architect, his agent or employees arising out of (1) the preparation or approval of maps, drawings, opinions, reports, surveys, change orders, designs or specifications, or (2) the giving of or the failure to give directions or instructions by the Architect, his agents or employees provided such giving or failure to give is the primary cause of the injury or damage.

8. Vendor/Supplier/Contractor will be responsible for complying with all federal, state and local environmental regulations relating to transportation, handling, storage, spillage and any other aspect of providing the services specified herein, as applicable.

9. Chesterfield County does not discriminate against faith-based organizations in accordance with the Code of Virginia, §2.2-4343.1.

10. Seller/Contractor agrees that he does not, and shall not during the performance of this contract knowingly employ an unauthorized alien as defined in the federal Immigration Reform and Control Act of 1986, in accordance with the Code of Virginia, §2.2-4311.1.

IN WITNESS WHEREOF, said parties have hereunto set their hands the day and year first above written.

**EXECUTED FOR THE COUNTY AND SCHOOL BOARD
OF CHESTERFIELD, VIRGINIA**

SIGNATURE_____

NAME (type/print)_____ Michael J. Bacile

TITLE_____ Purchasing Director

EXECUTED FOR THE CONTRACTOR

«Company»_____

SIGNATURE_____

NAME (type/print)_____

TITLE_____