



PROJECT MANUAL

October 6, 2022

2023 SUMMER HVAC IMPROVEMENTS AT HALE HIGH SCHOOL

BID PACKAGE

**BIDDING DOCUMENTS
PROJECT SPECIFICATIONS**

**INDEPENDENT SCHOOL DISTRICT NO. ONE
TULSA OKLAHOMA**

**Chris Hudgins, Executive Director Bond Projects
Charles C. Mason Education Service Center
3027 South New Haven
Tulsa, Oklahoma 74147-0208
Telephone (918) 746-6684, Fax Number (918) 746-6597**

TULSA PUBLIC SCHOOLS

BID DOCUMENTS

SPECIFICATIONS AND DETAILS

For

**2023 SUMMER HVAC IMPROVEMENTS
AT HALE HIGH SCHOOL**

BID OPENING DATE.....October 27, 2022

BID TIME.....2:00 PM

**MANDATORY WALK THROUGH.....October 17 @ 3:00PM
6960 East 21st Tulsa, OK 74129**

NOTICE TO BIDDERS

Before submitting a bid, the Contractor shall carefully examine each of the school sites indicated above, paying particular attention to the existing conditions.

The specific bid documents defining the work involved on each project along with Tulsa Public Schools' specifications and details form the basis of the work done and are to be included with the successful bidder.

PROJECT MANUAL
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THE FOLLOWING DOCUMENTS ARE NOT FOUND IN THE PROJECT MANUAL BID PACKET BUT ARE REQUIRED TO BE A PART OF THE CONTRACT – ON FILE AT OWNER'S OFFICE FOR BIDDER'S INSPECTION UPON REQUEST.

Owner-Contractor Agreement
Work Order
Tax Exempt State

SECTION 00010 FOR BIDS

Sealed Bids in duplicate for **TULSA PUBLIC SCHOOLS – HVAC IMPROVEMENTS AT HALE HIGH SCHOOL** will be received and publicly opened and read aloud by INDEPENDENT SCHOOL DISTRICT NUMBER ONE OF TULSA COUNTY, OKLAHOMA, hereinafter referred to as "Owner," in Rm 457, Education Service Center, 3027 S. New Haven Ave, Tulsa, OK, 74114 until **2:00 PM, OCTOBER 27, 2022**.

The bidding process will be in compliance with the Public Competitive Bidding Act of 1974. Bids must be accompanied by a bid security in the amount of 5% of the bid. By this notice, all provisions of the act apply to this project and are incorporated into notice by reference.

Upon receipt of an acceptable bid, the contract will be awarded within thirty days after the opening of bids and the written contract executed within sixty days thereafter.

Contractor qualification statement must be submitted **seven (7)** calendar days prior to bid date to the Owner, if not currently on file.

Attention is called to the fact that a designated completion date for this project site will be established based on the number of calendar days, as stated in the accepted bid, required to complete the Project work. There will be a \$2500 Liquidated Damages Clause for each day the contract is not completed. The scheduled completion date will be a very significant and material factor to the owner when selecting the Lowest Responsible Bid. Each Bidder must include (in the space provided on the Bid Form) the number of calendar days, which the Bidder will require to complete the specified Project.

Failure to comply with the above bid requirements will result in return of unopened Bid Proposal.

Engineer on this project is Allied Engineering

Bid Documents may be obtained from:

<http://www.tulsaschools.org/connect-with-us/partner-with-us/bond-bids>

Owner reserves the right to reject any or all bids and to waive informalities or minor irregularities in any bid.

INDEPENDENT SCHOOL DISTRICT NUMBER ONE OF TULSA COUNTY OKLAHOMA

By Ms. Stacey Woolley, Board President

ATTEST:

By Sarah Bozone, Clerk

SECTION 00020

INSURANCE REQUIREMENTS

Contractor shall obtain insurance of the types and in the amounts described below. The insurance shall be written by insurance companies and on forms acceptable to Owner.

1). Commercial General and Excess Liability or Umbrella Liability Insurance:

Contractor shall maintain commercial general liability (CGL) and, if necessary, commercial excess liability or umbrella insurance with a limit of not less than \$1,000,000 each occurrence. CGL insurance should contain a general aggregate with a \$2,000,000 limit and should apply separately to the Project.

- a) CGL insurance shall be written on an ISO occurrence form and shall cover liability arising from premises, operations, independent contractors, at a minimum, contractual liability equivalent to an intermediate form of contractual liability insurance, products/completed operations and personal injury and advertising injury.
- b) Owner shall be included as an additional insured on the CGL policy, using ISO Additional Insured Endorsement CG 20101185 or a substitute providing equivalent coverage, and under the commercial excess liability or umbrella, if any. This insurance, including insurance provided under the commercial excess liability or umbrella, if any, shall apply as primary insurance with respect to any other insurance or self insurance programs afforded to or maintained by Owner.
- c) There shall be no endorsement or modification of the CGL policy limiting the scope of coverage for liability arising from pollution, explosion, collapse or underground property damage.
- d) **Waiver of Subrogation.** Contractor waives all rights against Owner and its agents, officers, directors and employees for recovery of damages to the extent these damages are covered by the commercial general liability, excess liability or umbrella liability insurance maintained pursuant to this agreement.

2). Business Auto and Excess Liability or Umbrella Liability Insurance:

Contractor shall maintain business auto liability and, if necessary, excess liability or umbrella liability insurance with a limit of not less than \$1,000,000 each accident.

- a) Such insurance shall cover liability arising out of any auto (including owned, hired and non-owned autos).
- b) Business auto coverage shall be written on an ISO form. If necessary, the policy shall be endorsed to provide contractual liability coverage equivalent to that provided in the 1990 and later editions of CA 00 01.
- c) If the Contract Documents require Contractor to remove and haul hazardous waste from the project site or if the Project involves such similar environmental exposure, pollution liability coverage equivalent to that provided on the ISO Pollution Liability Broadened Coverage for Covered Autos Endorsement (CA 99 48) shall be provided, and the Motor Carrier Act Endorsement (MCS 90) shall be attached.
- d) **Waiver of Subrogation.** Contractor waives all rights against the Owner and its agents, officers, directors and employees for recovery of damages to the extent these damages are covered by the business auto liability, excess liability or umbrella liability insurance obtained by Contractor pursuant to this Agreement or under any applicable auto physical damage coverage.

3). Workers Compensation Insurance

Contractors shall maintain workers compensation and employer's liability insurance.

- a) The employer's liability, and if necessary excess liability or umbrella insurance limits shall not be less than \$1,000,000 each accident for bodily injury by accident or \$1,000,000 each employee for bodily injury by disease.

- b) The alternate employer endorsement (WC 00 03 01 A) shall be attached showing Owner in the schedule as the alternate employer.

4). Property Insurance

- a) Contractor shall purchase and maintain in force Builders Risk insurance for the entire Work. Such insurance shall be written in an amount at least equal to the initial contract sum as well as subsequent modifications of that sum. The insurance shall apply on a replacement cost basis and shall be written on a completed value form.
- b) The insurance as required in subparagraph (a) shall name as insured the Owner, Contractor and all subcontractors and sub-subcontractors on the Project. The insurance policy shall contain a provision that the insurance will not be canceled or allowed to expire until at least 30 days prior written notice has been given to the Owner.
- c) The insurance as required in Subparagraph (a) shall cover the entire Work as outlined in the project specifications and shall also cover portions of the Work located away from the site but intended for use at the site and shall also cover portions of the Work in transit. The policy shall include as insured property scaffolding, false work and temporary buildings located at the site. The policy shall cover the cost of removing debris, including demolition, as any is made legally necessary by the operation of any law, ordinance or regulation.
- d) The insurance as required by this Paragraph shall be written to cover all risks of physical loss except those specifically excluded in the policy and shall inure at least against the perils of fire, lightning, explosion, windstorm or hail, smoke, aircraft or vehicles, riot or civil commotion, theft, vandalism, malicious mischief and collapse.
- e) Any deductible applicable to the insurance purchased in compliance with this Paragraph shall be paid by Owner.
- f) Before the commencement of Work, Contractor shall provide Owner a copy the insurance policy obtained in compliance with this Paragraph.
- g) **Waiver of Subrogation.** Owner and Contractor waive all rights against each other and each of their subcontractors, sub-subcontractors, officer, directors, agents and employees for recovery for damages caused by fire and other perils to the extent covered by builders' risk or property insurance purchased pursuant to the requirements of this Paragraph 4 or any other property insurance applicable to the Work.
- h) Partial occupancy or use of the Work shall not commence until the insurance company or companies providing insurance as required in this Paragraph have consented to such partial occupancy or use. Owner and Contractor shall take reasonable steps to obtain consent of the insurance company or companies and agree to take no action, other than upon mutual written consent, with respect to occupancy or use of the Work that could lead to cancellation, lapse or reduction of insurance.

5). Evidence of Insurance

Prior to commencing the Work, Contractor shall furnish Owner with a certificate(s) of insurance, executed by a duly authorized representative of each insurer, setting out compliance with the insurance requirements set forth above.

- a) All certificates shall provide for 30 days written notice to Owner prior to the cancellation or material change of any insurance referenced to herein.
- b) The words "endeavor to" and "but failure to mail such notice shall impose no obligation or liability of any kind upon the company, its agents or representatives" shall be deleted from the cancellation provision of all certificates provided by the Contractor.
- c) Failure of Owner to demand such certificate or other evidence of full compliance with these insurance requirements or failure of Owner to identify a deficiency from evidence that is provided shall not be construed as a waiver of Contractor's obligation to maintain such insurance.
- d) Owner shall have the right, but not the obligation to prohibit Contractor or any subcontractor from entering the Project site unit such certificates or other evidence that insurance has been placed in the complete compliance with these requirements is received and approved by the Owner.

- e) Failure to maintain the insurance in this Insurance Requirement Section shall constitute an event of default pursuant to this Agreement and shall allow Owner to terminate this Agreement to Owner's option. If Contractor fails to maintain the insurance set forth herein, Owner shall have the right, but not the obligation, to purchase said insurance at Contractor's expense.
- f) Contractor shall provide certified copies of all insurance policies required above within 10 working days of Owner's written request for said copies.

6). General Insurance Provisions

- a) No Representation of Coverage Adequacy. By requiring the insurance as set out in the Insurance Requirement Section, Owner does not represent that coverage and limits will necessarily be adequate to protect Contractor and such coverage and limits shall not be deemed as a limitation on Contractor's liability under the indemnities provided to Owner in this Agreement or any other provision of the Contract documents.
- b) Cross Liability Coverage. If Contractor's liability policies do not contain the standard ISO separation of insureds provision or a substantially similar clause, they shall be endorsed to provide cross liability coverage.
- c) The insurance requirements set out in this Insurance Requirement Section are independent from all other obligations of Contractor under this Agreement and apply whether or not required by any other provision of this Agreement.
- d) Subcontractor's Insurance. Contractor shall cause each subcontractor employed by Contractor to purchase and maintain insurance of the type specified in the Insurance Requirement Section. When requested by the Owner, Contractor shall furnish to Owner copies of certificates of insurance evidencing coverage for each subcontractor.

END OF SECTION

SECTION 00100

INSTRUCTIONS TO BIDDERS

SCOPE:

1. GENERAL CONDITIONS:

Standard form "General Conditions of the Contract for Construction," The American Institute of Architects, Document A201, Fourteenth Edition, 1997, ("General Conditions") shall apply to the Work, except insofar as the General Conditions are modified, amended, waived, or changed by these Supplementary General Conditions. The following paragraph numbers refer to the paragraphs in the above referenced "General Conditions":

- (a) Paragraph 1. 1. 1: The last sentence is amended to read as follows: "The Contract Documents include the advertisement or invitation to bid, notice to bidders, instructions to bidders, sample forms, the Contractor's bid or proposal, any addenda relating to the foregoing and any other documents specifically enumerated in the Owner-Contractor Agreement."
- (b) Paragraph 3.7. 1. is amended to read as follows: "When applicable, Contractor shall secure all permits, licenses and inspections necessary for the proper execution and completion of the Work. Owner will not reimburse Contractor for any fees paid by Contractor for permits and inspections."
- (c) Paragraph 13.6.1 is amended to read as follows: "Any moneys not paid within thirty (30) days after they become due and payable under the terms of this Contract shall bear interest at the rate of six percent (6%) per annum from and after said thirty (30) day period."
- (d) Paragraph 8.3.1 is amended to read as follows: "The Contractor shall not be entitled to compensation for any loss, cost or expense, sustained by reason of delay in completion of the Work from any cause whatever."
- (e) Paragraph 11.3.1 is amended to read as follows: "The Contractor shall purchase and maintain, at Contractor's expense, property insurance upon the entire Work at the site to the full insurable value thereof. This insurance shall include the interests of Owner, Contractor, Subcontractor and Sub-subcontractors in the Work and shall insure against perils of fire and extended coverage on a 'broad-form, all risk' basis for physical loss of damage, including theft, vandalism and malicious mischief. Such insurance shall be purchased from a carrier licensed to do business in the State of Oklahoma. Certificates of such insurance shall be delivered to the Department Manager of Building Planning, Maintenance and Plant Operations of Owner prior to commencement of the Work. Said certificates shall provide that the carrier must give Owner at least thirty (30) days prior written notice before cancellation or reduction of the coverage for any reason. If not covered by the above insurance, Contractor shall also purchase and maintain similar coverage on portions of the Work stored off site or in transit when such portions of the Work are to be included in an Application for Payment under Subparagraph 9.3.2. Until substantial completion of the Work, all risk of loss shall be upon Contractor."
- (f) Paragraph 11.3.4 is eliminated.
- (g) Paragraph 3.6.1 is amended by adding the following "Contractor assumes full responsibility for the payment of all contributions and payroll taxes (State and Federal) for all employees engaged on the Work and provide proof of worker compensation coverage for all employees."

2. **DEFINITIONS:**

Wherever the words herein defined, or pronouns used in the stead, occur in this contract and these specifications, they shall have the meanings herein given.

- (a) The word "OWNER" shall mean the Independent School District Number One of Tulsa County, Oklahoma, a public corporation.
- (b) The word "CONTRACTOR" shall mean the person, persons, Partnership, company, firm or corporation entering into the contract for the performance of the Work, and the legal representative of said party, or agent appointed to act for said party in the performance of the Work.
- (c) The word "SURETY" or "SURETIES" shall mean the bondsman or party of parties who have made sure the fulfillment of the requirement of the contract by bonds, including the Payment Bond, and whose signatures are attached to said bonds.
- (d) The word "ADVERTISEMENT" shall mean all of the legal publications pertaining to the Work.
- (e) The word "SPECIFICATIONS" shall mean, collectively, all of the terms and stipulations contained in those portions of the contract known as Instructions to Bidders, General, Mechanical and Electrical Specifications.
- (f) The word "PLAN" shall mean, collectively, all of the drawings pertaining to the contract and made part thereof, and also such supplementary drawings as may be issued from time to time in order to elucidate the drawings or for the purpose of showing changes in the Work as authorized under the section "Changes and Alterations," or for showing details which are not shown thereon.
- (e) The words "CONTRACT PRICE" shall mean either the unit prices or unit price, or lump sum price, named in the contract or the total of all payments according to schedule or prices in the contract, as the case may be.
- (h) The word "BID" or "BIDS" shall mean the written statements duly filed with the Clerk of Independent School District Number One of Tulsa County, Oklahoma, for the person or persons, partnership, company, firm or corporation proposing to do the Work and furnish materials called for on plans at the prices named on said statement.
- (i) The word "CALENDAR DAYS" shall mean the actual days to complete the contract excluding days due to inclement weather.

3. **BONDS:**

If the Contract Price is in excess of **\$50,000.00**, Contractor will furnish the following bonds: (i202) a Payment Bond (the "statutory" bond required by Section 1 of Title 6 1, Okla. State, as amended) in an amount equal to 100% of the Contract Price; and (ii) a Performance Bond in such form as directed by Owner in an amount equal to 100% of the Contract Price for work on the project(s) as security for the proper and prompt completion of the Work in accordance with the contract and bidding documents; and (iii) a Warranty Bond in an amount equal to 100% of the Contract Price for work on the project(s) to protect Owner against defects in workmanship and materials for a period of one (1) year from Owner's acceptance of the Project(s). The Surety on all bonds of the successful bidder must be approved in the Treasury Department Circular 570. If the Surety Company is not on the list, those bids shall be rejected. Where the Contract Price is **\$50,000.00** or less, the above bonds will not be required. However, in lieu of the Payment Bond, as to contracts where the Contract Price is \$25,000.00 or less, Contractor shall submit an affidavit of the payment of all indebtedness incurred by the Contractor, Subcontractors, and all material men for labor, material, rental of machinery or equipment and repair of and parts for equipment as are used or consumed in the performance of the contract. The execution of the affidavit with knowledge that any of the contents of the affidavit are false, upon conviction, shall constitute perjury, punishable as provided by

law. Copies of the affidavit form may be obtained from the Facilities Bond Office Room 201 South, Charles C. Mason Education Service Center, 3027 South New Haven Avenue, Tulsa, Oklahoma, 74147.

4. **CORPORATE SURETY BONDS:**

To be acceptable, a corporate surety bond (including both a bid bond and the payment/performance/warranty bonds of the successful bidder) must be signed by BOTH the bidder, as principal, and by a properly authorized representative of the bonding company. If the bonding company is a corporation, the bond must have attached a power of attorney from the corporation authorizing the person signing the bond on behalf of the bonding company to sign bonds for the bonding company. Only original executed instruments will be acceptable.

The corporate surety issuing the bond must be licensed by the Oklahoma State Insurance Commissioner to issue corporate surety bonds in the State of Oklahoma. The Owner reserves the right to require the bidder to submit evidence that the corporate Surety Company is so authorized. The Corporate Surety on all bonds of the successful bidder must be approved in the Treasury Departments Circular 570. If the Surety Company is not on the list, those bids shall be rejected. A bond written by an "offshore" (non-United States) surety company will not be acceptable.

5. **SPECIFICATIONS REGARDING EQUALS:**

It is not the intent of these documents to have closed specifications and the brand names shown are the desired materials to be used. The name of a certain brand makes, or manufacturer does not restrict proposals to the specified brand, make or manufacturer named unless a brand, model or manufacturer is labeled "No Substitution" in the bid. It is not intended to exclude other products, but to convey the type, functional characteristics and quality of the item desired. Any item that the Owner, in its sole discretion, determines and approves to be the equal of that specified considering quality, workmanship, economy of operation and suitability for the purpose intended will be considered. Thus "equal" products of other manufacturers may be considered if the products meet or exceed the stated specifications, and if a detailed explanation of a claim of equivalency is submitted five (5) days prior to the bid opening. It will be the responsibility of the Bidder to provide data on all products so that the Owner can compare.

6. **COMPLETION:**

Upon completion of the project, the Contractor will notify Owner and Owner's Representative will make a final inspection of the work. The project shall be completed in good and workmanlike manner and to the satisfaction of the Owner.

7. **ETHICS IN PUBLIC CONTRACTING:**

By submitting their bid, Bidders certify that their bids are made without collusion or fraud and that they have not offered or received any kickbacks or inducements from any other bidder, supplier, manufacturer or subcontractor in connection with their proposal, and that they have not conferred on any public employee having official responsibility for this procurement transaction any payment, loan, subscription, advance, deposit of money, services or anything of more than nominal value, present or promised unless consideration of substantially equal or greater value was exchanged.

8. **NON-DISCRIMINATION:**

Contractor agrees Contractor will not discriminate against any employee or applicant for employment because of race, religion, color, sex, age, or national origin. Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, religion, color, sex, age or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff, or termination; rates of pay or other forms of compensation; and selection for training, including

apprenticeship. Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting for the provisions of this non-discrimination clause.

9. ERRORS OR OMISSIONS:

The Bidder shall not be allowed to take advantage of any errors or omissions in the specifications. Where they occur, the Bidder shall promptly notify the contact person listed. Inconsistencies in the specifications are to be reported before bids are submitted.

10. BID FORM:

The bid MUST be submitted on the bid form provided in the bid packet. A Xerox copy of this bid form is acceptable. All blanks must be completed.

END OF SECTION

SECTION 00110

SPECIAL CONDITIONS OF THE CONTRACT

The following conditions also apply to this contract:

1. **WORK COVERED UNDER THE CONTRACT:**

The scope of the work consists of all new materials, tools, equipment, labor and services, to complete the **HVAC IMPROVEMENTS AT HALE HIGH SCHOOL** listed in the "Solicitation and Notice for Bids" in accordance with the "Form of Proposal" and as indicated by the Drawings and by the Specifications included in this Project Manual.

2. **MATERIALS AND EQUIPMENT:**

All material and equipment utilized shall be in conformance with these Specifications and with good Standards of practice and shall meet or exceed the latest applicable industry standards such as A.S.T.M., Standards and Specifications along with all applicable local and national codes and ordinances, including B.O.C.A, N.E.C. and N.F.P.A.

Failure to comply with the terms and conditions of this solicitation or to deliver equipment, supplies or services identified in the Solicitation and Contract at the discount quoted will void the contract award. In the case of failure to deliver goods or provide services in accordance with the contract terms and conditions, Owner, after due oral or written notice, may procure them from other sources and hold the contractor responsible for any resulting additional purchase and administrative costs.

3. **CONTRACT METHOD:**

The method of Contract and Management shall be in accordance with the Owner's requirements and guidelines set forth at the time the Contract is signed, and a Work Order issued.

4. **CONTRACT ADMINISTRATOR:**

This individual shall serve as the monitor of the conditions of the contract and shall work directly with the contractor to schedule and coordinate the performance of services and to provide general direction under the resulting contract. The following individual is identified to use all powers under the contract to enforce its faithful performance for the Owner: **Chris Hudgins**, Project Supervisor, (918) 746-6684.

5. **PRIORITIES AND WORK SEQUENCE:**

The priority will be furnished by the Owner to the successful bidder at the Issuance of the Work Order. Completion of the project(s) in a timely manner is critical. The bidder is required to give the actual number of days to complete each project. Timing will be a consideration in determining the successful bidder.

6. **CONTRACTOR'S USE OF PREMISES:**

The contractor shall also furnish a schedule of intended workdays to the owner through the Department of Building Planning prior to commencing the work at any site and keep all parties informed of any adjustments made necessary by changes of shipping schedules or other causes.

Permission must be obtained from the Owner for temporary use of electric power, water, toilet facilities or other utilities. The Owner's approval must also be obtained for the exact on-site location

of any storage of materials, tools or equipment. Owner assumes no responsibility for items stored on school property.

Demolition items and/or debris shall be hauled away from the site after each day's activity and the site always maintained in a clean condition free of any build-up of objectionable scraps, waste material or refuse.

7. **OWNER OCCUPANCY AND PROTECTION OF PROPERTY:**

The owner's Site-based Personnel may occupy the site. Therefore, it may be necessary to erect a system of barricades or markers to direct traffic away from the area of each day's operations. The Contractor shall protect and safeguard against damage to all adjacent or nearby surfaces, materials, hardware, glass, furnishings, signage or other site improvements and/or vehicles if in the area of intended loading and unloading operations.

8. **SALES TAX:** (None Required)

The Owner will issue such Documents as necessary to exempt the sales tax upon execution of a contract for the Project(s); therefore, the Contractors are advised to omit the State Sales Tax when preparing their Bid.

9. **PROJECT START-UP:**

The contractor is advised to notify the Owner well in advance of commencing the work on the site.

10. **KNOWLEDGE OF SITE AND SCOPE OF WORK REQUIREMENTS:**

All Contractors shall visit the site on which work is proposed and become thoroughly familiar with the existing conditions and with the Bid Documents and the Scope of the Work included prior to submitting their bid. Sign in at the main office when visiting the site(s).

11. **SUBMITTALS AND CLOSING PROCEDURES:**

(Other than Start-up Contract Requirements such as Certificates of Insurance, Bonds, Etc.)

A. Submit Schedules of intended workdays and activity planned for each Site after receiving Owner's Project Priority list prior to commencing work. **Shop drawings and/or product data and samples** shall be submitted to Tulsa Public Schools' Building Planning department covering all Items in the Scope of Work **for approval prior to manufacture** shipment and installation at the project site. Submit the number of copies, which the contractor requires plus one copy, which will be retained by Tulsa Public Schools' Building Planning Department. Furnish information on characteristics of finish materials proposed for use, to ensure compatible prime coats are used. Provide barrier coats over incompatible primers or remove and re-prime as required. Notify the architect in writing of any anticipated problems using specified coating systems with substrates primed by others.

B. Unless the contract stipulates "Payment upon Completion" of the project or another method of payment; during Progress of the work, submit a separate "Application and Certificate for Payment"-AIA Document G702 on or about the 25th day of each month for work performed in that same month. A 10% retainage shall be calculated and withheld from each Pay Application until the project is completed and accepted by Owner.

C. Upon Final Completion and Final Acceptance by Owner, submit the following prepared and properly signed Closing Documents:

1. Certificate of Substantial Completion
(AIA Document G704)
2. Final Application and Certificate for Payment
(AIA Document G702)
3. Contractor's Affidavit of Payment of Debts
and Claims (AIA Document G706)
4. Contractor's Affidavit of Release of Liens
(AIA Document G706A)
5. Consent of Surety Company to Final Payment
(AIA Document G707)
6. Contractor's Affidavit Pursuant to Title 61
O.S.- Optional in lieu of items 3 above.
7. Contractor's Written Warranty for one (1) year against defects in Material or
Workmanship.

12. SUBSTITUTIONS AND DEVIATIONS FROM THE SPECIFICATIONS:

Substitutions prior to Bid are covered under Paragraph 6 "Instructions to Bidders". Any substitution or deviation from the specifications must be by Owner's prior approval and accepted by an approved change order stipulating the change in price and change in construction time, if any.

13. OWNER'S RIGHT TO REJECT BIDS:

The Owner reserves the right to reject any or all bids and to waive minor irregularities in any bid. In addition, Bidders should recognize the right of the Owner to reject a bid if said bidder fails to provide any data required in the bid or if the bid is in any way incomplete.

14. FINAL CLEANING:

- A. Execute prior to final inspection.
- B. Clean surfaces exposed to view; remove temporary labels, stains and foreign substances and polish transparent and glossy surfaces. Clean equipment and fixtures, sweep and vacuum interior areas and rake clean exterior areas. Remove waste and surplus materials, rubbish and construction facilities from the Project and from the site.

15. SPECIAL TERMS AND CONDITIONS:

- 15.1 Testing and Inspections: Owner reserves the right to conduct any test or inspection it may deem advisable to assure supplies and services conform to specifications.
- 15.2 Proprietary Indemnity: Bidder warrants that the system, each part of the system, and all other products and services used by or furnished by bidder, do not infringe upon or violate any patent, copyright, trade, secret, trademark, or any other proprietary right of any third party. In the event of claim against Owner, Owner shall promptly notify vendor and vendor shall defend and indemnify Owner against any loss, cost expense, claim, or liability arising out of such claim, whether or not such claim is successful.

- 15.3 Patent and Copyright Materials: Unless otherwise expressly provided in a contract, bidder shall be solely responsible for clearing the right to use any patented or copyrighted materials in the performance of this contract.
- 15.4 Audit: Contractor hereby agrees to retain all books, records and other documents relative to this contract for five (5) years after final payment or until audited by the owner, whichever is sooner. Owner, its authorized agents and/or auditors reserve the right to perform or have performed an audit of contractor's records and therefore shall have full access to the right to examine any of said materials within those five years.
- 15.5 Open Records: Ownership of all data, materials and documentation originated and prepared for the owner pursuant to this bid shall belong exclusively to Owner and be subject to inspections in accordance with the Oklahoma Open Records Act.
- 15.6 Contractor Compliance: Contractor shall comply with all procedural instructions that may be issued from time to time by Owner; however, the terms and conditions of the contract will not change:
- 15.7 Lead Based Paint: Contractor shall be certified and follow work practices established under the UPA Renovation, Repairing and Painting Program applicable to schools when performing any work which will disturb interior or exterior lead-based surface coatings in buildings constructed before 1978. All such work shall be performed in compliance with 40 CFR Part 745.

END OF SECTION

SECTION 00120

SUPPLEMENTAL CONDITIONS TO THE CONTRACT

(References are to Articles, Paragraphs, Subparagraphs and Clauses of the General Conditions of the Contract for Construction, AIA Document A201, 1997 Edition)

4.3.1 **Delete** entire Subparagraph, and substitute the following:

"Definition"

"A Claim is any demand or assertion by the Contractor that it should be paid more money than the Contract Sum, as adjusted under the Change Order provisions herein, by the Owner because of action or inaction on the part of Owner, Program Manager, Architect, or any party for whom Owner is responsible, or any party with whom Owner has separately contracted for other portions of the Project, including, but not limited to, any demand or assertion that Contractor's performance has been delayed, interrupted or interfered with, that Contractor's performance has been accelerated or suspended, that Contractor's performance has been wrongfully terminated, that the Contract Documents have been misinterpreted, that there has been a failure of payment, that Contractor has encountered concealed or unknown conditions, that Contractor has encountered hazardous materials, that there are problems with the Contract Documents, or the timing of Architectural approvals or decisions, that actions of the Owner have been intentionally wrongful or deceptive, that Owner is directly or indirectly guilty of negligence or an intentional tort related in any way to the Work, that the amount of time or money granted in a Construction Change Directive is inadequate, that an item treated as a minor change in the Work should have been treated as a Change Order, that a time extension grant was inadequate, or that Contractor is entitled to any other relief, on any legal theory, related to the Work and the Contract."

"Notice Requirement"

"Within five (5) days of the first occurrence of an event that Contractor has any reason to believe might result in a Claim, or within five (5) days of Contractor's discovery of the first occurrence of an event that Contractor has any reason to believe might result in a Claim, if the first occurrence of the event was willfully hidden from the Contractor, the Contractor shall file a written document clearly captioned "Notice of Claim" with Tulsa Public Schools, Program Manager and the Architect. The notice shall clearly set out the specific matter of complaint, and the impact or damages which may occur or have occurred as a result thereof, to the extent the impact or damages can be assessed at the time of the notice. If the impact or damages cannot be assessed as of the date of the notice, the notice shall be amended at the earliest date this is reasonably possible."

Add the following Subparagraph:

"Any claim or portion of a Claim that has not been made the specific subject of a notice strictly in accordance with the requirements of this section shall be waived. It is imperative that Owner have timely, specific notice of any subject, the impact of which Owner may be in a position to mitigate."

4.3.3 **Add** the following sentences:

"Claims Handling During Construction. After receipt of a Notice of Claim, the Owner may elect to refer the matter to the Architect, Program Manager or another party for review. Contractor will attend meetings called to review and discuss the Claims and mitigation of the problem and shall furnish any reasonable factual backup for the Claim requested. The Owner may also elect to defer

consideration of the Claim until the Work is completed, in which case the same review options shall be available to the Owner at the completion of the Work. At any stage the Owner is entitled to refer a Claim to mediation under the Construction Industry Mediation Rules of the American Arbitration Association, and if this reference is made Contractor and the Owner will take part in the mediation process. The filing, mediation or rejection of a Claim does not entitle Contractor to stop performance of the Work. The Contractor shall proceed diligently with performance of the Contract."

4.3.6.1 **Add** the following Subparagraph:

"Calculating Claim Amount"

"In calculating the amount of any Claim, the following standards will apply:

- .1 No indirect or consequential damages will be allowed.
- .2 All damages must be directly and specifically shown to be caused by a proven wrong. No recovery shall be based on a comparison of planned expenditures to total actual expenditures, or on estimated losses of labor efficiency, or on a comparison of planned man loading to actual man loading, or any other analysis that is used to shown damages indirectly.
- .3 Damages are limited to extra costs specifically shown to have been directly caused by a proven wrong.
- .4 The maximum daily limit on any recovery for delay shall be the amount estimated by the Contractor for job overhead costs divided by the total number of calendar days of Contract Time called for in the original Contract."
- .5 No monetary costs shall be allowed for delay.

5.2.1 In the first sentence, delete "as soon as practicable" and substitute "within seventy-two (72) hours."

5.2.5 **Add** this new Subparagraph:

"The Contractor shall not sublet the work as a whole. The approval of Subcontractors in no way relieves the Contractor from full responsibility for performance and completion of the Work and its obligations under the Contract Documents."

5.3.1 **Delete** the remainder of the second sentence beginning with the words "and shall allow to the Subcontractor."

5.4.2 **Delete** entire Subparagraph and substitute the following:

"Owner shall only be responsible for compensating Subcontractors for work done or materials furnished after the date Owner gives written notice of its acceptance of the subcontract agreement."

5.5 **Add** this new Paragraph:

5.5 "RESPONSIBILITY"

5.5.1 "Contractor shall be fully responsible for the performance of its Subcontractors.

6.1.1 **Delete** the entire Subparagraph, and substitute the following:

"The Owner reserves the right to perform other construction work, maintenance and repair work and school program operations at the site and near the site during the time period of the Work. Owner may perform other work with separate contractors or with its own forces. On renovation/addition projects, the Owner shall have access to the site and all buildings on the site at all times. On new construction, the Owner shall have access to the site and all buildings during normal business hours."

10.1.2 **Add** this new Subparagraph:

"The Contractor shall be responsible for the protection and security of the Work and the Project, until he receives written notification that the Substantial Completion of the work has been accepted by the Tulsa Public Schools."

10.2.8 **Add** this new Subparagraph:

"In an emergency affecting the safety of persons or property, the Contractor shall notify the Owner, Program Manager and Architect immediately of the emergency, simultaneously acting at his discretion to prevent damage, injury, or loss. Any additional compensation or extension of time claimed by the Contractor on account of emergency work shall be determined as provided in Article 4.3 and Article 7."

10.3.1 **Delete** entire Subparagraph and substitute the following:

"Contractor is responsible for reviewing all Asbestos Hazard Emergency Act Management Plans on file with Owner and for obtaining sign-off from Tulsa Public Schools Hazardous Materials Bureau prior to commencing the Work. In no event shall the Contractor engage in the disturbance or removal of asbestos or polychlorinated biphenyl (PCB). In the event the Contractor encounters on the site material reasonably believed to be asbestos or PCB which has not been rendered harmless, the Contractor shall immediately stop work in the area affected and report the condition to the Architect in writing. If the portion of the Work that is stopped is critical to overall completion, the Contractor shall reschedule the Work, if possible, to minimize the impact of the stoppage. The work in the affected area shall not thereafter be resumed except by written agreement of the Owner and Contractor if in fact the material is asbestos or PCB and has not been rendered harmless. The work in the affected area shall be resumed when the asbestos or polychlorinated biphenyl (PCB) has been removed, or when it has been rendered harmless. If the Work is stopped due to the presence of such materials, Owner shall arrange for the removal and/or rendering harmless of such materials prior to Contractor being allowed to proceed. The Owner shall have the option of arranging for removal by a qualified, adequately insured third party tendered to Contractor, and mutually agreed to by both parties, as a Subcontractor in which case a Change Order will be issued for the cost of this subcontract. Any tendered Subcontractor must indemnify the Contractor and the Owner with regard to its work. In the case of such a tender, Owner will not hold Contractor responsible for the work or other actions of the tendered Subcontractor, and Contractor's approval of tendered Subcontractor shall not be unreasonably withheld. In those instances, in which the presence of such materials was set forth in the Hazardous Materials documents or in which Contractor had other notice of such through information given to Contractor by Owner or its representative prior to the commencement of the Work, Contractor shall not be entitled to a Claim for any delays, disruption or interference it encounters. In those instances of work stoppage due to the existence of such hazardous materials which were not set forth in the Hazardous Materials Control plans and of which Contractor had no

other prior notice, Contractor may be entitled to a Claim for extension of time due to the work stoppage."

11.4 PROPERTY INSURANCE

11.4.1 **Delete** entire Subparagraph, and substitute the following:

"Until the Work is completed and accepted by the Owner, the Contractor shall purchase and maintain property insurance upon the entire Work at the site to the full insurable value thereof. The property insurance shall also cover portions of the Work stored off site after written approval of the Owner of the value established in the approval, and also portions of the Work in transit. This insurance shall include the interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Work and shall insure against the perils of fire and extended coverage including flood and earthquake and shall include "all risk" insurance for physical loss or damage including, without duplication of coverage, theft, vandalism and malicious mischief. The insurance shall cover reasonable compensation for Architect's and Program Manager's services and expenses required as a result of an insured loss. This "all risk" policy shall be written incorporating Actual Completed Value Form and General Change Endorsement incorporating the following language:

"Permission is given for the Project insured hereunder to become occupied, the insurance remaining in full force and effect until such time as the Project has been accepted by the Owner, all as currently approved by the Laws for the State of Oklahoma."

"The policy shall include coverage for Explosion, Collapse and Underground (XCU). Such insurance shall be evidenced by the kind of policy which does not have to be adjusted or reported upon periodically but provides constant insurance at full one hundred percent (100%) of all insurable values as they are created during construction by performance of the Contract. The Certificate of Insurance must include the names of the insured Contractor and the Tulsa Public Schools."

11.4.1.2 **Delete** entire Clause, and substitute the following:

"Loss under such All-Risk Builder's Risk Insurance shall be made payable jointly to the Tulsa Public Schools and to the Contractor by name (and, if separate mechanical contracts are awarded to each, by name, of the plumbing, heating, ventilating and electric contractors)."

11.4.1.3 **Delete** entire Clause, and substitute the following:

"In the case of loss under the risks covered, and of collection by insured, the Owner shall act as trustee for all parties concerned as their interests may appear."

12.1.3 **Add** this new Clause:

"Where nonconforming work is found, the entire area of work involved shall be corrected unless the contractor can completely define the limits to the Architect's satisfaction. Additional testing, sampling, or inspecting needed to define nonconforming work shall be at the Contractor's expense. He shall employ the Owner's testing laboratory if such services are reasonably required by the Architect. All connected work shall be retested at the contractor's expense. Extra Architectural or Program Manager Services required to analyze nonconforming work shall be paid for by the Contractor."

13.1.1 **Delete** entire Subparagraph, and substitute the following:

"District Court in and for the County of Tulsa, State of Oklahoma shall have sole jurisdiction in any action brought under this contract."

14.2.5 **Add** this new Subparagraph:

"If a Performance Bond has been furnished and the Contractor is declared by the Owner to be in default under the Contract, the Surety shall promptly remedy the default by completing the Contract in accordance with its terms and conditions, or by obtaining a bid or bids in accordance with its terms and conditions. Upon determination by the Owner and the Surety of the lowest responsible bidder, the Surety will arrange for a contract between such bidder and the Owner and make available as work progresses sufficient funds to pay the cost of completion less the balance of the Contract Sum, but not exceeding the Penal Sum of the bond and other costs and damages for which the Surety may be liable under the bond. The phrase 'balance of the Contract Sum' as used herein shall mean the total amount payable by the Owner to the Contractor under the Contract and amendments thereto less the amount previously paid by the Owner to the Contractor."

END OF SECTION

BID PACKAGE

FORM OF PROPOSAL

For

2023 SUMMER HVAC IMPROVEMENTS

At

HALE HIGH SCHOOL

BID OPENING AT 2:00 PM, THURSDAY, OCTOBER 27, 2022

CONTRACTORS WILL NOTE THAT A PROPOSAL MUST BE MADE ON THIS FORM. OTHER PROPOSALS WILL NOT BE ACCEPTED. COMPLETE ALL BLANKS. ALL BID PRICES SHALL BE IN BOTH FIGURES AND IN WRITING. PROPOSALS SHALL BE ENCLOSED IN A SEALED ENVELOPE, MARKED ON THE OUTSIDE **“SEALED BID: 2023 SUMMER HVAC IMPROVEMENTS AT HALE HIGH SCHOOL. ALSO INCLUDE COMPANY NAME, ADDRESS & PHONE NUMBER**

Selection of the successful bidder will be based on the lowest responsible bid taking into consideration the number of calendar days bid to reach substantial completion of the Work. The Owner reserves the right to reject any or all bids and to waive informalities and minor irregularities in any bid.

Independent School District Number One of Tulsa County, Oklahoma
Charles C. Mason Education Service Center
3027 South New Haven
Tulsa, Oklahoma 74147-0208

Dear School Board Members:

The undersigned Contractor, in compliance with your Solicitation and Notice for Bids and Instructions to Bidders contained in the Bid documents for **2023 SUMMER HVAC IMPROVEMENTS AT HALE HIGH SCHOOL** in Tulsa, County, Oklahoma, having examined the Specifications, Drawings, details, and Scope of Work, and areas where the work is proposed, and being familiar with all of the work required at the Project site(s), hereby proposes to furnish all labor, materials, tools, equipment, supplies and services to complete the Project(s) within the time set forth in this Proposal for the price as herein stated. The price(s) indicated is to cover all expenses incurred in performing all of the work required under the Contract Documents of which this Proposal is a part.

If awarded a contract for the Projects the undersigned agrees as follows:

1. To furnish a Contractor's Written Warranty which will warranty the Project(s) for a period of one (1) year after substantial completion and acceptance by Owner against all defects in materials and workmanship.
2. To furnish all other insurance and Bonds required as indicated in the "Solicitation and Notice for Bids" in the amount equal to the Total Contract Price.
3. To furnish a monthly Application and Certificate for Payment (AIA Documents G702) and Certificate of Substantial Completion (AIA Document G704) for the project(s) based on the contract bid price indicated on this proposal.

The bidder acknowledges the following Addendum: _____, _____, _____, _____.

OUR BID FOR COMPLETING THE REQUIRED WORK DEFINED ABOVE AND DESCRIBED IN THESE BID DOCUMENTS IS AS FOLLOWS: All work should be substantial complete by August 1, 2023.

Contractor will be required to obtain a permit where required by the city. All damage and relocation to existing finishes and lighting will be the Contractor's responsibility.

Contractor shall be responsible for all ceiling removal, replacement and or alterations required for Mechanical, Electrical, & Plumbing Systems installation.

Contractor to protect all floors and furniture during construction. Floors to be covered with "Ram-Board" type cardboard and furniture, tables, bookshelves, etc. covered with heavy visquine. All IDB's to be covered with bubble wrap and cardboard.

Warranty

Contractor to provide a one-year warranty from date of Substantial Completion on all work, including materials and equipment.

Furniture Moving

Furniture moving will be provided by TPS assigned mover if an allowance is shown on the bid form.

Domestic preferences for procurements

Should, to the greatest extent practicable under a federal award, provide a preference for the purchase, acquisition, or use of goods, products, or materials produced in the United States (including but not limited to iron, aluminum, steel, cement, and other manufactured products)

Davis Bacon Act, as amended (40 U.S.C. 3141-3148). When required by Federal program legislation, all prime construction contracts in excess of \$2,000 awarded by non-Federal entities must include a provision for compliance with the Davis-Bacon Act (40 U.S.C. 3141-3144, and 3146-3148) as supplemented by Department of Labor regulation (29 CFR Part 5, "Labor Standards Provisions Applicable to Contracts Covering Federally Financed and Assisted Construction"). In accordance with the statute, **contractors must be required to pay wages to laborers and mechanics at a rate not less than the prevailing wages specified in a wage determination made by the Secretary of Labor. In addition, contractors must be required to pay wages not less than once a week. The non-Federal entity must place a copy of the current prevailing wage determination issued by the Department of Labor in each solicitation. The decision to award a contract or subcontract must be conditioned upon the acceptance of the wage determination.** The non-Federal entity must report all suspected or reported violations to the Federal awarding agency. The contracts must also include a provision for compliance with the Copeland "Anti-Kickback" Act (40 U.S.C. 3145), as supplemented by Department of Labor regulations (29 CFR Part 3, "Contractors and Subcontractors on Public Building or Public Work Financed in Whole or in Part by Loans or Grants from the United States"). The Act provides that each contractor or subrecipient must be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he or she is otherwise entitled. The non-Federal entity must report all suspected or reported violations to the Federal awarding agency.

<u>HVAC - BID FORM</u>

BID TO INCLUDE HVAC AND ELECTRICAL RENOVATION

<u>BASE BID</u>	\$ _____ DOLLARS
HVAC EQUIPMENT ALLOWANCE	\$ <u>2,300,000.00</u> DOLLARS
FURNITURE MOVING ALLOWANCE	\$ <u>145,000.00</u> DOLLARS
CONTROLS ALLOWANCE -	\$ <u>182,000.00</u> DOLLARS

TOTAL BASE BID PLUS ALLOWANCES	\$ _____ DOLLARS
---------------------------------------	-------------------------

CALENDAR DAYS TO COMPLETE	_____ DAYS
---------------------------	------------

PHASE I -	\$ <u>3,500,000.00</u> DOLLARS
PHASE II -	\$ _____ DOLLARS

Phase I, \$3,500,000.00 purchase order will be issued at the start of the project and must be billed complete, no retainage withheld by May 30, 2023. Phase II will have a purchase order for the balance of the project issued after July 1, 2023.

We have included the following sworn and notarized bid affidavits and bid security. They are attached to this proposal:

1. Bid Bond, Certified Cashier's Check or other approved security as listed in the "Solicitation and Notice for Bids" and "Instructions to Bidders," in the amount of five (5%) of the bid.
2. Non-Collusion Affidavits
3. Business Relationship Affidavit
4. Non-Discrimination Affidavit
5. Felony Statement
6. No Kick Back Statement
7. Contractor's Qualification Statement **(completed and submitted seven days prior to bid)**

In submitting this Bid, the undersigned agrees that the Bid will not be withdrawn for a period of thirty (30) calendar days from the date hereof and it is understood that the right is reserved by the Owner to reject any and all Bids and to waive informalities and irregularities.

Respectfully submitted

Seal if Bid is by
Corporation

Company

By

Title

Address

City, State, Zip

Area Cide & Telephone Number

Company ID

Note: When submitting your bid, all blanks on this form must be filled in.

Warranty

Contractor to provide a one-year warranty from date of Substantial Completion on all work, including materials and equipment.

Furniture Moving

Furniture moving will be provided by TPS assigned mover if an allowance is shown on the bid form.

Domestic preferences for procurements

Should, to the greatest extent practicable under a federal award, provide a preference for the purchase, acquisition, or use of goods, products, or materials produced in the United States (including but not limited to iron, aluminum, steel, cement, and other manufactured products)

Davis Bacon Act, as amended (40 U.S.C. 3141-3148). When required by Federal program legislation, all prime construction contracts in excess of \$2,000 awarded by non-Federal entities must include a provision for compliance with the Davis-Bacon Act (40 U.S.C. 3141-3144, and 3146-3148) as supplemented by Department of Labor regulation (29 CFR Part 5, "Labor Standards Provisions Applicable to Contracts Covering Federally Financed and Assisted Construction"). In accordance with the statute, **contractors must be required to pay wages to laborers and mechanics at a rate not less than the prevailing wages specified in a wage determination made by the Secretary of Labor. In addition, contractors must be required to pay wages not less than once a week. The non-Federal entity must place a copy of the current prevailing wage determination issued by the Department of Labor in each solicitation. The decision to award a contract or subcontract must be conditioned upon the acceptance of the wage determination.** The non-Federal entity must report all suspected or reported violations to the Federal awarding agency. The contracts must also include a provision for compliance with the Copeland "Anti-Kickback" Act (40 U.S.C. 3145), as supplemented by Department of Labor regulations (29 CFR Part 3, "Contractors and Subcontractors on Public Building or Public Work Financed in Whole or in Part by Loans or Grants from the United States"). The Act provides that each contractor or subrecipient must be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he or she is otherwise entitled. The non-Federal entity must report all suspected or reported violations to the Federal awarding agency.

By

Title

Address

City, State, Zip

Area Cide & Telephone Number

Company ID

Note: When submitting your bid, all blanks on this form must be filled in.

Bid Bond

THIS DOCUMENT HAS IMPROTANT LEGAL CONSEQUENCES: CONSULTATION WITH AN ATTORNEY IS ENCOURAGED WITH RESPECT TO ITS COMPLETION OR MODIFICATION. AUTHENTICATION OF THIS ELECTRONICALLY DRAFTED AIA DOCUMENT MAY BE MADE BY USING AIA DOCUMENT⁴⁰¹.

KNOW ALL MEN BY THESE PRESENTS, that we *(Here insert full name and address or legal title or Contractor)* as principal, hereinafter called the Principal, and *(Here insert full name and address or legal title of Surety)* a corporation duly organized under the laws of the State of as Surety, hereinafter called the Surety, are held and firmly bound unto *(Here insert full name and address or legal title of Owner)* as Obligee, hereinafter called the Obligee, in the sum of Dollars (\$), for the payment of which sum well and truly to be made, the said Principal and the said Surety, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has submitted a bid for *(Here insert full name, address, and description of project)*

NOW, THEREFORE, if the Obligee shall accept the bid of the Principal and the Principal shall enter into a Contract with the Obligee in accordance with the terms of such bid, and give such bond or bonds as may be specified in the bidding or Contract Documents with good and sufficient surety for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof, or in the event of the failure of the Principal to enter such Contract and give such bond or bonds, if the Principal shall pay to the Obligee may in good faith contract with another party to perform the Work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect.

Signed and sealed this day of 20__

(Principal) *(Seal)*
(Witness)

(Title)

(Surety)

(Seal)

(Witness)

(Title)

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SECTION 00150 - NON-COLLUSION AFFIDAVIT

STATE OF OKLAHOMA)
) ss.
COUNTY OF TULSA)

_____, of lawful age, being first duly sworn, on oath says that (she)he is the agent authorized by the bidder to submit the attached bid. Affiant further states that the bidder has not been a party to any collusion among bidders in restraint of freedom of competition by agreement to bid at a fixed price or to refrain from bidding; or with any state official or employee as to quantity, quality, or price in any discussions between bidders and any state official concerning exchange of money or other thing of value for special consideration in the letting of a contract.

Subscribed and sworn to before me this _____ day of _____, 2021.

Company Representative

Notary Public

My Commission Expires:

SECTION 00160 – BUSINESS RELATIONSHIP AFFIDAVIT

STATE OF OKLAHOMA)
COUNTY OF TULSA) ss.
)

_____, of lawful age, being first duly sworn, on oath says that (she)he is the agent authorized by the bidder to submit the attached bid. Affiant further states that the nature of any partnership, joint venture, or other business relationship presently in effect or which existed within one (1) year prior to the date of this statement with the Architect, Engineer, or other party to the project is as follows:

Affiant further states that any such business relationship presently in effect or which existed within one (1) year prior to the date of this statement between any officer or director of the bidding company, any officer or director of the architectural or engineering firm or other party to the project is as follows:

Affiant further states that the names of all persons having any such business relationships and the positions they hold with their respective companies or firms are as follows:

(If none of the business relationships herein above mentioned exist, affiant should so state.)

Company Representative

Subscribed and sworn to before me this _____ day of _____, 2021.

Notary Public

My Commission Expires:

SECTION 00170 – NON-DISCRIMINATION AFFIDAVIT

The Contractor affirms and states that he/she complies with the following:

1. The Contractor will not discriminate against any employee or applicant for employment because of race, color, sex, religion, national origin or age. The Contractor will take affirmative action to insure that applicants are employed and that employees are treated during employment without regard to their race, color, sex, religion, national origin or age. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the requirements of these nondiscrimination provisions.
2. The Contractor will state, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, that all qualified applicants will receive consideration for employment without regard to race, color, sex, religion, national origin or age."

Company Representative

Subscribed and sworn to before me this _____ day of _____, 2021.

Notary Public

My Commission Expires:

SECTION 00180 - FELONY FREE AFFIDAVIT

STATE OF OKLAHOMA)
) ss.
COUNTY OF TULSA)

The undersigned, under the penalties of perjury, certifies to the Tulsa Public Schools (“School District”) as follows:

1. The undersigned:

_____ has a contract with the School District; OR
_____ is the duly authorized representative of a business
 (“entity”) having a contract with the School District,

to perform work on School District premises on a full-time or part-time basis.

2. The undersigned hereby certifies that neither the undersigned nor any employee of the undersigned or of the entity, or of any subcontractor of the undersigned or the entity, will perform work on School District premises on a full-time or part-time basis that would otherwise be performed by School District employees if such employee has been convicted in this State, the United States or any other state of any felony offense unless ten (10) years have elapsed since the date of the criminal conviction or the employee has received a pardon for the offense.

3. Neither the undersigned nor any employee of the undersigned, or the entity, or of any subcontractor of the undersigned or the entity, who performs any work on School District property is currently registered under the Oklahoma Sex Offenders Registration Act or the Mary Rippy Violent Crime Offenders Registration Act.

4. The undersigned, or the entity, has conducted a felony record search of all employees who will be assigned to work on a full-time or part-time basis on School District property.

5. This Affidavit is made and delivered pursuant to the requirements of **OKLA. STAT. tit. 70, § 6-101.48 (Supp. 2000)** and **OKLA. STAT. tit. 57, § 589 (Supp. 2004)** (the "Acts"). The undersigned further certifies to the School District that the undersigned and/or the entity are in full compliance with the requirements of the Acts.

EXECUTED AND DELIVERED this ____ day of _____,
_____.

AFFIANT'S SIGNATURE

(Print Name and Title)

Representing:

(Name of Entity)

Subscribed and sworn to before me this ____ day of _____,
_____.

Notary Public

(S E A L)

Notary Commission Number: _____

My Commission Expires: _____

SECTION 000190 – ASBESTOS COMPLIANCE FORM

**CERTIFICATION OF COMPLIANCE
WITH ASBESTOS RESTRICTIONS**

STATE OF _____)
COUNTY OF _____) SS.

The undersigned Contractor, of lawful age, being first duly sworn, on oath says that:

- A. Building materials or products incorporated or installed in the construction of _____ School addition and/or remodel will be free of asbestos containing materials or products of any kind.
- B. Certification of Compliance with Asbestos Restrictions will be included in any sub-contract connected with the performance of work for this project.
- C. Submit copy in O&M Manuals.

ARCHITECT

By _____

(Title)

SUBSCRIBED AND SWORN to before me this _____ day of _____ 20__.

Notary Public

My Commission Expires:

SECTION 00191

CONTRACTORS QUALIFICATIONS STATEMENT

This form must be submitted seven (7) days prior to the bid date. All questions must be answered, the data must be clear and comprehensive, and must be signed and notarized. If not previously on file.

1. Name of Bidder: _____
2. Permanent Main Office Address: _____
3. When organized: _____
4. If incorporated, when and where _____
5. How many years have you been engaged in the contracting business under your present firm or trading name? _____
6. List 5 projects of similar size work, references with telephone numbers, cost of project and year completed: _____

(1) Project: _____, Year: _____,

Cost: \$ _____

Reference: _____, Phone: _____

(2) Project: _____, Year: _____,

Cost: \$ _____

Reference: _____, Phone: _____

(3) Project: _____, Year: _____,

Cost: \$ _____

Reference: _____, Phone: _____

(4) Project: _____, Year: _____,

Cost: \$ _____

Reference: _____, Phone: _____

(5) Project: _____, Year: _____,

Cost: \$ _____

Reference: _____, Phone: _____

7. Have you ever failed to complete any work awarded to you? Please explain.

8. Please state the size of your business:

of employee's (total): _____

9. Are any of your job captains bilingual?

10. Financial Information:

a. State the name of the bank with whom you do your principal business:

Name of Bank

Address

City, State

Phone Number

b. State 5 trade references with whom you do business:

1. _____

2. _____

3. _____

4. _____

President of Company

(Notary Public)

(Date)

Affix Notary Seal

SECTION 00260 – NO KICK-BACK STATEMENT

SECTION 00260

NO KICK-BACK STATEMENT

A duplicate of the following statement is required to be signed, notarized, and submitted with each and every copy of the AIA Document G702, "Application and Certificate for Payment", that is presented to the Owner for payment.

STATE OF OKLAHOMA)
) ss.
COUNTY OF TULSA)

The undersigned Contractor, of lawful age, being first duly sworn, an oath says that this invoice is true and correct. Affiant further states that the services as shown by the invoice have been completed in accordance with the contract. Affiant further states that he has made no payment directly or indirectly to any elected official, officer or employee of the State of Oklahoma, any county or local subdivision of the state, of money or any other things of value to obtain payment.

Contractor

(Title)

By _____

Subscribed and sworn to before me this _____ day of _____, 20____.

Notary Public

My Commission Expires:

[SEAL]

END OF SECTION

A. At New HVAC Units:

1. Installation:

- a) New rooftop curbs are to be installed and located where noted on mechanical drawing. Flashing components shall consist of wood blocking, metal counterflashing, steel plating, galvanized condensation lines, protection pads and the specified roofing flashing system. Roof flashings shall be installed in strict accordance to manufacturer's requirements. The mechanical contractor shall provide metal protective cover when curbs are left exposed to the weather.
- b) When H-Frames are to be utilized to support HVAC unit and extend above the roof line, tapered insulation to be installed to direct water from units. Cover tapered insulation with three (3) ply roofing system consisting of One (1) ply of Tremco Standard FR Membrane and Two (2) plies of Tremco composite ply membrane set between alternate applications of the Tremco cold process adhesive. Tapered insulation shall be installed along the high sides of curbs to eliminate standing water conditions. Remove aggregate and bitumen 18" onto existing membrane to provide tie-in. Set tapered system in low rise insulation foam and install the specified three (3) ply system.
- c) Roofing contractor will provide all TRA flashings, metal counterflashing and pitch pans. All other condensate piping, straps, steel plating, curbs, H-frames, metal covers and wood blocking will be provided by others.
- d) All gas lines greater than 3" shall be resting on 10" X 10" X 1/4" steel plating buffered by a protection pad set in the specified adhesive. Install the specified 4 X 4 pressure treated blocking and spaced 5' o.c. Strap piping appropriately. Steel plating shall extend a minimum of 2" beyond the periphery of the wood blocking. Remaining piping smaller than 3" shall be resting on new 4 X 4

pressure treated lumber installed over a protection pad in the specified adhesive. Rest piping on new blocking and attach with galvanized pre-formed strap and secure to wood blocking with the appropriate screw fastener.

B. At Existing Curb infill:

1. Remove existing curb and re-deck to matching existing support decking. Ensure steel decking is supported by bar joist spaced 5' o.c.. New steel decking is span existing bar joist a minimum of 12". Mechanically attach decking to support members 12" o.c. Mechanically attach side laps 18" o.c.

NOTE: At lightweight concrete decks, it may be necessary to chip away lightweight materials to expose support members and span new steel decking a minimum of 12 o.c., It is imperative that new steel decking is supported by a steel member at 5' o.c., Secured appropriately.

2. Install new board stock insulation over steel decking and secure with appropriate screw fasteners and disc at 1 every 2 sq. ft. Insulation thickness is to match existing component. If required, install overlayment board in ribbon applications of insulation adhesive. Walk insulation board into place to ensure adhesion.
3. Install two (2) plies of Tremco composite play and One (1) ply of Tremco PowerPly Standard FR Membrane in alternate applications of PowerPly Cold Process adhesive. Extend new plies onto prepared existing membrane a minimum of 18". New walk protection landings along working sides of units and the finished flood coat and aggregate application **will not** be completed during this HVAC renovation project. This flood coat process/walk protection landing installation will be bid and completed at a later date.

Architectural Scope of Work

1. Replace al ceiling tile and grid per drawings. New ceilings to be per specifications.
2. Patching and painting of walls and floors as required due to new and demolition work. Paint all walls in classroom and corridors.
3. Provide new 3-1/2 metal stud with 5/8" gypsum to deck for all duct enclosures.
4. Paint all new walls and provide new rubber base.
5. Provide window shades at all exterior windows that have blinds, located in classroom and offices.
6. All data cabling to be replaced inside classrooms and offices. Typical classroom to receive 2 data for teacher desk and one behind interactive display board. Offices to receive one new data. All existing data cabling shall be removed from each IDF.
7. Contractor to begin March 13th with limited access inside the building. Project should be substantial complete by August 1st with final completion scheduled for October 1st.

HVAC Systems Scope of Work

Work Included: Provide HVAC and exhaust systems installation and modifications as outlined herein and as needed for a complete and proper installation including, but not necessarily limited to:

1. Furnish and install gas heat/electric cooling roof top units with curbs. Provide chases in 3rd and 2nd floors for ductwork serving the ground floor. Chases shall extend from the roof deck to the floor. Provide systems complete with insulated supply and return ductwork, air devices, balance dampers, fire dampers, smoke dampers, smoke detectors, interlocks, vibration isolation, air filters, and additional items required for a complete and fully functional system.
2. Provide Lennox mini-split systems with fan coil units, heat pumps, refrigerant piping, supply and return ductwork, outside air ductwork, air devices, system controls, throwaway filters, and all accessories required for a complete and fully functional system for areas as shown on drawings.
3. Provide electric baseboard or ceiling heaters mounted as shown on the drawings. Heater shall be provided with integral thermostat control, vandal proof covers, and fin guards.
4. Provide kitchen exhaust hood and associated upblast exhaust fans and ductwork systems for kitchen exhaust hood. Fans serving grease laden exhaust shall include NFPA ventilated roof curb, grease collection, and interface with hood controls. Grease hood exhaust ducts shall be welded black steel with fire rated insulation ductwrap.
5. Provide indirect fired gas make-up air unit for kitchen exhaust hood with, insulated supply air duct systems, temperature controls, interlock with kitchen hood exhaust operation.
6. Provide gas fired unit heaters where indicated on the drawings. Installation shall include gas piping, equipment hangers, flue, combustion air ducting, combination flue/combustion air roof/wall penetration kit, thermostat, summer/winter switch.
7. Building design shall include building pressure balance system to provide building pressure relief but still maintain building at slightly positive pressure.
8. Provide new toilet exhaust system exhaust fans and modify ductwork where necessary to meet current building code required exhaust air quantities. Provide individual exhaust fans in all spaces with mop service basins or service sinks.
9. Provide thermal and acoustical insulation for supply, return, and outside air duct systems. Ductwork shall be wrapped, except immediately at the unit for a minimum of 10ft. from the unit where the duct shall be lined with acoustical 3 pound density, 2 inch thick liner.
10. All air systems shall be balanced to the designed air flows by a NEBB certified contractor. Balance procedures and reporting shall be per NEBB Standard methods and procedures.
11. Provide building heating and cooling load calculations for determination of equipment sizes to be installed in each area to the owner for review and approval, prior to ordering equipment.
12. Mechanical contractor to furnish and install a "Supco" low pressure switch #SLP 0565 and a "Supco" SF 9602 1/4"MPT x 1/4"MPT x 1/4"FPT brass tee installed on high pressure side of all new and existing DX systems, RTU, and split systems. Wiring to alarm system by alarm contractor.

13. Demolition:

- Disconnect, remove, and prepare existing systems for completion of the Scope of Work of this section and as affected by other sections noted herein.
- If pipe, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and make repairs.
- Work abandoned in place: Cut and remove back to system main. Cap piping and patch surface to match final finish. Permanently mark all work abandoned in place and not operation.
- Removal: Remove equipment and materials from the Project site to approved location daily.
- Required disconnection or interruption of existing building systems shall be coordinated with the Owner prior to performing Work. All buildings users and departments affected by the interruption shall be notified as directed by the Owner within the time frame required by the Owner.
- All equipment removed as a part of this Work shall be returned to Owner or discarded in proper manner according to all applicable laws and removed completely from this site.

HVAC Design Criteria:

1. Heating and cooling calculations shall be done in compliance with ASHRAE methods and data for the building materials, outside ambient design temperatures for 2-1/2% column for summer and 1% column for winter, interior conditions shall be 75 deg. F. summer design and 70 deg. F. winter design, outside air shall be provided at current code requirements for cfm per person, special spaces and use areas shall be designed around recommendations as outlined by most current ASHRAE Standards of design and application.
2. Duct systems shall be designed using current SMACNA and ASHRAE Standards of design for pressure classification, ductwork dimensions, and velocities for system types and equipment installed. Duct velocities shall be as recommended for low velocity systems for branch main and branch ducts. Main duct velocities may are not to be at velocities that generate radiated noise. Duct system shall be designed to provide required static pressure at terminal VAV unit inlet to meet manufacturer's performance criteria and requirements.
3. Outside air ventilation shall be provided at current building code required CFM/person. Cafeteria spaces shall have occupancy calculated at 10 square feet per occupant. Assembly auditoriums shall be calculated based on the number of seats and normal presentation occupancy.
4. Air devices shall be selected to provide required throw and with NC levels of 25 or less. Lay-in air devices shall be provided where grid ceilings are installed. Gasketed, flange frame devices shall be provided for sidewall, duct mounted, and gyp board ceiling installations. Aluminum eggcrate grilles shall be provided for supply diffusers located within 10 feet of a kitchen hood installation. Perforated ceiling grilles are not approved.
5. Ventilation requirements are to be designed per code.

6. Refer to other sections of the project manual specification for additional system and equipment requirements.

END OF SECTION

ELECTRICAL SCOPE OF WORK

PART 1 GENERAL

1.01 QUALIFICATIONS:

- A. Engineering work shall be completed by a degreed person holding a Bachelor of Science in Electrical Engineering, licensed in the State of Oklahoma as a Professional Engineer, and in direct control of work performed in their office by qualified design staff.

1.02 CODES:

- A. All materials and workmanship shall comply with all latest adopted applicable codes, specifications, local ordinances, industry standards, latest edition of the N.E.C. and Utility Company regulations. In no case will work or materials inferior to these specifications be accepted even if permitted by code.
 - 1. NFPA 70 - National Electric Code (NEC) 2017 Edition
 - 2. Oklahoma State Fire Marshal Building Plan Review Submittal Requirements
 - 3. NFPA 72 - National Fire Protection Association (NFPA) 2016 Edition
 - 4. NFPA 101 - Life Safety Code, 2015 Edition
 - 5. International Building Code (IBC) 2015 Edition
- B. In cases of difference between building codes, specifications, state laws, local ordinances, industry standards, utility company regulations and the contract documents, the most stringent will govern.
- C. Non-compliance: Should the contractor perform any work that does not comply with the requirements of the applicable building codes, state laws local ordinances, industry standards, utility company regulations and without receiving instructions from owner, he shall bear all costs arising in correcting the deficiencies and corrections to comply with codes or standards. Written approval of any changes must be received before subject work is done. Failure to do so will result in corrections being made by the contractor at his expense.

1.03 PROJECT STANDARDS:

Engineer of Record shall follow the project standards outlined in this section for final submitted Construction Documents and Specifications.

- A. Coordinate purchase of materials with Construction Outlined Schedule and Phasing.
- B. Procurement: Coordinate purchase of materials with construction outlined Schedule and Phasing.

- C. Electrical systems to be grounded and bonded in accordance with the latest adopted NEC 2017 Edition. MDFs and IDF's require intersystem bonding per NEC 2017 Article 250.94.
- D. Determine electrical characteristics and requirements of all Division 23 equipment.
- E. Provide tabulation of removed and new loads per NEC Art. 220-87 to be utilized for utility coordination upon final load calculations.
- F. Perform voltage-drop calculations from service entrance to the furthest outlet. Voltage-drop not to exceed 5%. Size and de-rate branch circuits to maintain a 3% maximum voltage-drop. Provide 2% maximum voltage drop for feeders from switchboards or main distribution board to branch circuit panelboards.
- G. Specify all new electrical equipment and systems.
- H. Coordinate with Owner and other disciplines for proposed conduit routing prior to final drawings.
- I. Existing and new/modified panelboard and switchboard schedules shall be tabulated and indicated on sheets in final engineer signed Construction Documents.
- J. Provide One-Line Diagrams, Feeder Schedules, and all diagrams necessary to illustrate the complete electrical system on final sealed Construction Documents by a Registered Professional Electrical Engineer.
- K. Photometric calculations for NORMAL and EMERGENCY lighting shall be submitted to Owner for approval prior to final sealed Construction Documents. Illustrate new ceiling grid, ceiling heights, and layout of Owner's Standard fixtures in new work.
- L. Provide Owner's standard LED flat panel 2x4 fixture for the following:
 - 1. Classroom: 35-footcandle average at 30" AFF.
 - 2. Storage and Corridors: 20-footcandle average at floor level.
 - 3. Kitchen: 55-footcandle average at floor level.
- M. Provide Owner's standard emergency light fixtures and space per NFPA 101 for average 1-footcandle at the floor level.
- N. Coordinate the design/engineering of all new and existing low-voltage systems with Owner. Provide diagrams illustrating all low voltage systems. Low-voltage systems include but not limited to the following:

1. Data and Cabling – Existing cabling to be removed back to existing and corresponding MDF/IDF closet locations provided by Owner.
2. Fire Alarm System – Existing to remain. Provide manufacturer expansion cards and power supplies for additional appliances and initiation devices.
3. Security System – Existing to remain. Provide manufacturer expansion cards and power supplies for additional appliances and initiation devices.
4. Building Management System - Existing to remain. Coordinate raceway and support requirements with TPS Controls Contractor.

1.04 OWNER STANDARDS:

Engineer of Record (EOR) shall follow the Owner's standard guidelines summarized in this section and detailed in Section 260400 – Electrical System Specifications and 271500 – Premise Cabling.

A. Hangers and Supports:

1. Conduit and Cable Support Devices:

- i. Steel and malleable-iron hangers, clamps and associated fittings listed for types and sizes of raceway or cable to be supported as described in NECA 1 and NECA 101.
- ii. Tie wire not acceptable means.

2. Minimum hanger rod size for raceway: 1/4" diameter.
3. Single conduit support: Spring-steel clamps for 1-1/2" and smaller raceway
4. J-Hooks: (3) level, 4" wide, 6' on-center in corridor accessible ceiling cavity. Support new and existing CAT 6 cabling for low-voltage systems.

B. Conductors and Cables:

1. Service entrance: 600V THHN insulated copper or aluminum.
2. Line Voltage: 600V THHN/THWN insulated and color coded for voltage.
3. Solid wire: No. 10 and smaller.
4. Stranded wire: No. 8 and larger.
5. MC Cable: Limited use allowed only for lighting whips, millwork, small vibrating equipment and existing closed partition walls. NOT ALLOWED FOR HOMERUN CIRCUITS.

C. Raceways and Boxes:

1. EMT: Set screw type, 3/4" minimum for power circuits and 1" raceways for low-voltage cables.
2. IMC: Roof mounted equipment branch feeder on 4" equipment rails, sizes adjusted for derating and ambient temperature.
3. LFMC: Short motor connections or where subject to vibration.

4. Expansion Fittings: Required where raceway crosses building boundaries.
 5. Underground Raceways: PVC Schedule 40, 30" below finished grade minimum.
 6. Boxes: 4" square by 2-1/8" deep steel for interior locations. Weatherproof with while-in-use and gasketed covers for exterior locations.
- D. Panelboards:
1. Rated 400-Amps and below with standard enclosure depth.
 2. Phase and Neutral Bus: Copper, 100% neutral.
 3. Hinged front covers.
 4. Pull box on top of surface mounted panelboards.
 5. Panels may utilize a manufactured rooftop panel to minimize penetrations thru existing roof. Mounting means and methods shall be approved with Owner and roof manufacturer prior to design.
 6. Warranty: Five years.
- E. Wiring Devices:
1. NEMA WD 1, NEMA WD 6, UL Listed and labeled.
 2. GFCI outlets: 125V, 20A, 5-20R, UL 498 and FS WC-596, side-wired, feed-thru with nylon face and Tamper-Resistant below 5'-6".
- F. Low-Voltage Color Code:
1. Refer to Owner specification Section 271500 – Premise Cabling, for low voltage cabling color codes, devices and additional device raceway requirements.
- G. Fire Alarm System (Existing to Remain):
1. Engineer of Record shall coordinate with school site conditions and Owner prior to final Construction Documents with fire alarm requirements. Main FACP to be relocated from office to expanded MDF closet.
- H. Security System (Existing to Remain):
1. Control panel shall be Ademco Vista-250BP Commercial Burglary Partitioned Security System or equivalent. Provide Owner approved security devices.

PART 2 SCOPE OF WORK

2.0 1 DEMOLITION:

Site Inspection of existing electrical systems shall be performed by the awarded contractor. Documentation of existing electrical conditions shall be provided to the Engineer of Record (EOR) engaged by the contractor for the electrical design of Work

with copies provided to Owner. Phasing of demolition shall be documented and provided to the EOR and Owner for review, coordination, and comment prior to demolition.

A. Power Distribution Systems:

1. Field verify, trace, and document replaced HVAC circuits fed from switchboard or panelboard.
2. Remove existing fused disconnects at replaced HVAC units.
3. Remove feeder conductors serving Roof Top Units from distribution switchboard or panelboard.
4. Remove control wiring from room thermostats/sensors to removed units. Identify raceways that can be reused in new work and label.
5. Residential panels and panels older than 25-years old to be modified with new commercial listed panelboard interiors. Trace branch circuits to outlets and prepare for new index. Remove existing enclosures to accept the new interior as required. Repair adjacent walls per Owner's requirements.

B. Lighting:

1. Coordinate with Owner and HVAC contractor the classroom and other rooms where the complete ceiling grid system is to be removed. Remove existing LED fixtures and store in safe/clean location.
2. Remove and dispose properly fluorescent lighting in corridors to be replaced with new LED flat panel 2x4 fixtures.

C. Classrooms:

1. Remove all surface mounted data raceways, outlets and cabling back to source MDF/IDF closets ready for new paint. MDF/IDF closets located by Owner.
2. Remove all surface mounted power outlets and raceways from walls completely to ready for new paint.

D. HVAC:

1. Coordinate all HVAC work with Division 23 contractor prior to and during demolition work.
2. Remove and disconnect power to all existing mechanical HVAC units per Division 23 scope.
3. Remove and disconnect power and controls to existing roof top units back to source.

E. Fire Alarm System (Existing to Remain):

1. Coordinate fire alarm system requirements with TPS representative: Sam Troglin, 918-746-6410.
2. Remove existing fire alarm devices and appliances and store in Owner approved location for use in new work.

3. Document and submit to Owner demolition drawing of actual existing conditions indicating devices and locations of fire alarm panel and security devices.
- F. Security System (Existing to Remain):
1. Coordinate security system requirements with TPS representative: Sam Troglin, 918-746-6410.
 2. Indicate to remove and reinstall existing security devices, cabling and provide new to accommodate new HVAC equipment.
 3. Indicate new devices which match the U.L. Listed security system.
 4. Refer to TPS General Specifications for Premise Wiring Section 271500.

2.0 2 New Work:

After demolition of the existing electrical systems provide new electrical system installation and modifications as outlined herein and required for a complete and proper working electrical system to serve the new building mechanical equipment and other building electrical distribution systems installed as described in Owner provided criteria. Phasing of new Work shall be documented and provided to the Electrical Engineer of Record and Owner for review, coordination, and comment prior to issuing for construction.

A. Lighting:

1. Reinstall existing stored LED fixtures after new ceiling grid is reinstalled. Provide temporary lighting during removal phase.
2. Replace any classroom fluorescent lighting with TPS standard LED flat panel fixture, sensors, power packs and dimmer switch.
3. Remove and replace corridor lighting with TPS standard LED flat panel fixture, sensors and power packs.

B. Power Distribution:

1. Modify 208Y/120V and 480Y/277V Distribution Switchboards that serve the existing building loads and new HVAC loads.
2. Modify existing/replaced HVAC electrical distribution and low-voltage controls:
 - (a) Indicate sizing of new fused disconnects at replaced HVAC units and route new conductors in existing raceway back to source.
3. Provide new 3-Pole breaker in existing distribution source to serve new HVAC panelboards located on the roof. Provide new buss expansion and section required for number of new breakers.
 - (a) Route new feeders on roof to new HVAC systems replacing the removed chiller/hydronic systems. Route new raceway for various control cable to classroom BMS control board. Coordinate locations with Division 23 and TPS controls contractor.
4. Require testing of existing conductors for reuse by meg-ohm insulation testing and direct to replace all conductors failing tests. Provide written report with cost estimate prior to replacing failed conductors.

5. Field trace and verify all panelboards listed on the switchboard Oneline Diagram. Panels to be renamed and labeled by "Floor Number and Alphabetical sequence. Example: 1st floor panels – 1A, 1B, 1C, etc.; 2nd floor – 2A, 2B, 2C, etc.; Specify new phenolic panel labels and completed circuit index for all switchboards, distribution panels, and branch circuit panelboards. Locate label on outside panel door and index inside panel door.
 6. Residential panels and panels older than 25-years old to be modified with new commercial listed panelboard interiors. Trace branch circuits to outlets and prepare for new index. Modify enclosures to accept the new interior as required. Repair adjacent walls per Owner's requirements.
 7. Remove circuits and feeders to abandoned equipment, to be removed in demolition. Electrical legends to indicate breakers or revised sections are 'SPARE'.
- A. Classrooms:
1. Classrooms to have new ceiling grid tiles installed to accommodate for new HVAC and all walls to be painted.
 2. Route (3) new CAT 6 cables per TPS color codes to each classroom for the interactive board, teachers' desk and access point in ceiling. Coordinate with TPS representative prior to work. Provide labeling per Owner's guidelines and standards. Provide TPS standard raceways for surface mounted low-voltage outlet devices, color per Owner.
 3. Provide TPS standard raceways for surface mounted line-voltage outlet devices, color per Owner.
- B. HVAC:
1. Coordinate control requirements and raceways to room sensors/thermostats with TPS Controls Contractor. Specify surface mounted raceways and backboxes types per TPS standards and colors.
- C. Fire Alarm System (Existing reinstalled):
1. Coordinate fire alarm system requirements with TPS representative: Sam Troglin, 918-746-6410.
 2. Indicated new fire alarm devices and cabling to accommodate new HVAC equipment duct detectors and smoke dampers.
 3. Indicate new I/O devices which match the U.L. Listed FACP.
 4. Provide U.L. Listed power supplies for expansion (as required).
 5. Provide new voice evacuation system tied into existing FACP.
 6. Reinstall new and existing notification devices and appliances in classrooms and other areas where ceilings removed and replaced.
 7. Reinstall existing fire alarm devices that are code compliant, magnetic hold-opens, pull-stations, and cabling. Provide I/O module and power supplies for HVAC duct detectors to communicate with existing FACP as required.
 8. Provide combination smoke/fire dampers and duct detectors where required. Indicate new fire alarm devices to meet local codes and approved by Authority Having Jurisdiction (AHJ). Fire alarm devices shall not be installed until contractor receives final shop drawings approved by the AHJ.

- D. Security System (Existing to Remain):
1. Coordinate security system requirements with TPS representative: Sam Troglin, 918-746-6410.
 2. Reinstall existing security devices and cabling in classrooms and corridors. Provide new to accommodate requirements by Owner for other modified areas.
 3. Refer to TPS General Specifications for Premise Wiring Section 271500.
 4. Provide new Supco alarm controls for each new HVAC unit and route cabling back to main security control panel located in existing 'MDF/IDF' closet. Coordinate sensors for HVAC system with Division 23 contractor. Refer to specifications.

PART 3 EXECUTION

3.0 1 DIVISION OF WORK

- A. Power Distribution
1. Design: By Oklahoma Licensed Professional Electrical Engineer of Record.
 2. Materials/Installation: By Division 26 Contractor.
- B. Fire Alarm System Modifications (Existing to Remain)
1. Design: By NICET level 4 contracted vendor; Obtain location of Devices from approved shop drawings and indicate on Construction Documents.
 2. Materials/Installation: By Owner contracted vendor.
- C. Security System (Existing to Remain)
1. Design: By Owner contracted Vendor; Obtain location of devices from vendor shop drawings and indicate on Construction Documents.
 2. Materials/Installation: By Owner contracted vendor.

3.0 2 TPS DESIGN PARAMETERS:

- A. Design shall comply with all published TPS standards.
- B. Design shall comply with the Advanced Energy Design Guide for K-12 School Buildings.

END OF SECTION

Plumbing Scope of Work:

Work Included: Provide plumbing systems installation and modifications as outlined herein and as needed for a complete and proper installation including, but not necessarily limited to:

1. Existing gas service to be removed from the meter throughout the building. Verify new building gas connected load with Oklahoma Natural Gas Company (ONG) to verify existing meter size is correct for the new connected capacity. System shall be installed complete with all modifications or replacement to the existing gas meter, gas regulators, system shut-off valves, required increase of pipe size of existing gas service piping or system branch piping, pressure testing of existing piping system, or other system modifications such as rerouting of any existing gas piping identified to be located under the building or otherwise not installed per current code requirements. Provide gas piping system required for the installation of all new gas fired equipment and appliances, and the continued service to all existing gas piping systems. Gas piping system shall include all required pressure regulators, relief piping, valves, unions, cathodic protection, electrical grounding, and accessories required for a complete system. Contractor shall coordinate with ONG to provide certified testing to comply with the system provider "Zero" leak policy for all new and existing gas piping.
2. Provide and install new faucets at sinks noted on drawings, waste and vent piping, domestic hot and cold water piping for all sinks noted on drawings.
3. Demolition:
 - Disconnect, remove, and prepare existing systems for completion of the Scope of Work of this section and as affected by other sections noted herein.
 - If pipe, insulation, or equipment to remain is damaged or disturbed, removed damaged portions and make repairs.
 - Work abandoned in place: Cut and remove back to system main. Cap piping and patch surface to match final finish. Record all work abandoned in place on record drawings. Permanently mark all work abandoned in place and not operational.
 - Removal: Remove equipment and materials from the Project site to approved location daily.
 - Required disconnection or interruption of existing building systems shall be coordinated with the Owner prior to performing Work. All buildings users and departments affected by the interruption shall be notified as directed by the Owner within the time frame required by the Owner.
 - All equipment removed as a part of this Work shall be discarded in proper manner according to all applicable laws and removed completely from this site.

Plumbing Design Criteria:

1. Provide union and shut-off valves suitably located to facilitate maintenance and removal of equipment and apparatus. Provide full port ball valves for shut-off duty.
2. Provide shut-off gas valve and union at each piece of gas fired equipment and service penetration through exterior wall and roof.
3. Valves and fittings shall be full size of the line they serve unless otherwise noted.

4. Make change in pipe size note on the plans after last fitting of larger pipe. When supply pipes are larger than equipment tapings, reduce size immediately prior to entry.
5. Provide domestic hot water mixing valves for all lavatories that receive hot water supply temperatures above 110 deg. F.
6. Size piping to limit pressure drop to no more than 3-5 psig/100 ft. Velocities through piping to be a maximum of 6 fps except service entrance main may be sized to 8 fps.

END OF SECTION

SECTION 01300
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Administration of Contract: Provide administrative requirements for the proper coordination and completion of work including the following:
 - 1. Supervisory personnel.
 - 2. Preconstruction conference.
 - 3. Project meetings, minimum of two per month; prepare and distribute minutes.
- B. Reports: Submit daily and special reports.
- C. Work Schedule: Submit progress schedule, updated monthly.
- D. Submittal Schedule: Prepare submittal schedule; coordinate with progress schedule.
- E. Schedule of Values: Submit schedule of values.
- F. Schedule of Tests: Submit schedule of required tests including payment and responsibility.
- G. Perform Surveys: Lay out the work and verifying locations during construction. Perform final site survey.
- H. Emergency Contacts: Submit and post a list of emergency telephone numbers and address for individuals to be contacted in case of emergency.
- I. Record Documents: Submit record drawings and specifications; to be maintained and annotated by Contractor as work progresses.

1.2 SUBMITTALS

- A. Types of Submittals: Provide types of submittals listed in individual sections and number of copies required below.
 - 1. Shop drawings, reviewed and annotated by the Contractor - 3 copies.
 - 2. Product data - 3 copies.
 - 3. Samples - 2, plus extra samples as required to indicate range of color, finish, and texture to be expected.
 - 4. Inspection and test reports - 3 copies.
 - 5. Warranties - 3 copies.
 - 6. Survey data - 3 copies.
 - 7. Closeout submittals - 3 copies.
- B. Submittal Procedures: Comply with project format for submittals. Comply with submittal procedures established by Architect including Architect's submittal and shop drawing stamp. Provide required resubmittals if original submittals are not approved. Provide distribution of approved copies including modifications after submittals have been approved.
- C. Samples and Shop Drawings: Samples and shop drawings shall be prepared specifically for this project. Shop drawings shall include dimensions and details, including adjacent construction and related work. Note special coordination required. Note any deviations from requirements of the Contract Documents.

- D. Warranties: Provide warranties as specified; warranties shall not limit length of time for remedy of damages Owner may have by legal statute. Contractor, supplier or installer responsible for performance of warranty shall sign warranties.

PART 2 PRODUCTS - Not applicable to this Section

PART 3 EXECUTION - Not applicable to this Section

END OF SECTION

SECTION 01600
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Manufacturers: Provide products from one manufacturer for each type or kind as applicable. Provide secondary materials as acceptable to manufacturers of primary materials.
- B. Product Selection: Provide products selected or equal approved by Architect. Products submitted for substitution shall be submitted with complete documentation, and include construction costs of substitution including related work.
- C. Substitutions: Request for substitution must be in writing. Conditions for substitution include:
 - 1. An 'or equal' phrase in the specifications.
 - 2. Specified material cannot be coordinated with other work.
 - 3. Specified material is not acceptable to authorities having jurisdiction.
 - 4. Substantial advantage is offered to the Owner in terms of cost, time, or other valuable consideration.
- D. Substitution Requests: Substitutions shall be submitted prior to award of contract, unless otherwise acceptable. Approval of shop drawings, product data, or samples containing substitutions is not an approval of a substitution unless an item is clearly presented as a substitution at the time of submittal.

PART 2 PRODUCTS - Not applicable to this Section

PART 3 EXECUTION - Not applicable to this Section

END OF SECTION

SECTION 09511

SUSPENDED ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Acoustical units.

1.02 REFERENCES

- A. ASTM C 635 - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 1997.
- B. ASTM C 636 - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels; 1996.
- C. ASTM E 580 - Standard Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Moderate Seismic Restraint; 1996.
- D. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.03 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on suspension system components.
- C. Samples: Submit two samples 6 x 6 inch in size illustrating material and finish of acoustical units.
- D. Samples: Submit two samples each, 12 inches long, of suspension system main runner.

1.04 QUALITY ASSURANCE

- A. Installer shall be a company specializing in the installation of suspended acoustical ceilings with a minimum of three years documented experience.

1.05 ENVIRONMENTAL REQUIREMENTS

- A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

1.06 PROJECT CONDITIONS

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Install acoustical units after interior wet work is dry.

1.07 EXTRA MATERIALS

- A. See Section 01600 - Product Requirements, for additional provisions.
- B. Provide 5 percent of total acoustical unit area of each type of acoustical unit for Tulsa Public Schools' use in maintenance of project.

PART 2 PRODUCTS

2.01 ACOUSTICAL UNITS

- A. Manufacturers:
 - 1. Armstrong World Industries, Inc or CertainTeed
 - a. Classrooms, Halls, Offices & Cafeterias: 2' x 4' Armstrong #1729 Humiguard Plus-Fine fissured with BioBlock paint on face and back of panels; 2 x 4 CertainTeed HHF-197, High Humidity, Fine-fissured with BioShield paint on face and back of panel. Color: White
 - b. Gymnasiums and designated high abuse areas: 2' x 4' Armstrong #860 Armatuff or #862 where plans indicate fire rated is required; 2 x 4 CertainTeed PSB-197 (Fire-rated). Color: White
 - c. Libraries: 2' x 2' Armstrong #1910 Humiguard-Plus, Ultima/very fine texture with BioBlock paint on face and back of panels; 2 x 2 CertainTeed #1222-OVT-1-Symphony NRC-.65 - .70 x 5/8". Color: White.
 - d. Kitchens, Restrooms & Classroom Toilet Rooms: 2' x 4' Armstrong #605 Ceramaguard with BioBlock/BioShield & Humiguard-Max; 2 x 4 or CertainTeed Vinylrock 1140-CRF-1 (Fire-rated) or 1100-CRF-1 (Non-perforated) BioBlock/BioShield & Humiguard. Color: White

2. No Substitutions: See Section 01600 - Product Requirements.
- B. Acoustical Panels: ASTM E 1264 Type III, Painted mineral fiber, conforming to the following:
 1. Size: 24 x 24 inches, or 24 x 48 inches.
 2. Thickness: 5/8 inches.
 3. Composition: Wet felted.
 4. Density: 1.0 lb/cu ft.
 5. NRC Range: 0.55 to 0.65.
 6. Edge: Square.
 7. Surface Color: White.
 8. Surface Pattern: Non-directional fissured.

2.02 SUSPENSION SYSTEM(S)

- A. Manufacturers:
 1. Armstrong World Industries, Inc.
 2. Chicago Metallic Corp.
 3. CertainTeed
 4. Substitutions: See Section 01600 - Product Requirements.
- B. Suspension Systems - General: ASTM C 635; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.
 1. Profile: Tee; 15/16 wide face.
 2. Construction: Double web, Hot dipped galvanized.
 3. Finish: white over galvanized substrate.
- C. Match Acoustical Tile Manufacturer with same grid manufacturer to obtain 15-year warranty. 15/16" Grid System. Color: White.

2.03 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- B. Perimeter Moldings: Same material and finish as grid.
 1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.
- C. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C 636, ASTM E 580, and manufacturer's instructions and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1/360.
- C. Locate system on room axis according to reflected ceiling plan.
- D. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.
- E. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.
- F. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- G. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- H. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- I. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- J. Do not eccentrically load system or induce rotation of runners.
- K. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 1. Use longest practical lengths.
 2. Overlap and rivet corners.
- L. Form expansion joints as detailed. Form to accommodate plus or minus 1 inch movement. Maintain visual closure.

3.03 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install units after above-ceiling work is complete.
- E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- F. Cutting Acoustical Units:
 - 1. Cut to fit irregular grid and perimeter edge trim.
 - 2. Make field cut edges of same profile as factory edges.
 - 3. Double cut and field paint exposed reveal edges.
- G. Install hold-down clips on panels within 20 ft of an exterior door.

3.04 ERECTION TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.05 SCHEDULE

- A. See Room Finish Schedule.

END OF SECTION

SECTION 09901

PAINTS AND COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints, stains, varnishes, and other coatings.

1.02 REFERENCES

- A. Painting and Decorating Contractors of America–P.D.C.A. Type 1 Manual.
- B. ASTM D 4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials; 1992 (Re-approved 1997).

1.03 DEFINITIONS

- A. P.D.C.A. standards and interpretations.

1.04 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on all finishing products.
- C. Verification samples: submit a minimum of (3) three painted 6" x 10" (+/-) "pull down" samples, illustrating selected colors and textures for each color and system selected. Each sample to be identified on the backside with project ID and project color number. One set of samples will be returned to the CM, to remain at the job site for reference.
- D. Submit sealer and stain finishes on material on which that particular finish is to be used.
- E. Manufacturer's instructions: Indicated special surface preparation procedures.
- F. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.
- G. MSDS for each product to be utilized.

1.05 QUALITY ASSURANCE

- A. Applicator Qualifications: Company specializing in performing the work of this section with minimum three (3) years experience.
- B. Job Foreman: Company shall have a job foreman who speaks English on the job site during normal working hours (with a minimum of 5 years experience).

1.06 REGULATORY REQUIREMENTS

- A. Comply with safety recommendations of MSDS for each product utilized.
- B. Conform to applicable code for flame and smoke rating requirements for products and finishes.

1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees Fahrenheit and a maximum of 90 degrees Fahrenheit, in ventilated area, and as required by manufacturer's instructions.

1.08 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- C. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

1.09 EXTRA MATERIALS

- A. See Section 01600 - Product Requirements, for additional provisions.
- B. Supply 1 gallon of each color; store where directed.
- C. Label each container with color in addition to the manufacturer's label.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Paints: Pittsburgh Paint Co.
- B. Transparent Finishes: Pittsburgh Paint Co.
- C. Stains: Pittsburgh Paint Co.
- D. Primer Sealers: Pittsburgh Paint Co.
- E. Substitutions: See Section 01600 - Product Requirements.

2.02 MATERIALS

- A. Provide best of their respective kinds, delivered to job in original unopened containers, plainly marked with manufacturer's name, name of product and color. A schedule of colors will be prepared by TPS upon receipt of all paint samples and other items required for color selections.
1. Materials: PPG, SHERWIN-WILLIAMS, KELLY MOORE, BENJAMIN MOORE, and PORTER. Submit product information for equal material to TPS for approval prior to color selections.

2.03 PAINT SYSTEMS – EXTERIOR

- A. Paint WE-OP-3A - WOOD, Opaque, 3 coats
1. One coat of PPG 17-941 Seal Grip Interior/Exterior Alkyd Universal Wood Primer
 2. Two coats of PPG 78 Line Sun-Proof Exterior 100% Acrylics Semi-Gloss Enamel
- B. Paint WE-OP-3L - WOOD, Opaque, 3 coats
1. One coat of PPG 6-609 Speedhide Exterior Latex Wood Primer.
 2. Two coats of PPG 78 Line Sun-Proof Exterior 100% Acrylics Semi-Gloss Enamel
- C. Paint CE-OP-3L - CONCRETE/MASONRY, Opaque, 3 coats
1. One coat of PPG 6-7 Speedhide Interior/Exterior Latex Block filler
 2. Two coats of PPG 78 Line Sun-Proof Exterior 100% Acrylics Semi-Gloss Enamel
- D. Paint GE-OP-3L - GYPSUM BOARD AND PLASTER, Opaque, 3 coats
1. One coat of PPG 17-921 Seal Grip Interior/Exterior Universal Acrylic Primer
 2. Two coats of PPG 78 Line Sun-Proof Exterior 100% Acrylics Semi-Gloss Enamel
- E. Paint ME-OP-3A - FERROUS METALS, Unprimed, 3 coats
1. One coat of PPG 6-208 Speedhide Interior/Exterior Rust Inhibitive Metal Primer
 2. Two coats of PPG 90-474 Pitt-Tech DTM Acrylic Satin Enamel
- F. Paint MgE-OP-3L - GALVANIZED METALS, 3 coats
1. One coat of PPG 90-712 Pitt-Tech DTM Acrylic Metal Primer
 2. Two coats of PPG 90-474 Pitt-Tech DTM Acrylic Satin Enamel
- G. Paint MaE-OP-3A - ALUMINUM and COPPER, Unprimed, 3 coats
1. One coat of PPG 97-687 Polyclutch Wash Primer
 2. Two coats of PPG 90-474 Pitt-Tech DTM Acrylic Satin Enamel
- H. Paint E-PAV - PAVEMENT MARKING PAINT
1. Two coats of Richards 3007 Lead Free Yellow Latex Traffic Coating

2.04 PAINT SYSTEMS - INTERIOR:

- A. Paint WI-OP-3A - WOOD, Opaque, 3 coats
 - 1. One coat of PPG 17-956 Seal Grip Interior Alkyd Wood Primer/Under coater
- B. Paint WI-OP-3L - WOOD, Opaque, 3 coats
 - 1. One coat of PPG 6-2 Speedhide Interior Latex Wood Primer
 - 2. Two coats of PPG 6-500 Speedhide Interior Latex Semi-Gloss
- C. Paint WI-TR-V - WOOD, Transparent, Varnish, No Stain
 - 1. Three coats of PPG 43886 Clear Polyurethane Satin Varnish (Sand between each coat)
- D. Paint WI-TR-VS - WOOD, Transparent, Varnish and Stain
 - 1. One coat of PPG 44500 Oil Wiping Stain
 - 2. Three coats of PPG 43886 Clear Polyurethane Satin Varnish (Sand between each coat)
- E. Paint CI-OP-3L - CONCRETE / MASONRY, Opaque, 3 coats
 - 1. One coat of PPG 6-7 Speedhide Interior/Exterior Latex Block filler
 - 2. Two coats of PPG 6-500 Speedhide Interior Latex Semi-Gloss
- F. Paint MI-OP-3A - FERROUS METALS, Unprimed, 3 coats
 - 1. One coat of PPG 6-208 Speedhide Interior/Exterior Rust Inhibitive Alkyd Metal Primer
 - 2. Two coats of PPG 6-1110 Speedhide Interior Alkyd Semi-gloss Enamel
- G. Paint MI-OP-2A - FERROUS METALS, Primed, 2 coats
 - 1. Touch up if needed with PPG 6-208 Speedhide Interior/Exterior Rust Inhibitive Alkyd Metal Primer
 - 2. Two coats of PPG 6-1110 Speedhide Interior Alkyd Semi-Gloss Enamel
- H. Paint Mgl-OP-3A - GALVANIZED METALS, 3 coats
 - 1. One coat of PPG 6-209 Speedhide White Galvanized Metal Primer
 - 2. Two coats of PPG 6-1110 Speedhide Interior Alkyd Semi-Gloss Enamel
- I. Paint Mai-OP-3A - ALUMINUM, Unprimed, 3 coats
 - 1. One coat of PPG 97-687 Polyclutch Wash Primer
 - 2. Two coats of PPG 6-1110 Speedhide Interior Alkyd Semi-Gloss Enamel
- J. Paint GI-OP-3L - GYPSUM BOARD AND PLASTER, 3 coats
 - 1. One coat of PPG 6-2 Speedhide Interior Latex Primer.
 - 2. Halls and other rooms: Three coats of PPG 6-500 Speedhide Interior Latex Eggshell
 - 3. Classrooms: Two coats of PPG 6-411 Speedhide Interior Latex Eggshell

- K. Paint GI-OP-2E - GYPSUM BOARD AND PLASTER, Water Born Epoxy (Toilets, Kitchen, Drinking Fountains)
 - 1. One coat of PPG 17-921 Seal-Grip Interior/Exterior Acrylic Latex Primer/Sealer
 - 2. Two coats of PPG 16-510 Pitt-Glaze Precatalyzed WM Semi-Gloss Epoxy
- L. Existing Lockers – Wash with Peso. Sand to achieve a smooth surface free of all nicks and scratches by sanding to a featheredge.
 - 1. Two coats of PPG 95-8000 Pitt-Thane Ultra Urethane Enamel

2.05

2.06 SURFACES NOT TO BE PAINTED:

- A. Surfaces permanently concealed from view, unless noted to receive finish.
- B. Materials or equipment with a complete factory applied finish unless otherwise noted.
- C. Finish hardware unless specifically noted otherwise or previously painted.
- D. Non-ferrous metals unless specifically noted otherwise or previously painted.
- E. Plumbing fixtures.
- F. Lighting Fixtures.

2.07 ACCESSORY MATERIALS

- A. Accessory Materials: Linseed oil, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified; commercial quality.
- B. Patching Material: Latex filler – Gyp Board and Block
 - 1. Plaster Walls
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive Work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.

- D. Notify Architect of any incompatibilities of specified finish on substrates, including existing finishes.
- E. Contractor shall measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Plaster and Gypsum Wallboard: 12 percent.
 - 2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
 - 3. Interior Wood: 15 percent, measured in accordance with ASTM D 4442.
 - 4. Exterior Wood: 15 percent, measured in accordance with ASTM D 4442.

3.02 PREPARATION

- A. Surface Appurtenances: Remove electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
- B. Surfaces: Correct defects and clean surfaces which affect work of this section. Remove or repair existing coatings that exhibit surface defects.
- C. Marks: Seal with shellac those which may bleed through surface finishes.
- D. Impervious Surfaces: Remove mildew by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- E. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
- F. Gypsum Board Surfaces to be Painted: Clean thoroughly all wallboard surfaces to be painted. Sand smooth all rough surfaces. Fill minor defects with filler compound. Spot prime defects after repair.
- G. Aluminum Surfaces to be Painted: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.
- H. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- I. Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.
- J. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.
- K. Interior Wood Items to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes

and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

- L. Interior Wood Items to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.
- M. Exterior Wood to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior caulking compound after prime coat has been applied. Back prime concealed surfaces before installation.
- N. Exterior Wood to Receive Transparent Finish: Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes with tinted exterior caulking compound after sealer has been applied. Prime concealed surfaces.
- O. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.
- P. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.
- Q. Plaster Walls:

3.03 APPLICATION

- A. Apply products in accordance with manufacturer's instructions.
- B. Apply finishes at manufacturer's recommended spreading rate to provide total dry film of not less than 5 mils.
- C. Apply material without reduction except as specifically required by label direction; reduction shall be the minimum permitted.
- D. Provide uniform color and finish; the number of coats specified being a minimum, provide any additional coats to produce work satisfactory to TPS.
- E. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- F. Apply each coat to uniform appearance.
- G. Sand wood surfaces lightly between coats to achieve required finish.
- H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- I. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- J. Fire hose cabinets, air registers and grilles, flanges around ceiling fixtures, exposed electrical panel boards, primed hardware, etc., shall be painted to match adjacent surfaces unless factory finished such as aluminum registers and grilles.

- K. Where paint finish is specified on CMU, take special care to assure that every pore or irregularity of CMU texture is solidly and uniformly filled with block filler, adding extra coats to coarse textured units as necessary to provide a finish acceptable to TPS. Apply textured coating to uniform finish.
- L. Where Epoxy finish is specified on CMU, take special care to assure that every pore or irregularity of CMU texture is solidly and uniformly filled with block filler, adding extra coats to coarse textured units as necessary to provide an easily washable finish acceptable to TPS and local Health Department.
- M. Apply material without reduction except as specifically required by label direction; reduction shall be the minimum permitted.

3.04 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Paint shop-primed equipment, unless indicated otherwise.
- B. Paint rooftop equipment furnished with or without factory finish only as indicated on the drawings.
- C. Paint piping, equipment, conduits, vents, etc., on roof as indicated on the drawings. Identification labels will be provided by Mechanical Contractor.
- D. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- E. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.05 CLEANING

- A. Collect waste material which may constitute a fire hazard, place in closed metal containers, and remove daily from site.
- B. On completion of work, carefully clean all glass, hardware, factory finished surfaces, etc., and remove all misplaced paint and stain spots or spills and leave in a condition acceptable to TPS.
- C. Provide trash dumpster on site for debris collection as contractor may not use TPS dumpster.

TECHNICAL INFORMATION

General Requirements:

1. Owner shall provide the contractor with one location at each site to store supplies.
2. Contractor shall remove debris from the site daily. School shall be ready to be used each and every day that school is in session. Contractor shall clear all paint supplies from the classrooms.
3. **Minimum Preparations** are listed below for pricing unit cost items:
 - a. Doors varnished – wash, sand and apply two coats of polyurethane with staining agent.
 - b. Doors painted – wash, sand and apply one coat of rust inhibitive primer and two coats of alkyd enamel. New Doors to receive one coat of XIM primer and two coats of alkyd enamel.

- c. Single or double jambs – wash, sand and apply one coat of rust inhibitive primer and two coats of alkyd enamel.
- d. Single doorjamb and transom – wash, sand and apply one coat of rust inhibitive primer and apply two coats of alkyd enamel
- e. Single doorjamb, transom, and sidelight – wash, sand, and apply one coat of rust inhibitive primer and apply two coats of alkyd enamel
- f. Single doorjamb, transom and double sidelights – wash, sand, and apply one coat of rust inhibitive primer and apply two coats of alkyd enamel
- g. Painted base, moldings and chair rail – wash, sand and apply two coats of alkyd enamel
- h. Wall-mounted handrail – varnish or alkyd enamel as required
- i. Radiators – clean and spray with alkyd enamel
- j. Freestanding spindled handrail (stairwell, etc.) –
- k. Toilet Partitions – same procedure and finish as lockers
- l. Accent Stripe – Acrylic latex
- m. Open bookcases, varnished (repaint) – same procedure and finish as doors
- n. Open bookcases, varnished (new) – same procedure and finish as doors
- o. Open wood bookcases, epoxy – wash, sand and apply one coat of XIM and one coat of water-borne epoxy
- p. Cabinets with doors, (all ext. & int. of doors only) – one coat of XIM Product and one coat of water-borne epoxy
- q. Cabinets with doors, epoxy (ext. & int. of doors only) – wash, sand and prime with XIM Product and apply one coat of water-borne epoxy
- r. Gyp walls, latex – using two coats of acrylic semi-gloss. New walls shall be primed and receive 3 coats of semi-gloss.
- s. Gyp walls, epoxy – All restrooms. One coat of P. V. A. Prime and one coat of water-borne epoxy
- t. Block walls, latex – two coats of acrylic latex semi-gloss.
- u. Existing block walls, epoxy – solvent base, apply one coat of P. P. G. grip and seal, and one coat of water-borne epoxy
- v. Lockers, face side only – wash exterior surfaces and remove paint from numbered plates; power sand to feather edge, chipped paints, and scratches; apply one coat of primer using P. P. G. Multi-prime #97-680; apply one finish coat of P. P. G. Pitthane #95-8600 and two coats of alkyd enamel; mask and protect all numbering plates and protection plates on lockers.
- w. Acoustical lay-in ceilings and grid – apply one coat of P. P. G. Grip & Seal
- x. Existing metal cabinets – apply same finish as lockers
- y. HVAC and Uni-vent Units and Grilles – Paint using same procedure as for lockers.
- z. Exterior Waterproofing: Brick, Stucco, Block- Use Siloxane by Coronado Paint. Do not apply in temperatures above 90 Degrees. Apply per manufacturers recommendations.
- aa. Polymix: Prepare wall and apply paint per Manufacturer recommendations
- bb. Glazed Tile Epoxy:
 - 1. Power sand to dull glazed tile. 2. Prime tile using XIM,
 - 3. Apply tow coats of P. P. G. Polyurethane epoxy gloss #95-1 series
- cc. Glazed Tile Multi-Color:
 - 1. Power sand to dull surfaces, 2. Apply one coat of XIM, 3. Prime with acrylic latex to match background of multi-color, 4. Apply multi-color such as Poly-mix or equal per manufacturer's specifications, 5. Apply one coat of Non-ambering polyurethane

- dd. Sealant: Polyurethane sealant Vulkem 116 or equal. Do not apply to damp or contaminated surfaces. Clean all smears with Xylol or Toluol before sealant cures. Color: Match the adjacent material. Bronze, Buff or Almond. Owner to approve color.
- ee. Poured quartz floor: Manufacturer Benjamin Moore or equal. Prepare floor and apply per manufacturers directions. Color to be determined by Owner.
- ff. Painted Urethane Floor: Manufacturer: Benjamin Moore or equal. Prepare floor and apply paint per manufacturers recommendations.

END OF SECTION

SECTION 12492

MANUAL ROLLER SHADES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Manual roller shades

1.02 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM E 21 - Standard Test Method for Elevated Temperature Tension Tests of Metallic Materials.
 - 2. ASTM E 22 - Recommended Practice for Conducting Long Time High Temperature Tension Test of Metallic Materials.
 - 3. ASTM G 21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
 - 4. ASTM G 22 - Standard Practice for Determining Resistance of Plastics to Bacteria.
- B. National Fire Protection Association (NFPA):
 - 1. NFPA 70 - National Electrical Code.
 - 2. NFPA 701 - Fire Tests for Flame-Resistant Textiles and Films.
- C. Underwriters Laboratories Inc. (UL).

1.03 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: Latest edition of Manufacturer's literature including:
 - 1. Performance data and installation procedures meeting the requirements herein. Including installation details, styles, material descriptions, profiles, features, finishes and operating instructions.
 - a. Preparation instructions and recommendations.
 - b. Storage and handling requirements and recommendations.
 - c. Mounting details and installation methods.
- C. Maintenance Data: Submit instructions and precautions for cleaning and maintenance, operating hardware and controls as applicable.
- D. Manufacturer's Material Safety Data Sheet (MSDS) for each product being used.
- E. Submit working hand sample or mock up shade (mock up shade may be used as a final shade if approved).
- F. Shop Drawings: Submit manufacturer's shop drawings, including plans, elevations, sections, product details and finishes, installation details, operational clearances, wiring diagrams if applicable, and relationship to adjacent work.
- G. Window Treatment Schedule: Submit a schedule with same room designations indicated on the Drawings; including but not limited to opening sizes and key to typical mounting details.
- H. Samples:
 - 1. Submit two 4" x 6" samples of shade fabric material indicating color.

2. Submit two 4" x 6" samples of the fascia material indicating color.

1.04 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Engaged in manufacturing of products of similar type to that specified, with a minimum of 10 years successful experience.
- B. Installer Qualifications: Minimum 2 years successful experience installing similar products.
- C. Single Source Requirements: To the greatest extent possible, provide products specified in this section from a single manufacturer.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Product to be delivered in manufacturer's original packaging.
- B. Products to be handled and stored to prevent damage to materials, finishes and operating mechanisms. Store in a clean, dry area, laid flat to prevent sagging and twisting of packaging.

1.06 PROJECT CONDITIONS, COORDINATION AND SEQUENCING

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.
 1. Building shall be enclosed; windows, frames and sills shall be installed and glazed.
 2. Wet work shall be complete and dry.
 3. Ceilings, window pockets, electrical and mechanical work above window covering shall be complete.

1.07 WARRANTY

- A. Minimum 5 year.

PART 2 - PRODUCTS

2.01 Manufacture and Product Description

- A. InPro
 1. Clickeze
 2. Arid solar screen fabric
 3. Fabric Color: Charcoal/Sable
- B. Springs Window Fashions (SWF) Contract
 1. Shading Systems
 2. Double-Take T300
 3. Fabric Color: Grey/Bronze
- C. Substitution Request: Not permitted

2.02 Manual Roller Shades

- A. Product: manual roller shade
 1. **Shade fabric** shall be flame retardant, fade and stain resistant, anti-static, anti-microbial.
 - a. Passes NFPA 701-1999 FR

- b. Passes ASTM-G21 and G22
 - c. Shades with railroaded fabric will have heat-welded seams.
 - d. Fabric Style: 3% Openness
 - e. Shading Coefficient with single ¼" clear glass: 0.65-0.68
 - f. All shades within a room shall be from the same dye lot
2. **Roller tube** shall be extruded aluminum engineered with a channel to accept fabric spline. The tube size will be determined by the manufacturer based on window size and fabric selection.
3. **Clutch** system shall be made of glass-reinforced, polyester thermopolymer (PBT) for wear resistance, smooth operation and corrosion resistance. The clutch is comprised of multi-banded, steel springs that lock the shade in any position when operating the control loop. The clutch mechanism is bi-directional and never requires adjustment or lubrication.
4. **Control loop** shall be a #10 stainless steel bead chain. Bead stops attached to the chain protect the shade from over rotation. Bead stop shall be placed so that no more than the hembar shows below fascia when shade is fully rolled up.
- a. Length of chain shall be from mechanism to 48-inches above finished floor.
5. **Idler** end shall be made of high strength, glass-reinforced, polyester thermopolymer (PBT) for wear resistance, smooth operation and corrosion resistance.
6. **Lift assist system** shall be a heavy-duty torsion spring located inside the roller tube. The mechanism reduces the pull force allowing easy lifting of larger shades.
7. **Spline system** shall consist of a PVC spline heat-welded to the shade fabric and inserted into a channel on the roller tube. The spline system allows for adjustability on-site and ease in changing fabric panels in the field.
8. **Hem bar** shall be an aluminum extrusion enclosed in a fabric hem pocket with heat-welded seams and ends. Optional fabric wrapped hem bar.
9. **Battens** shall be enclosed in a heat-welded pocket providing additional stabilizing on large shades. Batten placement will be determined by the manufacturer based on window size and fabric selection.
10. **Installation brackets** shall be .125" thick steel and can accommodate overhead, side and face mounting. Optional dual shade brackets shall hold two shades in one bracket assembly. Coupled shades shall be connected with a linking bracket mechanism.
11. **Mounting:**
- a. Typically outside mounted.
 - b. Measure so a run of fascias are butting next to each other with no gaps and out to wall on ends.
 - c. Control loop shall typically be on the right side of the window unless access does not meet accessibility codes. Do not order without confirming with a site visit once millwork has been finalized.

2.03 ACCESSORIES

- A. **Fascia panel** shall be 4.25" or 7.625" dual shade snap-on design and made of .062" thick extruded 6063 T-5 aluminum alloy

1. Finish: either a powder-coated finish to match window mullion that is bronze or a clear anodized finish for window mullions of a color other than bronze, see drawings for specific colors.
 2. Brackets shall be universal and shall be clear anodized finish.
- B. **End Caps.** Same finish as fascia shall be placed at all fascia's; even fascias that are close; no exposed ends.
- C. **Locking Chain Guide.** User to identify each location per window due to odd situations.

2.04 FABRICATION

- A. Fabricate shades to hang flat without buckling or distortion.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Installer shall be responsible for inspection of jobsite, approval of mounting surfaces, blocking for shade brackets or pocket assemblies, suspended acoustical or gypsum ceiling for recessed shades, verification of field measurements and installation conditions. Installation shall commence when satisfactory conditions are met.
- B. Do not proceed with installation until substrates have been prepared using the methods recommended by the manufacturer and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.
- C. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.

3.02 INSTALLATION

- A. Install window treatments in accordance with manufacturer's instructions including the following.
1. Install with adequate clearance to permit smooth operation of the shades throughout entire operational range.
 2. Adjust and balance window coverings to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.03 CLEANING AND PROTECTION

- A. Clean surfaces after installation in accordance with manufacturer's written instructions. Do not use cleaning methods involving heat, bleach, abrasives, or solvents.
- B. Protect installed products until completion of project. Repair damaged or improperly installed before Substantial Completion.

END OF SECTION

SECTION 230000

MECHANICAL SPECIAL CONDITIONS

PART 1 GENERAL

1.01 CODES AND STANDARDS:

- A. All materials and workmanship shall comply with all applicable codes, specifications, local ordinances, industry standards and utility company regulations. In no case shall work or materials inferior to these specifications be accepted even if permitted by code.
- B. In cases of differences between codes, specifications, state laws, local ordinances, industry standards and utility company regulations and the contract documents, the most stringent shall govern.
- C. Non-compliance: Should the contractor perform any work that does not comply with the requirements of the applicable building codes, state laws, local ordinances, industry standards, and utility company regulations he shall bear all costs arising in correcting the deficiencies.

1.02 INSTALLATION AND ARRANGEMENT:

- A. The contractor shall install all mechanical work to permit removal (without damage to other parts) of all mechanical and electrical parts requiring periodic replacement or maintenance. The contractor shall arrange pipes, ducts and equipment to permit ready access to valves, cocks, traps, filters, starters, motors, control components and to clear the opening of swinging and overhead doors and access panels.
- B. Excavation and backfill:
- C. Trench excavation: Trenches shall be of necessary width for the proper laying of the pipe, and the banks shall be as nearly vertical as practical. The bottom of the trenches shall be accurately graded to provide uniform bearing and support for each section of the pipe on undisturbed soil at every point. Except where rock is encountered, care shall be taken not to excavate below the depths indicated. Where rock excavations are required, the rock shall be excavated to a minimum over-depth of 4 inches. Over-depths in rock excavation and unauthorized over-depths shall be back-filled with washed river sand, thoroughly tamped. Whenever unstable soil, as determined by the owner, is encountered in the trench bottoms, soil shall be removed to the depth required and the trench back-filled to the proper grade with coarse sand, fine gravel or other suitable material, as hereinafter specified.
 - 1. Depth of cover: Trenches shall be provided for the following minimum depths of cover from existing grade or from indicated finish grade, whichever is lower, unless otherwise specifically shown:
 - a) Two feet minimum cover: Gas
 - 2. Protection of existing utilities: Existing utility lines to be retained but uncovered during excavation operations, shall be protected from damage during excavation and back-filling and if damaged, be repaired by the contractor at his expense.
 - 3. Back-fill: Trenches shall not be back-filled until all required tests and inspections have been performed and until the systems conform to the drawings and specifications.
 - a) Normal back-fill: Where compacted back-fill is not specified, trenches shall be carefully back-filled to a depth of 6 inches over top of pipe with crusher run, then with the excavated materials approved for back-filling consisting of earth,

loam, sandy clay, sand and gravel, soft shale or other materials, free from large clods of earth or stones over 2 1/2 inch maximum dimensions, deposited in 6 inch layers and thoroughly and carefully rammed until the pipe has a cover of not less than 1 foot layers and tamped. Settling the back-fill with water will be permitted, and will be a requirement when directed by the owner. The surface shall be graded to a reasonable uniformity and the mounding over trenches left in a uniform and neat condition as approved by the owner.

- b) Crusher Run back-fill: Shall be used for full depth of excavation under slabs on grade, building structure, concrete paving and asphaltic concrete paving.
- c) Test for displacement if sewers: Storm and sanitary sewer mains will be checked by the owner to determine whether any displacement of the pipe has occurred after the trench has been back-filled to 2 feet or more above the pipe. A light will be flashed between manhole locations. If the illuminated interior of the pipelines shows poor alignment, displaced pipe or other defects, such defects shall be remedied by the contractor.

1.03 SUBMITTALS:

- A. The contractor shall submit to the owner for review conformance and compliance with the specifications and the contract drawings, information covering the material and equipment that he proposes to furnish. Such submittals shall indicate where the proposed equipment or material will be installed, and shall include sufficient manufacturer's information to determine that the material is in accordance with the specifications. Any material or equipment that is not in accordance with the specification requirements may be rejected. A minimum of two (2) copies of the submittals are required and shall be bound in two (2) 3-ring binders complete with index and tabs for each item. Partial submittals will not be accepted.
- B. Submittals will be required on the following materials.
 - 1. Pipe and Pipe fittings
 - 2. Identification of Pipe
 - 3. Supports, Anchors and Seals
 - 4. Valves, Cocks and Faucets
 - 5. Vibration Isolation
 - 6. Piping and Equipment insulation
 - 7. Duct Insulation
 - 8. Plumbing systems
 - 9. Air Distribution Equipment (Fans)
 - 10. Ductwork
 - 11. Duct Accessories
 - 12. Air Outlets
 - 13. Air Treatment Equipment (filters) at Roof-top and AHU Units
 - 14. Roof-Top Units and Thermostats.
- C. Shop Drawings and submittals information shall be clearly indexed and marked to indicate the proposed items of equipment, as well as to indicate under which paragraph of the specifications each item of the equipment is described.
- D. Submittals that list only the specified capacities of equipment instead of the actual proposed capacities will not be acceptable except when, by coincidence, the proposed values are identical to those specified. The contractor will be required to indicate in the submittal information the actual operating characteristics of the proposed equipment at the specified design conditions.

1.04 DRAWINGS BY CONTRACTOR:

- A. Record Drawings- The contractor shall furnish to the owner CAD record drawings consisting of three (3) sets of 11" x 17" prints (To be bound in O&M Manuals), one (1) full size set of prints and one (1) disk, showing the piping and ductwork for the HVAC and plumbing systems. Piping sizes, rerouting, etc., for both under floor and above ceiling piping shall be shown. In addition to these drawings, a complete set of approved ductwork shop drawings and temperature control shop drawings shall be included in this set of drawings.
 - 1. CAD Record drawings shall incorporate all change and field orders. (No separate or supplemental drawings).
 - 2. All equipment schedules to be revised to reflect installed manufacturer model numbers and capabilities.

1.05 EQUIPMENT AND MATERIALS:

- A. All materials shall be new and shall bear the manufacturer's name, trade name and the UL label in every case where a standard has been established for the particular material. The equipment to be furnished under each section of the specifications shall be essentially the standard product of a United States of America manufacturer, manufactured in the U.S.A., regularly engaged in the production of the required type of equipment, and shall be the manufacturer's latest and approved design.
- B. Delivery and storage: Equipment and materials shall be delivered to the site and stored in original containers, suitably sheltered from the elements, but readily accessible for inspection until installed. All items subject to moisture damage (such as controls, motors and electrical equipment) shall be stored in dry, heated spaces.
- C. Equipment and materials of the same general type shall be of the same make throughout the work to provide uniform appearance, operation and maintenance.
- D. Protection: Equipment shall be tightly covered and protected against dirt, water and chemical or mechanical injury and theft. At the completion of the work fixtures, equipment and materials shall be cleaned and polished thoroughly. Damage or defects developing before acceptance of the work shall be made good at the contractors' expense.

1.06 IDENTIFICATION FOR MECHANICAL EQUIPMENT:

- A. Identification for mechanical equipment shall be provided and furnished under mechanical section, using item numbers and nomenclature as shown on the mechanical drawings, or as per owner's direction.
- B. Roof top air conditioning units, fans, etc., furnished by the contractor shall be identified. Nameplates shall conform to MIL-P-15024 Phenolic. Nameplates shall be red with white background and shall have 1 1/2 " letters. If the equipment, identified, is too small to accept this size nameplate, as determined by the owner, the size of the lettering may be reduced to 1/2" size. Plates shall be adhesive backed or be riveted to equipment.
- C. Items to be identified and nomenclature used shall be submitted to the owner for approval.

PART 2 MATERIALS

2.01 FIRE STOP-PENETRATION SEALANT:

- A. All penetrations through fire rated floors and walls shall be sealed with "Flameseal" as manufactured by Nelson Electric or equal product, to prevent the passage of smoke, fire, toxic gas or water through the penetration either before, during, or after a fire. The fire rating of the penetration seal shall be at least that of the floor or wall into which it is installed, so that the original fire rating of the floor or wall is maintained as required by Article 300-21 of the National Electrical Code. (Equal products by 3-M Products, DOW Corning Corp., or approved equal).
- B. No flammable material may be used to line the chase or hole in which the fire stop material is to be installed.
- C. Damming materials shall be left in place after the seal is complete. All such materials shall be non-flammable.
- D. The sealant shall be placed into the hole after each duct or pipe has been spread apart to allow approximately 1/2" of material to be placed to fill all voids around and between them. No duct or pipes may be touching each other and thereby allow voids to form in the fire stop.
- E. The sealant shall remain resilient and pliable to allow for the removal and/or addition of duct or pipe without the necessity of drilling holes. It shall adhere to itself perfectly to allow nay and all repairs to be made with the same material. It shall allow for vibration, expansion and/or contraction of anything passing through the penetration without affecting the seal, or cracking crumbling or spalling.
- F. The sealant products shall have been subjected to fire exposure in accordance with standard time-temperature curve in the Standard, UL 263, ASTM E119, and NFPA 251. The fire-stop products shall have also been subjected to the hose stream test in accordance with UL 10B. The sealant shall be UL classified as a Fill, Void or Cavity Material for use in Wall or Floor Openings.
- G. All materials shall be installed per manufacturer's installation instructions.

PART 3 EXECUTION

3.01 AIR SYSTEMS, AIR DISTRIBUTION TEST AND BALANCE:

- A. The contractor shall balance, adjust and test air moving equipment and air distribution and/or exhaust systems as herein specified. All instruments used shall be accurately calibrated and maintained in good working order. If requested, the tests shall be conducted in the presence of the owner responsible for the project and/or his representative. Provide test and balance reports in operating and maintenance manuals. Provide list of filter sizes and quantities for each piece of equipment requiring filters.
- B. Air balance and testing shall not begin until system has been completed and is in full working order. The contractor shall put all heating, ventilating and air conditioning systems and equipment into full operation and shall continue the operation of same during each working day of testing and balancing.
- C. Test and Balance to be performed by N.E.B.B Certified Contractor and reports submitted to owner (Include in O&M Manual).

3.02 INSTRUCTION TO OWNER:

- A. The contractor shall instruct the operating personnel of the owner in the proper operation and maintenance of all elements of the mechanical system. A competent representative of the contractor shall provide instructions as required to fully prepare the owner to operate and maintain the mechanical systems.

3.03 OPERATING AND MAINTENANCE MANUALS:

- A. Spare parts lists, operating instructions, manufacturer's recommended preventative maintenance instructions and specification sheets for each item of the mechanical equipment shall be submitted, in triplicate, by the contractor at the pay application for 75% completion. All payment requests over 75% will be denied until this information is received. Provide three (3) copies in 3-ring binders. Manuals to be three-ring binders with project name, contractors name, index and shall include all approved shop drawings. Provide manufacturer's installation and start-up instructions. Provide written step by step instructions for owner-start-up of systems. Manuals shall include list of HVAC equipment requiring filters. List to show each equipment filter quantities and sizes. Include all City of Tulsa, final inspections.
- B. Each manual to include copies of "City of Tulsa" Electrical and Mechanical "Final Inspections." List of air filter sizes and quantities for each piece of equipment. Provide 11" x 17" building "Record Drawings", in each manual. Manuals shall include list of HVAC equipment requiring filters. List to show equipment filter quantities and sizes. Include all City of Tulsa, final inspections.
- C. Manuals shall include contractors name, address, and phone number. Manuals to be indexed and include electrical, plumbing, HVAC, and Fire Alarms Record Drawings and data.

END OF SECTION

SECTION 230090

SUPPORTS, ANCHORS AND SEALS

PART 1 GENERAL

1.01 WORK INCLUDED:

- A. Pipe hangers, anchors and supports
- B. Duct hangers and supports
- C. Flashing for mechanical equipment
- D. Sleeving for mechanical equipment

1.02 RELATED WORK

- A. Section 230060: Pipe and Pipe Fittings
- B. Section 2300840: Ductwork

1.03 REFERENCE STANDARDS:

- A. Pipe Supports: ANSI B31.1, Power Piping
- B. Duct Hangers: SMACNA Duct Manuals

PART 2 PRODUCTS

2.01 PIPE HANGERS, ANCHORS AND SUPPORTS:

- A. Hangers: Pipe sizes 1/2" to 1 1/2"; adjustable wrought steel ring
- B. Hangers: Pipe sizes 2" to 4" and Cold Pipe sizes 6" and over, adjustable wrought steel clevis
- C. Wall Support: Pipe sizes to 3", cast iron hook
- D. Wall Support for pipe sizes 4" and over: Welded steel bracket and wrought steel clamp, adjustable steel yoke and cast iron roll for hot pipe sizes 6" and over
- E. Design hangers to impede disengagement by movement of support pipe. Provide retainer clips where "C" clamps are installed
- F. Provide plastic-coated hangers and supports for copper piping or provide approved packing between hanger or support and piping
- G. Vertical Support: Steel riser clamps for steel pipe, copper-plated clamps for copper pipe
- H. Anchor piping as recommended by expansion joint and pipe guide manufacturer. After these anchor points are established, transmit anchor point loading forces to general contractor for coordination of appropriate building structural members to support such forces. Submit anchor design to owner with submittals for approval.

- I. Contractor shall be responsible for all temporary-piping supports that shall be required while permanent supports are being installed.
- J. Sheet metal insulation shields shall extend a minimum of 6" on each side of hanger.

2.02 HANGER RODS:

- A. Provide steel hanger rods threaded both ends or continuous threaded. Diameter of rod shall be sized for support loads of equipment installed under operating conditions.

2.03 DUCT HANGERS AND SUPPORTS:

- A. Hangers: Galvanized steel band iron
- B. Wall Supports: Galvanized steel band iron or fabricated angel bracket
- C. Vertical Support at Floor: Rolled angle

2.04 FLASHING:

- A. Steel Flashing: 26 gauge galvanized steel
- B. General Flashing: Provide sheet neoprene for waterproofing of floor drains
- C. Caps: Steel. 22 gauge minimum, 16 gauge at fire resistance structure

2.05 SLEEVES:

- A. Pipes through Floors: Form with 18 gauge galvanized steel
- B. Pipes through Beams, Walls, Fire Proofing, Footings, and Potentially Wet Floor: Form with steel pipe or 18 gauge galvanized steel.
- C. Round Ducts: Form with galvanized steel
- D. Size large enough to allow for movement due to expansion and to provide for continuous insulation

PART 3 EXECUTION

3.01 PIPE HANGERS AND SUPPORTS

- A. Support horizontal steel and copper piping as follows:

Nominal Pipe Size (In.)	Maximum Distance Between Support (Ft.)	Hanger Rod Diameter (In.)
1/2" to 1"	6 ft.	3/8"
1 1/2" to 2"	9 ft. *	3/8"
2 1/2" to 3"	10 ft *	1/2"
4"	12 ft. *	5/8"

MAXIMUM 8FT SPACING ON ALL PIPING ON ROOF

B. Support horizontal PVC or CPVC piping as follows:

Nominal Pipe Size (in.)	Maximum Distance Between Support (ft.) Sch. 40	Hanger Rod Sch. 80	Diameter (in.)
1/2" to 1 1/4"	3	4	3/8"
1 1/2" to 2"	4	5	3/8"
3" to 4"	5	7	1/2"

- C. Install hangers to provide minimum 1/2" clear space between finished covering and adjacent work. Where structure is protected with gypboard, seal around each pipe hanger that penetrates fire proofing.
- D. Place a hanger within one foot of each horizontal elbow.
- E. Use hangers that are vertically adjustable 1 1/2" minimum after piping is erected.
- F. Support horizontal cast iron soil pipe near each hub, joint or fitting with 10 feet maximum spacing.
- G. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- H. Where practical, support riser piping independently of connected horizontal
- I. Pipe supports on roof to be a manufactured polycarbonate resin similar to "Mird Industries", and appropriately sized for pipes. All pipes supports on roof to be set on 3/4" pad. Provide sized 1/4" steel plate on pad for pipe 3" diameter and larger.

3.02 LOW VELOCITY DUCT HANGERS AND SUPPORTS:

A. Rectangular Duct Hanger Minimum Sizes:

- 1. Duct 1/2 of perimeter Up to 30": 1" x 22 gauge at 8'
- 2. Duct 1/2 of perimeter 31" to 72": 1" x 20 gauge at 8' spacing
- 3. Duct 1/2 of perimeter 73" to 96": 1" x 18 gauge at 8' spacing
- 4. Duct 1/2 of perimeter Over 96": 1" X 18 gauge at 8' spacing

B. Horizontal Duct on Wall Supports Minimum Sizes:

- 1. Duct up to 18" wide: 1 1/2" x 16 gauge or 1" x 1/8" angle at 8' spacing
- 2. Duct 19" to 40" wide: 1 1/2" X 1 1/2" X 1/8" angle at 4' spacing

C. Vertical Duct on Wall Supports Minimum Sizes:

- 1. Ducts up to 24" wide: 1 1/2" x 16 gauge; 25" to 36" wide: 1" x 1" x 1/8" angle at 12'-0" spacing.
- 2. Ducts 37" to 48" wide: 1 1/4" x 1 1/4" x 1/8" angle at 12'-0" spacing.

D. Round Duct Hanger Minimum Sizes:

1. Duct up to 24" diameter: 1" x 22 gauge at 8' spacing
 2. Duct 25 to 36" diameter: 1" x 20 gauge at 8' spacing
 3. Duct 37 to 50" diameter: Two (2) 1" x 20 gauge at 8' spacing
 4. Duct 51 to 60" diameter: Two (2) 1" x 18 gauge at 8' spacing
- E. Support all ductwork in such a manner as to provide the minimum distance from top of ductwork to bottom of structure or fire proofing. Coordinate clearance requirements with other trades.

3.03 EQUIPMENT BASES AND SUPPORTS:

- A. Construct supports of structural steel members or steel pipe and fittings. Brace and fasten with flanges bolted to structure.
- B. Provide rigid anchors for ducts and pipes immediately after vibration connections to equipment.

3.04 PRIMING:

- A. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts and suspended ceiling spaces are not considered exposed.

3.05 FLASHING:

- A. Flash and counter flash where mechanical equipment passes through weather or water proofed walls, floors and roofs.
- B. Provide vent and soil pipes projecting 12" minimum above finished roof surface with aluminum flashing and neoprene boot or neoprene flashing and boot. For pipes through outside walls, turn flange back into wall and caulk.
- C. Provide curbs for mechanical roof installations 12" high minimum. Flash and counter flash as required by roofing manufacturer to meet roof warranty requirements.

3.06 SLEEVES:

- A. Set sleeves in position in advance of concrete work. Provide suitable reinforcing around sleeves.
- B. Extend sleeves through potentially wet floor 1" above finished floor level. Caulk sleeves full depth and provide floor pile.
- C. Where piping or ductwork passes through floor, ceiling or wall, close off space between pipe or duct and construction with non-combustible insulation. Provide tight fitting metal caps on both sides and caulk.
- D. Install chrome-plated escutcheons where piping passes through finished surfaces.

END OF SECTION

SECTION 230210

VIBRATION ISOLATION

PART 1 GENERAL

1.01 WORK INCLUDED:

- A. Inertia bases
- B. Vibration isolators

1.02 RELATED WORK:

- A. Section 230060: Pipe and Pipe Fittings
- B. Section 230820: Air Distribution Equipment (Fans)

1.03 REFERENCE STANDARDS:

- A. Provide and install mechanical equipment so that Average Noise Criteria Curves, as outlined in ASHRAE Guide, are not exceeded.
- B. Vibration isolation shop drawings shall show isolator locations, load on each isolator, inertia slab dimensions, and include installation instructions.

1.04 SHOP DRAWINGS:

- A. Submit shop drawings in accordance with Section 230000.

1.05 INSPECTION:

- A. Provide inspection services by vibration isolation equipment and materials manufacturer's representative for final installation and provide written report that installation is in accordance with specifications and manufacturer's recommendations.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Amber-Booth
 - 2. Vibration Eliminator Co.
 - 3. Mason
- B. Substitutions: Items of same function and performance are acceptable in conformance with Section 15000.

2.02 VIBRATION ISOLATORS:

- A. Vibration hangers shall contain a steel spring and 0.3" deflection neoprene element in series. The neoprene element shall be molded with a rod isolation bushing that passes through the hanger box.

Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30 degree arc before contacting the hole and short circuiting the spring. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Submittals shall include a scale drawing of the hanger showing the 30-degree capability. Hangers shall be type 30N as manufactured by Mason Industries, Inc.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install vibration isolators for all mechanical motor-driven equipment.
- B. Provide spring hangers for all suspended motor driven equipment.
- C. Provide spring isolators for all motor driven equipment not located on slab on grade applications.
- D. Provide one inch waffle type isolation pads under all chillers. All chiller piping to have rubber bellows type pipe isolators.

END OF SECTION

SECTION 230258

DUCT INSULATION

PART 1 GENERAL

1.01 WORK INCLUDED:

- A. Duct thermal insulation
- B. Adhesives, tie wires, tapes
- C. Recovery

1.02 RELATED WORK

- A. Section 230250: Piping and Equipment Insulation

1.03 SUBMITTALS:

- A. Submit shop drawings and samples in accordance with Section 15000.
- B. Submit shop drawings which indicate complete data, a list of materials proposed for this project and indicate thickness of material for individual services.

1.04 JOB CONDITIONS:

- A. Delivery material to job site in original non-broken factory packaging, labeled with manufacturer's density and thickness.
- B. Perform work at ambient and equivalent temperatures as recommended by the adhesive manufacturer.

1.05 ALTERNATIVES:

- A. Alternative insulations are subject to approval. Alternatives to provide same thermal resistance within 10%, at normal conditions as material specified.

PART 2 PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturers:
 - 1. Owens-Corning
 - 2. Manville
 - 3. Certain-Teed
 - 4. P.P.G.

2.02 GENERAL:

- A. Adhesives and Insulation Materials: Composite fire and smoke hazard ratings maximum 25 for Flame Spread and 50 for Smoke Developed. Adhesives to be waterproof.
- B. All insulation materials shall be approved for ceiling plenum installation.

2.03 MATERIALS AND COMPONENTS:

- A. Round and Rectangular Ducts: Flexible fibrous glass insulation, "K" value at 75 degrees F. maximum 0.179 Btu/hr/sq. ft/deg F./hr. with factory applied reinforced aluminum foil vapor barrier.
- B. Kitchen Hood exhaust duct: Cover the surface of the duct and on all sides with listed materials and products and the materials are installed in accordance with the conditions of the listing and manufacturer's instructions and are acceptable to the authority having jurisdiction.

PART 3 EXECUTION

3.01 INSTALLATION:

- A. Round and Rectangular Ducts: Adhere flexible insulation to ductwork with adhesive applied in 6" wide strips on 16" centers. Provide 16 gauge annealed tie wire tied, spiral wound or half hitched at 16" centers for securing duct insulation until adhesive sets. Butt insulation and seal joints and breaks with 2" lap of foil adhered over joint.
- B. Repair separation of joints or cracking of insulation due to thermal movement or poor workmanship.

3.02 INSULATION THICKNESS SCHEDULE

Duct and Equipment	Insulation Thickness (In.)
Round and Rectangular Supply, Return, and Outside Air Ducts	2"

END OF SECTION

SECTION 230740
MAKE-UP AIR UNIT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Indirect gas fired Make-up Air Unit.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design final make-up air unit selection in coordination with kitchen hood exhaust air performance and requirement for exhaust make-up air through kitchen hood and determine requirements of installation including vibration isolation, gas furnace section sizing, fan performance, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated in the specifications and on the drawings.

1.3 SUBMITTALS

- A. Product Data: For each air-handling unit indicated.
 - 1. Unit dimensions and weight.
 - 2. Cabinet material, metal thickness, finishes, insulation, and accessories.
 - 3. Fans:
 - a. Certified fan-performance curves with system operating conditions indicated.
 - b. Certified fan-sound power ratings.
 - c. Fan construction and accessories.
 - d. Motor ratings, electrical characteristics, and motor accessories.
 - 4. Certified gas furnace section performance ratings with system operating conditions indicated.
 - 5. Dampers, including housings, linkages, and operators.
 - 6. Filters with performance characteristics.
 - 7. Mounting Details and roof curb.
 - 8. Wiring diagrams for power and interlock control wiring with kitchen hood exhaust control panel and exhaust fan.
- B. Source quality-control reports.
- C. Operation and maintenance data.

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. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.
- C. Comply with NFPA 70.

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components listed below of indirect-fired H&V units that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than five years 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. Captive-Air Systems, Inc.
 - 2. Greenheck.
 - 3. Modine Mfg. Co.; Commercial HVAC&R Division.
 - 4. Rapid Engineering, Inc.
 - 5. Reznor-Thomas & Betts Corporation; Mechanical Products Division.
 - 6. Sterling Gas; Mestek, Inc.
 - 7. Trane Company (The); Unitary Products Group.
 - 8. Weather-Rite, Inc.

2.2 PACKAGED UNITS

- A. Factory-assembled, prewired, self-contained unit consisting of cabinet, supply fan, controls, filters, and indirect-fired gas furnace to be installed outside the building.

2.3 CABINET

- A. Cabinet: Single-wall galvanized-steel panels, formed to ensure rigidity and supported by galvanized-steel channels or structural channel supports with lifting lugs. Cabinet shall be fully weatherized for outside installation.
- B. Access Panels: Piano hinged with cam-lock fasteners for furnace and fan motor assemblies on both sides of unit.
- C. Internal Insulation: Fibrous-glass duct lining, comply with ASTM C 1071, Type II, applied on complete unit. Thickness: 2 inches.
- D. Finish: Heat-resistant, baked enamel.
- E. Roof Curb: Full-perimeter curb of sheet metal, minimum 16 inches high, with wood nailer, neoprene sealing strip, and welded Z-bar flashing.

- F. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

2.4 SUPPLY-AIR FAN

- A. Fan Type: Centrifugal, rated according to AMCA 210; statically and dynamically balanced, galvanized steel; mounted on solid-steel shaft with heavy-duty, self-aligning, permanently lubricated ball bearings, or pillow-block bearings rated for L50 or 200,000 hours with external grease fittings.
- B. Motor: Open dripproof, single-speed motor.
- C. Drive: V-belt drive with matching fan pulley and adjustable motor sheaves and belt assembly.
- D. Mounting: Fan wheel, motor, and drives shall be mounted in fan casing with elastomeric or spring isolators.

2.5 OUTDOOR-AIR INTAKE

- A. Outdoor-Air Hood: Galvanized steel with rain baffles, bird screen complying with ASHRAE 62.1-2004, and finish to match cabinet; and sized to supply maximum 100 percent outdoor air.

2.6 AIR FILTERS

- A. Comply with NFPA 90A.
- B. Disposable Panel Filters: 2-inch- thick, factory-fabricated, flat-panel-type, disposable air filters with holding frames, with a minimum efficiency report value of 6 according to ASHRAE 52.2 and 90 percent average arrestance according to ASHRAE 52.1.

2.7 DAMPERS

- A. Outdoor-Air Damper: Galvanized-steel, opposed-blade dampers with vinyl blade seals and stainless-steel jamb seals, having a maximum leakage of 10 cfm/sq. ft. of damper area, at differential pressure of 2-inch wg.
- B. Damper Operator: Direct coupled, electronic with spring return or fully modulating as required by the control sequence.

2.8 INDIRECT-FIRED GAS FURNACE

- A. Description: Factory assembled, piped, and wired; and complying with ANSI Z21.47, "Gas-Fired Central Furnaces," and NFPA 54, "National Fuel Gas Code."
 - 1. AGA Approval: Designed and certified by and bearing label of AGA.
 - 2. Burners: Aluminized steel with stainless-steel inserts.
 - a. Gas Control Valve: 4:1 Modulating.
 - b. Fuel: Natural gas.
 - c. Minimum Combustion Efficiency: 80 percent.
 - d. Ignition: Electronically controlled electric spark with flame sensor.
- B. Power Vent: Integral, motorized centrifugal fan interlocked with gas valve.

- C. Outside Unit External Housing: Weatherproof steel cabinet with integral support inserts and removable bottom arranged to serve as drain pan. External Casing and Cabinet Finish: Baked enamel over corrosion-resistant-treated surface in color to match fan section.
- D. Internal Casing: Aluminized steel, arranged to contain airflow, with duct flanges at inlet and outlet.
- E. Heat Exchanger: Stainless steel.
- F. Heat-Exchanger Drain Pan: Stainless steel.
- G. Safety Controls:
 - 1. Vent Flow Verification: Differential pressure switch to verify open vent.
 - 2. Control Transformer: 24-V ac.
 - 3. High Limit: Thermal switch or fuse to stop burner.
 - 4. Gas Train: Regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, electronic-modulating temperature control valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.
 - 5. Purge-period timer shall automatically delay burner ignition and bypass low-limit control.
 - 6. Gas Manifold: Safety switches and controls to comply with ANSI standards.
 - 7. Automatic-Reset, High-Limit Control Device: Stops burner and closes main gas valve if high-limit temperature is exceeded.
 - 8. Safety Lockout Switch: Locks out ignition sequence if burner fails to light after three tries. Controls are reset manually by turning the unit off and on.

2.9 CONTROLS

- A. Factory-wired, fuse-protected control transformer, connection for power supply and field-wired unit to remote control panel.
- B. Control Panel: Recessed, with trim ring, remote panel, with engraved plastic cover, and the following lights and switches:
 - 1. Control panel to interface with kitchen hood control panel.
 - 2. On-off fan switch.
 - 3. Summer-winter-off switch.
 - 4. Supply-fan operation indicating light.
 - 5. Heating operation indicating light.
 - 6. Thermostat.
 - 7. Dirty-filter indicating light operated by unit-mounted differential pressure switch.
 - 8. Safety-lockout indicating light.
- C. Refer to Division 15 Section "HVAC Instrumentation and Controls" for control equipment and sequence of operation.
- D. Fan Control: Interlock fan to start with kitchen hood exhaust fan(s).
- E. Outdoor-Air Damper Control, 100 Percent Outdoor-Air Units: Outdoor-air damper shall open when supply fan starts, and close when fan stops.

- F. Temperature Control: Operates gas valve to maintain supply-air temperature.
 - 1. Operates gas valve to maintain discharge-air temperature with factory-mounted sensor in blower outlet.
- G. DDC: Interface status output signal for monitoring unit operation by building management system.

2.10 ACCESSORIES

- A. Inlet air sensor de-energizes the gas system to prevent operation of the furnace burners when the inlet air temperature is above sensor set point.
- B. Factory roof curb.
- C. Weatherhood with birdscreen for outside air intake.
- D. Duct adapter for connection of ductwork to unit/roof curb assembly.
- E. Photoelectric smoke detector interlocked to shut down unit. Smoke detector shall be fully compatible with building fire alarm system and interlocked with building fire alarm to signal when smoke condition occurs.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting installation of indirect-fired H&V units.
- B. Examine roughing-in for piping, ducts, and electrical systems to verify actual locations of connections before equipment installation.
- C. Examine roof curbs and equipment supports for suitable conditions where rooftop replacement-air units will be installed. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install gas-fired units according to NFPA 54, "National Fuel Gas Code."
- B. Install roof curb on roof structure in coordination with building structure and roofing manufacturer's requirements and recommendations to maintain roof warranty. Install and secure indirect-fired H&V units on curbs, and coordinate roof penetrations and flashing with roof construction.
- C. Install controls and equipment shipped by manufacturer for field installation.

3.3 CONNECTIONS

- A. Piping Connections: Drawings indicate general arrangement of piping, fittings, and specialties. Install piping adjacent to machine to allow service and maintenance.
- B. Duct Connections: Drawings indicate the general arrangement of ducts. Connect supply ducts to indirect-fired H&V units with flexible duct connectors.
- C. Ground equipment according to Division 16 Project Specification Manual.
- D. Connect wiring according to Division 16 Project Specification Manual.

3.4 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
- B. Complete installation and startup checks according to manufacturer's written instructions:
 - 1. Start unit according to manufacturer's written instructions.
 - 2. Inspect and record performance of interlocks and protective devices; verify sequences.
 - 3. Calibrate thermostats.
 - 4. Inspect dampers for proper stroke and interlock with return-air dampers.
 - 5. Inspect controls for correct sequencing of heating, mixing dampers and normal and emergency shutdown.
 - 6. Verify operation of remote panel, including pilot-operation and failure modes.
 - 7. After startup and performance testing, change filters, verify bearing lubrication, and adjust belt tension.
- C. Remove and replace malfunctioning components that do not pass tests and inspections and retest as specified above.
- D. Prepare written report of the results of startup services.

END OF SECTION 15740

SECTION 230771

PACKAGED ROOF TOP HEATING/COOLING UNITS

PART 1 GENERAL

1.01 WORK INCLUDED:

- A. Packaged roof top heating/cooling unit (RTU)
- B. Roof mounting frame

1.02 RELATED WORK:

- A. Section 26000: Electrical supply and hook-up to equipment
- B. Section 23000: Utility supply and hook-up to equipment

1.03 QUALITY ASSURANCE

- A. Meet the requirements of UL and applicable codes.
- B. Test and rate cooling systems to ARI Standard 210.

1.04 SUBMITTALS:

- A. Submit shop drawings and product data in accordance with Section 15000.
- B. Submit manufacturer's installation instructions.
- C. Submit manufacturer's descriptive literature, operating instructions and maintenance and repair data.

1.05 WARRANTY:

- A. Provide 15 year unconditional part warranty on heat exchangers.
- B. Provide 5-year unconditional parts warranty on compressor units.

PART 2 PRODUCTS

2.01 MANUFACTURER:

- A. Units shall be products of a manufacturer who provides local service personnel from factory representative, franchised dealer or certified maintenance service shop.
- B. Acceptable Manufacturer's: NO SUBSTITUTION
 - 1. Lennox

2.02 TYPE:

- A. Provide roof mounted units having two (2) stage gas burner and electric refrigeration.
- B. Units shall be self-contained, packaged, factory assembled and pre-wired, consisting of cabinet and frame, supply fan, heat exchanger and burner, controls, air filter, direct expansion cooling coil, compressor, condenser coil, fan, curbs, and or insulated curb adapters, see RTU schedule on drawings..

2.03 CONSTRUCTION:

- A. Cabinet: Steel with bonderized, baked enamel finish, hinged access doors or removable access panels with screwdriver operated flush cam type fasteners. Structural members shall be minimum 18 gauge, with access doors or removable panels, minimum 20 gauge.
- B. Insulation: Neoprene-coated glass fiber on surfaces where conditioned air is handled. Protect edges from erosion.
- C. Heat Exchangers: Aluminized steel; of welded construction.
- D. Supply Fan: Centrifugal type rubber-mounted V-belt drive, adjustable variable pitch motor pulley, or multi-speed direct drive and rubber isolated hinge mounted motor as scheduled. Complete fan assembly shall be isolated.
- E. Air Filter: 2"thick glass fiber, Farr 30/30, disposable media in metal frames arranged for easy replacement.

2.04 BURNER:

- A. Gas Burner: Stainless steel induced draft type burner with adjustable combustion air supply, pressure regulator, gas valve, manual shut-off, intermittent spark ignition, flame sensing device and automatic 100% shut-off.
- B. Gas Burner Safety Controls: Energized ignition, limit time for establishment of flame, prevent opening of gas valve until pilot flame is proven, stop gas flow on ignition failure, energize blower motor, and after air flow proven and slight delay, allow gas valve to open.
- C. High Limit Control: With fixed stop at maximum permissible setting, de-energize burner on excessive bonnet temperature and energize burner when temperature drops to lower safe value.
- D. Supply Fan Control: From bonnet temperatures and independent of burner controls. Include switch for continuous fan operation.

2.05 EVAPORATOR COIL:

- A. Provide copper tube aluminum fin coil assembly with galvanized drain pan and connection, capillary tubes and expansion valve.

2.06 COMPRESSOR:

- A. Provide hermetic compressor, 3600-RPM maximum resiliently mounted with positive lubrication, crankcase heater, high and low pressure safety controls, motor overload protection, service valves and filter drier.

- B. Timed off circuit shall limit number of compressor starts to 12 per hour.

2.07 CONDENSER:

- A. Provide copper tube aluminum fin coil assembly with sub-cooling rows.
- B. Provide direct drive axial fans, resiliently mounted with fan guard, motor overload protection, wired to operate with compressor.
- C. Provide refrigerant pressure switch to cycle condenser fans.
- D. Provide hail guards.

2.08 SUPPLY/RETURN CASING:

- A. Dampers: Provide manual outside air dampers for fixed outside air quantity.
- B. Gaskets: Provide tight fitting dampers with edge gaskets.

2.09 OPERATING CONTROLS:

- A. Contractor shall coordinate with Owner designated controls contractor to furnish and install low voltage, adjustable combination thermostat/CO2 sensor to control burner operation heater stages in sequence with delay between stages and cooling stages in sequence of compressor and condenser fan, and supply fan to maintain temperature setting. Owner designated controls contractor shall also install CO sensor provided by Mechanical contractor. Owner designated controls contractor shall install control board and all conductors from control board to MDF/IFD room. Electrical contractor shall install all control wiring for Owner designated controls contractor. Owner designated controls contractor shall provide all terminations at all control and HVAC equipment. Mechanical contractor shall be responsible for all system start-ups.
- B. Manufacturer to provide "Addressable" duct mounted "Firelite" #D350RP smoke detector for all units 2000 CFM and larger.
- C. Integrated Economizers: (as noted on drawings)
 - 1. Integrated integral-modulating type capable of simultaneous economizer and compressor operation.
 - 2. Includes all hardware and controls to provide cooling with outdoor air.
 - 3. Equipped with low-leakage dampers not to exceed 3% leakage, at 1" wg pressure differential (variable sliding economizer).
 - 4. Capable of introducing up to 100% outdoor air in minimum and fully open positions.
 - 5. Equipped with a gravity relief sliding plate damper (variable sliding economizer). Damper shall close upon unit shutoff.
 - 6. Parallel-blade economizer shall be equipped with a barometric relief damper with up to 305 of return air (004-007) or 45% of return air (008-014) relief. The variable sliding economizer is equipped with 15% of return air relief (004-014).

7. Designed to close damper during loss of power situations with emergency power supply (variable sliding economizer) or spring return built into motor (parallel blade economizer).
8. Variable sliding economizer is a guillotine-style damper, and the other economizer is a parallel blade design.

D. Solid State Enthalpy Control:

1. For use with variable sliding economizer package only.
2. Capable of sensing outdoor air enthalpy content (temperature and humidity) and controlling economizer cut-in point to have minimum heat content air passing over the evaporated coil for most efficient system operation.

PART 3 EXECUTION

3.01 INSTALLATION:

- A. Mount new units on 24" high factory built roof-mounting frame providing watertight enclosure to protect ductwork and utility services, or insulated curb adapter for exist curbs. Provide wood nailer atop curb. Provide pitched roof curbs where required.
- B. Condensate drains to be galvanized and run to roof drain and connected to trap at RTU with flexible rubber coupler and S. S. Clamps.

END OF SECTION

SECTION 230820

AIR DISTRIBUTION EQUIPMENT (FANS)

PART 1 GENERAL

1.01 WORK INCLUDED:

- A. Fan accessories
- B. In-line fans

1.02 RELATED WORK:

- A. Section 230210: Vibration Isolation
- B. Section 230840: Ductwork

1.03 QUALITY ASSURANCE:

- A. Submit shop drawings in accordance with Section 15000.
- B. Submit with shop drawings, operating point plotted on curves.
- C. Submit manufacturer's printed installation instructions.

1.04 JOB CONDITIONS:

- A. Do not operate fan for any purpose, temporary or permanent until ductwork is clean, filters in place, bearings lubricated and fan has been run under observation.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

- A. Provide and install items in schedule on the drawings.
- B. Manufacturer named items are for standard of reference and do not necessarily limit supply to name manufacturer. Items of same physical size, function and performance are acceptable in conformation with Section 15000. Approved manufacturers:
 - 1. Twin City
 - 2. Cook
 - 3. Greenheck
 - 4. Penn
 - 5. Carnes
- C. Equivalent fan selections shall not decrease motor horsepower, increase noise level, increase tip speed by more than 10%, or increase inlet air velocity by more than 20% from that specified.
- D. Fan performance based on sea level conditions.
- E. Refer to Fan Schedule on the drawings.

2.02 SELECTION AND BALANCING:

- A. Provide fans capable of accommodating static pressure variations of plus or minus 10%.
- B. Statically and dynamically balance fans to eliminate vibration or noise transmission to occupied areas of the building.
- C. Provide totally enclosed motor, shaft belt, pulley guard on belt driven fans.
- D. Provide safety screens where inlet or outlet is exposed.

2.03 PAINTING:

- A. Prime coat fan wheels and housing factory inside and outside. Prime coating on aluminum parts is not required.

2.04 IN-LINE CABINET FANS:

- A. In-line shall be forward curve, direct cabinet type with resiliently mounted fan and motor. Motor bearings shall be permanently lubricated type.
- B. Housing shall be steel, insulated and of one of the sides shall be hinged and shall provide access for servicing.
- C. Furnish with back draft damper on fan discharge and disconnect switch.

PART 3 EXECUTION

3.01 INSTALLATION:

- A. Supply and install sheaves as necessary for final air balancing.
- B. Install fans per manufacturer's requirements and recommendations.
- C. Install factory roof curb per roofing manufacturer's requirements to maintain integrity of roof warranty.

FAN SCHEDULE:

- D. Refer to Schedule on drawings.

END OF SECTION

SECTION 230840

DUCTWORK

PART 1 GENERAL

1.01 WORK INCLUDED:

- A. Ductwork
- B. Fasteners
- C. Sealants
- D. Duct cleaning

1.02 RELATED WORK:

- A. Section 230090: Supports, Anchors and Seals
- B. Section 230580: Fans
- C. Section 230860: Duct Accessories
- D. Section 230870: Air Outlets

1.03 REFERENCE STANDARDS:

- A. Fabricated in accordance with SMACNA duct manuals and ASHRAE handbooks.
- B. Construction ductwork to NFPA 90Am Air Conditioning and Ventilating Systems; NFPA 90B, Standard for the Installation of Warm Air Heating and Air Conditioning Systems.

1.04 DEFINITIONS:

- A. Duct Sizes: Round and rectangular duct sizes are inside clear dimensions.
- B. Low Pressure: Static pressure in duct less than 2" w.g. and velocities less than 2,000 fpm.

1.05 SUBMITTALS:

- A. Submit in accordance with Section 15000.
- B. Submit sheet metal shop drawings including particulars such as gauge sizes and configurations prior to start of work.
- C. Confirm ductwork has been fabricated and installed in accordance with recommendations and SMACNA standards.

PART 2 PRODUCTS

2.01 MATERIALS:

A. Ducts:

1. General Duty: Build ductwork with new galvanized prime grade copper bearing steel sheets, gauges as tabulated in latest edition of ASHRAE Guide. All sides of all unlined ducts shall be cross-broken.
2. Kitchen Type 1: Build ductwork with new carbon steel or stainless steel. All joints shall have a liquid tight continuous external weld.

B. Fasteners: Use rivets and bolts throughout; sheet metal screws accepted on low-pressure ducts.

C. Sealant: Water-resistant, fire resistive, compatible with mating materials.

2.02 FABRICATION:

- A. Size round ducts installed in place of rectangular ducts from ASHRAE table of equivalent rectangular and round ducts. No variation of duct configuration or sizes permitted except by written permission.
- B. Complete metal ducts within themselves with no single partition between ducts. Where width of duct exceeds 18"m cross break for rigidity. Open corners are not acceptable.
- C. Lap metal ducts in direction of airflow. Hammer down edges and slips to leave smooth duct interior.
- D. Construction tees, bends and elbows with radius of not less than 1 1/2 times width of duct on center line. Where not possible and where rectangular elbows used, provide double wall turning vanes. Space turning vanes to provide maximum efficiency and minimum resistance to air flow.
- E. Increase duct sizes gradually, not exceeding 15 degrees divergence where ever possible. Maximum divergence upstream of equipment to be 30 degrees and 45 degrees convergence downstream.
- F. Rigidly construct metal ducts with joints mechanically tight, substantially airtight, braced and stiffened so as not to breathe, rattle, vibrate or sag. Caulk duct joints and connections with two layers of sealant. Sealant to be equal to Hardcast Inc. Versa Grip. Apply sealant per manufacturer's requirements and recommendations.
- G. Coordinate location of low-pressure ductwork with conduit piping and structure to provide maximum head room and to provide a neat and orderly appearance.
- H. Construct plenums of galvanized panels joined by standing seams on outside of casing riveted or bolted on approximately 12" centers. Reinforce with steel angles and provide diagonal bracing. Tightly fit at apparatus and seal with two layers of sealant. Sealant to be equal to Hardcast Inc. Versa Grip. Apply sealant per manufacturer's requirements and recommendations.
- I. Secure adjustable dampers to operating rods; construct of a metal gauge heavy enough to prevent any bending, rattling or fluttering when systems are in operation. Equip all adjustable dampers in ductwork that is concealed with Young Regulators end bearings. No Young Regulators shall be installed on any ceiling.

- J. Exhaust ductwork shall conform to all requirements for low-pressure ductwork. Apply two part sealing system to all exhaust duct joints. Sealant to be equal to Hardcast Inc. FTA-20 system. Apply sealant per manufacturer's requirements and recommendations.

2.03 LOW PRESSURE DUCT GAUGES:

- A. Use gauges listed per the most recent published SMACNA standards for the system pressure and velocity classification at installed reinforcement spacing.

2.04 PLENUM GAUGES:

- A. Fabricate plenums in accordance with SMACNA duct gauges for pressure classification with adherence to reinforcement and panel width requirements.

PART 3 EXECUTION

3.01 INSTALLATION:

- A. Rigidly support all ductwork by hangers from above. Use galvanized straphangers, as previously specified in Section 15090, spaced to carry the load, but not further than eight (8) feet apart. All hangers shall be neatly installed and shall be truly vertical. All horizontal runs of ductwork shall be truly horizontal except those ducts that must slope to miss structural members of continuously grading piping. Hangers shall be sized to carry load adequately.
- B. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide Pitot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, insulate material inside a metal ring.
- C. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment, which may be harmed by excessive dirt with filters, or bypass during cleaning.
- D. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- E. Connect diffusers to low pressure ducts with 5' maximum lengths of flexible duct and 90 hard elbow. Hold in place with strap or clamp. Provide spin-in extractor with damper at connection to main duct. (Not allowed in inaccessible plaster or gyp board ceiling spaces).
- F. At each point where ducts pass through partitions, seal joints around duct with non-combustible material.
- G. Reinforcement: All ducts requiring reinforcement shall be reinforced according to the latest publication of the SMACNA manual for the pressure and velocity classification and the installed duct section lengths.
 - 1. Material for reinforcement members shall be galvanized steel. All screws and washers shall be plated or galvanized.

END OF SECTION

SECTION 230860
DUCT ACCESSORIES

PART 1 GENERAL

1.01 WORK INCLUDED:

- A. Access doors
- B. Fire Dampers
- C. Balancing Dampers
- D. Backdraft Dampers
- E. Flexible Connections

1.02 RELATED WORK:

- A. Section 230950: Testing and Balancing
- B. Section 230210: Vibration Isolation
- C. Section 230840: Ductwork

1.03 QUALITY ASSURANCE:

- A. Fire dampers shall be UL listed and constructed in accordance with UL Standard UL555 Fire Dampers.
- B. Fusible links on fire dampers shall be constructed to UL Standard 33, Fusible Links for Fire Protection Service.
- C. Demonstrate re-setting of fire dampers to authorities having jurisdiction and owner's representative.
- D. Smoke dampers shall be UL listed and classified in accordance with UL Standard UL555 smoke control system and NFPA 90A and 92A.
- E. Access doors shall be UL labeled.

1.04 REFERENCE STANDARDS:

- A. Accessories shall meet the requirements of NFPA 90A, Air Conditioning and Ventilating Systems.
- B. Fabricated in accordance with ASHRAE handbooks and SMACNA duct manuals.

1.05 SUBMITTALS:

- A. Submit in accordance with Section 230000.
- B. Submit shop drawings of factory fabricated assemblies.

- C. Submit manufacturer's printed installation instructions.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

- A. Manufacturers:
 - 1. Air Balance
 - 2. Ruskin
 - 3. Controlled Air
 - 4. Vent Fabric
 - 5. Phillips-Aire
 - 6. Prefco
 - 7. Louvers and Dampers
 - 8. Safe-Air
 - 9. Cesco

2.02 ACCESS DOORS:

- A. Fabricated rigid and close-fitting doors of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, install minimum 1" thick insulation with sheet metal cover.
- B. Provide two hinges and two sash locks for sizes up to 18" square, two hinges and two compression latches with outside and inside handles for sizes up to 24" x 48". Provide an additional hinge for larger sizes.

2.03 FIRE DAMPERS:

- A. Fabricated of galvanized steel or prime coated black steel weighted to close and lock in closed position when released by fusible links.
- B. Fire dampers in low-pressure ductwork shall be multi-blade type.
- C. Fire dampers shall have blades retained in a recess so free area of connecting ductwork is not reduced.
- D. Set or select fusible links for 160 degrees F. release (return air). Set or select fusible links for 212 degrees F. release (supply air).
- E. Access doors to Fire Dampers: Provide for each fire damper in ductwork an access door of a size and so located to provide adequate room for inspection and servicing of fire damper. Access doors shall be airtight and secured to duct with screws or other approved manner. Provide neoprene gasket between doors and ducts. Provide and install access doors in chase walls of other locations to provide access to ductwork and fire dampers located in an accessible space.

2.04 DAMPERS:

- A. Dampers: Shall be single or multiple-opposed blade as required. Provide blank-off plates and conversions necessary to install smaller than duct size dampers.
- B. All damper frames are to be constructed of #13 gauge galvanized sheet metal and shall have flanges for duct mounting and a minimum of 2" stand-off handle.
- C. Damper blades shall not exceed 6" width. All blades are to be of corrugated type construction, fabricated from two sheets of #22 gauge galvanized sheet steel spot welded together. Blades are to be suitable for high velocity performance.
- D. Replaceable rubber seals are to be provided with the damper. Seals are to be installed along the top, bottom and sides of the frame and along each blade edge. Seals shall provide a tight closing, low leakage damper. Leakage and flow characteristic charts must be submitted to the owner prior to approval of dampers.
- E. All damper operators shall be of the molded rubber diaphragm piston type and shall be fully proportioning unless otherwise specified. They shall be quiet in operation and shall have ample power to overcome friction of damper linkage and air pressure acting on louvers to position dampers accurately and smoothly. Damper operator mounting arrangement shall be outside the air stream whenever possible.
- F. No damper operator shall drive more than 16sq. ft. of damper.
- G. Provide spin-in extractor with lockable volume damper where each round duct branch duct attaches to rectangular duct.

2.05 FLEXIBLE CONNECTIONS:

- A. Fabricated of neoprene coated flameproof fabric approximately 2" wide tightly crimped into metal edging strip and attach to duct and equipment by screws or bolts at 6" intervals.

PART 3 EXECUTION

3.01 INSTALLATION:

- A. Install items in accordance with manufacturer's printed instructions.

3.02 APPLICATION:

- A. Provide access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers and elsewhere as indicated. Review locations prior to fabrication.
- B. Provide 4" X 4" quick opening access doors for inspection at balancing dampers.
- C. Provide fire dampers at locations shown, and where ducts and outlets pass through floors and fire rated walls and ceilings, and where required by authorities having jurisdiction. Fire dampers shall be completed with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges. Refer to owner drawings for rated wall locations and fire ratings.

- D. Provide fire dampers at locations shown and where ducts and outlets pass through smoke barrier walls. Refer to architectural drawings for smoke barrier wall locations.
- E. Provide balancing dampers at points on low-pressure supply, return and exhaust systems where branches are taken from larger ducts as required for air balancing.
- F. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and equipment subject to forced vibration.

END OF SECTION

SECTION 230870

AIR OUTLETS

PART 1 GENERAL

1.01 WORK INCLUDED:

- A. Diffusers
- B. Grilles and Registers

1.02 RELATED WORK:

- A. Section 230950: Testing, Adjusting and Balancing of Systems

1.03 QUALITY ASSURANCE:

- A. Make airflow tests and sound level measurements in accordance with applicable ADC equipment test codes and ASHRAE standards.
- B. Manufacturer shall certify cataloged performance and ensure correct application of air outlet types.

1.04 SUBMITTALS:

- A. Submit in accordance with Section 230000.
- B. Submit product data and shop drawings covering each item together with schedule of outlets.
- C. Submit manufacturer's installation instructions.

1.05 JOB CONDITIONS:

- A. Review requirements of outlets as to size, finish and type of mounting prior to submitting shop drawings and schedule of outlets.
- B. Check locations of outlets and make necessary adjustments in position to conform with architectural features, symmetry and lighting arrangements.
- C. Refer to architectural reflected ceiling plans for final location of air devices to be located in ceiling.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

- A. Provide and install items as listed in schedule on the drawings, complete in all respects.
- B. Other acceptable manufacturers:
 - 1. Titus
 - 2. Carnes-Empco (grilles & registers)

3. Krueger (grilles & registers)
4. Tuttle & Bailey
5. Metal-Aire (grilles & registers)
6. Ruskin (louvers)

2.02 APPLICATION:

- A. Provide air devices as required and as indicated on the drawings.
- B. Surface mounted supply outlets and diffusers to have sponge rubber gaskets, and mounted in a manner that will prevent any air leakage around edge.
- C. All supply outlets and diffusers shall have opposed blade dampers for control. Exhaust registers shall consist of grille faces combined with opposed blade dampers for balancing.
- D. Each low velocity branch duct, at the point of connection to a main duct, shall be provided with an adjustable volume controller with locking device, factory made, Titus AG-45, GenFlex #SM-2DEL, or GenFlex #DB-2DEL.
- E. All grilles, registers, volume controllers and ceiling diffusers shall be as shown in the schedule on the plans. If the contractor proposes to use devices made by another manufacturer, he must furnish, together with shop drawings and brochures, engineering data indicating proper air distribution patterns, pressure drops and other pertinent characteristics. Complete certified performance ratings are required.
- F. Where ceiling diffusers are shown as lay-in with face sizes less than 24 x 24, they shall be panel mounted for 24 x 24 grid lay-in application.
- G. Provide 90 degree adjustable sheet metal elbow at round neck diffuser connections to flexible duct runout.
- H. All supply air ceiling diffusers located within 10 feet of the kitchen hood shall be egg create and aluminum.

PART 3 EXECUTION

3.01 INSTALLATION:

- A. Install items in accordance with manufacturer's printed instructions.
- B. Paint ductwork visible behind air outlet matte black.

END OF SECTION

SECTION 230950

TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

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

1.3 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.

1.4 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 60 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
- C. Strategies and Procedures Plan: Within 120 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 NEBB.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by NEBB.
2. TAB Technician: Employee of the TAB contractor and who is certified by NEBB as a TAB technician.

B. TAB Conference: Meet with Owner on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location.

1. Agenda Items:

- a. The Contract Documents examination report.
- b. The TAB plan.
- c. Coordination and cooperation of trades and subcontractors.
- d. Coordination of documentation and communication flow.

C. 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.

D. TAB Report Forms: Use standard TAB contractor's forms approved by Owner.

E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

1.6 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

B. 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 manual volume dampers. Verify that locations of these balancing devices are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Division 15 Section "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in 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 62.1-2004, Section 7.2.2, "Air Balancing."
- B. Cut insulation, ducts, 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 Division 15 Section "Duct Accessories."
 - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 15 Section "HVAC Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR 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 Division 15 Section "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 Owner for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 15 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 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.
- C. Record compressor data.

3.8 TOLERANCES

- A. Set HVAC system's air 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.

3.9 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.

3.10 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. Engineer's name and address.
 6. Contractor's name and address.
 7. Report date.
 8. Signature of TAB supervisor who certifies the report.
 9. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 10. 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.
 11. Nomenclature sheets for each item of equipment.
 12. Notes to explain why certain final data in the body of reports vary from indicated values.
- 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. Cooling-coil static-pressure differential in inches wg.
- g. Heating-coil static-pressure differential in inches wg.
- h. Outdoor airflow in cfm .
- i. Return airflow in cfm .
- j. Outdoor-air damper position.
- k. Return-air damper position.
- l. Vortex damper position.

E. Instrument Calibration Reports:

1. Report Data:

- a. Instrument type and make.
- b. Serial number.
- c. Application.
- d. Dates of use.
- e. Dates of calibration.

3.11 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 at least 10 percent of air outlets.
 - b. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
 - c. Verify that balancing devices are marked with final balance position.
 - d. 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 Owner.

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.

3.12 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230950

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T U L S A

PUBLIC SCHOOLS

260400
Electrical Systems

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SECTION 260400 - ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. Work Included: Provide Design, Engineering and Construction Documents incorporating the Owner's Guidelines and Specifications defined herein, with proper installation of materials, assemblies and equipment including, but not limited to:
 - 1. Basic Materials and Methods.
 - 2. Control-Voltage Electrical Power Cables
 - 3. Low-Voltage Electrical Power Conductors and Cables.
 - 4. Grounding and Bonding.
 - 5. Hangers and Supports.
 - 6. Raceways and Boxes.
 - 7. Handholes And Boxes for Exterior Underground Wiring.
 - 8. Sleeve-Seal Systems for Electrical Raceways
 - 9. Lighting Control Devices.
 - 10. Low-Voltage Transformers.
 - 11. Switchboards.
 - 12. Panelboards.
 - 13. Wiring Devices.
 - 14. Fuses.
 - 15. Enclosed Switches and Circuit Breakers.
 - 16. Enclosed Controllers.
 - 17. Surge Protection for Electrical Power Circuits
 - 18. Interior and Exterior Lighting.
 - 19. Other items and services required to complete the systems.
- B. Drawings:
 - 1. These Design Guidelines and Specifications are accompanied by floor plans of the building showing the general location of the work. Exact locations shall be subject to the approval of the Owner who reserves the right to make any reasonable changes in locations indicated, prior to rough-in, without cost to the Owner. While the general run of feeders, branches, and conduits are indicated on the Drawings, it is not intended that the exact routing of circuits or locations of conduits be determined by Conceptual Drawings. Detailed arrangements of all Work shall be subject to the Owner's approval.
- C. Related Work:
 - 1. Documents affecting Work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
- D. Temporary Power:
 - 1. Arrange, provide and pay for the costs of installing temporary power to the site in accordance with the requirements of Division 1.

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1.2 QUALITY ASSURANCE:

- A. Use adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this Section.
- B. Codes and Ordinances:
 - 1. The installation shall comply with requirements of all applicable laws, codes and ordinances including those of the state, county and city.
 - 2. NFPA 70 - 2014.
 - 3. NFPA 72 – 2015 (including FM Directives)
 - 4. NFPA 101 – 2014.
 - 5. Where these Drawings, Design Guidelines and Specifications show more stringent requirements than required codes, the more stringent shall prevail.
 - 6. The Work shall comply with current standards of the serving utility companies.
- C. Permits, Fees and Licenses:
 - 1. The Contractor shall obtain and pay for all permits, fees and licenses, for Work required under these Specifications.
- D. Utility Company Fees:
 - 1. Coordination of existing utilities and easements including fees associated with the project shall be included in the Work.
- E. Without additional cost to the Owner, provide such other labor and materials as are required to complete the Work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

1.3 EXAMINATION OF SITE:

- A. Visit the site, inspect the existing conditions and check the Drawings and Specifications to be fully informed of the requirements for completion of the Work.
- B. Lack of such examination shall not justify a request for extra compensation to the Contract price.

1.4 MATERIAL AND EQUIPMENT:

1.5 SUBMITTALS:

- A. SHOP DRAWINGS AND SUBMITTAL DATA
 - 1. Process shop drawings and submittal data to ensure that the proposed materials, equipment and devices conform to the requirements of the Contract Documents, and that there are no omissions or duplications. Provide layouts, fabrication information and data for systems, materials, equipment and devices proposed for the project.

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- a. Shop drawings shall be drawn on a scale not less than $\frac{1}{4}$ inch equals 1 foot showing actual dimensions. Shop drawings shall include, but not be limited to:
 - 1) Switchboards
 - 2) Distribution Panelboards
2. Submittal data (manufacturer's catalog data) shall include Manufacturer's Specifications, product literature and other data needed to demonstrate compliance with the specified requirements, but not be limited to the following:
 - a. Equipment: Switchboards, Panelboards, Transformers, Disconnect Switches, Enclosed Controller, Circuit Breakers, Fuses, etc.
 - b. Materials: conduit, conductors, connectors, supports, etc.
 - c. Lighting Fixtures and Lamps.
 - d. Wiring Devices.
 - e. Lighting Control Devices – Sensors, Dimming, etc.
 - f. Low-Voltage Data outlet devices and Cabling systems.
 - g. Low-Voltage Clock and Intercom System – (Existing).
 - h. Security and Camera Systems – (Existing)
 - i. Addressable Fire Alarm System – (Existing).
3. Manufacturer's recommended installation procedure which, when approved by the Owner, will become the basis for accepting or rejecting actual installation procedures used on the work.
4. The submittal data shall not consist of manufacturer's catalogs or cut sheets that contain no indication of the exact item offered. The submission on individual items shall designate the exact item offered.
5. Do not submit detailed quantitative listings of materials, equipment and devices. It is the Contractor's responsibility to provide proper sizes and quantities to conform to Contract Documents.
6. Assemble submittals on related items procured from a single manufacturer in brochures or other suitable package form, rather than submitting a multiplicity of loose sheets.
7. The Contractor shall submit shop drawings whenever equipment proposed varies in physical size and arrangement from that indicated thus causing rearrangement of equipment space, where tight spaces require extreme coordination between this work and other work, where called for elsewhere in these Specifications and where specifically requested by the Owner. Shop drawings shall be prepared at a scale of not less than $\frac{1}{4}$ inch equals 1 foot.

B. SUBSTITUTIONS

1. Where a single manufacturer is mentioned by trade name or manufacturer's name, it has been done to establish a standard rather than to discriminate against an equal product made by another manufacturer.
2. Where multiple manufacturers are listed in the Owner's drawings and/or specification, none other than those manufacturers will be accepted.
3. Substitute manufacturers will be considered prior to bid only. The substitute manufacturer shall submit a complete copy of the appropriate technical specification section minimum ten (10) business days prior to bid with each subparagraph noted with the comment, "compliance", "deviation" or "alternate". In the case of non-primary, vendor-supplied items, the name of the sub-vendor supplying said item, including model number, shall be indicated.

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4. By noting the term "compliance" or "C", it shall be understood that the manufacturer is in full compliance with the item specified and will provide exactly the same with no deviations.
5. By noting the term "deviation" or "D", it shall be understood that the manufacturer prefers to provide a different component in lieu of that specified. Manufacturer shall indicate all deviations.
6. It shall be understood that space allocations have been made on the basis of present and known future requirements and the dimensions of items of equipment or devices of a particular manufacturer whether indicated or not. If any item of equipment or device is offered in substitution which differs substantially in dimension or configuration from that indicated on the Drawings or specifications, provide as part of the submittal ¼ inch equals 1-foot scaled drawings showing that the substitute can be installed in the space available without interfering with other portions of the work or with access for operations and maintenance in the completed project.
7. Where substitute equipment or devices requiring different arrangement or connections from that indicated is accepted by the Owner, install the equipment or devices to operate properly and in harmony with the intent of the Contract Documents, making all incidental changes in piping, ductwork or wiring resulting from the equipment or device selection without any additional cost to the Owner. The Contractor shall pay all additional costs incurred by other portions of the work in connection with the substituted equipment or device.
8. The Owner reserves the right to call for samples of any item of material, equipment or device offered in substitution, together with a sample of the specific item when, in their opinion, the quality of the item and/or the appearance is involved, and it is deemed that an evaluation of the item may be better made by visual inspection.
9. When any request for a substitution of material, equipment or device is submitted and rejected, the item named in the Contract Documents shall be furnished. Repetitive submittal of substitutions for the same item will not be considered.

C. Samples:

1. When requested by the Owner, promptly provide samples of items scheduled to be exposed in the final structure.
2. When specifically, so requested by the Contractor and approved by the Owner, approved samples will be returned to the Contractor for installation on the Work.

D. Record Drawings:

1. Comply with pertinent provisions of Division 1.
2. Include a copy of the Record Drawings in each copy of the operation and maintenance manual described below.

E. Manual:

1. Upon completion of this portion of the Work, and as a Condition of its acceptance, deliver the operation and maintenance manual to the Owner complied in accordance with the provisions of Division 1 of these specifications. Include within each manual.
 - a. Copy of the approved Record Documents for this portion of the Work.
 - b. Copy of each circuit directories.
 - c. Copy of each warranty and guaranty.

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1.6 GUARANTEE:

- A. The Contractor guarantees all Work against any defects due to faulty workmanship or material and that all raceways, ducts and piping are free from foreign material, obstructions, holes or breaks of any nature.
- B. Upon written notice from the Owner or Owner, the Contractor shall promptly remedy without cost to the Owner any defects occurring within a period of one (1) year from the date of final acceptance.

1.7 WARRANTY:

- A. The Contractor shall properly execute in the Owner's name all Manufacturers' standard warranty certificates applying to equipment installed on the project and shall deliver said certificates to the Owner at completion of the job. All warranty cards shall also be properly executed and delivered to the supplier or Manufacturer's representative for Manufacturer's records. Standard warranties for equipment shall be not less than one (1) year.

PART 2 - PRODUCTS

2.1 BASIC ELECTRICAL MATERIALS AND METHODS:

- A. Provide only materials that are new and of the type and quality specified. Where Underwriter's Laboratories, Inc. have established standards for such materials, provide only materials bearing the UL label.
- B. Materials and equipment shall be new, of the same type and manufacturer, of the best quality and design, free from defects and meet the requirements of UL and NFPA where standards are established for those items and assemblies.
- C. Manufacturer's nameplate affixed in a conspicuous place will be required on each major component of equipment stating Manufacturer's name, address and catalog number.
- D. Manufacturer's name and model number used herein and, on the Drawings, establish type and quality required. Equal products may be considered if submitted in writing to the Owner's Representative for approval 10 (ten) days prior to bid date. The Contractor shall be responsible for assuring the items and equipment substituted for those shown on the Drawings will physically fit in the space allocated.
- E. Fire stopping material shall be 3M Fire Seal Caulking, or approved substitution.
- F. Terminals and enclosures shall be marked for 75° C operation or conductor size shall be increased as required at no cost to the Owner.
- G. Steel Pipe Wall Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends. Comply with NECA 1.

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- H. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work and roof manufacturer's requirements.
- I. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.
- J. Provide sleeves and chases where conduits pass through rated floors and walls, fire stopped in accordance with UL Listed assembly.
- K. When boring, cutting or drilling structural wood or wall members, drill only in locations as approved by the Owner.
- L. Immediately prior to final inspection, the Contractor shall make a final cleanup of dirt and refuse resulting from his Work and shall assist in keeping the premises clean at all times.
- M. Immediately prior to final inspection, the Contractor shall clean all material and equipment installed under this Contract. Dirt, dust, plaster, stains and foreign matter shall be removed from all surfaces. Damaged finishes shall be touched up and restored to their original Condition.
- N. Mechanism of all equipment shall be checked, adjusted and tested for proper operation. Protective devices and parts shall be checked and tested for specified and required application and adjusted as required to produce the intended performance.
- O. Service voltage and color codes for 480Y/277V: Phase A - Brown, Phase B - Orange, Phase C - Yellow, Neutral - White, and Ground - Green.
- P. Service voltage and color codes for 208/120V: Phase A - Black, Phase B - Red, Phase C - Blue, Neutral - White, and Ground - Green.

2.2 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS

- A. Related Requirements:
 - 1. Section 260400 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2, and 3 control cables.
 - 2. Section 270400 "Communications Horizontal Cabling" for cabling used for voice and data circuits.
- B. Copper Building Wire: Flexible, insulated and uninsulated, drawn copper current-carrying conductor complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors with an overall insulation layer or jacket, or both, rated 600 V or less.
- C. Basis-of-Design Product: Subject to compliance with requirements, provide Southwire Company or comparable product by one of the following:

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1. Alpha Wire Company.
 2. Cerro Wire LLC.
 3. Encore Wire Corporation.
 4. General Cable Technologies Corporation.
 5. Southwire Company.
- D. Service Entrance Conductors:
1. For line voltages, provide 600 V THHN insulated copper wire with UL Label, listing, and color coded for voltage.
- E. Conductors:
1. For line voltages, provide 600 V insulated copper wire and cable, with UL Label, listing, and color coded for voltage.
 2. Use type THHN/THWN color coded for voltage at interior, type THHN/THWN-2 for exterior.
 3. For wire No. 10 and smaller, provide solid wire: for wire larger than No. 10, provide stranded wire.
 4. Conductors No. 8 and larger, provide insulating bushings or insulating sleeves.
 5. Use only copper wires and cables.
- F. No. 12 AWG THHN conductors and larger for all branch circuits, protected by 20-amp circuit breakers. Where so indicated on the Drawings, by actual load, or by the N.E.C., use larger wires to limit voltage drops:
1. Increase wire sizes to next largest AWG size for:
 - a. 120-volt circuits exceeding 150 feet in circuit length.
 - b. 208-volt circuits exceeding 200 feet in circuit length.
 2. Wire and conduit sizes shall be increased for the above conditions whether shown on the Drawings or not.
- G. Use identified (white) neutrals and colored-coded phase wires for all branch circuit wiring.
- H. Make splices electrically and mechanically secure with pressure-type. Push-in connectors shall not be allowed.
1. For wires size 10 AWG and smaller, provide NSI twist-on connectors.
 2. For wires size 8 AWG and larger, provide NSI Polaris insulated connectors.
- I. Tape all joints with rubber tape 1-1/2 times the thickness of the conductor insulation, then cover with the friction tape or the vinyl-plastic electrical tape specified above.

2.3 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

A. Related Requirements:

1. Section 260400 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2, and 3 control cables.
2. Section 270400 "Communications Horizontal Cabling" for cabling used for voice and data circuits.

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- B. Copper Building Wire: Flexible, insulated and uninsulated, drawn copper current-carrying conductor complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors with an overall insulation layer or jacket, or both, rated 600 V or less.
- C. Basis-of-Design Product: Subject to compliance with requirements, provide Southwire Company or comparable product by one of the following:
 - 1. Alpha Wire Company.
 - 2. Cerro Wire LLC.
 - 3. Encore Wire Corporation.
 - 4. General Cable Technologies Corporation.
 - 5. Southwire Company.
- D. Service Entrance Conductors:
 - 1. For line voltages, provide 600 V THHN insulated copper or aluminum wire with UL Label, listing, and color coded for voltage.

E. INSERT ALUMINUM, METAL-CLAD MC PER PROJECT REQUIREMENTS

- F. Conductors:
 - 1. For line voltages, provide 600 V insulated copper wire and cable, with UL Label, listing, and color coded for voltage.
 - 2. Use type THHN/THWN color coded for voltage at interior, type THHN/THWN-2 for exterior.
 - 3. For wire No. 10 and smaller, provide solid wire; for wire larger than No. 10, provide stranded wire.
 - 4. Conductors No. 8 and larger, provide insulating bushings or insulating sleeves.
 - 5. Use only copper wires and cables.
- G. No. 12 AWG THHN conductors and larger for all branch circuits, protected by 20-amp circuit breakers. Where so indicated on the Drawings, by actual load, or by the N.E.C., use larger wires to limit voltage drops:
 - 1. Increase wire sizes to next largest AWG size for:
 - a. 120-volt circuits exceeding 150 feet in circuit length.
 - b. 208-volt circuits exceeding 200 feet in circuit length.
 - 2. Wire and conduit sizes shall be increased for the above conditions whether shown on the Drawings or not.
- H. Use identified (white) neutrals and colored-coded phase wires for all branch circuit wiring.
- I. Make splices electrically and mechanically secure with pressure-type. Push-in connectors shall not be allowed.
 - 1. For wires size 10 AWG and smaller, provide NSI twist-on connectors.
 - 2. For wires size 8 AWG and larger, provide NSI Polaris insulated connectors.
- J. Tape all joints with rubber tape 1-1/2 times the thickness of the conductor insulation, then cover with the friction tape or the vinyl-plastic electrical tape specified above.

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2.4 GROUNDING AND BONDING

- A. Submittals:
 - 1. Product Data: For each type of product.
 - 2. Product Schedule: Indicate type, use, location, and termination locations.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Burndy; Part of Hubbell Electrical Systems.
 - 2. ERICO International Corporation.
 - 3. TE Connectivity Ltd.
 - 4. ILSCO.
 - 5. O-Z/Gedney; a brand of Emerson Industrial Automation.
- C. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- D. Bare Copper Conductors:
 - 1. Stranded Conductors: ASTM B 8.
 - 2. Tinned Conductors: ASTM B 33.
 - 3. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
 - 4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 5. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- E. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.
- F. Connectors: Listed and labeled by an NRTL as complying with NFPA 70, acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected. Comply with UL 467.
 - 1. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
 - 2. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
 - 3. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.
 - 4. Cable-to-Cable Connectors: Compression type, copper or electroplated tinned copper, C and H shaped.
 - 5. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.
 - 6. Conduit Hubs: Mechanical type, terminal with threaded hub.
 - 7. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.
 - 8. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.

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9. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.
10. Straps: Solid copper, cast-bronze clamp. Rated for 600 A.
11. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.
12. Water Pipe Clamps: Tin-plated aluminum or Silicon Bronze. Mechanical type, two pieces with zinc-plated bolts.

G. NEW ELECTRICAL SERVICES

1. The neutral conductor for each system shall be grounded in accordance with the National Electrical Code using $\frac{3}{4}$ " diameter copper ground rods, 8 feet in length, in a tripod formation. The conduit system and service entrance equipment shall be bonded to the grounding conductors in an approved manner. All equipment, motors, conduit and other electrical items shall be grounded properly to prevent accidental shock to operators or other persons. All PVC conduit runs shall have grounding conductor installed per code EXCEPT AT SERVICE ENTRANCE FROM UTILITY TRANSFORMER.
2. Ground all equipment and other apparatus to metallic cold water main (if pipe is metal and direct buried for a minimum of 10 foot outside the building) and to independent grounding electrode (minimum 20 foot of steel reinforcing bar buried within the foundation or footing) with 1/0 AWG minimum as shown on the Drawings, using ground clamps manufactured by Burndy or T&B, and approved by the Owner. Bond all grounds in accordance to current NFPA 70.
3. Bond all water piping systems per local codes. Do not bond to gas piping systems within the building, only on the exterior of buildings.
4. Install a ground conductor in all feeder conduits connecting main switchboards, distribution panels, branch circuit panels, and all major pieces of mechanical equipment whether or not called for on the Drawings.
5. Use ground rods if water mains or piping are not metallic, or if isolation couplings have been used.
6. Make meg ground tests to measure ground resistance, and provide not more than 5 ohms resistance, adding ground rods as required to achieve that level.
7. Make ground rods accessible for inspection and testing.

H. Provide exothermic connections with Erico/Cadweld or approved substitutes.

I. Ground Rods: Copper-clad steel, sectional type; 5/8 by 96 inches.

J. Bond all water piping systems per local codes. Do not bond to gas piping systems within the building.

2.5 HANGERS AND SUPPORTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Material: Pre-galvanized steel.
2. Channel Width: 1-5/8 inches.
3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

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4. 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 and malleable-iron 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. 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.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. B-line, an Eaton business.
 - b. Empire Tool and Manufacturing Co., Inc.
 - c. Hilti, Inc.
 - d. 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. Toggle Bolts: All-steel springhead type.
 5. Hanger Rods: Threaded steel.
- F. Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- G. 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. Wire-ties and zip-ties shall not be an acceptable means of support to structure(s).
- H. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- I. 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.
- J. 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 Existing Concrete: Expansion anchor fasteners.

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5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
 6. To Light Steel: Sheet metal screws.
 7. 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.
- K. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- L. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

2.6 RACEWAYS AND BOXES

- A. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use. Conduit Fittings for Hazardous (Classified) Locations: UL 1203.
- B. Raceways and Fittings:
1. Steel Electrical Intermediate Metal Conduit (IMC) - UL 1242 and UL Category Control Number DYBY: Exterior - Zinc coated; Interior - Zinc with organic top coated. Fittings: Steel, compression coupling.
 2. Steel Electrical Metal Tubing (EMT) and Elbows: UL 797 and UL Category Control Number FJMX: Exterior - Zinc coated; Interior - Zinc with organic top coated. Fittings: Steel, compression coupling.
 3. Aluminum Electrical Metal Tubing (EMT) and Elbows: UL 797A and UL Category Control Number FJMX: Exterior - Zinc coated; Interior - Zinc with organic top coated. Fittings: Steel, compression coupling.
 4. Flexible Metal Conduit (FMC): Steel_Aluminum. UL 1 and UL Category Control Number DXUZ. Fitting: UL 514B and UL Category Control Number ILNR.
 5. Liquidtight Flexible Metal Conduit (LFMC): Steel_Aluminum. UL 360 and UL Category Control Number DXHR. UL 514B and UL Category Control Number DXAS.
 6. Schedule 40 Rigid PVC Conduit (PVC-40) and Fittings: UL 651 and UL Category Control Number DZYR. For use with maximum 90 deg C wire.
 7. Minimum raceway size: 3/4" raceway for power circuits and 1" raceways for low-voltage communication cable raceways.
- C. Surface mounted raceways: Wiremold or Owner approved equal, steel 500 or 700 Series with matching surface mount box and mounting accessories. Color as directed by Owner. EMT conduit is not an allowable method for surface raceways. Submit to Owner prior to installation.

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- D. Surface mounted raceways on existing walls: 3/4" EMT maximum. Provide 1/2" EMT raceways for thermostat, HVAC sensors and control circuits anchored to wall system by approved method.
- E. Boxes, Enclosures and Cabinets:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crouse-Hinds, an Eaton business.
 - b. Hubbell Incorporated.
 - c. RACO; Hubbell.
 - d. Thomas & Betts Corporation; A Member of the ABB Group.
 - e. Wiremold / Legrand.
 - 2. General Requirements for Boxes, Enclosures, and Cabinets: Comply with NFPA 70 for intended location and use. UL 514A and UL CCN QCIT.
 - 3. Wireways and Auxiliary Gutters:
 - a. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system. Manufacturer's standard enamel finish.
 - b. Wireway Covers: Hinged, Screw-cover and Flanged-gasketed as indicated in drawings.
 - 4. Metallic Outlet, Device Boxes, Rings, Covers and Conduit Bodies:
 - a. Description: 4" square outlet box having pryout openings, knockouts, threaded entries, or hubs in either the sides of the back, or both, for entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting outlet box cover, but without provisions for mounting wiring device directly to box.
 - b. Material: Sheet steel and Cast metal.
 - c. Sheet Metal Depth: 2-1/8" deep minimum to accommodate 1" knockout.
 - d. Cast-Metal Depth: 2.4 inch deep.
 - e. Luminaire Outlet Boxes and Covers: Nonadjustable, listed and labeled for attachment of luminaire weighing 50 lb.
 - f. Paddle Fan and Large Luminaire Outlet Boxes and Covers: Nonadjustable, designed for attachment of paddle fan weighing up to 70 lb.
 - g. Conduit Bodies: Means for providing access to interior of conduit or tubing system through one or more removable covers at junction or terminal point.
 - 5. Metallic Floor Boxes and Floor Box Covers: RFB4 series with (4) independent compartments, stamped steel, and shallow steel for concrete 2 7/16" depths accepting 3/4" and 1" conduit.
 - a. Coverplates shall be scrub-proof with carpet in-lay and easy open handle. Activate all compartments with specified and approved wiring devices.
 - 6. Nonmetallic Outlet, Conduit Bodies and Device Boxes: UL 514C and UL CCN QCMZ.
- F. Termination Boxes: UL 1773 and UL Category Control Number XCKT.
 - 1. Description: Enclosure for termination base consisting of lengths of bus bars, terminal strips, or terminal blocks with provision for wire connectors to accommodate incoming or outgoing conductors or both.
 - 2. Listed and labeled for installation on line or load side of service equipment.

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- G. Cabinets, Cutout Boxes, Junction Boxes and Pull Boxes: UL 50 and 50E.
 - 1. Sheet Metal Cabinets:
 - a. Description: Enclosure provided with frame, mat, or trim in which swinging door or doors are or can be hung. UL Category Control Number CYIV.
 - 2. Sheet Metal Cutout Boxes:
 - a. Description: Enclosure that has swinging doors or covers secured directly to and telescoping with walls of enclosure.
 - 3. Sheet Metal, Cast-Metal, and Polymeric Junction and Pull Boxes:
 - a. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable. UL Category Control Number BGUZ.

- H. Cover Plates for Devices Boxes: UL 514D and UL Category Control Numbers QCIT and QCMZ.
 - 1. Wallplate-Securing Screws: Metal with head color to match wallplate finish.
 - 2. Cover Plates for Device Boxes:
 - a. Damp and Wet Locations: Listed, labeled, and marked for location and use. Provide gaskets and accessories necessary for compliance with listing.
 - b. Metallic Wallplate Material: 0.032-inch-thick Type 302/304 non-magnetic stainless steel with brushed finish.
 - c. Metallic Wallplate Material: Steel with white baked enamel, suitable for field painting.
 - d. Metallic Wallplate Material: Galvanized steel.
 - e. Metallic Wallplate Material: As indicated on architectural Drawings.
 - f. Nonmetallic Wallplate Material: 0.060 inch thick high-impact thermoplastic (nylon) with smooth finish and color matching wiring device.
 - g. Color: As indicated on architectural drawings or selected by Owner/Architect. Red for emergency outlets.
 - 3. Hoods for Outlet Boxes:
 - a. Reference Standards:
 - 1) UL 514D and UL Category Control Numbers QCIT and QCMZ.
 - 2) Receptacle, hood, cover plate, gaskets, and seals comply with UL 498 Supplement SA when mated with box or enclosure complying with UL 514A, UL 514C, or UL 50E.
 - b. Mounts to box using fasteners different from wiring device.
 - 4. provide galvanized code-gauge sheet steel units with screwed-on covers, of size and shape required to accommodate wires without crowding, and to suit the location. Mark with permanent ink circuit designations on cover plate. If box is to be painted provide permanent ink marking on inside of box cover.
 - 5. For exterior pull boxes, provide fiberglass quazite box with sealed lid identified "ELECTRICAL" at size required to accommodate wires at 40% fill.
 - 6. Provide sleeves and chases where conduits pass through floors and walls, fire-stopped in accordance with NEC Article 300.21.
 - 7. For switches and receptacles, provide standard ganged switch boxes with plastic or stainless-steel covers as required by Architect; except for exposed Work, provide pressed steel boxes with galvanized or cadmium plated steel covers.
 - a. For telephone/communication outlets, provide 4" square boxes with single device cover. Route conduit to accessible ceiling cavity with end bushings and nylon pullstring.

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- I. Junction boxes may not be installed back-to-back in walls and partitions. Consult with Owner for proper separation of boxes (typically, 12" in non-rated walls, 24" in rated walls).
- J. Securely and rigidly support boxes to super structure throughout the Work.

2.7 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. General Requirements for Handholes and Boxes:
 - 1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
 - 2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armorcast Products Company.
 - b. NewBasis.
 - c. Oldcastle Enclosure Solutions.
 - d. Quazite: Hubbell Power Systems, Inc.
 - 2. Standard: Comply with SCTE 77.
 - 3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
 - 4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
 - 5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 - 6. Cover Legend: Molded lettering, "ELECTRIC" or "COMMUNICATIONS".
 - 7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
 - 8. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.8 SLEEVE-SEAL SYSTEMS FOR ELECTRICAL RACEWAYS

- A. Wall Sleeves:
 - 1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
 - 2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
- C. Sleeves for Rectangular Openings:

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1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
 - b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

D. SLEEVE-SEAL SYSTEMS

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. Advance Products & Systems, Inc.
 - b. CALPICO, Inc.
 - c. Metraflex Company (The).
2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel.
4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

E. SLEEVE-SEAL FITTINGS

1. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
 - 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) HOLDRITE.
 - 2) Presealed Systems.

F. GROUT

1. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
2. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
3. Design Mix: 5000-psi, 28-day compressive strength.

G. SILICONE SEALANTS

1. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
 - a. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
2. A Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

2.9 LIGHTING CONTROL DEVICES:

A. Occupancy Sensors and Presence Detection:

1. Ceiling mounted in Classrooms: STEINEL: 64470 IR QUATTRO HD COM2-24.

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2. Ceiling mounted in Corridors: STEINEL: 64560 US HALLWAY COM2-24.
 3. Ceiling mounted in Restrooms: STEINEL: 64700 DT QUATTRO COM1-24.
 4. Manufacturer part numbers change and must be verified prior to work.
- B. Wall Dimmers/Occupancy/Vacancy Sensors:
1. LEVITON: DS710-10Z, Locations may vary, final by Owner.
- C. Photocells: Integral with egress exterior fixtures.
- D. Provide and install time clocks for automatic operation of lighting and equipment loads in accordance with the Time Clock Schedule shown on the Drawings, and as follows:
1. Equipment Control:
 - a. Tork W-220-L, SPST, reserve power, 40 AMP contacts, NEMA 1 surface mounted enclosure.
 - b. Lighting Control:
 - 1) Tork 7200ZL, DPST, reserve power, 40 AMP contacts, astronomic dial, NEMA 1 surface mounted enclosure.
 - c. Photocell:
 - 1) Tork 2101, SPST, 2000 Watt rating, 120 Volt.

2.10 LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

- A. Description: Factory-assembled and -tested, air-cooled units for 60 Hz service.
- B. Manufacturers:
1. Eaton Corp.
 2. Schneider Square D.
 3. General Electric – GE.
- C. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application. UL 50E.
1. Comply with IEEE C2 and C57.12.01.
- D. Transformers Rated 15 kVA and Larger:
1. Comply with 10 CFR 431 (DOE 2016) efficiency levels.
 2. Marked as compliant with DOE 2016 efficiency levels by qualified electrical testing laboratory recognized by authorities having jurisdiction.
 3. Comply with NFPA 70, and list and label as complying with UL 1561.
 4. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses. One leg per phase.
 5. Coils: Continuous windings without splices except for taps.
 - a. Coil Material: Aluminum or copper.
 - b. Internal Coil Connections: Brazed or pressure type.
 - c. Terminal Connections: Welded
 6. Enclosure: Ventilated
 - a. Core and coil must be encapsulated within resin compound using vacuum-pressure impregnation process to seal out moisture and air.

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- b. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.
 - c. Wiring Compartment: Sized for conduit entry and wiring installation.
- 7. Transformer Ratings:
 - a. 480-volt, 3-phase Delta primary, 120/208 volt, 3 phase, 4 wire Wye secondary.
 - b. 2.5% full-capacity taps maximum. Comply with IEEE C57.12.51 requirements.
 - c. Class H insulation, 150° C rise when operated at design load in 40° C ambient temperature.
- 8. Grounding: Provide ground-bar kit or ground bar installed on inside of transformer enclosure.
- 9. Wall Brackets for transformers up to 75 kVA: Manufacturer's standard brackets.
- 10. Nameplates: Engraved, laminated-acrylic or melamine plastic signs for distribution transformers, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260400 "Identification for Electrical Systems."

2.11 SWITCHBOARDS

A. ACTION SUBMITTALS

- 1. Product Data: For each switchboard, overcurrent protective device, surge protection device, ground-fault protector, accessory, and component.
 - a. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
- 2. Shop Drawings: For each switchboard and related equipment.
 - a. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
 - b. Detail enclosure types for types other than NEMA 250, Type 1.
 - c. Detail bus configuration, current, and voltage ratings.
 - d. Detail short-circuit current rating of switchboards and overcurrent protective devices.
 - e. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - f. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graph paper; include selectable ranges for each type of overcurrent protective device.
 - g. Include schematic and wiring diagrams for power, signal, and control wiring.

B. WARRANTY

- 1. Manufacturer's Warranty: Manufacturer agrees to repair or replace switchboard enclosures, buswork, overcurrent protective devices, accessories, and factory installed interconnection wiring that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period: Three years from date of Substantial Completion.

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2. Manufacturer's Warranty: Manufacturer's agrees to repair or replace surge protection devices that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period: Five years from date of Substantial Completion.
- C. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 1. Eaton.
 2. General Electric Company.
 3. Square D; by Schneider Electric.
- D. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- E. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 1. Comply with NEMA PB 2, NFPA 70 and UL 891.
- G. Front-Connected, Front-Accessible Switchboards:
 1. Main Devices: Fixed, individually mounted.
 2. Branch Devices: Panel mounted.
 3. Sections front and rear aligned.
- H. Indoor Enclosures: Steel, NEMA 250, Type 1. Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.
- I. Outdoor Enclosures: Type 3R. Finish: Factory-applied finish in manufacturer's standard color; undersurfaces treated with corrosion-resistant undercoating. Downward, rearward sloping roof; bolt-on rear covers for each section, with provisions for padlocking.
- J. Service Entrance Rating: Switchboards intended for use as service entrance equipment shall contain from one to six service disconnecting means with overcurrent protection, a neutral bus with disconnecting link, a grounding electrode conductor terminal, and a main bonding jumper.
- K. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.
- L. Pull Box on Top of Switchboard:
 1. Adequate ventilation to maintain temperature in pull box within same limits as switchboard.
 2. Removable covers shall form top, front, and sides. Top covers at rear shall be easily removable for drilling and cutting.
 3. Bottom shall be insulating, fire-resistive material with separate holes for cable drops into switchboard.

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- M. Cable supports shall be arranged to facilitate cabling and adequate to support cables indicated, including those for future installation.
- N. Buses and Connections: Three phase, four wire unless otherwise indicated.
 - 1. Provide phase bus arrangement A, B, C from front to back, top to bottom, and left to right when viewed from the front of the switchboard.
 - 2. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity, silver-plated.
 - 3. Copper feeder circuit-breaker line connections.
 - 4. Ground Bus: 1/4-by-2-inch- hard-drawn copper of 98 percent conductivity, equipped with compression connectors for feeder and branch-circuit ground conductors.
 - 5. Main-Phase Buses and Equipment-Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
 - 6. Disconnect Links: Isolate neutral bus from incoming neutral conductors. Bond neutral bus to equipment-ground bus for switchboards utilized as service equipment or separately derived systems.
 - 7. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with compression connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.
 - 8. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.
- O. SURGE PROTECTION DEVICES
 - 1. Direct bus connected type as indicated in drawings.
- P. SPDs: Factory installed integral to switchboards in segregated compartment, complying with UL 1449, Type I with the following accessories:
 - 1. Integral disconnect switch.
 - 2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
 - 3. Indicator light display for protection status.
 - 4. Surge counter.
- Q. Disconnecting and Overcurrent Protective Devices:
 - 1. Service Entrance Label: 65kA.
 - 2. Molded-Case Circuit Breaker (MCCB), 80% rated, comply with UL 489, with series-connected rating to meet available fault currents.
 - 3. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger. Magnetic trip element with front-mounted, field-adjustable trip setting.
 - 4. Standard electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long and short time adjustments.
 - 5. Full-function electronic trip circuit breakers as indicated on drawings with rms sensing; field-replaceable rating plug or electronic trip; digital display, multi-button keypad to access functions, event trip log, communications and the following field-adjustable settings:

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- a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long and short time adjustments.
 - d. Ground-fault pickup level, time delay, and I^2t response.
 6. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 7. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
 8. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
 9. Kitchen Areas and similar inaccessible outlet locations: Single to three-pole configurations with Class A ground-fault protection for personnel rated at 6-mA trip. Provide shunt-trip for circuit breakers serving under exhaust hoods.
- R. Where existing facility switchboard(s) or main switches are instructed to remain by Owner that require current-limiting fuses:
1. For above 600 Amps, provide Class L "Hi-Cap" manufactured by Bussman.
 2. For below 600 Amps, as shown for short circuit duty, provide Class RK-1 time delay, "Limitron", or Class RK-5 "Low Peak", or Class RK-9 "Fusetron", manufactured by Bussman, or equal manufacture by Gould-Shawmut.
 3. At switches provide a micarta nameplate with white lettering on a red background, reading WARNING, REPLACE ONLY WITH CURRENT-LIMITING FUSES AS ORIGINALLY INSTALLED.
 4. Provide 100% spare fuses with spare fuse cabinet installed in the main electric room.
- S. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:
1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:
 - a. Phase Currents, Each Phase: Plus or minus 0.5 percent.
 - b. Phase-to-Phase Voltages, Three Phase: Plus or minus 0.5 percent.
 - c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 0.5 percent.
 - d. Megawatts: Plus or minus 1 percent.
 - e. Megavars: Plus or minus 1 percent.
 - f. Power Factor: Plus or minus 1 percent.
 - g. Frequency: Plus or minus 0.1 percent.
 - h. Accumulated Energy, Megawatt Hours: Plus or minus 1 percent; accumulated values unaffected by power outages up to 72 hours.
 - i. Megawatt Demand: Plus or minus 1 percent; demand interval programmable from five to 60 minutes.
 - j. Contact devices to operate remote impulse-totalizing demand meter.
- T. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.

2.12 PANELBOARDS:

- A. Panelboards and Retrofit Panelboards: Comply with NEMA PB 1 and NFPA 70.

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- B. Eaton - Cutler-Hammer Type "Pow-R-Line" or approved equal. Commercial Grade.
- C. Retrofit panelboards shall be Cutler-Hammer Pow-R-Line or equal. Commercial.
- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers or Plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.
- E. Enclosures: Flush and Surface-mounted, dead-front cabinets as indicated in drawings.
 - 1. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - 2. Outdoor Locations: NEMA 250, Type 3R:
 - 3. Wash-Down Areas: NEMA 250, Type 4X S.S.
 - 4. Kitchen Areas: NEMA 250, Type 1 with seal for Stainless Steel front cover.
 - 5. Cabinets, flush or surface mounted as indicated. Top and/or Bottom Entry.
 - 6. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
 - 7. Gutters: Same gage and finish of panel enclosure; integral with body.
 - 8. Directory Card: Inside panelboard door, mounted in metal frame with transparent cover.
 - 9. Doors shall be as required, accurately fitted with catch-lock and two (2) keys. All front keys alike.
- F. Panel boards shall be rated for the voltage, 3 phase, 4 wire, solid neutral, UL 489 and rated 250 or 600 volts.
- G. Incoming Mains Location: Convertible between top and bottom and terminate in cable lugs or main circuit breaker.
- H. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 1. Material: Phase, Neutral and Ground Bus shall be hard drawn copper of 98 percent conductivity.
 - 2. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
 - 3. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
 - 4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device where indicated on drawings.
 - 5. Sub-feed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device where indicated on drawings.
- I. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- J. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

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- K. Surge Suppression: Comply with UL 1449 SPD for the following Types indicated on drawings and specified in “Surge Protection for Electrical Power Circuits”:
 - 1. Type 1 for service equipment where the device is ahead of the service disconnect. Factory installed as an integral part of panelboard in segregated compartment.
 - 2. Type 2 for panelboards on the load side of the service disconnect. Provide SPD mounted in rated enclosure, exterior of panelboard.
- L. DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES (OCPDs):
- M. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 - 3. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 - 4. GFCI Circuit Breakers: Single- thru three-pole configurations with Class A ground-fault protection (6-mA trip).
 - 5. MCCB Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - c. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - d. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
 - e. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in “on” or “off” position.
 - f. Handle Clamp: Loose attachment, for holding circuit-breaker handle in “on” or “off” position.
- N. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.
- O. Circuit Directory: Directory card inside panelboard door, mounted in transparent card holder. Provide name and phone number of installing company.
- P. Provision for Future Devices: Equipment with mounting brackets, bus connections, and necessary appurtenances for the OCPD ampere ratings indicated for future installation of devices.
- Q. Tandem and mini-circuit breakers shall NOT be used. Multipole breakers shall have common trip.

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2.13 WIRING DEVICES:

- A. UL Listed and labeled as defined in NFPA 70.
- B. Color of wiring devices shall match existing facility devices or per Owner's requirements. Color of isolated ground receptacles to be orange. Coordinate with Architect/Owner for final color of all devices.
- C. Duplex Convenience Receptacles: 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
- D. Industrial Heavy Duty, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement SD, and FS W-C-596.
- E. Twist-Locking Receptacles: Twist-Lock, Single Convenience Receptacles: 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration Heavy-duty, NEMA 5-20R, and UL 498.
- F. GFCI Receptacles: 125 V, 20 A, straight blade, 20 A feed-through type. Comply with NEMA WD 1, Heavy-duty NEMA 5-20R, UL CCN KCXX, UL 498, UL 943 Class A, and FS W-C-596.
 - 1. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
 - 2. Self-testing technology with indicators including disconnecting power if damaged.
 - 3. Receptacles shall be side wired feed-thru.
- G. Tamper-Resistant Duplex Straight-Blade Receptacle: 125 V, 20 A: Comply with NFPA 70, Heavy-duty NEMA 5-20R, UL CCN RTRT and UL 498, and FS W-C-596.
- H. Tamper-Resistant Duplex Straight-Blade Receptacle with USB Outlet to Power Class 2 Equipment: 125 V, 20 A: Comply with NFPA 70, Heavy-duty NEMA 5-20R, UL CCN RTRT and UL 498, and FS W-C-596.
- I. Duplex Straight-Blade Receptacle with Type 3 Surge Protective Device: 125 V, 20 A: Comply with color BLUE per NEMA WD 1, heavy-duty. Configuration NEMA 5-20R, UL 498, and FS W-C-596.
- J. Pendant Cord-Connector Devices:
 - 1. Matching, locking type plug and receptacle body connector.
 - 2. NEMA WD 6 Configurations L5-20P and L5-20R, heavy-duty grade, and FS W-C-596.
 - 3. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.
 - 4. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.
- K. Cord And Plug Sets:

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1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
 2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
 3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.
- L. Clock outlets (simplex) shall be 120V, Leviton Cat. No. 689 or equal, cover plate to match existing facility installations.
- M. Toggle Switches: Comply with NEMA WD 1, UL 20, and FS W-S-896. Commercial-industrial type, 20 amp, 120/277 V AC, from the following:
1. Single Pole:
 - a. Cooper; AH1221.
 - b. Hubbell; HBL1221.
 - c. Leviton; 1221-2.
 - d. Pass & Seymour; CSB20AC1.
 2. Two Pole:
 - a. Cooper; AH1222.
 - b. Hubbell; HBL1222.
 - c. Leviton; 1222-2.
 - d. Pass & Seymour; CSB20AC2.
 3. Three Way:
 - a. Cooper; AH1223.
 - b. Hubbell; HBL1223.
 - c. Leviton; 1223-2.
 - d. Pass & Seymour; CSB20AC3.
 4. Four Way:
 - a. Cooper; AH1224.
 - b. Hubbell; HBL1224.
 - c. Leviton; 1224-2.
 - d. Pass & Seymour; CSB20AC4.
- N. Pilot-Light Switches, 120/277 V, 20 A: Single pole, with neon-lighted handle, illuminated when switch is "off."
1. Cooper; AH1221PL.
 2. Hubbell; HBL1201PL.
 3. Leviton; 1221-LH1.
 4. Pass & Seymour; PS20AC1RPL, PS20AC1RPL7.
- O. Key-Operated Switches, 120/277 V, 20 A: Single pole, with factory-supplied key in lieu of switch handle.
1. Cooper; AH1221L.
 2. Hubbell; HBL1221L.
 3. Leviton; 1221-2L.
 4. Pass & Seymour; PS20AC1-L.
- P. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors unless noted otherwise.

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1. Cooper; 1995.
2. Hubbell; HBL1557.
3. Leviton; 1257.
4. Pass & Seymour; 1251.

Q. Cover plates for flush mounted receptacles and switches:

1. Mechanical, utility, kitchen and Exterior: provide 0.040" stainless steel cover plates in all areas and all devices.
2. Office and classroom areas: Provide 0.040" stainless steel cover plates. Plastic cover plates matching the wiring devices specified for millwork.
3. Where wiring devices are grouped, set in gangs with one cover plate.
4. Where wiring devices are noted to be weatherproof, provide cast cover, gasketed & hinged, while-in-use rated and lockable cover.
5. Use jumbo size plates, 302 stainless steel for outlets installed in masonry walls or as specified by Owner and existing facility standard installation.

R. Manual motor starter: Square D "Class 2510" for 120V, 1ph motors.

S. Communication Outlets:

1. CommScope is Owner Standardized Equipment.
2. Terminate each data outlet listed in drawings with one blue CommScope Cat 6 snap in jack. Use the TIA/EIA T568-A/B termination method. Provide blanks as necessary to fill all unused positions of the outlet. Snap-in jacks to accommodate UTP, fiber optic, and coaxial connectors were indicated on drawings.
3. Surface Mounted Data Outlets: Provide raceway #LD10E16-A to metal junction box #JBX3510EI-A. Color by Owner.

2.14 FUSES

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

1. Bussmann, an Eaton business.
2. Edison; a brand of Bussmann by Eaton.
3. Littelfuse, Inc

B. CARTRIDGE FUSES

1. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.
 - a. Type RK-1: 600-V, zero- to 600-A rating, 200 kAIC, time delay.
 - b. Type RK-5: 600-V, zero- to 600-A rating, 200 kAIC, time delay.
 - c. Type CC: 600-V, zero- to 30-A rating, 200 kAIC, fast acting, time delay.
 - d. Type J: 600-V, zero- to 600-A rating, 200 kAIC, time delay.
2. 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.
3. Comply with NEMA FU 1 for cartridge fuses.
4. Comply with NFPA 70.
5. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

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2.15 ENCLOSED SWITCHES AND CIRCUIT BREAKERS:

- A. Provide safety and fused switches, horsepower rated, quick-make and quick-break design, externally operated with provision for padlocking in "OFF" position, fusible or non-fusible as shown on the Drawings. Cartridge to accommodate Class R fuses.
- B. Provide enclosures clearly marked for maximum voltage, current, and horsepower rating, and:
 - 1. Indoor: General Duty, NEMA Type 1
 - 2. Outdoor: Heavy Duty, NEMA Type 3R, Rain-tight
 - 3. Kitchen Wash-down areas: Heavy Duty, NEMA Type 4x
- C. For switches having dual ratings (higher rating when used with dual-element fuses), provide ratings indicated on a metal plate riveted or otherwise, or permanently fastened to the enclosure.
- D. For switches serving equipment with multiple motors, switches shall be fused as indicated on the equipment nameplate.

2.16 ENCLOSED CONTROLLERS:

- A. General: Provide Cutler-Hammer or equal, of the sizes and types needed for the operations shown on the Drawings, specified herein, and otherwise required for the facility and with the following attributes:
 - 1. Comply with pertinent requirements of NEMA and NEC.
 - 2. Include required accessory items.
 - 3. Lockable handle to "OFF" position for combination starters.
 - 4. Horsepower rated, with interchangeable thermal overloads and with double-break contacts capable of interrupting 10 times the rated motor current.
 - 5. Normally reset without entering the starter enclosure.
 - 6. Equipped with overloads in each ungrounded leg.
 - 7. Equipped with integral phase loss protection.
 - 8. In finished areas where conduit is concealed, switches shall be flush mounted.
- B. Manual Starters:
 - 1. For both single-phase and three-phase starters, provide units that open all ungrounded conductors simultaneously.
 - 2. For single-phase starters, provide units of tumbler switch type that clearly indicate ON, OFF, and TRIPPED positions. Switches shall have built-in thermal overload protection for reach ungrounded conductor. Switches shall be Square D class 2510 or equal.
 - 3. For three-phase starters, provide pushbutton operated units with START-STOP-RESET button on the enclosure cover. Provide handle guards for padlocking in the "OFF" position.
- C. Magnetic Starters:
 - 1. Provide units with operating coils designed to operate on line voltage or any other auxiliary voltage shown on the Drawings.

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2. For starters with line voltage operating coils, provide built-in under-voltage release.
 3. Provide units with the accessories and auxiliary contacts needed for automatic or remote operation as shown on the Drawings.
- D. Combination Starters:
1. Provide units complying with requirements for magnetic starters and, in addition, with a fused switch on the same enclosure.
 2. Provide circuit protection to comply with NEC requirements for the motor being operated.
- E. Lock-out/Tag-out Requirements: Per Owners requirements.

2.17 SURGE PROTECTION FOR ELECTRICAL POWER CIRCUITS

- A. General SPD Requirements:
1. SPD with Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Comply with NFPA 70.
 3. Comply with UL 1449.
 4. MCOV of the SPD shall be the nominal system voltage.
- B. SERVICE ENTRANCE AND TRANSFER SWITCH SUPPRESSOR
1. Type 1 for service equipment where the device is ahead of the service disconnect.
 2. Integral disconnect switch.
 3. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
 4. Indicator light display for protection status.
 5. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
 6. Surge counter.
- C. PANELBOARD SUPPRESSORS
1. Type 2 for panelboards on the load side of the service disconnect.
 2. Include LED indicator lights for power and protection status.
 3. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
- A. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 200 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.
- B. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V, three-phase, four-wire circuits shall not exceed the following:
1. Line to Neutral: 1200 V for 480Y/277 V.
 2. Line to Ground: 1200 V for 480Y/277 V.
 3. Line to Line: 2000 V for 480Y/277 V.

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- C. Protection modes and UL 1449 VPR for grounded wye circuits with 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:
 - 1. Line to Neutral: 700 V for 208Y/120 V.
 - 2. Line to Ground: 1200 V for 208Y/120 V.
 - 3. Line to Line: 1000 V for 208Y/120 V.
- D. Protection modes and UL 1449 VPR for 240/120 V, single-phase, three-wire circuits shall not exceed the following:
 - 1. Line to Neutral: 700 V.
 - 2. Line to Ground: 700 V.
 - 3. Neutral to Ground: 700 V.
 - 4. Line to Line: 1200 V.
- E. SCCR: Equal or exceed 200 kA.
- F. Inominal Rating: 20 kA.
- G. ENCLOSURES
 - 1. Indoor Enclosures: NEMA 250, Type 1.
 - 2. Outdoor Enclosures: NEMA 250, Type 3R.

2.18 INTERIOR AND EXTERIOR LIGHTING FIXTURES:

- A. LED TROFFER - MANUFACTURERS
 - 1. Pre-Approved Manufacturers Listed: Products of firms regularly engaged in the manufacture of recessed LED lighting fixtures of types and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years. The manufacturer of the lighting fixtures shall comply with the provisions of the appropriate code and standards. All fixtures shall be pretested before shipping. Provisions for a single fixture shipped to the project site shall become property of the Owner to test and evaluate the construction meets or exceeds the original fixture approved by the Owner and listed in the fixture schedule.
 - 2. Conformance: Fixtures shall be manufactured in strict accordance with the Contract Drawings and Specifications.
 - 3. Codes: Materials and installation shall be in accordance with the latest revision of the National Electrical Code and any applicable Federal, State, and local codes and regulations.
 - 4. UL or CSA US Listing: All fixtures shall be manufactured in strict accordance with the appropriate and current requirements of the "Standards for Safety" to UL 8750 or others as they may be applicable. A listing shall be provided for each fixture type, and the appropriate label or labels shall be affixed to each fixture in a position concealing it from normal view.
 - 5. Luminaire Flat Panel Edge Lit shall be DLC Premium Certified (Design Lights Consortium).
 - 6. Specifications and scale drawings are intended to convey the salient features, function and character of the fixtures only, and do not undertake to illustrate or set forth every item or detail necessary for the work.
 - 7. Base Bid Manufacturers: Are listed on fixture schedule and specification. Manufacturers listed without accompanying catalog numbers are responsible for

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meeting the quality standards and photometric distribution set by the specified product.

8. Alternate Manufacturers: Identification by means of manufacturers names and catalog numbers is to establish basic features, quality and performance standards. Any substitutions must meet or exceed these standards. The three listed manufacturers are pre-approved Owner's standard fixtures and substitution request may not be allowed prior to bid.

B. LED LUMINAIRE SOURCE REQUIREMENTS

1. LED's shall be manufactured by, Nichia, Cree, Samsung or Osram.
2. Lumen Output – minimum initial lumen output of the luminaire shall be as follows for the lumens exiting the luminaire in the 0-90-degree zone - as measured by IESNA Standard LM-79-08 in an accredited lab. Exact tested lumen output shall be clearly noted on the shop drawings.
3. Type 2x4: 40 Watt, Efficacy (lm/W) >123 @ 5000K for ceilings up to 10'-0".
4. Type 2x4: 48 Watt, Efficacy (lm/W) >124 @ 5000K for ceilings 10'-1" to 12'-0".
5. Type 2x2: 30 Watt, Efficacy (lm/W) >121 @ 5000K for ceilings up to 10'-0".
6. Type 2x2: 40 Watt, Efficacy (lm/W) >119 @ 5000K for ceilings 10'-1" to 12'-0".
7. 4-Ft Strip: 45 Watt, Efficacy (lm/W) >128 @ 5000K.
8. Recessed Fixtures: Comply with NEMA LE 4.
9. Provide adjustable Kelvin Rating drivers for fixtures located in Special Education Classrooms. Provide manufacturer specified wall switch.
10. Rated lamp life of 50,000 hours. Lumen output shall not decrease by more than 20% over the minimum operational life of 50,000 hours.
11. Individual LEDs shall be connected such that a catastrophic loss or the failure of one LED will not result in the loss of the entire luminaire.
12. LED Boards shall be suitable for field maintenance or replacement with plug-in connectors at power supply/drive.
13. Light Color/Quality:
14. Correlated Color temperature (CCT) range as per specification, luminaire sources and 5000K shall be correlated to chromaticity as defined by the absolute (X, Y) coordinates on the 2- D CIE chromaticity chart.
15. The color rendition index (CRI) shall be 82 or greater.
16. Chromaticity shift over 6,000 hours shall be <0.007 change in delta-u'v' average as demonstrated data set in IESNA LM-80-08 report.
17. Lumen Maintenance Factor: >0.84 at 25°C, 50,000 hours and reported in TM-21 L70 Lifetime >60,000 hours.
18. Binning: Per ANSI, 3-step MacAdam ellipse with abilities to produce uniform color across copious quantities of fixtures.

C. LED LUMINAIRE POWER SUPPLY AND DRIVE REQUIREMENTS

1. Driver: Instant start. 120 – 277 Volt, UL Listed, CSA Certified, Sound Rated A+. Driver shall be > 85% efficient at full load across all input voltages. Input wires shall be 18AWG solid copper minimum.
2. Flat Panel Edge-lit LED: The electronics/power supply enclosure shall be external to the SSL luminaire and be accessible per UL requirements.
3. Dimming: Driver shall be suitable for full-range dimming. The luminaire shall be capable of continuous dimming without perceivable flicker over a range of 100% to 5% of rated lumen output with a smooth shut off function. Dimming shall be

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controlled by a 0-10V signal. Signal wires shall be 22 AWG solid copper minimum.

4. Compatible with Leviton dimming device(s): DS710-10Z or equal.
5. Electrical Characteristics:
6. Power Factor: >0.93.
7. Input Power: 120-277V, 50/60 Hz.
8. Total Harmonic Distortion (THD): <20%.
9. The surge protection which resides within the driver shall protect the luminaire from damage and failure for transient voltages and currents as defined in ANSI/IEEE C64.41 2002 for Location Category A, where failure does not mean a momentary loss of light during the transient event.
10. Material Usage: Drivers shall be (ROHS)-compliant.
11. Warranty: Five (5) years.

D. LED FLAT PANEL CONSTRUCTION

1. Frame: LED strips mounted on edges enclosed in solid extruded aluminum frame, painted after formed with UV-stabilized acrylic optical lens with a full aluminum back. Construction seals conditioned air from the plenum or non-conditioned air. Housing shall be designed rigid to eliminate warping or bending for level installation. Frame corners conformed for seamless appearance.
2. Optical Lens/Diffusers:
3. Acrylic: One hundred percent virgin UV-stabilized acrylic (PMMA) optical panel, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
4. Each luminaire shall consist of an assembly that utilizes LEDs as the light source. In addition, a complete luminaire shall consist of a housing, LED array, and electronic driver (power supply) and integral controls as per this specification.
5. Each luminaire shall be designed to operate at an average operating temperature - 4°F to 104°F.
6. Humidity: 20% – 85% RH, Lighting Facts.
7. Luminaire housing to have no visible welding, screws, springs, hooks, rivets, bare LED's or plastic supports in viewing angles at floor to ceiling placement.
8. The luminaire shall be a single, self-contained device, not requiring on-site assembly for installation. The power supply and circuit board for the luminaire shall be fundamental to the unit.
9. Driver disconnect shall be provided where required to comply with codes.
10. Finish: Polyester white powder coat painted with 92% high-reflective paint after fabrication.
11. Integral Grid Clips required on recessed mounted luminaires along with integral tie wire mounting points. Compatible with standard 15/16" and 9/16" T-Bar ceilings.
12. Luminaire to have air removal capability where specified.
13. Any questions shall be directed to Randy Ramsey in the Bond office of TPS. Office: 918-746-6131 or E-mail: ramsera@tulsaschools.org
14. NOTE: As new technologies become available this specification will be changed. Do not assume you have the latest spec, ask for the most recent revised specification from Tulsa Public Schools bond office.

E. RECESSED LED DOWNLIGHTS

1. An approved manufacturer same as LED troffers or equal. 4000K minimum.
2. Housing finish to be white unless otherwise specified

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3. Must be able to accept an actual lensed R-30 LED, with Edison medium base.

F. LED HIGH-BAY

1. Housing: Low copper, corrosion resistant, die cast aluminum.
2. Optics/Lens: High transmittance opaque glass lens sealed (IP66) with silicone gasket. Narrow, medium and wide distribution types. Optically opaque plastic lens factory installed to diffuse source intensity.
3. LED Source: High power LED source, with performance of 135 lumens per Watt.
4. LED source color: 3000K-5000K, CRI >80.
5. LED Drivers: UL/CSA recognized component to meet UL8750 & EN61347.
6. Light beam spread: 120° wide beam.
7. Finish: High-gloss black powder coated heat-radiative coating, anti-corrosion, anti-UV paint.
8. Mounting: Beam clamp, ceiling, hook and stem mount availability.
9. Input Power: 120-277V, 50/60 Hz.
10. Total Harmonic Distortion (THD): <20%.
11. Dimming: Driver shall be suitable for full-range dimming. The luminaire shall be capable of continuous dimming without perceivable flicker over a range of 100% to 10% of rated lumen output with a smooth shut off function. Dimming shall be controlled by a 0-10V signal. Signal wires shall be 22 AWG solid copper minimum. Compatible with Leviton dimming device(s): DS710-10Z or equal.
12. Operating Temperature: -30°C to +55°C ambient.
13. Material Usage: Drivers shall be (ROHS)-compliant.
14. Warranty: Five (5) years.

G. EXIT SIGNS:

1. Comply with LM80 and with authorities having jurisdiction for sign colors and lettering size, and with be LED illuminated
2. Internally Lighted Signs: As follows:
3. Lamps for AC Operations: Light-emitting diodes, 50,000 hours minimum rated lamp life
4. Self-Powered Exit Signs (Battery Type)” Integral automatic charger in a self-contained power pack.
5. Battery: Sealed, maintenance-free, nickel-cadmium type with special warranty
6. Charger: Fully automatic, solid-state type with sealed transfer relay.
7. Operation: Relay automatically energizes lamp from unit when circuit voltage drops to 80 percent of nominal or below. When normal voltage is restored, relay disconnects lamps, and battery is automatically recharged and floated on charger.

H. EMERGENCY LIGHTING UNITS:

1. Self-contained units Comply with UL 924/LM 80. Units include the following features:
 - a. Battery: Sealed, maintenance-free nickel - cadmium type with minimum 10-year nominal life and special warranty.
 - b. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - c. Operation: Relay automatically turns lamp on when supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level

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when normal voltage is restored, relay disconnects lamps and batter is automatically recharged and floated on charger.

I. EMERGENCY LED POWER SUPPLY UNIT:

1. Self-contained, modular, battery-inverter unit factory mounted within fixture body-comply with UL 924/LM 80.
2. Test Switch and light-emitting diode indicate light: Visible and accessible without opening fixture or entering ceiling space.
3. Battery: Sealed, maintenance-free, nickel-cadmium type with minimum 10-year nominal life.
4. Charger: Fully automatic, solid-state, constant-current type.
5. Operation: Relay automatically energizes lamp from unit when normal supply circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamp, and battery is automatically recharged and floated on charger.
6. Do not support from sub-purlins of panelized roof systems.

PART 3 - EXECUTION

3.1 ELECTRICAL SITE COORDINATION AND PREPARATION

- A. Examine the areas and the Conditions under which Work of this Section will be performed. Correct conditions detrimental to timely and proper completion of this work. Do not proceed until unsatisfactory conditions are corrected.
- B. Coordinate with local utility company temporary and permanent power requirements for the project. Provide a request for all utilities to be located and marked at project site prior to the start of Work. Prepare site easements for saw-cutting, trenching and backfill. Coordinate power outages with Owner and utility company 10-days prior to outage.
- C. Coordination with Division Trades:
 1. Coordinate as necessary with other trades to assure proper and adequate provision in this Work of those trades for interface with the Work of this Section.
 2. Coordinate the installation of electrical items with the schedule for Work of other trades to prevent unnecessary delays in the total Work.
 3. Where lighting fixtures and other electrical items are shown in conflict with locations of structural members and mechanical or other equipment, provide required supports and wiring to clear the encroachment.
 4. Provide 110-volt temperature control, control transformers in enclosures and interlock wiring. Coordinate all requirements with mechanical contractor prior to rough-in and installation.
 5. Provide weatherproof ground-fault receptacles within 25'-0" of devices and equipment to be readily-accessible for maintenance.
- D. Coordinate arrangement, mounting and support of electrical equipment:
 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.

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2. Provide for ease of disconnecting the equipment with minimum interference to other equipment installations.
 3. Allow right-of-way for piping and conduit installed at required slope.
 4. Connecting raceways, cables, wireways, cable trays and busways to be clear of obstructions and allow working clearances of other equipment.
- E. Where outlets are not specifically located on the Drawings, locate as determined in the field by the Architect. Where outlets are installed without such specific direction, relocate as directed by the Architect and at no additional cost to the Owner.
- F. The Electrical Drawings are diagrammatic but are required to be followed as closely as actual construction and Work of other trades will permit. Where deviations are required to conform with actual construction and the Work of other trades, make such deviations without additional cost to the Owner.

3.2 INSTALLATION OF CONTROL-VOLTAGE ELECTRICAL POWER CABLES

- A. Comply with requirements in Section 260400 "Raceways and Boxes for Electrical Systems" for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or modified in this Section.
1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.
 2. Outlet boxes for optical-fiber cables shall be no smaller than 4 inches square by 2-1/8 inches deep with extension ring sized to bring edge of ring to within 1/8 inch of the finished wall surface.
 3. Flexible metal conduit shall not be used.
- B. Comply with TIA-569-C for pull-box sizing and length of conduit and number of bends between pull points.
- C. Install manufactured conduit sweeps and long-radius elbows if possible.
- D. Raceway Installation in Equipment Rooms:
1. Position conduit ends adjacent to a corner on backboard if a single piece of plywood is installed, or in the corner of the room if multiple sheets of plywood are installed around perimeter walls of the room.
 2. Secure conduits to backboard if entering the room from overhead.
 3. Extend conduits 3 inches above finished floor.
 4. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
- E. General Requirements for Cabling:
1. Comply with TIA-568-C Series of standards and BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems".
 2. Cables may not be spliced.
 3. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 4. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in

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- BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Install lacing bars and distribution spools.
 - 5. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 - 6. Support: Do not allow cables to lay on removable ceiling tiles.
 - 7. Secure: Fasten securely in place with hardware specifically designed and installed to not damage cables.
- F. Installation of Control-Circuit Conductors:
- 1. Install wiring in raceways. Comply with requirements specified in Section 260400 "Raceways and Boxes for Electrical Systems."
- G. Open-Cable Installation:
- 1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 - 2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 30 inches apart.
 - 3. Cable shall not be run through or on structural members or in contact with pipes, ducts, or other potentially damaging items. Do not run cables between structural members and corrugated panels.
- H. Installation of Cable Routed Exposed under Raised Floors:
- 1. Install plenum-rated cable only.
 - 2. Install cabling after the flooring system has been installed in raised floor areas.
 - 3. Below each feed point, neatly coil a minimum of 72 inches of cable in a coil not less than 12 inches in diameter.
- I. Minimum Control-Circuit Conductor Sizes:
- 1. Class 1 remote-control and signal circuits; No 14 AWG.
 - 2. Class 2 low-energy, remote-control, and signal circuits; No. 16 AWG.
 - 3. Class 3 low-energy, remote-control, alarm, and signal circuits; No 12 AWG.
- J. Identification: Identify data and communications system components, wiring, and cabling according to TIA-606-A; label printers shall use label stocks, laminating adhesives, and inks complying with UL 969.

3.3 INSTALLATION OF LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS

- A. Conductor Material Applications:
- 1. Feeders: Copper for feeders smaller than No. 250 MCM; copper or aluminum for feeders No. 250 MCM and larger. Conductors shall be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger. Adjust raceway sizes accordingly where use of aluminum material is allowed.
 - 2. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
 - 3. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.
- B. Conductor Insulation and Multiconductor Cable Applications and Wiring Methods:

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1. Service Entrance: Type THHN/THWN-2, single conductors in raceway.
 2. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
 3. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway.
 4. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.
 5. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
 6. Branch Circuits Concealed in Millwork and Wall Partitions: Metal-clad cable, Type MC.
 7. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
- C. Installation of Conductors and Cables:
1. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
 2. Complete raceway installation between conductor and cable termination points according to Section 260400 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
 3. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
 4. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
 5. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.
 6. Support cables according to Section 260400 "Hangers and Supports for Electrical Systems."
- D. Connections:
1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
 2. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.
- E. Identification: Identify and color-code conductors and cables according to NFPA 70. Identify each spare conductor at each end with identity number and location of other end of conductor and identify as spare conductor.
- F. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- G. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260400 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."
- H. Other Requirements:
1. Conductors No. 4 and larger, provide insulating bushings or insulating sleeves.
 2. Provide barriers in boxes where different voltages and conductor insulation exist.
 3. Install control wiring for equipment or as required by other Division Trade Work.

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4. Tape all joints with rubber tape 1-1/2 times the thickness of the conductor insulation, then cover with a minimum of two half-lapped layers of Scotch Brand No. 33 vinyl-plastic electrical tape.
 5. Provide expansion fittings in conduits which are non-continuous and exposed to the weather.
- I. Wire Sizes:
1. Increase wire sizes and raceway to next largest AWG size for: (Size shown of 60% load, increase as required for larger loading)
 - a. 120 volt circuits exceeding 150 feet in circuit length.
 - b. 208 volt circuits exceeding 250 feet in circuit length.
 2. Wire sizes shall be increased for the above conditions whether indicated on the Drawings.
- J. Use identified (white) neutrals and colored-coded phase wires for all branch circuit wiring.
1. Make splices electrically and mechanically secure with pressure-type ILSCO Snapblock connectors, or LSI lugs to make splices electrically and mechanically secure. Soldering is not permitted for grounding equipment.
 - a. For wires size 6 AWG and smaller, provide "Scotch-lock" connectors.
 2. For wires size 4 AWG and larger, provide Burndy "Versitaps" and heavy-duty connectors, or T&B "lock-tite" connectors.

3.4 INSTALLATION OF GROUNDING SYSTEMS

- A. Coordinate existing conditions and wiring configurations to assure proper grounding systems are installed per NEC Art. 250. Where existing system grounding means are not known or clearly identifiable, contact Owner to provide as-built documents prior to start of Work.
- B. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- C. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.
1. Bury at least 24 inches below grade.
- D. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.
- E. Conductor Terminations and Connections:
1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 3. Connections to Ground Rods at Test Wells: Bolted connectors.

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4. Connections to Structural Steel: Welded connectors.
- F. Grounding at The Service: Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.
- G. Grounding Separately Derived Systems: Generator - Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.
- H. Comply with IEEE C2 grounding requirements.
- I. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.
- J. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.
- K. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation. Coordinate with the local utility company requirements and specifications for utility transformers prior to Work.
- L. Equipment Grounding: Install insulated equipment grounding conductors with all feeders and branch circuits.
- M. Water Heater, Heat-Tracing, and Anti-frost 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.
- N. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.
- O. 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.

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- P. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- Q. 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.
- R. 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.
- S. 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.
- T. Perform tests and inspections as listed in "Testing and Inspections".
- U. Report measured ground resistances that exceed the following values:
 - 1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
 - 2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
 - 3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
 - 4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).
 - 5. Substations and Pad-Mounted Equipment: 5 ohms.
 - 6. Manhole Grounds: 10 ohms.
- V. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance.

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3.5 HANGERS AND 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, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70 utilizing listed beam clamps and supports. Tie-wires shall not be an acceptable method of securing raceways.
- C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
- E. 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.
- F. 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 .
- G. 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 Existing Concrete: Expansion anchor fasteners.
 - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
 - 6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
 - 7. To Light Steel: Sheet metal screws.
 - 8. 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.
- H. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

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I. Concrete Bases:

1. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
2. Use 3000-psi , 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements as specified by equipment manufacturer.
3. Anchor equipment to concrete base:
 - a. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - b. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - c. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.6 RACEWAYS AND BOXES INSTALLATION

- A. Selection of Raceways: Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of raceways. Consult Architect for resolution of conflicting requirements.
- B. Outdoors:
1. Exposed and Subject to Physical Damage: RMC.
 2. Exposed and Not Subject to Physical Damage: IMC.
 3. Concealed Aboveground: EMT.
 4. Direct Buried: PVC-40.
 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
- C. Indoors:
1. Hazardous Classified Locations: RMC.
 2. Exposed and Subject to Physical Damage: IMC.
 3. Exposed and Not Subject to Physical Damage: EMT.
 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 5. Damp or Wet Locations: IMC.
 6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC.
- D. Raceway Fittings: Select fittings in accordance with NEMA FB 2.10 guidelines.
1. RMC and IMC: Provide threaded type fittings unless otherwise indicated.
- E. Installation of Raceways:
1. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for installation of raceways. Consult Architect for resolution of conflicting requirements.
 2. Comply with requirements in Section 260400 "Hangers and Supports for Electrical Systems" for hangers and supports.

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3. Install raceways square to the enclosure and terminate at enclosures without hubs with locknuts on both sides of enclosure wall. Install locknuts hand tight, plus one-quarter turn more.
 4. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4" and insulated throat metal bushings on 1-1/2" and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
 5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
 6. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
 7. Support conduit within 12" of enclosures to which attached.
 8. MC Cable or FMC is allowed in limited uses: Lighting whips, interior partition walls, and millwork. MC Cable is NOT allowed for homerun branch circuits.
 9. Adjust raceway sizes required for derating and ambient temperatures.
 10. Provide necessary sleeves and chases where conduits pass through floors and walls, and provide other necessary openings and spaces, arranging to prevent unnecessary cutting.
 11. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal interior of raceways at the following points:
 - a. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - b. Where an underground service raceway enters a building or structure.
 - c. Conduit extending from interior to exterior of building.
 12. Do not install conduits within 2" of the bottom side of a metal deck roof.
 13. Keep raceways at least 6" away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
 14. Install pull wires in empty raceways. Provide polypropylene or monofilament plastic line with not less than 200 lb tensile strength.
 15. Do not install aluminum raceways or fittings in contact with concrete or earth.
- F. Underground conduit installations where open trenching occurs and accessible to public, shall require barriers and warning tape per OSHA guidelines.
- G. Where conduit or wiring is exposed, run parallel to, or at right angles with, lines of the building.
1. Make bends with standard conduit elbows or conduit bent to not less than the same radius.
 2. Make bends free from dents and flattening.
 3. Where outlets and devices are installed exposed on masonry walls, contractor shall route conduit up to highest point on wall to junction box serving the device vertically.
- H. Where conduits pierce the roof, provide 24-gauge galvanized iron roof jacks and flashing collar brazed onto the conduits and covering the top of the roof jacks. Any brazing shall occur prior to installation of conductors.
- I. When boring, cutting or drilling structural wood or wall members, drill only in locations as approved by the Architect.

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J. Installation of Boxes and Enclosures:

1. Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures.
2. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
3. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box, whether installed indoors or outdoors.
4. Locate boxes so that cover or plate will not span different building finishes.
5. Support boxes in recessed ceilings independent of ceiling tiles and ceiling grid.
6. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for purpose.
7. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits.
8. Do not install aluminum boxes, enclosures, or fittings in contact with concrete or earth.

K. INSTALLATION OF UNDERGROUND RACEWAYS

L. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit 36-inch below grade and 24-inch below finished slab-on-grade. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured rigid steel conduit elbows for stub-ups at poles, equipment pads and at building entrances through floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
 - c. For PVC stub-ups at equipment mounted on concrete bases with formed raceway opening to enter cabinets, enclosures and boxes. Install PVC End Bell on service conduits for conductors No. 4 AWG and larger prior to pulling conductors.
5. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits, but a minimum of 6 inches below grade. Align planks along centerline of conduit.

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6. Underground Warning Tape: Provide at all utility and onsite generation for service entrances and comply with requirements listed by the Owner and local utility company.

M. INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

1. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
2. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
3. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.
4. Install handholes with bottom below frost line, 16-inches below grade.
5. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.
6. Field cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.7 SLEEVE-SEAL SYSTEM INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
 - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

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- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
 - 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work and as specified by roofing manufacturer.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.
- H. Sleeve-Seal-System Installation
 - 1. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
 - 2. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- I. Sleeve-Seal-Fitting Installation
 - 1. Install sleeve-seal fittings in new walls and slabs as they are constructed.
 - 2. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
 - 3. Secure nailing flanges to concrete forms.
 - 4. Using grout, seal the space around outside of sleeve-seal fittings.

3.8 LOW-VOLTAGE TRANSFORMER INSTALLATION

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for transformers.
- B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's published instructions.
- C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.
- D. Environment: Enclosures must be rated for environment in which they are located. Covers for UL 50E, Type 4X enclosures may not cause accessibility problems.

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- E. Coordinate system connection types for WYE, DELTA and CORNER GROUNDED DELTA configurations prior to installation.
- F. Install wall-mounted transformers level and plumb with wall brackets fabricated.
- G. Construct concrete bases and anchor floor-mounted transformers in accordance with manufacturer's published instructions, seismic requirements applicable to Project, and requirements in Section 260400 "Hangers and Supports for Electrical Systems."
- H. Secure transformer to concrete base in accordance with manufacturer's published instructions.
- I. Secure covers to enclosure and tighten bolts to manufacturer-recommended torques to reduce noise generation.
- J. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

3.9 SWITCHBOARD INSTALLATIONS

- A. Install switchboards and accessories according to NECA 400 and NECA 1.
- B. Floor-Mounting: Section 260400 "Installation of Power Equipment."
- C. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.
- D. Install filler plates in unused spaces of panel-mounted sections.
- E. Install overcurrent protective devices, surge protection devices, and instrumentation.
- F. Provide breakers with ground-fault protection of equipment for listed areas:
 - 1. Kitchens.
 - 2. Garages.
 - 3. Bathrooms and Locker Rooms.
 - 4. Exterior equipment not supplied with integral ground-fault protection.
 - 5. Mechanical and Janitorial closets for equipment not supplied with integral ground-fault protection.
 - 6. Locations where equipment is located within 6'-0" of water source or listed wet locations.
- G. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with OSHA and NFPA 70E.
- H. Switchboard Nameplates: Label each switchboard compartment with a nameplate.

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- I. Device Nameplates: Label each disconnecting, and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate.
- J. Test and Inspections: Section 260400 "Testing and Inspections."
- K. Switchboard will be considered defective if it does not pass tests and inspections.
- L. Train Owner's maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories.

3.10 PANELBOARD INSTALLATION

- A. Comply with NECA 1.
- B. Install panelboards and accessories according to NECA 407.
- C. Mount top of trim 90 inches above finished floor where top-most operating handle is not higher than 79 inches above finished floor unless otherwise indicated.
- D. Mount panelboard cabinet plumb and rigid without distortion of box.
- E. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- F. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
- G. Provide breakers with ground-fault protection of equipment for listed areas:
 - 1. Kitchens.
 - 2. Garages.
 - 3. Bathrooms and Locker Rooms.
 - 4. Exterior equipment not supplied with integral ground-fault protection.
 - 5. Mechanical and Janitorial closets for equipment not supplied with integral ground-fault protection.
 - 6. Locations where equipment is located within 6'-0" of water source or listed wet locations.
- H. Make grounding connections and bond neutral for service entrance and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
- I. Install filler plates in unused spaces.
- J. Stub three 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or floor below slab not on grade.
- K. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

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- L. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with OSHA and NFPA 70E.
- M. Panelboard Nameplates: Label each switchboard compartment with a nameplate.
- N. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate.
- O. Test and Inspections: Section 260400 "Testing and Inspections."
 - 1. Panelboards will be considered defective if they do not pass tests and inspections.

3.11 INSTALLATION OF WIRING DEVICES

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
 - 1. Protect installed devices and their boxes. 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 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 right 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.

3.12 INSTALLATION OF FUSES

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- B. Install labels complying with requirements for identification specified in "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

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3.13 INSTALLATION OF ENCLOSED SWITCHES AND CIRCUIT BREAKERS

A. ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

1. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.
 - a. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 - b. Outdoor Locations: NEMA 250, Type 3R.
 - c. Kitchen or Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
 - d. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
 - e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
 - f. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7 with cover attached by Type 316 stainless steel bolts.

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Owner no fewer than ten days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Owner or Construction Manager's written permission.
4. Comply with NFPA 70E.

C. 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.

D. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

E. Install fuses in fusible devices.

F. Comply with NFPA 70 and NECA 1.

G. IDENTIFICATION

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

H. Test and Inspections: Section 260400 "Testing and Inspections."

1. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

I. Prepare test and inspection reports.

1. Test procedures used.
2. Include identification of each enclosed switch and circuit breaker tested and describe test results.

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3. List deficiencies detected, remedial action taken, and observations after remedial action.

3.14 INSTALLATION OF ENCLOSED CONTROLLERS

- A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height, and with disconnect operating handles not higher than 79 inches above finished floor, unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with "Hangers and Supports for Electrical Systems."
- B. Floor-Mounted Controllers: Section 260400 "Installation of Power Equipment."
- C. Install fuses in each fusible-switch enclosed controller.
- D. Install fuses in control circuits if not factory installed. Comply with requirements in "Fuses."
- E. Install heaters in thermal overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.
- F. Comply with NECA 1.
- G. Identification
 1. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified in "Identification for Electrical Systems."
 - a. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - b. Label each enclosure with engraved nameplate.
 - c. Label each enclosure-mounted control and pilot device.
- H. Control Wiring Installation
 1. Install wiring between enclosed controllers and remote devices and facility's central control system. Comply with requirements in "Control-Voltage Electrical Power Cables."
 2. Bundle, train, and support wiring in enclosures.
 3. Connect selector switches and other automatic-control selection devices where applicable.
 - a. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.
 - b. Connect selector switches with enclosed-controller circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.
- I. Test and Inspections: Section 260400 "Testing and Inspections."
- J. Adjusting:

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1. Set field-adjustable switches and overload-relay pickup and trip ranges.
2. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable instantaneous trip elements. Initially adjust to six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Engineer of Record before increasing settings.

3.15 INSTALLATION OF INTERIOR LIGHTING

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Supports: Sized and rated for luminaire weight.
- E. Flush-Mounted Luminaire Support: Secured to outlet box.
- F. Wall-Mounted Luminaire Support:
 1. Attached to structural members in walls.
 2. Do not attach luminaires directly to gypsum board.
- G. Ceiling-Mounted Luminaire Support:
 1. Ceiling mount with two 5/32-inch- diameter aircraft cable supports adjustable to 120 inches in length.
 2. Ceiling mount with pendant mount with 5/32-inch- diameter aircraft cable supports adjustable to 120 inches in length.
 3. Ceiling mount with hook mount.
- H. Suspended Luminaire Support:
 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
 2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
 3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of luminaire chassis, including one at each end.
 4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
- I. Ceiling-Grid-Mounted Luminaires:
 1. Secure to any required outlet box.

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2. Secure luminaire using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
 - J. Comply with requirements in Section 260400 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.
 - K. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260400 "Identification for Electrical Systems."
 - L. Perform the following tests and inspections:
 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
 3. Photometric Requirements:
 - a. The performance shall be adjusted (depreciated) by using the LED manufacturer's data or the data from the IESNA Standard TM-21 test report, whichever one results in a higher level of lumen depreciation.
 - b. The initial minimum illuminance level is achieved in 100% of the area of the specified lighting pattern.
 - c. The measurements shall be calibrated to standard photopic calibrations.
 - d. Luminaire shall be tested per IESNA LM 79-08.
 - M. Luminaire will be considered defective if it does not pass operation tests and inspections.
 - N. Prepare test and inspection reports.
- 3.16 INSTALLATION OF SURGE PROTECTION FOR ELECTRICAL POWER CIRCUITS
- A. Comply with NECA 1.
 - B. Install an OCPD or disconnect as required to comply with the UL listing of the SPD.
 - C. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible, and adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
 - D. Use crimped connectors and splices only. Wire nuts are unacceptable.
 - E. Complete startup checks according to manufacturer's written instructions. Energize SPDs after power system has been energized, stabilized, and tested.
 - F. Test and Inspections: Section 260400 "Testing and Inspections."
 - G. Prepare test and inspection reports.

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- H. Train Owner's maintenance personnel to operate and maintain SPDs.

3.17 INSTALLATION OF POWER EQUIPMENT

- A. FLOOR-MOUNTED EQUIPMENT CONCRETE PAD: Install switchboards, transformers and enclosed controllers on concrete bases, 4-inch nominal thickness. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."
 - 1. Install conduits entering under the vertical section where the conductors will terminate. Install with couplings flush with the concrete base. Extend 2 inches above concrete base after equipment is anchored in place.
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
 - 3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, straps and brackets, and temporary blocking of moving parts from enclosures and components.
- C. Provide power and control wiring for HVAC, switchboards, panelboards, motor starters and safety switches as shown on the Drawings.
- D. Connections to miscellaneous building equipment:
 - 1. Wire to, and connect to, all items of building equipment not specifically described but to which line-voltage electrical power is required.
 - 2. Coordinate as necessary with other trades and suppliers to verify types, numbers and locations of equipment.
 - 3. Make final connections to all kitchen equipment per manufacturer's instructions.
 - 4. Mark each pull-box/junction box with a permanent ink marker the panel designation and circuit number contained.
- E. Mounting Heights:
 - 1. Install light switch at 48 inches to center of device above finished floor. Unless otherwise noted.
 - 2. Install convenience receptacle at 18 inches to center of device above finished floor. Unless otherwise noted.
 - 3. Install convenience receptacle at 4 inches to center of device, above back splash of counter top. Unless otherwise noted.
 - 4. Install telephone jack rough in at 18 inches to center of device above finished floor. Unless otherwise noted.
 - 5. Install telephone jack for side-reach wall telephone, to position top of telephone at 54 inches to center of device, above finished floor. Unless otherwise noted.

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3.18 MATERIAL AND EQUIPMENT

- A. All materials and equipment shall be new, of the same type and manufacture, and shall be of the best quality and design and free from defects.
- B. A Manufacturer's nameplate affixed in a conspicuous place will be required on each major component of equipment stating Manufacturer's name, address and catalog number.

3.19 MISCELLANEOUS ITEMS

- A. The Contractor shall provide all miscellaneous items that would normally be required for proper installation of all electrical systems specified herein.
- B. Completed wiring systems shall be free from short circuits. After completion, this Division 26 shall perform tests for insulation resistance in accordance with the requirements of the National Electrical Code.
- C. Complete temperature control wiring rough-in is the responsibility of this Division 26. Coordinate with Division 23 to provide all locations for rough-in box and conduit requirements. Temperature control wiring shall be installed in conduit as specified by Division 23. Final terminations shall be by Division 23 unless system is 110 volts or greater.
- D. Provide all disconnects and safety switches for mechanical and plumbing equipment. Where safety switches serve equipment with multiple motors, switches shall be fused according to the nameplate of the equipment, or the breaker serving the equipment shall be "HACR" type.

3.20 CUTTING AND PATCHING

- A. The Electrical Contractor shall be responsible for cutting all floors, walls, partitions, ceilings or other construction required for proper installation of his Work. No cutting shall be done without prior approval of the Architect and all cutting shall be performed as directed by the Architect. Compacting of soil shall be provided in accordance to Division 2 Work. Concrete and Asphalt Work shall be provided in accordance to Division 2 Work.
- B. The Electrical Contractor shall provide and install fire-safing material in penetrations through fire rated walls, floors, and ceilings in accordance with local codes.

3.21 CLEANING AND PLACING IN SERVICE

- A. Immediately prior to final inspection, the Contractor shall make a final cleanup of dirt and refuse resulting from his Work and shall assist in keeping the premises clean at all times.

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- B. Immediately prior to final inspection, the Contractor shall clean all material and equipment installed under this Contract. Dirt, dust, plaster, stains and foreign matter shall be removed from all surfaces. Damaged finishes shall be touched up and restored to their original Condition.
- C. Mechanism of all equipment shall be checked, adjusted and tested for proper operation. Protective devices and parts shall be checked and tested for specified and required application and adjusted as required to produce the intended performance.

3.22 ADJUSTMENT AND INSTRUCTION

- A. Energize all systems, equipment, and fixtures and check for proper operation. Check electrical feeders for proper phasing and balance loads between phases.
- B. Position adjustable light fixtures to meet approval of Architect.

3.23 TESTING AND INSPECTION:

- A. Provide personnel and equipment, make required tests, and secure approvals from the Owner and governmental agencies having jurisdiction.
- B. Make written notice to the Owner adequately in advance of each of the following stages of construction:
 - 1. Underground electrical system installation is complete, but not covered.
 - 2. Rough-in installation of electrical systems are complete, but not covered.
 - 3. At final completion of the Work of this Section 260400.
- C. When material and/or workmanship is found to not comply with the specified requirements, within three days after receipt of notice of such non-compliance, remove the non-complying items from the job site and replace them with items complying with the specified requirements, all at no additional cost to the Owner.
- D. Provide personnel and equipment to perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Acceptance Testing:
 - a. Test insulation resistance for each distribution bus, component, connecting supply, feeder, and control circuit. Open control and metering circuits within the enclosure and remove neutral connection to surge protection and other electronic devices prior to insulation test. Reconnect after test.
 - b. Test continuity of each circuit. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Values shall not deviate more than 50 percent of lowest value tested.
 - c. Test ground-fault protection for service equipment per NFPA 70.
 - d. Use suitable test instrument to measure resistance to ground system. Test in accordance with test instrument manufacturer's specified fall-of potential method.
 - 2. Tests and Inspections:

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- a. Perform each visual, accessible bolted electrical connection, mechanical inspection and electrical test for component type stated in NETA Acceptance Testing Specification including Tables. Certify compliance with test parameters.
 - b. Correct malfunctioning units on-site where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - c. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
 - d. Prior to energizing motors, verify voltages are within plus or minus 10 percent of nameplate rated voltages at motor.
 - e. Test each connected motor for proper phase rotation.
- E. In the Owner's Presence:
- 1. Test all parts of the electrical system and prove that all such items provided under this Section function electrically in the required manner.
 - 2. Measure voltages between phases and between phase wires and neutrals, and report these voltages to the Owner.
 - 3. Immediately submit to the Owner a report of maximum and minimum voltages, and a copy of the recording volt-meter chart.
- F. Adjust and set all time clocks in accordance with Owner's instructions.
- G. When material and/or workmanship is found to not comply with the specified requirements, within three days after receipt of notice of such non-compliance, remove the non-complying items from the job site and replace them with items complying with the specified requirements, all at no additional cost to the Owner.
- 3.24 PROJECT COMPLETION:
- A. Upon completion of the Work of this Section, thoroughly clean all exposed portions of the electrical installation, removing all traces of soil, labels, grease, oil, and other foreign material, and using only the type cleaner recommended by the Manufacturer of the item being cleaned.
 - B. Thoroughly indoctrinate the Owner's operation and maintenance personnel in the contents of the operations and maintenance manual required to be submitted under Article 1.05 of this Section of these Specifications.

END OF SECTION 260400



T U L S A

PUBLIC SCHOOLS

Premise Cabling Specifications

January, 2019

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Objective

This document establishes a structured cable system standard for Tulsa Public Schools. The design and installation should conform to the applicable Electronics Industry Association (EIA) and Telecommunications Industry Association (TIA) standards, Building Industry Consulting Service International (BICSI) guidelines. Proposed adjustments or exceptions to this "Premise Cabling Specification" document will need to be approved by the Tulsa Public Schools IT Project Manager prior to installation.

General Information

The Premise Wiring System will be a copper & fiber optic based TIA/EIA T568-A/B compliant infrastructure for voice & data communications. The CAT 6 & fiber optic cabling shall be a certified Uniprise solution.

Work Included

The specifications consist of furnishing all labor, equipment, supplies and materials. It includes performing all operations necessary for the complete installation of a Premise Wiring System in accordance with the accompanying drawings & specifications. The work shall include but not be limited to the following:

- A. Furnish and install cable and terminations as specified. Terminate all pairs.
- B. Furnish and install Cat 6 Patch Panels for termination of network cabling.
- C. Furnish and install cabinets or racks and extend AC power to the same.
- D. Furnish and install telephone 110 blocks and surge protection.
- E. Furnish & install 110-C5 connecting blocks for feeder cables & 110-C4 blocks for station cables.
- F. Furnish and install connectors and wall plates and terminate as specified.
- G. Furnish and install all conduit, surface mounted raceway systems, boxes, cover plates and connector housings for all communications systems outlet locations.
- H. Furnish and install all bridle rings and or D-rings, J-hooks required to support the data and phone cable as specified here in.

Acceptable Manufacturers

These specifications are based on equipment manufactured by or for specific manufacturers. It is not the intent of these specifications to limit or restrict submission of proposals for products by other manufacturers but to maintain the current architecture and system integrity.

Vendor Qualifications

The installing Vendor must have a minimum of 5 year's previous experience in Premise Wiring. The installing Contractor's on site Project Lead shall be a registered Communications Distribution Designer (RCDD). The Vendor must have a current Uniprise Certification. Change of the Project Lead shall not be acceptable without prior approval from the owner's Project Lead. The installing Vendor is required to provide references.

Cat. 6 Applications for Premise Wiring

The specifications for premise wiring contained in this document adhere to the CAT 6 standard. The CAT 6 solution is the current standard for Tulsa Public Schools.

1 General Specifications for Premise Wiring

1A. Functional Requirements

This specification is built around a plenum rated copper and fiber optic cable based TIA/EIA T568-A/B compliant wiring infrastructure for telephone and data communications. Any use of this section will require authorization from the TPS IT Project Manager.

(Exception: A flooded cable and industrial modular jacks will be required where pathways to the users work stations are susceptible to moisture or water table fluctuations, in order to prevent corrosion. The installer of the flush mounted floor boxes will require coordination with the Cabling Contractor to insure the mounting frame for these specific industrial data jacks meets functional requirements).

1B. Cabling from IDF

Data Cabling Fiber

The new IDF is located in _____. Provide one six strand armored multimode fiber optic cable directly to the site MDF located _____ and terminate all strands with LC connectors. Rack mounted fiber interconnect enclosures should be provided for the termination of the fiber optic cables that the contractor will pull from the new IDF to the sites MDF.

Duplex, Multimode, Six Strand Fiber Cable

- A. OEM4 armored and Aqua in color general purpose tight buffer multi-mode cable with glass size of 50 microns (Zip cord type is not allowed). The product is to conform to TIA/EIA Horizontal Distribution Fiber Requirements.
- B. Each strand will have a 125um diameter elastomeric buffer surrounded by aramid strength member.
- C. Loaded minimum bend radius of **6.8** inches, unloaded minimum bend radius of **1** inch.
- D. Maximum short-term load will be ? lbs., long-term maximum load of **180** lbs.
- E. The maximum attenuation in Db per kilometer at 850 nm will be **3.0** Db and at 1300 nm it will be **1.0** Db.
- F. The minimum bandwidth at 850 nm will be **1500** MHz and at 1300 nm it will be **500** MHz.

Data Cabling Copper

Provide TIA/EIA T568A Cat 6 compliant UTP four pair cable for locations noted herein. Do not exceed a total footage of 300' for any single run including the 10' loop. As noted on the Room Matrix, provide Cat 6 UTP, blue cable directly to local data port locations.

Voice Cabling Copper

The new IDF is located in _____. Provide 1-25 pair Uniprise Cat 6 UTP White tie cables between the IDF and the site MDF. The site MDF is located _____. Terminate each pair using White Uniprise Cat 6 snap in jacks installed in vertical rack, provide blanks as necessary to fill all unused positions of the outlet. As noted in Room Matrix, provide TIA/EIA 568A Cat 6 UTP White.

Data Patch Cables:

The IDF will require a Patch Panel as well as wire management, vertical on each side of the rack and horizontal between each jack panel and each switch scheduled for install. The cabling contractor will provide each station to be activated with the proper length Uniprise Patch Cabling. The Patch Cables

will be Cat 6 compliant, factory terminated with RJ45 connectors in accordance with EIA T568B method. The cordage will be formed neatly in the rack with Velcro style ties. The work station locations noted in the Room Matrix will require Cat 6 compliant Uniprise Patch Cables, factory terminated with RJ45 connectors in accordance with EIA T568B method. The Contractor will provide each station to be activated with the appropriate length patch cable. Provide quantity in IDF or MDF = equal to the number of patch panel ports and workstations = equal to the number of jacks.

1C. Hardware

Racks and Cabinets:

MDF Relay Racks – Data racks that are to contain multi-media components or larger data components must follow these specifications:

- A. Standard two post aluminum relay rack frame to accept standard 19” wide equipment
Do not place the rack in a permanent position without prior written consent from the owner’s Project Lead. The rack must be anchored.
- B. Coordinate with the project electrical contractor or project lead to hardwire Electrical power from the proper circuit to the rack mounted battery backup unit.
- C. Provide rack mounted vertical surge protective AC power strip to each new rack as required.
- D. Color: Black with matte (satin) finish.
- E. Provide proper length Uniprise Category 6 jumper cables for all active ports at this location. Install the cables using wire management in such a manner that there is no weight or stress on the connectors.
- F. Provide vertical and horizontal wire management for all data racks and cabinets. **One 2 unit horizontal management will be placed above and below every 48 port patch panel.**

Coordinate the installation of all racks with the owner’s project lead. Racks or cabinets shall not be installed without prior approval from the owner’s project lead. Installations that have not been approved and are incorrectly located will be moved at the contractor’s expense.

Racks:

IDF Relay Racks - Data racks that are to contain minimal components must follow these specifications:

- A. Standard two post aluminum relay rack frame to accept standard 19” wide equipment.
Do not place the rack in a permanent position without prior written consent from the owner’s project lead. The rack must be anchored.
- B. Coordinate with the project electrical Vendor or project lead to hardwire Electrical power from the proper circuit to the IDF rack mounted power strips.
- C. Provide surge protective AC power strips, shelves, etc. as required.
- D. Color: Black with matte (satin) finish.
- E. Provide proper length Uniprise Category 6 jumper cables for all active ports at this location. Install the cables using wire management in such a manner that there is no weight or stress on the connectors.

F. Provide vertical and horizontal wire management for all data racks and cabinets.

Coordinate the installation of all racks with the owner's project lead. Racks or cabinets shall not be installed without prior approval from the owner's project lead. Installations that have not been approved and are incorrectly located will be moved at the Vendor's expense.

- #55053-703 (Chatsworth) -- Black Rack with matte finish
- #30091-703 (Chatsworth) -- Black vertical wire management
- #12853-701 (Chatsworth) -- Black rack mount AC power strip 38"

Data Jack Panels

Each IDF\MDF will require a modular blank jack panel either 24 or 48 port based upon quantity of cables terminated. Terminate all Category 6 cabling on Uniprise Cat 6 compliant jack panels. Provide sufficient quantity of connection points for all Cat 6 active ports plus 20% open for spares. With each jack panel and associated switch location, provide a wire management panel with dimensions sufficient for the number of connections being supported.

Fiber Optic Connectors

Fiber Optic connectors will be provided for all fiber optic strands and will provide the following features:

- A. Field installable LC compatible high-precision glass-in-ceramic ferrule accommodating all 50 micron multi-mode fibers.
- B. Installation methods – Any warranty approved method.
- C. Typical average loss of 0.25dB and a maximum of 0.5 dB with no more than 0.2 dB loss after 1000 insertions.

Quantities As Required

Wall plates & Connectors

The contractor will be responsible for providing all plates for communications boxes for interconnection to voice and data systems. The contractor will also be responsible for providing blank inserts for every communications face plate having available unused ports. Provide sample color to the owner for approval prior to purchase. Coordinate these plates and connectors with the existing components and match those components.

- Wall plates – Provide single gang Uniprise flush mount wall plates for all communication box locations shown on drawings.
 - a. #M12L-262 ---- White two port faceplate
 - b. #M13L-262 ---- White three port faceplate
 - c. #M14L-262 ---- White four port faceplate
 - d. #M16L-262 ---- White six port faceplate
- Provide j-boxes and faceplates for surface mounted raceway.
 - All Raceway must be anchored no less than every 3', all boxes must have 2 anchors installed.***
 - a. #JBX3510WH-A ---- Junction box
 - b. #LD5WH8-A ---- Raceway (for up to 3 Cat 6 cables)
 - i. #LD10WH8-A ---- Raceway for 4 or more Cat 6 cables

Data Outlets

Terminate each data outlet with one blue Uniprise Cat 6 snap in jack. Use the TIA/EIA T568-A/B termination method. Provide blanks as necessary to fill all unused positions of the outlet.

1D. Voice Termination System

- A. Analog voice lines will use White Cat 6 snap in jacks for all terminations located in the distribution frames and room. MDF/IDF will have patch panels in racks exclusively for analog voice lines.
- B. Provide single White Cat 6 4 pair from MDF to Demarcation location. Provide single White Cat 6 from MDF to Principals office for 911 Red phone connectivity.
- C. Provide a single ¾' ACX plywood sized to accommodate the terminating block at the AT&T Demarcation. This backboard must be painted with fire retardant, high quality white paint. Coordinate the location of the backboard to be installed with the owner. Mount all voice related blocks to this board.
- D. All ferrous hardware, screws and associated miscellaneous items will be galvanized for cadmium plated to prevent rust.
- E. Provide a 12 pair surge protection block with plug-in gas style module for each line pair. Protection blocks will be grounded through a #8 conductor to a single start solid ground point. Protectors will be capable of clamping to a voltage of no more that (+) 15% of the sets operating voltage.

1E. Data & VOIP Systems

The Data Premise Wiring System will be a copper based **TIA/EIA T568-A/B/B compliant** infrastructure for data communications. The CAT 6 cabling shall be a Certified Uniprise installation as required utilizing the following cabling:

- CS-Uniprise (#6540+Blue CPK) Cat 6 plenum Blue

Cabling from the MDF/IDF

Data Cabling– Provide **TIA/EIA compliant 568B CAT 6** UTP cable runs, not to exceed a maximum footage of 295' each, including a 10' maintenance loop. As noted on the Location Matrix, provide CAT 6 CS-Uniprise (#6540+Blue CPK) blue cable directly to local data port locations. A 10' cable loop should be left at the location of the cable drop and terminated to jack part number #UNJ600-BL – Cat 6 jacks blue terminated to B standard. A white label with the IDF-Panel and port number will be placed on station end of the cable.

Data Jack panels & Patch Cables

Each IDF\MDF will require a modular blank jack panel either 24 or 48 port based upon quantity of cables terminated. The following Commscope part numbers should be used for the jack panels and jacks.

- #UNJ600-BL -- Cat 6 jacks blue

- #M2000-24-1U(Commscope) -- 24-P modular blank jack panel
- #M2000-48-2U(Commscope) -- 48-P modular blank jack panel

The vendor will provide each terminated cable to be patch in with the proper length Commscope Patch Cabling. The Patch Cables will be CAT 6 compliant, terminated with RJ 45 connectors in accordance with the TIA/EIA T568-A/B/B method. The patch cable will be formed neatly in the rack with Velcro style ties. The following Commscope part numbers should be used for the patch cables:

- #UNC6-BL-3F ---- Cat 6 3ft blue patch cable (only in wall racks)
- #UNC6-BL-5F ---- Cat 6 5ft blue patch cable
- #UNC6-BL-7F ---- Cat 6 7ft blue patch cable

1F. Specifications for Wireless Premise Wiring

The Wireless Premise Wiring System will be a copper based TIA/EIA T568-A/B CAT 6 compliant infrastructure for data communications. The CAT 6 cabling shall be a Certified Uniprise installation as required utilizing the following cabling:

- CS-Uniprise 655 (#4759314/10) Cat 6 plenum Yellow

Cabling from the MDF/IDF

Data Cabling– Provide TIA/EIA compliant 568B CAT 6 UTP cable for locations noted herein. Do not exceed a total footage of 300' for any single run. As noted on the Location Matrix, provide CAT 6 CS-Uniprise (#6540+YELLOW CPK) yellow cable directly to local data port locations. A 10' cable loop should be left at the location of the cable drop and terminated to jack part number # UNJ600-YL – Cat 6 jacks yellow terminated to B standard. A yellow label with the IDF-Panel and port number will be placed on the ceiling grid directly below the station end of the cable.

Data Jack panels & Patch Cables

Each IDF\MDF will require a modular blank jack panel either 24 or 48 port based upon quantity of cables terminated. The following Systimax part numbers should be used for the jack panels and jacks.

- # UNJ600-YL -- Cat 6 jacks yellow
- # 107984007 | M101SMB-B-262 – Ceiling biscuit jack White
- #M2000-24-1U(Systimax) -- 24-P modular blank jack panel
- #M2000-48-2U(Systimax) -- 48-P modular jack panel

The cabling contractor will provide each terminated cable to be patch in with the proper length Systimax Patch Cabling. The Patch Cables will be CAT 6 compliant, terminated with RJ 45 connectors in accordance with the TIA/EIA T568-B method. The cordage will be formed neatly in the rack with Velcro style ties. The following Systimax part numbers should be used for the patch cables:

- #UNC6-YL-3F ---- Cat 6 3ft yellow patch cable
- #UNC6-YL-5F ---- Cat 6 5ft yellow patch cable
- #UNC6-YL-7F ---- Cat 6 7ft yellow patch cable

1G. Specifications for Security Premise Wiring

The Security Premise Wiring System will be a copper based TIA/EIA T568-B compliant infrastructure for data communications. The CAT 6 cabling shall be a Certified Uniprise installation as required utilizing the following cabling:

- CS-Uniprise (#6504+ORANGE CPK) Cat 6 plenum orange

Cabling from the MDF/IDF

Data Cabling– Provide TIA/EIA compliant 568B CAT 6 UTP cable for locations noted herein. Do not exceed a total footage of 300' for any single run. As noted on the Location Matrix, provide CAT 6 CS-Uniprise (#6504+ORANGE CPK) orange cable directly to local data port locations. A 10' cable loop should be left at the location of the cable drop and terminated to jack part number at both ends # UNJ600-OR – Cat 6 jacks orange terminated to B standard. An orange label with the IDF-Panel and port number will be placed on the camera housing and the station end of the cable.

The cabling contractor will provide each terminated cable a 5' Orange patch cable

Data Jack panels & Patch Cables

Each IDF/MDF will require a modular blank jack panel either 24 or 48 port based upon quantity of cables terminated. The following Systimax part numbers should be used for the jack panels and jacks.

- # UNJ600-OR -- Cat 6 jacks orange
- # 107984007 | M101SMB-B-262 – Ceiling biscuit jack White
- #M2000-24-1U(Systimax) -- 24-P modular blank jack panel
- #M2000-48-2U(Systimax) -- 48-P modular jack panel

The cabling contractor will provide each terminated cable to be patch in with the proper length Systimax Patch Cabling. The Patch Cables will be CAT 6 compliant, terminated with RJ 45 connectors in accordance with the TIA/EIA T568-B method. The cordage will be formed neatly in the rack with Velcro style ties. The following Systimax part numbers should be used for the patch cables:

- # UNC6-OR-3F ---- Cat 6 3ft orange patch cable
- # UNC6-OR-5F---- Cat 6 5ft orange patch cable
- # UNC6-OR-7F---- Cat 6 7ft orange patch cable
- #M101SMB-B-262 ---- White bisect jack

1H. Specifications for Energy ES2 Premise Wiring

The Energy ES2 Premise Wiring System will be a copper based TIA/EIA 568-A/B compliant infrastructure for data communications. The Cat 6 cabling shall be a Certified Uniprise installation as required utilizing the following cabling:

- CS-Uniprise 655(#4760314/10) Cat 6 plenum Green

Cabling from the MDF/IDF

Data Cabling– Provide TIA/EIA compliant 568B CAT 6 UTP cable for locations noted herein. Do not exceed a total footage of 300' for any single run. As noted on the Location Matrix, provide CAT 6 CS-Uniprise 655 (#4760314/10) Green cable directly to local data port locations. A 10' cable loop should be left at the location of the cable drop and terminated to jack part number #CC0020552/1 – Cat 6 jacks Green terminated to B standard. A yellow label with the IDF-Panel and port number will be placed on the ceiling grid directly below the station end of the cable.

The cabling contractor will provide each terminated cable with a 5' Green patch cable

Data Jack panels & Patch Cables

Each IDF\MDF will require a modular blank jack panel either 24 or 48 port based upon quantity of cables terminated. The following Systimax part numbers should be used for the jack panels and jacks.

- # UNJ600-GN -- Cat 6 jacks Green
- # 107984007 | M101SMB-B-262 – Ceiling biscuit jack White
- #M2000-48-2U(Systimax) -- 48-P modular jack panel

The cabling contractor will provide each terminated cable to be patch in with the proper length Systimax Patch Cabling. The Patch Cables will be CAT 6 compliant, terminated with RJ 45 connectors in accordance with the TIA/EIA T568-B method. The cordage will be formed neatly in the rack with Velcro style ties. The following Systimax part numbers should be used for the patch cables:

- #UNC6-GN-3F ---- Cat 6 3ft Green patch cable
- #UNC6-GN-5F ---- Cat 6 5ft Green patch cable
- #UNC6-GN-7F ---- Cat 6 7ft Green patch cable

1I. Specifications for Video Premise Wiring

The Video Premise Wiring System will use the same specifications for Data & VOIP listed in section 1E.

1J. Specifications for Lighting Premise Wiring

The Lighting Premise Wiring System will be a copper based TIA/EIA T568-A/B CAT 6 compliant infrastructure for data communications. The CAT 6 cabling shall be a Certified Uniprise installation as required utilizing the following cabling:

- CS-Uniprise (#6540+BROWN CPK) Cat 6 plenum Brown

Cabling from the MDF/IDF

Data Cabling– Provide TIA/EIA compliant 568B CAT 6 UTP for locations noted herein. Do not exceed a maximum footage of 300' for any single run. As noted on the Location Matrix, provide CAT 6 CS-Uniprise (#6540+BROWN CPK) brown cable directly to local data port locations. A 10' cable loop should be left at the location of the cable drop and terminated to jack part number # UNJ600-BR – Cat 6

jacks Brown terminated to B standard. A brown label with the IDF-Panel and port number will be placed on the ceiling grid directly below the station end of the cable.

Data Jack panels & Patch Cables

Each IDF\MDF will require a modular blank jack panel either 24 or 48 port based upon quantity of cables terminated. The following Systimax part numbers should be used for the jack panels and jacks.

- # UNJ600-BR -- Cat 6 jacks brown
- # 107984007 | M101SMB-B-262 – Ceiling biscuit jack White
- #M2000-24-1U(Systimax) -- 24-P modular blank jack panel
- #M2000-48-2U(Systimax) -- 48-P modular jack panel

The vendor will provide each terminated cable to be patch in with the proper length Systimax Patch Cabling. The Patch Cables will be CAT 6 compliant, terminated with RJ 45 connectors in accordance with the TIA/EIA T568-B method. The cordage will be formed neatly in the rack with Velcro style ties. The following Systimax part numbers should be used for the patch cables:

- #UNC6-BR-3F ---- Cat 6 3ft brown patch cable
- #UNC6-BR-5F ---- Cat 6 5ft brown patch cable
- #UNC6-BR-7F ---- Cat 6 7ft brown patch cable

1K. Specifications for Clocks Premise Wiring

The Clocks Premise Wiring Systems will be a copper based TIA/EIA 568-A/B compliant infrastructure for data communications. The Cat 6 cabling shall be a Certified Uniprise installations as required utilizing the following cabling:

- CS-Uniprise 655 (#4760314/10) Cat 6 plenum Black

Cabling from the MDF/IDF

Data Cabling– Provide TIA/EIA compliant 568B CAT 6 UTP for locations noted herein. Do not exceed a maximum footage of 300' for any single run. As noted on the Location Matrix, provide CAT 6 CS-Uniprise (# 6-1427215-1 BLACK CPK) Black cable directly to local data port locations. A 10' cable loop should be left at the location of the cable drop and terminated to jack part number # UNJ600-BL – Cat 6 jacks Black terminated to B standard. A white label with the IDF-Panel and port number will be placed on the ceiling grid directly below the station end of the cable.

The cabling contractor will provide each terminated cable a 5' Black patch cable.

Data Jack panels & Patch Cables

Each IDF\MDF will require a modular blank jack panel either 24 or 48 port based upon quantity of cables terminated. The following Systimax part numbers should be used for the jack panels and jacks.

- #700206667 – Cat 6 jacks Black
- #760163444 (Commscope) – 48-P unloaded modular patch panel

The vendor will provide each terminated cable to be patch in with the proper length Systimax Patch Cabling. The Patch Cables will be CAT 6 compliant, terminated with RJ 45 connectors in accordance with the TIA/EIA T568-B method. The cordage will be formed neatly in the rack with Velcro style ties. The following Systimax part numbers should be used for the patch cables:

1L. Specifications for Intercoms Premise Wiring

The Intercoms Premise Wiring System will be a copper based TIA/EIA 568-A/B compliant infrastructure for data communications. The Cat A cabling shall be Certified Uniprise installations as required utilizing the following cabling:

- CD-Uniprise 655 (#4760314/10) Cat 6 plenum Black

Cabling from the MDF/IDF

Data Cabling— Provide TIA/EIA compliant 568B CAT 6 UTP for locations noted herein. Do not exceed a maximum footage of 300' for any single run. As noted on the Location Matrix, provide CAT 6 CS-Uniprise (# 6-1427215-1 BLACK CPK) Black cable directly to local data port locations. A 10' cable loop should be left at the location of the cable drop and terminated to jack part number # UNJ600-BL – Cat 6 jacks Black terminated to B standard.

A white label with the MDF/IDF-Panel and port number will be placed on the ceiling grid directly below the station end of the cable.

The cabling contractor will provide each terminated cable a 5' Black patch cable.

Data Jack panels & Patch Cables

Each IDF\MDF will require a modular blank jack panel either 24 or 48 port based upon quantity of cables terminated. The following Systimax part numbers should be used for the jack panels and jacks.

- #700206667 – Cat 6 jacks Black
- #760163444 (Commscope) – 48-P unloaded modular patch panel

The vendor will provide each terminated cable to be patch in with the proper length Systimax Patch Cabling. The Patch Cables will be CAT 6 compliant, terminated with RJ 45 connectors in accordance with the TIA/EIA T568-B method. The cordage will be formed neatly in the rack with Velcro style ties. The following Systimax part numbers should be used for the patch cables:

1M. Premise Wiring Specifics for Trailers

- A. A minimum of 1 voice and 6 data connections installed per trailer.
- B. All Basic Link data cabling and all voice connectivity should come to the trailers from the nearest IDF/MDF. (Exceptions: 1. Fiber Optic link required for network connectivity should terminate at MDF. 2. No pairs available at IDF for voice.)
- C. Aerial feeders are preferred over underground, depending on the availability of poles to flag or height restrictions.
- D. Buried cabling will be placed in a 3-inch schedule 40 rigid, nonmetallic aboveground/underground conduit.
- E. Voice and data wire will be run separate from fire alarm, security and intercom wire.
- F. When the trailer or trailers are located over 300 ft. from the nearest MDF/IDF, a 4 strand Multimode Fiber Optic feeder should be installed from the MDF/IDF. The Fiber should then terminate in a small LIU. All station cabling will be brought to this point. This will require a Wall Mounted Rack and Jack panel.
- G. All Voice cabling will need to come directly from the MDF room via 25 pr. and terminated on a 110 block at a predetermined area to be determined by the owner. Phone lines will be distributed from here.
- H. All voice and data wiring, 110 blocks and panels, faceplates and fiber strands should be by standards set forth by Tulsa Public Schools
- I. Any point of entry made to trailers or buildings should be sealed.
- J. Areas where any digging takes place should be level and free of debris (rocks, trash etc.) upon completion.

2 Labeling Standard

2A. Guidelines

COLOR	CABLING	JACK	PATCH CABLES	USE
BLACK	6504+BLACK CPK	UNJ600-BK	UNC6-BK	Intercom/Clock
ORANGE	6504+ ORANGE CPK	UNJ600-OR	UNC6-OR	SECURITY CAMERAS (Jack patch only)
YELLOW	6504+YELLOW CPK	UNJ600-YL	UNC6-YL	WIRELESS
BROWN	6504+BROWN CPK	UNJ600-BR	UNC6-BR	LIGHTING
WHITE	6504+ WHITE CPK	UNJ600-WH	UNC6-WH	VOICE
VIOLET	6504+VIOLET CPK	UNJ600-VL	UNC6-VL	Analog Voice to

A.	h				Rack	
	e	BLUE	6504+ BLUE CPK	UNJ600-BL	UNC6-BL	DATA/VOIP
	T u	PINK	6504+ Pink CPK			Security Camera Runs

sa Public Schools color code standard is as follows: Blue for data, White for voice, Yellow for wireless and Pink for security cameras runs. The correct color label will be placed on the ceiling grid directly below any cables terminated above the ceiling. *The patch cables and jacks or outlets will follow the same standard.*

- B. All cables shall be labeled on the insulation jacket on each terminating end.
- C. All cable terminations shall be clearly and permanently labeled.
- D. Labeling of the jack panels, jacks or outlets shall be provided on white labels with black typed characters.
- E. Hand written labels shall not be permitted.
- F. Labeling will consist of MDF/IDF room location, (Rack number if multiple racks), patch panel termination and port number. Patch panel labeling will be alphabetical starting at the top of the rack with A and descending down the rack. Please use the following example:
MDF162-PPA-24 (Single rack, no identification required)
MDF162R2-PPA-24 (Rooms with multiple Racks Installed)
- G. The installer will provide a sample of the labeling terminology for approval with project submittals.

2B. Racks, Jack panels & Termination Blocks

Racks located in MDF/IDF locations should be labeled using a numerical format beginning with 1 and continuing as required.

- A. Termination Blocks or Jack panels shall be labeled with an alphabetical identifier. This identifier for a rack mounted panel should begin with the letter A and continue on through the alphabet as more jack panels are added to that particular rack or wall space.
- B. Labeling of panels or punch blocks with letters will begin again with A as more blocks are added in a different termination zone. For example, labeling of panels should begin again with the letter A for each new rack and the labeling of panels on the wall should begin with A.
- C. Individual ports on the panel should be numbered in ascending order. If not printed on the panel by the manufacturer, the vendor is responsible for making sure that each port is labeled with its own number.

2C. Horizontal Cable and Outlet Boxes

- A. Each end of the horizontal cable should be labeled on the outside jacket of the cable within 12 inches of the termination points.

B. Outlet boxes shall be labeled on the appropriate area with the cable identifier.

3. Communication Room Requirements

3A. MDF Room

The telecommunications closet must have enough space to support required communications systems, including projected growth. A typical Main Distribution Frame (MDF) Room is composed of a wall mounted plywood backboard and relay racks designed for mounting termination equipment and electronics. There will be one MDF communications closet per building. It should ideally be located in a central location. If the building does not require additional communications closets then the MDF must be located where the farthest cable point is no more than 300' as described below.

Size

A distance of 4 feet is the required clearance from all sides of a relay rack. However, if there are space constraints, it is acceptable to provide a minimum of two feet clearance on one rack side of access clearance for cross-connect fields, patch panels, etc. If possible, locate sleeves, cores, slots and/ or conduits together in one area to maximize usable wall space. To plan for future expansion space should be allowed for an extra rack. When requirements are not known, the EIA 569 standard recommends that there be a minimum of 0.74 square feet of space for every 100 square feet of workspace (a minimum 150 square feet is recommended).

Cable Length

Telecommunications closets should be situated to minimize the length and the quantity of wire runs needed for the vertical (backbone) and horizontal distribution systems. The maximum horizontal distribution cable distance must be less than 90 meters (295ft.), independent of media type. This distance represents the cable length from the mechanical termination of the media in the telecommunications closet to the outlet in the work area. Vertical (backbone) distribution system distance limitations vary, and are dependent upon media, topology and facility issues. If the length of any cable run to a work area exceeds the 90 meter limitation, additional IDF or MDF/ IDF Telecommunications Closets must be used. Note that this limitation is for actual terminated cable length, not point-to-point distance.

Door

The door should be at least thirty-six inches (36") wide by eighty inches (80") tall and should swing open out of the room. The door should lock from outside access. The lock core should be keyed as a TPS standard MDF key. The door shall contain no glass.

Lighting

All telecommunications closets require adequate light. Within ceilings, position light fixtures at least 8 feet above the finished floor. Indirect (reflected) lighting is not recommended. If possible, minimize heat and glare by using LED light fixtures with protective covers instead of incandescent fixtures. Do not place light fixtures where the light may be blocked or filtered. Typically, light fixtures should not be directly above or within 12 inches of cabling, equipment cabinets, termination frames or other free standing equipment. Install light fixtures on power circuits separate from those used for communications equipment. Light switches should be the motion sensor, auto switching type.

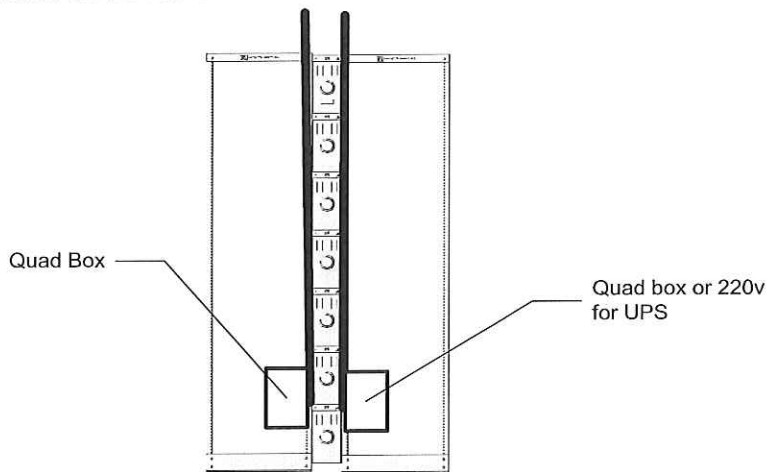
Environment

Since electronic equipment is somewhat sensitive to changes in temperature and humidity, it is recommended that a stable environment be established for areas housing such equipment. HVAC should be included in the design of the room in order to maintain a room temperature of approximately 70

degrees with the full complement of equipment in the room. Relative humidity should be maintained between 30% and 55%. MDF closets should also be equipped with temperature sensing monitors.

Electrical Requirements

MDF rooms shall have a minimum of two dedicated 120volt/30 amp circuits for the rack mounted equipment and one 120volt/30 amp circuit for the voice equipment. Depending upon the UPS requirements the requirements could be one 220 volt circuit and one 120volt dedicated 30 amp circuits. Each individual circuit should be provided via a four position outlet box. The 220 Volt circuit will be for the UPS with the 120volt/30 amp provided for the other equipment in the rack. The remaining 30 amp circuit will be placed in the room for the voice equipment and should be located in an area with that equipment on the plywood backboard. One Chatsworth 10 outlet rack mounted power strip should be available for each two relay racks. The feed should be run from above the racks and mounted to the frame of the rack.



Electrical layout - view
from back

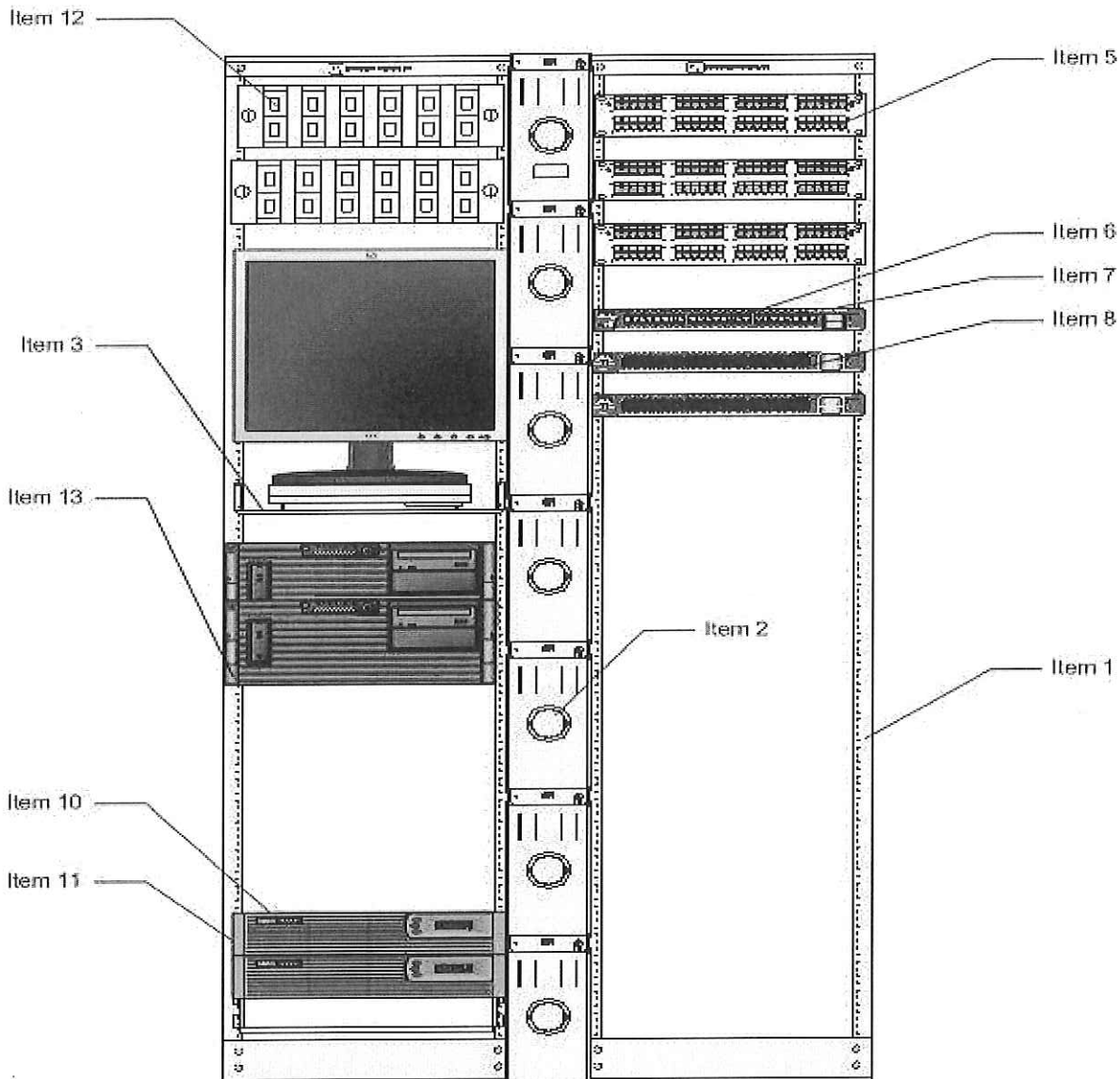
Grounding:

Most telecommunications equipment requires bonding and grounding of equipment cabinets. Do not use plumbing or conduit (EMT) fixtures as a ground source. Grounding shall meet the NEC and EIA/TIA requirements and practices except where other authorities or codes impose more stringent requirements or practices. Grounding should be terminated directly to the "Building Source Ground".

Plywood Backboard:

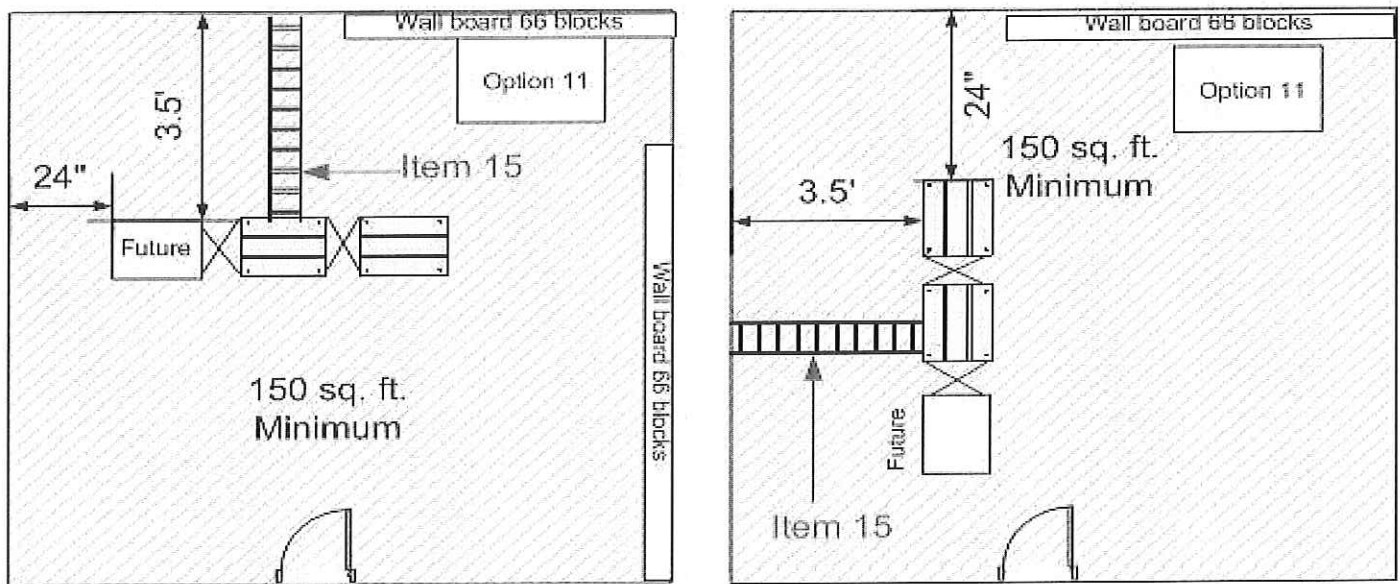
Each MDF Room will contain a minimum of one flush mounted sheet of plywood (4' X 8') on the wall. Securely fasten the plywood to wall-framing members to ensure that it can support attached equipment. The plywood is to be 3/4", A/C grade and fire retardant. All plywood backboards are to be mounted smooth side out and painted white fire retardant paint at time of installation and prior to installation of equipment onto the plywood.

Rack Layout and Equipment List:



Ref #	Qty	Part Number	Vendor	Description
1	2	55053-703	Chatsworth	Chatsworth - "Universal" rack - Black
2	1	30162-703	Chatsworth	Chatsworth - Cable management, 7', 6" wide, 6.38" deep - black
3	1	12487-719	Chatsworth	Chatsworth - monitor shelf with single sliding keybd tray - black
4	1	12853-701	Chatsworth	Chatsworth -10 position vertical power strip, 10' cord, 6.5" standoff
5	3			48 Position Jack panel
6	2			Fiber jack panel Qty is 1 or 2 depending upon # of IDF's
7	1	10595-712	Chatsworth	Chatsworth 3" Channel Rack to Runway mounting plate
8	1	10250-712	Chatsworth	Chatsworth Universal Cable runway 12" Black (9" is 10250-709)
				Horizontal wire management between each panel and switch

Example MDF Room Layout Minimum Requirements (Top View)



3B. IDF Room

The telecommunications closet must have enough space to support required communications systems, including projected growth. A typical Intermediate Distribution Frame (IDF) Room is composed of a wall mounted plywood backboard and relay racks designed for mounting termination equipment and electronics. The IDF rooms on each floor provide area coverage of connectivity based upon the same rules as the MDF room. IDF's are considered extensions of the Main Distribution Frames (MDF) and the guidelines established above also pertain to the IDF rooms as well.

Size:

A distance of 4' feet is preferred clearance from all sides of relay rack. Intermediate Distribution Frame rooms should be sized to meet the requirements of the current and planned communications equipment. When requirements are not known, the EIA 569 standard recommends that there be a minimum of 0.75 square feet of space for every 100 square feet of workspace. (A minimum of 80 square feet is recommended). Always allow for the minimal stated clearance's stated under the MDF guidelines.

Number of IDF's:

Each floor in a building should have at least one IDF Telecommunications Closet. Wiring stations to IDF Telecommunications Closets on different floors is not a preferred practice but can be done if no alternative exists. If possible, IDF Telecommunication Closets should be positioned toward the center of the building (usually the core area) and stacked vertically, when possible, in multi-story buildings.

The cable distance between the IDF and any workspace must not exceed 90 meters (295 feet).

Plywood Backboard:

Each IDF Room will contain a minimum of one flush mounted sheet of plywood (4' X 8') on the wall. Securely fasten the plywood to wall-framing members to ensure that it can support attached equipment. The plywood is to be 3/4", A/C grade and fire retardant. All plywood backboards are to be mounted

smooth side out and painted white fire retardant paint at time of installation and prior to installation of equipment onto the plywood.

Environmental:

Since electronic equipment is somewhat sensitive to changes in temperature and humidity, it is recommended that a stable environment be established for areas housing such equipment. HVAC should be included in the design of the room in order to maintain a room temperature of approximately 70 degrees with the full complement of equipment in the room. Relative humidity should be maintained between 30% and 55%. IDF closets should also be equipped with temperature sensing monitors.

Electrical Requirements:

Two 20 amp circuits should be provided. These should be mounted along the wall behind the equipment rack. These should be mounted per electrical standards. One Chatsworth 10 outlet rack mounted power strip or equivalent should be available for the equipment racks. Each individual circuit should be provided via a four position outlet box.

3C. Unacceptable locations for Communication Rooms

- Anywhere water vapor exists, such as boiler rooms, washrooms, janitor's closets or where access requires traversing a restroom.
- The telecommunications closet must be free of corrosives, explosives, and combustibles, including acid, ammonia, chlorine, oxygen, and petroleum vapors.
- Spaces containing steam pipes, drains, or clean-outs.
- Areas with high traffic volumes (for security reasons, as well as to minimize the risk of Inadvertent damage) unless separately enclosed.
- Areas of high electromagnetic interference (EMI) or radio frequency interference (RFI). Some examples are.
- Near equipment that cause's high interference includes, but is not limited to:
 - Audio visual equipment
 - Copiers and electric bursting equipment
 - Elevators
 - Fluorescent lights
 - Motors, transformers and fans
 - Microwave and radio transmitters

4. Deliverables

4A. Contractor

- The Contractor is required to perform this work in accordance with acknowledged industry standards and professional standards and practices, and the procedures specified herein. Furnish and install all materials, devices, components and equipment for complete operational systems.

- The contractor will be required to provide a project lead during the entire installation. The technical lead will be required to interface with the Tulsa Public Schools Project Lead at various intervals throughout the project.
- Systems are to be installed only by certified Systimax or Uniprise personnel. All system equipment installations and tests are to be made by workmen skilled in the specific trade.
- Provide and make connections to all specified products as indicated. Install all products in accordance with manufacturer's instructions. All installation practices and materials shall be fully TIA/EIA T568-A compliant. Provide test results for each drop upon completion of installation. Test results must be submitted before "completion walkthrough" can begin.

4B. Project Sign Off

- Contractor is responsible for maintaining safe working environment on job site. Upon completion of installation, job site must be free of any debris related to the cabling installation before project sign off can begin.
- A "completion walkthrough" will be conducted by TPS and contractor leads upon completion of the installation. Punch list items will be detailed and noted by the TPS project lead. Resolution of punch list items will be the responsibility of the Vendor. The TPS lead will request completion dates from the Vendor specific to resolution of punch list items.
- Payment will be withheld from TPS until all "Project Scope & Specifics" have been met and punch list items resolved by the contractor.
- The TPS Project Lead and Contractor Lead will sign the "Project Sign Off" document once all scope and specifics have been met. Copies will be distributed to both parties.

SECTION 280513 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. UTP cabling.
 - 2. RS-232 cabling.
 - 3. RS-485 cabling.
 - 4. Low-voltage control cabling.
 - 5. Control-circuit conductors.
 - 6. Fire alarm wire and cable.
 - 7. Identification products.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site. Test each pair of UTP cable for open and short circuits.

1.7 FIELD CONDITIONS

- A. Do not install conductors and cables that are wet, moisture damaged, or mold damaged.

1. Indications that wire and cables are wet or moisture damaged include, but are not limited to, discoloration and sagging of factory packing materials.
- B. Environmental Limitations: Do not deliver or install UTP cable and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 1. Flame-Spread Index: 25 or less.
 2. Smoke-Developed Index: 50 or less.
- B. 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.

2.2 UTP CABLE

- A. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
 1. ADC.
 2. AMP Netconnect; a brand of Tyco Electronics Corporation.
 3. Belden Inc.
 4. Berk-Tek; a Nexans company.
 5. CommScope, Inc.
 6. Mohawk; a division of Belden Networking, Inc.
 7. 3M; Communication Markets Division.
- B. Description: 100-ohm, four-pair UTP, covered with a blue thermoplastic jacket.
 1. Comply with ICEA S-90-661 for mechanical properties.
 2. Comply with TIA/EIA-568-B.1 for performance specifications.
 3. Comply with TIA/EIA-568-B.2, Category 6.
 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - a. Communications, General Purpose: Type CM or CMG.
 - b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
 - c. Communications, Riser Rated: Type CMR, complying with UL 1666.
 - d. Communications, Limited Purpose: Type CMX.

2.3 UTP CABLE HARDWARE

- A. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
 - 1. ADC.
 - 2. American Technology Systems Industries, Inc.
 - 3. AMP Netconnect; a brand of Tyco Electronics Corporation.
 - 4. Belden Inc.
 - 5. Dynacom Inc.
 - 6. Hubbell Incorporated; Hubbell Premise Wiring.
 - 7. Leviton Commercial Networks Division.
 - 8. Panduit Corp.
- B. UTP Cable Connecting Hardware: IDC type, using modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of the same category or higher.
- C. Connecting Blocks: 110-style for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.

2.4 RS-232 CABLE

- A. Plenum-Rated Cable: NFPA 70, Type CMP.
 - 1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
 - 2. Plastic insulation.
 - 3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
 - 4. Plastic jacket.
 - 5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
 - 6. Flame Resistance: Comply with NFPA 262.

2.5 RS-485 CABLE

- A. Plenum-Rated Cable: NFPA 70, Type CMP.
 - 1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
 - 2. Fluorinated ethylene propylene insulation.
 - 3. Unshielded.
 - 4. Fluorinated ethylene propylene jacket.
 - 5. Flame Resistance: NFPA 262, Flame Test.

2.6 LOW-VOLTAGE CONTROL CABLE

- A. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.
 - 1. One pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors.
 - 2. PVC insulation.

3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.

2.7 CONTROL-CIRCUIT CONDUCTORS

- A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, complying with UL 83, in raceway.
- B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, complying with UL 83, in raceway.
- C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or TF, complying with UL 83.

2.8 FIRE ALARM WIRE AND CABLE

- A. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
 1. Comtran Corporation.
 2. Draka Cableteq USA.
 3. Genesis Cable Products; Honeywell International, Inc.
 4. Rockbestos-Suprenant Cable Corp.
 5. West Penn Wire.
- B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.
- C. Signaling Line Circuits: Twisted, shielded pair, No. 18 AWG.
 1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a 2-hour rating.
- D. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.
 1. Line-Voltage Circuits: No. 12 AWG, minimum.
 2. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with outer jacket with red identifier stripe, NRTL listed for fire alarm and cable tray installation, plenum rated, and complying with requirements in UL 2196 for a 2-hour rating.

2.9 IDENTIFICATION PRODUCTS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:

1. Brady Worldwide, Inc.
 2. HellermannTyton North America.
 3. Kroy LLC.
 4. Panduit Corp.
- B. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- C. Comply with requirements in Section 260400 "Identification for Electrical Systems."

PART 3 - EXECUTION

3.1 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements in Section 260400 "Hangers and Supports for Electrical Systems" for installation of supports for cables.

3.2 WIRING METHOD

- A. Install cable, concealed in accessible ceilings, walls, and floors when possible.
- B. Wiring within Enclosures:
1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
 2. Install lacing bars and distribution spools.
 3. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer.
 4. Install conductors parallel with or at right angles to sides and back of enclosure.
 5. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with intrusion system to terminal blocks.
 6. Mark each terminal according to system's wiring diagrams.
 7. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1.
- B. Conductors: Size according to system manufacturer's written instructions unless otherwise indicated.
- C. General Requirements for Cabling:
1. Comply with TIA/EIA-568-B.1.
 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.

4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 5. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
 6. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 7. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
 8. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
- D. UTP Cable Installation: Install using techniques, practices, and methods that are consistent with Category 6 rating of components and that ensure Category 6 performance of completed and linked signal paths, end to end.
1. Comply with TIA/EIA-568-B.2.
 2. Install 110-style IDC termination hardware unless otherwise indicated.
 3. Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.
- E. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
 3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- F. Separation from EMI Sources:
1. Comply with BICSI TDMM and TIA-569-B recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
 2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
 3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

4. Separation between cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.4 FIRE ALARM WIRING INSTALLATION

- A. Comply with NECA 1 and NFPA 72.
- B. Wiring Method: Install wiring in metal raceway according to Section 260400 "Raceways and Boxes for Electrical Systems."
 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 2. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.
- C. Wiring Method:
 1. Fire-Rated Cables: Use of 2-hour, fire-rated fire alarm cables, NFPA 70, Types MI and CI, is not permitted.
 2. Signaling Line Circuits: Power-limited fire alarm cables shall not be installed in the same cable or raceway as signaling line circuits.
- D. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- E. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- F. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.
- G. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.

- H. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the fire alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.5 POWER AND CONTROL-CIRCUIT CONDUCTORS

- A. 120-V Power Wiring: Install according to Section 260400 "Low-Voltage Electrical Power Conductors and Cables" unless otherwise indicated.
- B. Minimum Conductor Sizes:
 - 1. Class 1 remote-control and signal circuits, No. 14 AWG.
 - 2. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
 - 3. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

3.6 CONNECTIONS

- A. Comply with requirements in Section 271500 "Access Control" for connecting, terminating, and identifying wires and cables.
- B. Comply with requirements in Owner Guidelines - "Video Surveillance" for connecting, terminating, and identifying wires and cables.
- C. Comply with requirements in Section 283111 "Zoned (DC Loop) Fire-Alarm System" for connecting, terminating, and identifying wires and cables.

3.7 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."
- B. Comply with TIA-569-B, "Firestopping" Annex A.
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.8 GROUNDING

- A. For communications wiring, comply with J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. For low-voltage wiring and cabling, comply with requirements in Section 260400 "Grounding and Bonding for Electrical Systems."

3.9 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Section 260400 "Identification for Electrical Systems."

3.10 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Visually inspect UTP cable jacket materials for NRTL certification markings. Inspect cabling terminations to confirm color-coding for pin assignments and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1.
 - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 - 3. Test UTP cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross connection.
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
- B. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide or transfer the data from the instrument to the computer, save as text files, print, and submit.
- C. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 280513

"General Decision Number: OK20220053 09/02/2022

Superseded General Decision Number: OK20210053

State: Oklahoma

Construction Type: Building
Building Construction -does not include residential construction consisting of single family homes and apartments up to and including 4 stories. (Including building projects on industrial sites and treatment plants)

County: Tulsa County in Oklahoma.

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	<ul style="list-style-type: none">Executive Order 14026 generally applies to the contract.The contractor must pay all covered workers at least \$15.00 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2022.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	<ul style="list-style-type: none">Executive Order 13658 generally applies to the contract.The contractor must pay all covered workers at least \$11.25 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on

that contract in 2022.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at <https://www.dol.gov/agencies/whd/government-contracts>.

Modification Number	Publication Date
0	01/07/2022
1	02/18/2022
2	02/25/2022
3	06/17/2022
4	08/05/2022
5	08/26/2022
6	09/02/2022

BROK0005-004 06/01/2022

	Rates	Fringes
BRICKLAYER.....	\$ 26.42	12.49

ELEC0584-006 06/01/2021		

	Rates	Fringes
ELECTRICIAN (Excludes Low Voltage Wiring and Installation of Alarms and Sound and Communication Systems).....	\$ 32.38	7%+10.15

ELEV0083-003 01/01/2022		

	Rates	Fringes
ELEVATOR MECHANIC.....	\$ 44.93	36.885+a+b

PAID HOLIDAYS:

a. New Year's Day, Memorial Day, Independence Day, Labor Day,

Veteran's Day, Thanksgiving Day, the Friday after Thanksgiving, and Christmas Day.

b. Employer contributes 8% of regular hourly rate to vacation pay credit for employee who has worked in business more than 5 years; 6% for less than 5 years' service.

* ENG10627-020 06/01/2022

POWER EQUIPMENT OPERATOR:

	Rates	Fringes
Group 1.....	\$ 34.15	15.70
Group 2.....	\$ 32.45	15.70
Group 3.....	\$ 31.90	15.70
Group 4.....	\$ 31.10	15.70
Group 8.....	\$ 26.05	15.70
Group10.....	\$ 24.60	15.70

POWER EQUIPMENT OPERATOR

GROUP 1: All Crane Type Equipment 200 ton and larger and including 400 ton capacity cranes. All Tower Cranes.

GROUP 2: All Crane Type Equipment 100 ton capacity and larger cranes, and less than 200 ton capacity.

GROUP 3: All Crane Type Equipment 50 ton capacity and larger cranes, and less than 100 ton capacity. Crane Equipment (as rated by mfg.) 3 cu. yd. and over Guy derrick Whirley Power Driven Hole Digger (with 30' and longer mast).

GROUP 4: CRANES with Boom Incl. Jib less than 100 ft and less than 3 cu. Yd.; Overhead Monorail Crane

GROUP 8: FORK-LIFT

GROUP 10: OILER; SEMI-TRAILER TRUCK DRIVER

IRON0584-025 06/01/2022

	Rates	Fringes
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IRONWORKER (Ornamental, Reinforcing and Structural).....	\$ 28.00	16.00
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PLUM0430-010 07/01/2021

	Rates	Fringes
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PLUMBER (Excludes HVAC Pipe and Unit Installation).....	\$ 32.85	14.08
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PLUM0430-019 10/01/2020		
HVAC MECHANIC (Installation of HVAC Unit Only, Excludes Installation of HVAC Pipe and Duct).....	\$ 32.25	13.98
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PLUM0430-020 07/01/2021		
PIPEFITTER (Including HVAC Pipe Installation, excluding HVAC Unit Installation).....	\$ 32.85	14.08
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ROOF0143-001 07/01/2022		
ROOFER.....	\$ 24.00	9.30
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SHEE0270-006 06/01/2020		
SHEET METAL WORKER (HVAC Duct Installation Only).....	\$ 35.49	14.60
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* SUOK2012-033 07/30/2012		
CARPENTER (Drywall Hanging Only).....	\$ 15.08	1.21
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CARPENTER, Excludes Drywall Hanging, and Form Work.....	\$ 14.96 **	1.55
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CAULKER.....	\$ 20.00	1.61
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CEMENT MASON/CONCRETE FINISHER...	\$ 13.72 **	1.27
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DRYWALL FINISHER/TAPER.....	\$ 13.00 **	0.00

ELECTRICIAN (Alarm Installation).....	\$ 19.48	3.34
ELECTRICIAN (Low Voltage Wiring).....	\$ 20.65	3.06
ELECTRICIAN (Sound and Communications Systems Installation).....	\$ 21.11	2.47
FORM WORKER.....	\$ 12.69 **	0.38
LABORER: Common or General.....	\$ 12.44 **	2.71
LABORER: Mason Tender - Brick...\$	12.43 **	0.00
LABORER: Mason Tender - Cement/Concrete.....\$	13.00 **	1.91
LABORER: Pipelayer.....\$	12.39 **	0.00
OPERATOR: Asphalt Paver.....\$	16.25	0.00
OPERATOR: Backhoe/Excavator/Trackhoe.....\$	16.96	4.22
OPERATOR: Bulldozer.....\$	21.07	2.48
OPERATOR: Grader/Blade.....\$	14.28 **	1.70
OPERATOR: Loader (Front End)....\$	16.18	0.00
PAINTER: Brush, Roller and Spray, Excludes Drywall Finishing/Taping.....\$	12.22 **	0.00
SHEET METAL WORKER, Excludes HVAC Duct Installation.....\$	22.11	4.93
SPRINKLER FITTER (Fire Sprinklers).....\$	21.86	1.19
TRUCK DRIVER: Dump and Flatbed Truck.....\$	11.00 **	0.00

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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** Workers in this classification may be entitled to a higher minimum wage under Executive Order 14026 (\$15.00) or 13658 (\$11.25). Please see the Note at the top of the wage determination for more information.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at <https://www.dol.gov/agencies/whd/government-contracts>.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or

""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. Example: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of

each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material,

etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION"