# CONTRACT CONDITIONS FOR

# GENERATOR UPGRADES AT

# FAIRVIEW FIRE STATION #2

# TOWN OF FAIRVIEW, TEXAS

**Project Manual**



**ENGINEER**
**RWB CONSULTING ENGINEERS**
**12222 MERIT DRIVE, SUITE 400**
**DALLAS, TEXAS 75251**

**RWB Project No. 23110.00**
**Issue for Construction**
**November 3, 2023**

SPECIFICATION INDEX

**SECTION 00 30 00**

**PROPOSAL FORM**

SUBMITTED BY: _____
(Name of Proposer)

_____

_____
(Address)

Dear Sir:

The undersigned, having examined the drawings, specifications, related documents, and each site of the proposed work which is being bid, and being familiar with all of the conditions surrounding the work, including the availability of materials and labor, hereby proposes to furnish all labor, materials, and equipment required for the following projects at North Lake College for the Dallas County Community College District, in accordance with the project manual prepared by Reed, Wells, Benson and Company, for the lump sum amounts listed below:

A. For all work identified in the contract, provide a base bid proposal to complete all work per the conditions indicated in the Contract Drawings and Project Manual as follows:

BASE BID PROPOSAL:
_____Dollars ($_____).

State the name of the HVAC Equipment manufacturer upon which the bid is based:
_____

ALTERNATES

The following are alternates to the Base Bid amount listed above. It is understood that if no figure is listed for an Alternate, that the Alternate may be accepted and there shall be no added charge to the corresponding Base Bid amount indicated above. Strike out (add) or (deduct) as required for each alternate.

ALTERNATE NO. 1:

Provide the Added/Deductive Cost to the Base Bid to provide VRF/VRV air conditioning equipment manufactured by **Daikin**, as specified.

_____Dollars ($_____).

ALTERNATE NO. 2: NOT USED

Provide the Added/Deductive cost to the Base Bid to provide _____
_____ as shown on the Drawings and as specified.

_____Dollars ($_____).

ALTERNATE NO. 3: NOT USED

Provide the Added/Deductive Cost to the Base Bid to provide _____
_____ as shown on the Drawings and as specified.

_____Dollars ($_____).

Notes:

1. Amounts shall all be shown in both words and figures. In case of discrepancy, the amount shown in words shall govern.
2. The above amount does not include State of Texas Sales Tax.
3. The Base and Alternate Proposal Work is intended to be performed during normal working hours, except for activities that create excessive noise or causes a disruption in building services. In these instances, work shall be performed only when scheduled through the Owner, after hours, and on weekends. All Base and Alternate Bid work shall be substantially completed by June10, 2024 unless specifically noted otherwise.
4. The existing building is operational and is required to remain in operation for the duration of the contract. The building will be made to Contractor, and their subcontractors, only after a Notice to Proceed is issued. The building will still be in full use by the Owner.

The undersigned affirms that the above stipulated base Proposal sum for each project represents the entire cost per drawings, specifications, and addenda and that no claim will be made on account of any increase in wage scales, material prices, taxes, insurance, cost indexes, or any other rates affecting the construction industry and/or this project.

The undersigned Proposer agrees that this Proposal shall be good and may not be withdrawn for a period of at least 45 calendar days after the scheduled closing time for receiving Proposals.

The undersigned Proposer understands that the Owner reserves the right to reject any or all Proposals and to waive any informalities in each proposal.

The Owner reserves the right to require Bonds from the successful Proposer. If written notice of acceptance of this Proposal is received within 45 days after date designated for opening of Proposals, the undersigned, within 10 days of receipt of the Contract, will sign and deliver to the Owner the contract and all required Performance, Labor and Material Payment Bonds, along with a properly executed Insurance Verification Form required by the Owner.

Should the undersigned fail to deliver the signed Contract or the required Bonds or Insurance Form within the 10 day period, the Owner reserves the right to terminate the relationship.

Time of completion: The undersigned agrees to commence work under this contract within 10 days of receipt of written notice-to-proceed from the Owner, and to be substantially complete with the mechanical/electrical work of the contract no later than that stated above, and to achieve Final Completion of the entire contract no later than that stated above, unless stipulated otherwise in the Base Proposal choice above.

**Proposed Calendar Days to Complete Work after receipt of a Notice to Proceed:**
**_____Days**

Addenda: The undersigned hereby acknowledges receipt of the following addenda to the Drawings and Specifications, all of the provisions and requirements of which addenda have been taken into consideration in the preparation of this Proposal.

Addendum No._____Dated_____

Addendum No._____Dated_____

Date:_____ Signed _____

Title _____

Name of Firm_____

_____

Organized as a: (Mark one)

Proprietorship_____
Partnership_____
Corporation_____

Under the law of the State Of:

_____

_____

(Date)

Legal Address:

_____

_____

_____

Telephone No. _____
Fax No._____
E-mail Address: _____

If Proposal is by a corporation, affix seal above address.

END OF PROPOSAL FORM

# TOWN OF FAIRVIEW

## NOTICE TO CONTRACTORS

1. Sealed bids (proposals) addressed to the Town of Fairview (Town), 372 Town Place, Fairview, Texas 75069, will be received at Town Hall until 2:00 p.m., November 28th, 2023, for

**FIRE STATION 2 GENERATOR UPGRADES**

At such time bids will be publicly opened and read aloud.

2. The work consists of furnishing all labor, equipment and materials (except as otherwise specified), and performing all work necessary for the replacement and upgrade of the existing HVAC (Air Conditioning) systems at this facility.

3. Plans and Specifications for the work may be downloaded at www.fairviewtexas.org

TOWN OF FAIRVIEW, TEXAS

Jeff Bell
Fire Chief

# INSTRUCTIONS TO BIDDERS

1. Each proposal shall be legibly written or printed in ink, on the proposal form provided in this bound copy of proposed Contract Documents. No alterations in proposal, or in the printed forms thereof, by erasures, interpolations, or otherwise will be acceptable unless each such alteration is signed or initialed by the Bidder; if initialed, the Town may require the Bidder to identify any alterations so initialed. No alteration in any proposal, or in the proposal form on which it is submitted, shall be made by the person after the proposal has been submitted by the Bidder. Any and all addenda to the Contract Documents on which a proposal is based, properly signed by the Bidder, shall accompany the proposal when submitted. The Bidder may withdraw their proposal any time prior to the bid opening date and time stipulated in the Notice to Contractors.

Each proposal submitted shall be enclosed in a sealed envelope, addressed to the Town of Fairview, 372 Town Place, Fairview, Texas 75069, identified on the outside with the words "FIRE STATION 2 GENERATOR UPGRADES" and identifying the Bidder. Proposals shall be delivered to the Fire Chief by 2:00 p.m., November 28th, 2023, at such time bids will be publicly opened and read aloud. **Facsimile Transmittals Will Not Be Accepted.**

All bids will be tabulated for the Town Council by the Fire Chief. The Town Council will determine the lowest responsible bid, after considering the recommendations of the Fire Chief and RWB Consulting Engineers, determine whether such bid is that of a responsible Bidder, and award a contract to the Contractor determined to be the lowest responsible Bidder. The Fairview Town Council will authorize the Town Manager to enter into a contract with said Contractor.

2. Each Proposal shall be accompanied by either a cashier's check, a certified check, or an acceptable bid bond in an amount of not less than five percent (5%) of the proposed bid price, made payable without conditions to "Town of Fairview, Texas", and the amount of the said proposal Guarantee may be retained by and forfeited to the Town as liquidated damages if the proposal covered thereby is accepted and a contract based thereon is awarded and the Bidder should fail to enter into a contract in the form prescribed, with legally responsible sureties, within the ten (10) days after such award is made by the Town.

The proposal guarantee deposit of the unsuccessful Bidders will be returned if and when their proposals are rejected. The proposal guarantee deposit of the Bidder to whom a contract is awarded will be returned provided, and when, said successful Bidder executes a contract and files satisfactory bonds as hereinafter stipulated. The proposal guarantee deposit of the second and third lowest responsible Bidders may be retained for a period of not to exceed sixty (60) days pending the execution of the contract and bonds by the successful Bidder.

3. Accompanying the proposal, each Bidder shall furnish an experience list of similar work along with such other information as will tend to show the Bidder's ability to prosecute the required work. The Bidder shall have a minimum of three years experience and successful history in the performance of similar work. The Town may make such investigations as they deem necessary to determine the

ability of the Bidder to perform the work. The experience list is not required for those Bidders who have performed similar work for the Town of Fairview within the past 5 years.

4. Each Bidder shall carefully examine the Specifications, and other Contract Documents, shall visit the site and fully inform themself of all conditions affecting the work or the cost thereof, and shall be presumed to have done so and their bid shall be based upon their own conclusions from such examination. Each Bidder shall inform themself concerning all Federal, State, and local laws, ordinances or regulations which may in any manner affect their proposed construction operations, or those engaged or employed on the work or the material or equipment. Should a Bidder find discrepancies in, or omissions from, the Plans, Specifications or other Contract Documents, he should at once notify the Town Engineer and obtain clarification or interpretation prior to submitting any bid.

Any interpretation of the proposed Contract Documents will be made only by addendum duly issued and a copy of such addendum will be mailed or delivered to each person obtaining a set of such documents from the Town Engineer. The Town will not be responsible for any other explanations or interpretations of the proposed Contract Documents.

5. Each Bidder to whom a contract for the work is awarded will be required to furnish surety as follows:

Performance Bond: A contract bond to the Town, in an amount equal to 100 percent (100%) of the not to exceed contract price.

Payment Bond: A payment bond to the Town, in an amount equal to 100 percent (100%) of the not to exceed contract price.

The bonds shall be executed in three (3) counterparts on the forms bound herein, signed by an acceptable surety company authorized to do business in the State of Texas as required by Article 5160 V.A.T.C.S.

Attorneys-in-fact who sign the bonds must file with each bond a certified and effective dated copy of their power of attorney.

Certificates of Insurance: Satisfactory certificates of insurance shall be filed with the Town in accordance with the GENERAL CONDITIONS and SUPPLEMENTARY CONDITIONS in the Contract Documents.

6. The Bidder's attention is directed to Texas House Bill 11 (72nd Legislature, 1st C.S.) which amended the Texas Tax Code Section 151.311. This amendment provides that by the CONTRACTOR entering into a separated contract, The CONTRACTOR will become a seller of materials purchased for the project, which will obviate paying taxes, on materials incorporated into the project.

7. No Bidder may submit more than one proposal. Two proposals under different names will not be received from one firm or association.

8. No Bidder may withdraw their proposal for a period of sixty (60) days after the date and hour set for the opening herewith. A Bidder may modify or withdraw their proposal at any time prior to the expiration of the period during which proposals may be submitted, by written request of the same persons or person who signed the Proposal.

9. The Town reserves the right to accept the bid which, in its judgment is the lowest responsible bid; to reject any or all bids; and to waive irregularities or informalities in any bid submitted. Bids received after the specified time of closing will be returned unopened. Conditional or qualified bids will not be accepted.

10. None of the Instructions to Bidders, Proposal, Performance Bond, Payment Bond, Contract Agreement, General Conditions, Special Conditions or Specifications shall be removed from the bound copy of the Contract Documents prior to filing the proposal contained therein.

11. Each Bidder shall sign their proposal, using their usual signature and giving their full business address. Bids by partnerships shall be signed with the partnership name followed by the signature of one of the members of the partnership or by an authorized representative and designation of the person signing. Bids by corporations shall be signed with the name of the corporation, followed by the signature and designation of the president, secretary, or other person authorized to bind it in the matter. The names of all persons signing should also be printed below the signature. A bid by a person who affixes to their signature the word "President", "Secretary", "Agent", or other designation, without disclosing their principal, may be held to be the individual signing. When requested by the Town, satisfactory evidence of the authority of the officer signing on behalf of a corporation shall be furnished.

12. The Notice of Award shall be accompanied by the necessary Contract Agreement and Bond forms. The Bidder to whom the Contract is awarded will be required to execute the Contract Agreement and obtain the Performance and Payment Bonds and Certificates of Insurance within ten (10) calendar days from the date when notice of Award is delivered to the Bidder. In case of failure of the Bidder to execute the Contract Agreement, the Town may at its option consider the Bidder in default, in which case, the bid security accompanying the Proposal shall become the property of the Town.

13. The Town, within ten (10) days of receipt of acceptable Performance Bond, Payment Bond, Certificates of Insurance and Contract Agreement signed by the Bidder to whom the contract was awarded, shall sign the Contract Agreement and return to the Bidder two (2) executed copies of the Contract Agreement. The Bidder may withdraw their signed Agreement should the Town not execute the Agreement within the stated period by written notice to the Town.

14. The Notice to Proceed shall be issued within ten (10) days of the execution of the Contract Agreement by the Town. The time may be extended by mutual agreement between the Town and Contractor. If the Notice to Proceed has not been issued within the specified time or mutually agreed upon extension, the Contractor may terminate the Contract Agreement without further liability on the part of either party.

15. Attention is called to the fact that not less than the federally determined prevailing wage rate, as issued by the U.S. Department of Labor, must be paid on this project.

16. The Town intends to award the Contract to a Bidder that will be doing a substantial portion of the work rather than through subcontracts. The Bidder must complete the item in the Proposal regarding the amount of work to be done by the Prime Contractor. The Town reserves the right to consider this breakdown in awarding the Contract.

17. Each Bidder shall list all subcontractors they propose to use on this project for which the amount of the subcontract is in excess of $10,000. The list shall include the name and address of the subcontractor, the work they will be performing and the amount of the subcontract. The Bidder shall also complete a Statement of Qualifications and Experience for each subcontractor. The Contractor shall not change subcontractors or enter into contract with subcontractors not listed without prior approval by the Town. The Town reserves the right to refuse any or all requests for changes.

## SECTION 01 01 00

## SUMMARY OF WORK

## PART 1 - WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of this Contract consists of the furnishing of all labor, materials, services, equipment, and appliances required in conjunction with or properly incidental to the Generator and Automatic Transfer Switch Upgrades at Fire Station #2 (Fairview, Texas) for the Town of Fairview.

B. The Drawings and Specifications do not necessarily indicate or describe all work required for completion of Project. Contractor shall provide and install all incidentals reasonably inferable from the Contract Documents that are required for a complete Project.

C. These documents describe the essential elements sufficiently to determine the scope of the Project.

D. Provide all items required for complete operating systems including items not necessarily shown in these documents, but that can be reasonably inferred as being required for a complete operating system.

E. The Drawings and Specifications indicate the basic quality of material and quality of construction required for entire Project.

### 1.2 RELATED REQUIREMENTS

A. Division 1 - General Requirements of Project Manual governs execution of Specification Sections within Divisions 2 through 28, inclusive.

### 1.3 WORK SEQUENCE

A. Construct Work in stages to accommodate Owner's use of premises during construction period. Coordinate construction schedule and operations with Owner's Representative:

1. Do not interrupt any existing utilities without prior approval and coordination.
2. Existing utilities must be maintained and uninterrupted as noted above and in accordance with provisions in Supplementary Conditions to the Contract.

B. Minimum disruption of Fire Station operation and use of adjacent facilities and access to those facilities is required. Cooperation with Owner to minimize inconvenience is essential.

C. Construct the Work in stages to provide for public convenience. Do not close off public use of facilities until completion of one stage of construction will provide alternative usage.

D. Stages of construction are those indicated on Drawings, unless noted otherwise.

E. Owner may require certain work to be performed after normal working hours or on holidays or weekends. Refer to Supplementary Conditions of the Contract for specific requirements.

## 1.4 CONTRACTOR'S USE OF PREMISES

A. Contractor shall have complete use of the immediate premises of the Project site for execution of the Work of this Contract after issuance of notice to proceed.

B. Coordinate use of premises under direction of Engineer and Owner. Contractor shall be responsible for monitoring the use of premises by Contractor's employees and sub-contractors.

C. Access routes for delivery of materials and equipment shall be as indicated by the Owner. Do not use access routes other than those indicated without permission of the Owner.

D. Assume full responsibility for the protection and safekeeping of Products under this Contract, stored on the site. Store materials and products only in those areas indicated for staging.

E. Move any stored Products, under Contractor's control, which interfere with operations of the Owner or separate contractor, or as required by Engineer. Do not unnecessarily encumber project site with materials and equipment.

F. Staging and material storage shall be limited to the areas indicated by the Owner. Obtain specific permission from the Engineer for the use of other areas for storage and staging.

G. Do not overload existing or new structures with weight that would compromise safety. Verify design loads for structure if necessary prior to loading structure.

H. Obtain and pay for the use of additional storage or work areas needed for operations.

I. Protect existing lawns, sidewalks, pavements, curbs and utilities subject to damage by work under this Contract. Repair or replace any existing work damaged by the Contractor. Replace existing lawns damaged by Contractor's activities with sod to provide full stand of replacement grass.

J. Parking areas for Contractor's personnel shall be as acceptable to Owner.

## 1.5 WORK ON EASEMENTS, R.O.W., AND ADJACENT PROPERTY

A. Obtain permission from other property Owners, obtain and pay all fees required by applicable governing authorities, prior to commencing with work on easements, right-of-ways, and adjacent property. This also applies to the transport of cranes and other related equipment.

B. Post all notices and warning signs required by applicable governing authorities.

C. Perform work on easements, right-of-ways, and adjacent property in accordance with local codes and ordinances and utility company requirements.

## 1.6 OWNER OCCUPANCY

A. Cooperate with Owner's Representative in all construction operations to minimize conflict and to facilitate Owner usage.

B. Contractor shall at all times conduct his operations as to ensure least inconvenience to general public.

C. Maintain at all times safe access and egress from existing building. Maintain safe exit paths from building for emergency egress.

D. All construction equipment, materials or work must be adequately fenced and protected.

E. Any damage or interruption to any of Owner's existing utilities or services described above in Item 1.4 shall be repaired immediately. Contractor shall immediately place an adequate work force at place of disruption to minimize time required for repairs. Contractor shall make every effort to expedite repairs, regardless of cause of damage, or responsibility for damage, to return damaged utility or service to full operation as quickly as possible.

## 1.7 PARTIAL OWNER OCCUPANCY

A. Contractor agrees to use and occupancy of Project by Owner prior to Substantial Completion of entire Project.

B. Use and occupancy prior to Substantial Completion of entire Project does not relieve Contractor of responsibility to maintain specified insurance coverages on 100% basis for benefit of Owner, Contractor and subcontractors until Project is complete and accepted by Owner.

C. Contractor provides for:

1. Access for Owner's personnel.
2. Temporary operation of heating, ventilating, air-conditioning and electrical systems.
3. Access for public to extent allowed by Owner.

D. Operation: During occupancy, mutually acceptable arrangements shall be negotiated between Owner and Contractor regarding warranties and insurance requirements respecting portions of Work affected by partial occupancy and regarding operation and cost of building services so that costs attributable to partial occupancy shall be borne by Owner and costs attributable to performance of Work shall be borne by Contractor.

**PART 2 - PRODUCTS**

**Not Used**

**PART 3 - EXECUTION**

**Not Used**

**END OF SECTION**

# SECTION 26 00 00

# ELECTRICAL

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. This Division and all Electrical sections contained hereinafter are subject to the Contract Documents of Division 1 whether attached or not, the various Divisions of the General Construction specifications and Division 23 of the Construction specifications and respective plans.

B. All drawings, material in other Divisions of these specifications, addenda, and other pertinent documents are considered to be a part of the technical requirements of this Division of the specifications insofar as they are applicable.

C. The material contained in this section shall be applicable to other sections of the specifications under this Division.

### 1.2 DEFINITIONS

A. The following definitions shall apply to all sections of this Division:

1. "Owner" shall mean the Owner or his designated representative.

### 1.3 SCOPE OF WORK

A. This Division and all electrical sections of the specifications include all labor and material to complete all electrical systems as specified or shown on the Drawings.

B. All work shown and specified shall be completely installed and connected in a workmanlike manner by mechanics properly qualified to perform the work required. All work shall be left in a satisfactory operating condition as determined by the Owner.

C. Provide all services and perform all operations required in connection with or properly incidental to the construction of complete and fully operating systems with all accessories as herein specified or shown on the Drawings.

### 1.4 GENERAL

A. The accompanying plans show diagrammatically the location of the various light fixtures, devices, conduits and equipment items, and methods of connecting and controlling them. It is not intended to show every connection in detail or all fittings required for a complete system. The Contractor shall carefully lay out his work at the

site to conform to the conditions, to avoid obstructions and provide proper routing of raceways. Exact locations of light fixtures, devices, equipment, and connections thereto shall be determined by reference to the accompanying Plans, etc., by field measurement at the project, and in cooperation with other Contractors and Sub-Contractors, and in all cases shall be subject to the approval of the Owner. Minor relocations necessitated by the conditions at the site or directed by the Owner shall be made without any additional cost to the Owner.

B. These specifications and the accompanying drawings are intended to describe and illustrate systems which will not interfere with the structures, which will fit into available spaces, and which will insure complete and satisfactorily operating installations. The Contractor shall be responsible for the proper fittings of his material and apparatus into the building and shall prepare installation drawings for all critical areas illustrating the installation of his work as related to the work of all other trades. Interferences with other trades or with the building structures shall be corrected by the Contractor before the work proceeds. Should any changes become necessary due to failure to comply with these stipulations, the Contractor shall make such necessary changes at his own expense.

C. All work shall be run parallel or perpendicular to the lines of the building unless otherwise noted on the Drawings.

D. It is the intent of the Contract Documents to provide an installation complete in every respect. In the event that additional details or special construction may be required for work indicated or specified in this section or work specified in other sections, it shall be the responsibility of the Contractor to provide those details or special construction as well as to provide material and equipment usually furnished with such systems or required to complete the installation.

E. The Contractor, by submitting a bid on this work, sets forth that he has the necessary technical training and ability and that he will install his work in a satisfactory manner which is up to the best standards of the trade, complete and in good working order. If any of the requirements of the Drawings and Specifications are impossible to perform, or if the installation when made in accordance with such requirements will not perform satisfactorily, he shall report such occurrences to the Owner promptly after discovery of the discrepancy.

F. No extra compensation will be allowed for extra work or changes caused by failure to comply with the above requirements.

## 1.5 INSPECTION OF THE SITE

A. The Contractor shall visit the site, verifying all existing items indicated on the Drawings or specified, and familiarize himself with the existing work conditions, hazards, grades, actual formations, soil, conditions, and local requirements. The submission of bids shall be deemed evidence of such visit.

B. All proposals shall take these existing conditions into consideration, and the lack of specific information on the Drawings shall not relieve the Contractor of any responsibility.

C. All site visits shall be coordinated and scheduled with the Owner.

## 1.6 CUTTING AND PATCHING

A. When cutting or patching becomes necessary to permit the installation of any work under this contract, or should it become necessary to repair any defects that may appear in patching up to the expiration of the guarantee, such cutting shall be done under the supervision of the Architect by the trade or Contractor whose work is to be disturbed. After the necessary work has been completed, damage shall be repaired by the Contractor or trade whose work has been disturbed. The cost of all such cutting and patching shall be paid by the Contractor requiring it to be done.

   1. Refer to Division 1 requirements.

B. The Contractor shall do all necessary cutting and drilling of present walls, floors, ceilings, etc. for the installation of new work or for modifications to the existing work, but no structural work shall be cut unless specifically approved by the Architect. Patching and painting of services as required shall be by the General Contractor unless specified otherwise hereinafter.

C. Locations of the various existing services, walls, and equipment to be altered, removed or connected to have been taken from plans of the existing building and other substantially reliable sources and are offered as a general guide only, without guarantee as to their accuracy. This Contractor shall examine the site and shall verify to his own satisfaction the location of all existing work and shall adequately inform himself as to their relation to and effect on the work before entering into a contract. Submission of a bid shall constitute evidence that the submitting Contractor has inspected the site of the proposed work.

D. The Contractor shall examine the existing building and plans for the new work and note the sizes of the openings available and shall be responsible for any cutting, patching, and alterations required to place new equipment in the building.

E. Where walls, acoustical tile, suspended ceilings, etc., not scheduled to be re-worked or re-finished under the general contract are damaged during installation of new raceways, or other work, etc., such walls, tiles, etc., shall be replaced by the General Contractor at the expense of the Contractor.

F. All damage done to the existing equipment, services, etc., incurred in the execution of this contract shall be repaired and restored to its original conditions by the Contractor.

G. Holes through concrete shall be drilled with "Mole", or "Core-It", or equal diamond point hole saw.

## 1.7 DEMOLITION OF EXISTING EQUIPMENT

A. Certain types of equipment will be retained by the Owner. The Owner will provide a list of all such salvage items. Before removal of any equipment, contact the Architect, who will determine the disposition. Equipment designated to be salvaged and remain the property of the Owner shall be carefully removed to prevent damage and delivered to a location on the site as directed by the Architect. Any equipment not retained by the Owner shall become the property of the Contractor and shall be removed from the premises.

B. The Contractor shall visit the site and verify all outlets, devices, wall switches, light fixtures, etc., that are to be removed due to remodeling work and building additions.

C. The attendant raceways, hangers, wiring, foundations, etc., of those items of existing equipment to be removed and not intended for reuse, shall also be removed in their entirety. No raceways, hangers, etc., shall be abandoned in place except those raceways concealed in existing walls or buried below grade.

## 1.8 CODE REQUIREMENTS

A. All work shall comply with the provisions of these specifications, as illustrated on the accompanying drawings, or as directed by the Architect, and shall satisfy all applicable local codes, ordinances, or regulations of the governing bodies, and all authorities having jurisdiction over the work, or services thereto. In all cases where alterations to, or deviations from, the drawings and specifications are required by the authority having jurisdiction, report the same in writing to the Architect and secure his approval before proceeding. Upon completion of the work, furnish a statement from the inspecting authority stating that the installation has been accepted and approved. Provide complete utility service connections as directed, and submit, as required, all necessary drawings; secure all permits and inspections necessary in connection with the work, and pay all legal fees on account thereof. In the absence of other applicable local codes acceptable to the Architect, the National Electrical Code shall apply to this work.

## 1.9 RECORD DRAWINGS

A. The Contractor shall, during the execution of the work, maintain a complete set of drawings upon which all locations of equipment, panels, and all deviations and/or changes in the work shall be recorded. All underground and overhead utilities provided under, or affected by, work of this Division shall be accurately located by dimensions. These "Record" drawings shall be delivered to the Architect in good condition upon the completion and acceptance of the work and before final payment is made.

1. Refer to Division 1 requirements.

## 1.10 RECORDS AND INSTRUCTIONS FOR OWNER

A. The Contractor shall accumulate, during the project's progress, the following sets, prepared in neat brochures or packet folders and turned over to the Architect for checking and subsequent delivery to the Owner:

1. All warranties and guarantees and manufacturer's directions on equipment and material covered by the Contractor.
2. Approved equipment brochures, wiring diagrams and control diagrams.
3. Copies of reviewed Shop Drawings.
4. Operating instructions for all systems. Operating instructions shall include recommended maintenance procedures.
5. Any and all other data and drawings required during construction.
6. Repair parts lists of all major items and equipment including name, address, and telephone number of local supplier or agent.

B. All of the above data shall be submitted to the Architect for review at such time as the Contractor makes application for final payment, but in no case less than two weeks before final observation.

C. The Contractor shall also give not less than two (2) days of operating instructions, during the adjustment and testing period, to the Owner's operating personnel in order to familiarize them with the proper care and operation of the equipment. The written operating instructions referred to in above paragraphs shall be used as a basis for this on-the-job instruction.

1. Refer to Division 1 requirements.

## 1.11 SHOP DRAWINGS AND SUBMITTALS

A. The Contractor shall submit, to the Architect, shop drawings and catalog data on all equipment and materials designated on the Drawings and specified herein.

B. The submittal will be reviewed for compliance with general requirements of design and arrangement only; it is not a contract document and acknowledgement of compliance does not relieve the Contractor from responsibility for performance of the work in

compliance with all provisions and requirements of the Contract Documents. Job measurements and the coordination of all the dimensions for proper fit of all parts of the work and performance of all equipment supplies to meet specification requirements are and remain specific responsibilities of the Contractor.

C. Shop Drawings shall be furnished by the Contractor for the work involved after receiving approval on the make and type of material and in sufficient time so that no delay or changes will be caused. This is done in order to facilitate progress on the job, and failure on the part of the Contractor to comply shall render him liable to stand the expense of any and all delays, changes in construction, etc., occasioned by his failure to provide the necessary detailed drawings. Also, if the Contractor fails to comply with this provision, the Architect reserves the right to go directly to the manufacturer he selects and secure any details he might deem necessary, and should there be any charges in connection with this, they shall be borne by the Contractor.

D. The Shop Drawings submitted shall not consist of manufacturers' catalogues or tear sheet therefrom that contain no indication of the exact item offered. Rather, the submission on individual items shall designate the exact item offered.

E. Shop Drawings submitted without indicating markings or Contractor's stamp shall not be reviewed and will be returned to the Contractor for correction of such discrepancies.

F. The Shop Drawings are not intended to cover detailed quantitative lists of electrical specialties, and similar items, as the plans and specifications illustrate and describe those items, and it is the Contractor's responsibility to procure the proper sizes and quantities required to comply with the established requirements.

G. Any Shop Drawings prepared to illustrate how equipment can be fitted into available spaces will be examined under the assumption that the Contractor has verified all the conditions, and obtained any approval thereon shall not relieve the Contractor of responsibility in the event the material cannot be installed as shown on those Drawings.

H. Various material submissions of such as raceways, switches, panelboards, and related items shall be assembled in brochures or in other suitable package form and shall not be submitted in a multiplicity of loose sheets.

I. Each Contractor shall process his submitted data to insure that it conforms to the requirements of the plans and specifications and that there are no omissions, errors or duplications.

J. Shop Drawings shall be accompanied by certification from this Contractor that Shop Drawings have been checked by him for compliance with Contract Drawings.

K. Samples of various products or mock-ups of particular details or systems may be required by various sections of this Specification.

L. Refer to Division 1 requirements.

## 1.12 PENETRATIONS THROUGH FIRE-RATED ASSEMBLIES

A. Seal voids around ducts and pipes penetrating fire-rated assemblies and partitions using fire-stopping materials and methods in accordance with provisions in Division 1.

## 1.13 CONNECTION OF EQUIPMENT FURNISHED BY OTHERS

A. All equipment furnished under other Divisions of the specification requiring service connections shall be connected by this Contractor. Materials and labor required for the connection of this equipment shall be furnished under Division 26. The respective supplier shall furnish proper roughing-in diagrams for the installation of these items. All items shall be roughed-in and connected in strict accordance therewith. All equipment requiring connection may not be specified herein, but may be included in other Division documents. This Contractor shall ascertain for himself all equipment so specified is included as part of his work.

B. Refer to Section 26 05 23.

## 1.14 DRAWINGS

A. The drawings show diagrammatically the locations of the various conduits, fixtures, and equipment, and the method of connecting and controlling them. It is not intended to show every connection in detail and all fittings required for a complete system. The systems shall include, but are not limited to, the items shown on the drawings. Exact locations of these items shall be determined by reference to the general plans and measurements at the building and in cooperation with other trades and, in all cases, shall be subject to the approval of the Architect. The Architect reserves the right to make any reasonable change in the location of any of this work without additional cost to the Owner.

B. Should any changes be deemed necessary in items shown on the contract drawings, the shop drawings, descriptions, and the reason for the proposed changes shall be submitted to the Architect for approval.

C. Exceptions and inconsistencies in plans and specifications shall be brought to the Architect's attention before bids are submitted; otherwise, the Contractor shall be responsible for the cost of any and all changes and additions that may be necessary to accommodate his particular apparatus.

D. Lay out all work maintaining all lines, grades, and dimensions according to these drawings with due consideration for other trades and verify all dimensions at the site prior to any fabrication or installation; should any conflict develop or installation be

impractical, the Architect shall be notified before any installation or fabrication and the existing conditions shall be investigated and proper changes effected without any additional cost.

E. Titles of Sections and Paragraphs in these specifications are introduced merely for convenience and are not to be construed as a correct or complete segregation or tabulation of the various units of material and/or work. The Architect does not assume any responsibility, either direct or implied, for omissions or duplications by the Contractor due to real or alleged error in the arrangement of matter in the Contract Documents.

## 1.15 COOPERATION

A. All work under these specifications shall be accomplished in conjunction with other trades on this project in a manner which will allow each trade adequate time at the proper stage of construction to fulfill his work.

B. Maintaining contact and being familiar with the progress of the general construction and the timely installation of sleeves and inserts, etc., before concrete is placed shall be the responsibility of this trade as will the installation of the required systems in their several stages, at the proper time to expedite this contract and avoid unnecessary delays in the progress of other contracts.

C. Should any question arise between trades as to the placing of lines, ducts, conduits, or equipment, or should it appear desirable to remove any general construction which would affect the appearance or strength of the structure, reference shall be made to the Architect for instructions.

## 1.16 MATERIALS AND EQUIPMENT

A. All materials purchased for this Project shall be new.

B. Where specified product is not manufactured, manufacturer's current product meeting specification shall be substituted, subject to written approval of Engineer.

C. Space allocations in electrical spaces are based on equipment scheduled in each case. Should the Contractor offer equipment of another make, he shall verify that such equipment will fit in the spaces allowed.

D. Manufacturers' names are listed herein to establish a standard. The products of other manufacturers will be acceptable; if, in the opinion of the Architect, the substitute material is of a quality as good or better than the material specified, and will serve with equal efficiency and dependability, the purpose for which the items specified were intended.

E. It is fully the Contractor's responsibility to assemble and submit sufficient technical information to fully illustrate that the material or equipment proposed for substitution is equal or superior as the Architect or his Engineer is under no obligation to perform the service for the Contractor. The proposal shall be accompanied by manufacturers' engineering data, specification sheet, and a sample, if practical or if requested. In no event shall a proposal for substitution be cause for delay of work.

F. Should a substitution be accepted under the above provisions, and should the substitution prove defective or otherwise unsatisfactory for the intended service, within the warranty period, the Contractor shall replace the substitution with the equipment or material specified, and on which the specifications required him to base his proposal.

## 1.17 STORAGE AND PROTECTION OF MATERIALS

A. The Contractor shall provide his own storage space for protection and storage of his materials and assume complete responsibility for all losses due to any cause whatsoever. All storage shall be within the property lines of the building site, or as directed by the Owner's representative. In no case shall storage interfere with traffic conditions in any public or project thoroughfare.

B. All work and material shall be protected at all times. This Contractor shall make good any damage caused, either directly or indirectly, by his workmen. He shall be responsible for safe handling of all electrical equipment and shall replace, without charge, all items damaged prior to acceptance by the Owner.

## 1.18 FOUNDATIONS

A. Provide bases and foundations for all equipment specified or shown, unless specifically noted to the contrary. Foundations are generally to be built in compliance with the equipment manufacturer's shop drawings which have been approved by the Architect, or as directed by the Architect. Vibration or noise created in any part of the building by the operation of any equipment furnished or installed under this portion of the work will be objectionable. Take all precautions against same by isolating the various items of equipment from the building's structure, and by such other means as may be necessary to eliminate all excessive vibration and objectionable noise produced by any equipment installed; install all foundations, supports, etc., for raceway system and equipment with this end in view.

## 1.19 EXCAVATION AND BACKFILLING

A. The Contractor shall do all necessary excavating and backfilling for the installation of his work. Trenches for underground conduits shall be excavated to required depths with bell holes provided as necessary to insure uniform bearing. Care shall be taken

not to excavate below depth, and any excavation below depth shall be refilled with sand or gravel firmly compacted. Where rock or hard objects are encountered, they shall be excavated to a grade six inches (6") below the lowermost part of the conduit and refilled to grade as specified. After the conduit has been installed and approved, the trenches shall be backfilled to grade with approved materials, well tamped or puddled compactly in place. Where streets, sidewalks, etc., are disturbed, cut, or damaged by this work, the expense of repairing same in a manner approved by the Architect shall be a part of this contract.

B. The Contractor shall bear sole responsibility for design and execution of acceptable trenching and shoring procedures, in accordance with State of Texas Regulations. On trench excavations in excess of five feet in depth, contractor shall pay a qualified engineer to prepare detailed plans and specifications directing Contractor in the safe execution of trenching and shoring. It is understood that trench safety systems constitute a means and method of construction for which the Architect, Engineer, and Owner are not responsible. Accordingly, such documents when prepared, shall be separately issued by Contractor's Consultant, independent or project Contract Documents.

## 1.20 SCHEDULE OF WORK

A. The work under the various sections must be expedited and close coordination will be required in execution of the work. The various Contractors shall perform their work at such times as directed so as to insure meeting scheduled completion dates, and to avoid delaying any other Contractor. The Architect will set up completion dates, schedule the times of work in the various areas involved, etc. This Contractor shall cooperate in establishing these times and locations and shall process his work so as to insure the proper execution of it.

## 1.21 CONTINUATION OF SERVICES

A. The Contractor shall realize that the existing building must continue in operation during the construction period, except as the Architect and the Owner may direct otherwise.

B. Under no conditions shall any work be done in the present building that would interfere with its natural use during the normal hours of occupancy, unless special permission is granted by the Owner. This is particularly applicable where new connections are to be made to present services or items of equipment in the building or where present equipment items in the building are to be relocated or modified in any way.

C. Existing utility systems shall continue to function with a minimum of interruptions in service. This Contractor shall install any temporary lines, connections, etc., required to

place and maintain the electrical systems in operation unless otherwise directed by the Architect.

D. Arrange for and provide temporary electric and telephone services to the building where new construction conflicts with existing utility locations.

## 1.22 COMMISSIONING OF EQUIPMENT AND SYSTEMS

A. The Contractor shall provide qualified personnel, as requested by the Owner and Architect, to assist in all on-site testing and commissioning of all equipment.

## 1.23 CLEANING UP

A. The Contractor shall be responsible for cleaning up his work as specified in the General Requirements of these Specifications.

## 1.24 FINAL OBSERVATION

A. Schedule: Upon completion of the Contract, there shall be a final observation of the completed installation. Prior to this observation, all work under this Division shall have been completed, tested, and balanced and adjusted in final operating condition and the test report shall have been submitted to and approved by the Owner.

B. Qualified personnel representing the Contractor must be present during final observation to demonstrate the systems and prove the performance of the equipment.

## 1.25 CERTIFICATIONS

A. Before receiving final payment, the Contractor shall certify that all equipment furnished and all work done is in compliance with all applicable codes mentioned in these Specifications.

B. Furnish, at the completion of the job, a final Inspection Certificate from the local inspecting authority.

## 1.26 GUARANTEE

A. The guarantee provision of this specification requires prompt replacement of all defective workmanship and materials occurring within one year of final job acceptance. This includes all work required to remove and replace the defective item and to make all necessary adjustments to restore the entire installation to its original specified operating condition and finish at the time of acceptance. The Contractor shall also guarantee that the performance of all equipment furnished and/or installed under this Division of the specifications shall be at least equal to the performance as called for in the specifications and as stated in the equipment submittals. Should there be indication

that the equipment and installation is not producing the intended conditions, the Contractor shall make further tests as the Engineer may direct to demonstrate that the equipment installed meets the specifications. If there is indication that the equipment does not meet the specifications, the Contractor shall, at his expense, institute a program to demonstrate the adequacy of the installation. This program shall include all necessary testing and testing equipment. Should the Contractor not have the equipment or technical skill to perform the tests, it shall be his responsibility to provide recognized experts to perform the tests and shall provide certified laboratory tests, certified factory reports and work sheets, or other certified data to support results of any tests required.

B. Refer to Division 1 requirements.

## PART 2 - PRODUCTS

**NOT USED**

## PART 3 - INSTALLATION

### 3.1 DEVICE MOUNTING REQUIREMENTS

A. Mounting heights listed in Drawings shall be defined as measured from the centerline of the device or outlet box to finished floor elevation. Unless specifically noted otherwise on the Drawings. Device heights shall be in accordance with the Texas Accessibility Standards or the Americans with Disabilities Act.

B. Where devices are grouped together, they shall be mounted at the same height.

C. Coordinate all mounting dimensions with Owner's requirements and coordinate with architectural elevations and details.

### 3.2 HOUSEKEEPING PADS

A. Provide 4 inch thick concrete housekeeping pad with 6 x 6 wire mesh and same cure strength as adjacent floor for all floor-mounted electrical equipment unless otherwise indicated on the Drawings. Provide dowel connections to floor if pad is not part of continuous floor pour.

1. Provide inserts for anchor bolts as required for each floor-mounted piece of electrical equipment.
2. Provide 3/4 inch chamfered edge at all exposed edges.

B. Minimum pad dimensions shall be 6 inches greater than dimensions, including all protrusions, of equipment to be installed.

1. Free-standing equipment: Center equipment on housekeeping pad.

2. Equipment anchored to wall: Center equipment side-to-side on housekeeping pad and reduce pad front-to-back dimension by 3 inches.

**END OF SECTION**

# SECTION 26 05 01

# ELECTRICAL DEMOLITION

## PART 1 - GENERAL

### 1.1 REFERENCED DOCUMENTS

A. Comply with Division 1- General Requirements and related documents.

B. All sections of this Specification.

### 1.2 DESCRIPTION

A. Contractor shall remove several items of materials and equipment under this section of the specifications. Equipment and materials to be removed shall be as indicated and noted on the Drawings and as required to facilitate the new installations.

B. Provide labor, materials, equipment, tools and services as required to complete the demolition work indicated.

C. Refer to Division 1 for "Schedule of Work".

### 1.3 DISRUPTION OF EXISTING FUNCTIONS

A. Under no conditions shall any work be done in the present building that would interfere with its natural or intended use unless special permission is granted by the Owner.

B. Disruptions: Maintain existing lighting, power, telephone, and other systems, and maintain existing functions in service, except for scheduled disruptions as allowed in Division 01, "General Conditions".

C. Provide all temporary connections as necessary to facilitate the phasing of construction.

### 1.4 SALVAGE, DEMOLITION, AND RELOCATION

A. It shall be the responsibility of the Contractor to remove and store those items of existing equipment as indicated on the Drawings to be removed. All items of equipment or fixtures removed shall be protected from damage insofar as is practical.

B. These items shall be stored on site for a minimum of two (2) weeks unless indicated otherwise by the Owner's representative to allow for inspection by the Owner. Deliver, all items tagged to be retained by the Owner to a designated storage location on site or to the Owner's designated Service Center or Warehouse. All items not retained by the

Owner shall be removed from the site by the Contractor at no additional cost to the Owner.

C. The attendant conduit, hangers, foundations, etc., of those items of existing equipment to be removed, shall also be removed in their entirety. No hangers, etc., shall be abandoned in place.

D. Relocations:

1. Repair and restore to good functional condition materials and items scheduled for relocation and/or reuse and which are damaged during dismantling or reassembly operations.
2. New materials and items of like design and quality may be substituted for materials and items indicated to be relocated, in lieu of relocation, upon approval of shop drawings, product data and samples.
3. Remove carefully, in reverse to original assembly or placement, items which are to be relocated.
4. Protect items until relocation is complete.
5. Clean and repair and provide new materials, fittings, and appurtenances required to complete the relocation and to restore to good operative order.
6. Perform the relocation work in accordance with pertinent sections of the specifications, utilizing skilled workers.
7. Refer to Drawings for specific requirements of temporary services and relocated equipment and fixtures.
8. Coordinate with the General Contractor repairs required to bring finishes back to their original conditions after demolition and or installation of new equipment.

## 1.5 CLEAN UP

A. Remove all debris, rubbish, and materials resulting from cutting, demolition, or patching operations from the work area on a daily basis.

B. Transport materials and legally dispose of off-site.

# PART 2 - PRODUCTS

## 2.1 GENERAL

A. Provide materials and equipment for patching and extending work as specified in individual sections or as indicated on the Drawings.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Field Conditions: Demolition Drawings are based on non-invasive field observations and existing record documents. Report discrepancies in location, dimensions or quantity to Owner and Architect prior to disturbing existing installation.

B. Abandoned Wiring: Verify that abandoned wiring and equipment serve only facilities scheduled for demolition.

C. Existing Conditions: Commencing demolition means Contractor accepts existing conditions.

### 3.2 PREPARATION

A. Demolition: Disconnect electrical systems in walls, floors, ceilings and equipment scheduled for removal.

B. Project Coordination: Coordinate utility service outages with utility companies and schedule work with Facility management and Owner.

C. Temporary Wiring: Provide temporary wiring and connections as necessary to maintain existing systems in service during construction.

D. Schedule installation of temporary wiring and connections to eliminate hazard to installing personnel.

1. When work must be performed on energized circuits or equipment, use qualified personnel experienced in such operations.
2. Submit "hot work" policy information to Architect for review prior to performing work on any energized circuits.

E. Electrical Service: Maintain existing system in operation until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission, in writing, from Owner prior to partially or completely disabling system. Minimize outage duration. Make temporary connections as necessary to maintain service to areas unaffected by the scope of Work.

F. Telephone Service: Maintain existing system in operation until new system is complete and has been accepted. Disable system only to make switchovers and connections. Obtain permission, in writing, from Owner, and notify the utility company, prior to partially or completely disabling system. Minimize outage duration. Make temporary connections as necessary to maintain service to areas unaffected by the scope of Work.

G. Special Systems: Maintain existing systems in operation until new systems are complete and have been accepted. Disable systems only to make switchovers and

connections. Obtain permission, in writing, from Owner prior to partially or completely disabling systems. Minimize outage duration. Make temporary connections as necessary to maintain service to areas unaffected by the scope of Work.

1. The following systems will be affected by the scope of Work:
    a. Fire Alarm System
    b. Public Address System
    c. Security System
    d. Data System

## 3.3 DEMOLITION AND EXTENSION OF EXISTING WORK

A. General: Demolish and extend existing work as indicated or described in the Drawings and Specifications.

1. Lighting fixtures and electrical distribution equipment shall be salvaged for possible re-installation as directed by the Owner and Architect.

B. Wiring: Remove abandoned wiring and cables to source of supply or termination.

C. Raceways:

1. Remove exposed abandoned conduits and raceways, including abandoned conduits and raceways above accessible ceilings.
2. Conduits and raceways concealed in existing construction to remain shall be abandoned in place. Cut conduits and raceways such that finished surfaces can be patched smooth.

D. Wiring Devices: Remove abandoned wiring devices. Provide blank device plate for outlet box not being removed.

E. Electrical Distribution Equipment: Disconnect and remove abandoned panelboards and electrical distribution equipment.

F. Lighting Fixtures: Disconnect and remove abandoned lighting fixtures, including brackets stems, hangers and other accessories not indicated to be re-used.

G. Existing Installations to Remain: Maintain access to existing electrical installations which remain active.

H. Modify installation or provide access panel as required.

I. Extension of existing circuits: Extend existing installations as required to maintain service to items to remain using materials and methods, as specified that are compatible with original installation.

J. Adjacent Construction: Repair adjacent construction and finishes damaged during demolition and extension work.

K. Dispose of hazardous materials, such as fluorescent and H.I.D. lamps and PCB's in lamp ballasts, in accordance with all Local, State and Federal ordinances and regulations.

## 3.4 SALVAGED MATERIALS

A. Salvage existing materials for re-installation as directed by Owner. Coordinate locations for storage of salvaged materials with Owner.

## 3.5 CLEANING AND REPAIR

A. Existing Materials: Clean and repair existing materials and equipment which remain or are to be re-used.

B. Existing Panel boards: Clean exposed surfaces and check tightness of all electrical connections. Replace damaged circuit breakers with units of compatible construction and provide closure plates for vacant positions.

C. Existing Lighting Fixtures: Where existing lighting fixtures are indicated to remain, clean reflector and lens and replace lamps.

1. Use mild detergent to clean all interior and exterior surfaces; rinse with clean water and wipe dry; allow to dry thoroughly prior to re-installation.
2. Replace lamps and broken electrical components. Replace cracked or broken lenses and louvers with new identical materials.
3. Ballasts: Replace ballasts in all fluorescent lighting fixtures to remain or to be re-used with new ballasts as specified.

**END OF SECTION**

## SECTION 26 05 19

## LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

## PART 1 - GENERAL

### 1.1 REFERENCED DOCUMENTS

A. Comply with Division 1 - General Requirements and related documents.

B. Comply with all other Division 26 sections as applicable.

C. Refer to other Divisions for coordination of work with other portions of work.

### 1.2 DESCRIPTION

A. Provide systems of wires and cables for electric power, signaling and control.

B. Related work specified in other sections:

1. 26 00 00 - Electrical
2. 26 05 20 - Cable Connections
3. 26 05 23 - Control Voltage Electrical Power Cables
4. 26 05 32 - Raceways
5. 26 05 33 - Boxes for Electrical Systems

### 1.3 QUALITY ASSURANCE

A. The equipment supplied and installed shall meet the requirements of the National Electrical Code and all applicable local codes and ordinances.

B. All equipment supplied shall be Underwriter's Laboratories Inc. listed and so labeled.

### 1.4 REFERENCED STANDARDS

A. ICEA 5-61-402 Thermoplastic Insulated Wire and Cable

B. ICEA 5-66-524 Cross Linked Thermosetting Polyethylene Insulated Wires and Cables

C. ICEA 5-68-516 Ethylene Propylene Rubber Insulated Wire and Cable

D. ICEA 5-19-81 Rubber Insulated Wire and Cable

E. ANSI 1581 Standard of Electrical Wires, Cables, and Flexible Cords.

F. UL 83 Thermoplastic Insulated Wires and Cables

G. ASTM B3 Standard Specification for Soft or annealed Copper Wire

H. ASTM B8 Standard Specification for Concentric Lay Standard Copper Conductors

## 1.5 SUBMITTALS

A. Samples: Provide samples upon specific request.

B. Submit product data under provisions of section 26 00 00 Electrical.

C. Provide closeout documents as required in Division 1.

## 1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver conductors and cable assemblies to the project in the manufacturer's standard reels or boxes marked with conductor material, insulation type, conductor size and U.L. Label.

B. Store conductors and cable assemblies in a clean, dry location to prevent damage from moisture, dust, personnel and equipment.

C. Handle conductors and cables in a manner to prevent damage to conductor, insulation, jackets, and identifying markings.

## 1.7 MANUFACTURERS

A. The material shall be the product of a manufacturer with a minimum of ten years experience in the manufacture of similar material.

B. Acceptable Manufacturers:

1. Cerro Wire, Inc.
2. Encore Wire
3. General Cable
4. Southwire Company

## 1.8 WARRANTY

A. The material shall be warranted to be free from defect and in proper working order for one year following the date of final acceptance.

# PART 2 - PRODUCTS

## 2.1 CONDUCTORS

A. Copper Conductors

1. Conductors shall be copper unless specifically noted otherwise on the Drawings.
2. Copper conductors shall be soft drawn annealed copper, minimum conductivity 98% of pure copper per ASTM ASTM-B3.
3. Sizes No. 10 AWG and smaller shall be solid conductor, single strand.
4. Sizes No. 8 AWG and larger shall be concentric lay Class B stranding.
5. Shall conform to the Conductor Properties proscribed in the NEC.

B. Insulation

1. Type THW: 600 volt moisture and heat resistant thermoplastic rated 75 Deg.C. in wet or dry loactions.
2. Type THW-2: 600 volt moisture and heat resistant thermoplastic rated 90 Deg.C. in wet or dry location.
3. Type THWN: 600 volt moisture and heat resistant thermoplastic rated 75 Deg.C. in wet or dry.
4. Type THWN-2: 600 volt moisture and heat resistant thermoplastic rated 90 Deg.C. in wet or dry locations.
5. Type XHHW: 600 volt moisture resistant cross linked polyethylene rated 75 Deg.C. in wet or dry locations.
6. Type XHHW-2: 600 volt moisture resistant cross linked polyethylene rated 90 Deg.C. in wet or dry locations.

## PART 3 - EXECUTION

### 3.1 USES PERMITTED

A. Unless specifically noted on the drawings, permitted by the NEC and local codes and ordinances, wiring shall be Type THHN/THWN-2 or XHHW-2 installed in metal raceways as specified in 26 05 32, Raceways.

### 3.2 COLOR CODING

A. Where available, insulation shall be color coded by factory pigmentation for each phase and each voltage system employed on the project.

B. 120/208 and 120/240 volt systems:

1. Phase A - Black
2. Phase B - Red
3. Phase C - Blue
4. Neutral - White
5. Ground - Green

C. Where factory pigmentation is not available, code conductors with 1-1/2" colored tape band at each terminal and at each pull or junction box.

## 3.3 GROUNDING CONDUCTORS

A. All branch circuits and feeders shall include an insulated equipment grounding conductor. Raceway systems shall not be used as the sole equipment grounding path without specific approval.

## 3.4 MULTIWIRE BRANCH CIRCUITS

A. Multiwire branch circuits shall not be permitted unless required by the device served, such as for connection to modular furniture systems or track lighting systems.

B. Where multiwire branch circuits are required, branch circuit breakers shall be two or three pole with common trip and one handle.

## 3.5 MINIMUM SIZE

A. Conductors shall be of the minimum size shown on the drawings, lighting and power branch circuit wiring shall be minimum No.12 AWG.

B. Feeder circuit wiring shall be sized to limit the effect of voltage drop, based on the actual installed conductor length to limit voltage drop to 2% of nominal system voltage.

C. Branch circuit wiring shall be size to limit the effect of voltage drop, based on the actual installed conductor length, to limit voltage drop to 3% or less of nominal system voltage.

D. Circuits shall be grouped in raceways and grouped together when passing through enclosures to have phases and neutral grouped together to minimize circuit reactance.

## 3.6 INSTALLATION

A. Examine the system in which the conductors are to be installed for defects in equipment and installation which may cause damage to the conductors, insulation, or jackets.

B. Pull a swab or mandrel through conduit systems immediately before pulling conductors to insure a full bore, clean raceway system.

C. Do not exceed the conductor manufacturer’s maximum pulling force or minimum bending radius.

D. Use pulling lubricant compound where necessary and recommended by the manufacturer.

E. Conductors or cables which have insulation or jackets damaged in the pulling process shall be removed and replace with new material.

## 3.7 FIELD QUALITY CONTROL

A. Test all wiring insulation with a megohm meter prior to energization:

1. Phase to ground
2. Phase to phase
3. Phase to neutral
4. Neutral to ground

B. Perform test in accordance with manufacturer's recommendation and to meet manufacturer's published minimum insulation values.

C. Correct all defects revealed by such tests including replacing material with new as required.

**END OF SECTION**

## SECTION 26 05 20

## CABLE CONNECTIONS

### PART 1 - GENERAL

### 1.1 REFERENCED DOCUMENTS

A. Comply with Division 1- General Requirements and related documents.

B. All sections of this Specification.

### 1.2 DESCRIPTION

A. Work Included: Provide wire connections and devices to be readily identifiable, mechanically and electrically secure wiring system.

B. Related work specified in other sections:

1. 26 05 19 - Low Voltage Electrical Power Conductors and Cables

### 1.3 QUALITY ASSURANCE

A. The equipment supplied and installed shall meet the requirements of the National Electrical Code and all applicable local codes and ordinances.

B. All equipment supplied shall be Underwriter's Laboratories Inc. listed and so labeled.

### 1.4 SUBMITTALS

A. Samples: Provide samples upon specific request.

B. Submit product data under provisions of section 26 00 00 Electrical.

C. Provide closeout documents as required in Division 1.

### 1.5 DELIVERY, STORAGE AND HANDLING

A. Connections shall be made in atmospheres that are free from dirt, moisture, and elements which may be damaging.

### 1.6 MANUFACTURERS

A. The materials shall be the product of a manufacturer with a minimum ten years experience in the manufacture of similar materials.

B. Acceptable manufacturers are listed with the products.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

A. Spring Connectors: Ideal "Wingnut" 3M-Scotch, Buchanan, and Thomas and Betts.

B. Terminal Connectors: O-Z/Gedney, Burndy, and Thomas and Betts.

C. Splice Connectors: O-Z/Gedney or Burndy with insulating cover.

D. "T" and Parallel Connectors: O-Z/Gedney or Burndy with insulating cover.

E. Vinyl Plastic Tape: 3M-Scotch #33 or #88, Plymouth and Okonite.

F. Rubber Tape: Okonite, 3M-Scotch and Plymouth.

G. Colored Tape: 3M-Scotch, Plymouth.

H. Wire Ties: Thomas and Betts "Ty-Rap", Ideal and Panduit.

I. Tie Mounts, Plates, Anchors: Thomas and Betts, Ideal, and Panduit.

J. Wire Tags: Self-laminating, cloth, wrap-on type by Thomas and Betts, Ideal, and Brady.

K. Terminal Strips: Nylon; 600 volt; modular plug-on construction; tubular compression slip-in terminals properly sized; complete with mounting track, end clips, and anchors by Allen-Bradley, Square D, and Buchanan.

L. Cable and Cord Fittings: Crouse-Hinds with wire mesh grip or Appleton.

## PART 3 - EXECUTION

### 3.1 INSPECTION

A. Examine wires to be joined, tapped, spliced, terminated, and their connecting devices for defects which may affect the mechanical and electrical integrity of the connection.

B. Do not proceed until defects are corrected.

### 3.2 PREPARATION

A. Remove proper amount of insulation necessary for connection, clean conductors.

### 3.3 INSTALLATION

A. No. 10 Wire and Smaller: Connect with spring connectors, terminate at terminal strips.

B. No. 8 Wire and Larger: Connect and terminate with above specified tape half-lapped to produce a dielectric value equal to wire insulation.

C. Train, hold, clamp, and tag wiring in cabinets, pull boxes, panels, and junction boxes with above specified devices.

D. Splices in feeders and mains may only be made where designated on the drawings and where prior approval is obtained from the Architect.

E. Install terminal strips in enclosures without means for termination of wiring.

F. Install cable and cord grips on all cables and cords, entering enclosures. Use wire mesh grips where necessary for strain relief.

## 3.4 FIELD QUALITY CONTROL

A. Test: Connections shall be resistance tested with megohm meter as specified for wire.

## 3.5 ADJUSTMENTS

A. Assure that wire connections made by others in equipment furnished by others are mechanically and electrically sound prior to energization.

**END OF SECTION**

## SECTION 26 05 23

## CONTROL - VOLTAGE ELECTRICAL POWER CABLES

### PART 1 - GENERAL

### 1.1 REFERENCED DOCUMENTS

A. Comply with Division 1 - General Requirements and related documents.

B. Comply with all other Division 26 sections as applicable.

C. Refer to other Divisions for coordination of work with other portions of work.

### 1.2 DESCRIPTION

A. Work Included: Provide power wiring, raceways, and connections for items of equipment and control systems.

B. All wiring for every system shall be installed in metal conduit. Refer to Section 26 05 32 Raceways for conduit types and materials for specific locations and applications.

C. Related work specified in other sections:

1. 23 09 00 - Instrumentation and Controls for HVAC
2. 26 00 00 - Electrical
3. 26 05 19 - Low Voltage Electrical Power Conductors and Cables
4. 26 05 32 - Raceways
5. 26 28 16 - Enclosed Switches and Circuit Breakers

### 1.3 QUALITY ASSURANCE

A. The equipment supplied and installed shall meet the requirements of the National Electrical Code and all applicable local codes and ordinances.

B. All equipment supplied shall be Underwriter's Laboratories Inc. listed and so labeled.

### 1.4 WARRANTY

A. The material shall be warranted to be free from defect and in proper working order for one year following the date of final acceptance.

### 1.5 COORDINATION

A. For equipment furnished under other Divisions, obtain equipment supply and wiring requirements from the Contractor supplying the equipment.

B. For equipment furnished under Division 23, obtain complete temperature control system drawings, and power supply and interlock wiring requirements from the Contractor furnishing the systems.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

A. Refer to related work specified in other sections for material requirements.

## PART 3 - EXECUTION

### 3.1 GENERAL REQUIREMENTS

A. Work Included: The Electrical Contractor shall provide:

1. Branch circuit and motor feeder circuit conductors, raceway, connections, and overcurrent protection for each motor or item of equipment furnished by the Owner or other Contractors.
2. Motor Control Centers, where indicated on the drawings.
3. Installation of motor controllers furnished by the Owner or other Contractors, along with branch circuit and motor feeder circuit conductors, raceway, and connections in accordance with the manufacturer's approved wiring diagrams.
4. Disconnect switches and combination disconnect switches and motor controllers, where indicated on the drawings or required by codes, except as provided as an integral part of manufactured equipment.
5. Power supply conductors, raceway, connections, and overcurrent protection for input power to HVAC Temperature Controls, HVAC Automation, and HVAC Energy Management Systems in accordance with approved rough-in and connection diagrams furnished by the system suppliers.
6. The above represents an outline of the work for the purpose of describing one division of the work which is acceptable to ensure that all work is contained within the General Contract. Nothing herein shall be construed to confine the General Contractor from assigning the work to any member or group of contractors deemed best suited to executing the work to affect the contract. Refer to specific bidding instructions of the General Contractor for the actual division of the work. The General Contractor is fully responsible for the installation of complete, operating systems in accordance with the functional intent of the specifications.

B. Work Not Included: The Mechanical Contractor shall provide:

1. Motors and equipment, erected in place and ready for final connection of power supply wiring, along with manufacturer's approved wiring diagrams.
2. Motor controllers, in suitable enclosures and of the type and size in accordance with the manufacturer's recommendations and NEMA requirements, along with properly sized overload elements and approved wiring diagrams.

3. Disconnecting switches or devices which are normally provided as a part of manufactured equipment.
4. Rough-in and connection diagrams for input power supply and connections for the HVAC Temperature Control, HVAC Automation, and HVAC Energy Management Systems.
5. Conductors, raceways, devices, and connections for low voltage control, line voltage control, and signaling systems for the HVAC Temperature Control, HVAC Automation, and HVAC Energy Management Systems in accordance with the provisions of Division 26, and approved systems shop drawings to provide complete operating systems in accordance with the functional requirements of the specifications.
6. The above represents an outline of the work for the purpose of describing one division of the work which is acceptable to ensure that all work is contained within the General Contract. Nothing herein shall be construed to confine the General Contractor from assigning the work to any member or group of contractors deemed best suited to executing the work to affect the contract. Refer the specific bidding instructions of the General Contractor for the actual division of work. The General Contractor is fully responsible for the installation of complete, operating systems in accordance with the functional intent of the specifications.

C. Completely connect all electrical consuming items of mechanical equipment, kitchen equipment, shop equipment, etc., provided by the Owner or other trades. Outlets of various types have been indicated at equipment locations, but no indications or exact location or scope of work is indicated on the accompanying drawings.

D. Refer to details and information furnished by the Owner and various equipment suppliers for equipment wiring requirements and to the Plumbing and Heating, Ventilating and Air Conditioning Specifications for the scope of the connections to equipment provided under those sections, and determine from the various trades by actual measurements at the site, and by direction from the Owner and the Architect the exact locations of all items. Roughing-in drawings, wiring diagrams, etc., required for the proper installation of the electrical work will be furnished by applicable trades furnishing equipment. Request the drawings and information required in writing to the equipment supplier in ample time to permit preparation of the drawings and to permit proper installation of all wiring. Obtain from those furnishing equipment the size and type of service required for each motor or piece of electrical equipment and verify that the service to be installed is compatible.

## 3.2 INSTALLATION

A. All conduits shall terminate in conduit boxes on motors where possible. When motors are direct connected, the conduit may continue rigid into the box, but when motors drive through belts and have sliding bases, a piece of flexible liquid tight conduit not less than 12 inches long shall be connected between the rigid conduit and the motor

terminal. Where motors are not provided with conduit boxes, terminate the conduit in a condulet at the motor.

B. Where disconnecting switches are not provided integral with the control equipment for motors, provide and install a disconnect switch in the circuit to each motor where indicated and required by code. Switches shall be installed as close as possible to the motor or controls they serve and they shall be within sight of the motor or control circuit.

C. Be responsible for installing all conductors and protective devices serving equipment motors furnished by others in strict conformance with all applicable codes, regardless of any discrepancy in plans and/or mechanical equipment sizes variations, unless covered by directives issued by the Architect.

**END OF SECTION**

## SECTION 26 05 26

## GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

### 1.1 REFERENCED DOCUMENTS

A. Comply with Division 1 - General Requirements and related documents.

B. Comply with all other Division 26 sections as applicable.

C. Refer to other Divisions for coordination of work with other portions of work.

### 1.2 DESCRIPTION

A. Provide a grounding electrode for the facility and a ground electrode conductor system to connect to the electric service main equipment.

B. Provide supplementary grounding electrodes as specified herein.

1. Provide connections from the grounding electrode system to:
2. The electric power system grounded circuit conductor (neutral).
3. The electric power system non-current carrying enclosures and equipment ground conductors (equipment ground).

C. Provide connections from the grounding electrode system to auxiliary ground conductors for data and voice communication systems (isolated ground).

### 1.3 QUALITY ASSURANCE

A. The equipment supplied and installed shall meet the requirements of the National Electrical Code and all applicable local codes and ordinances.

B. All equipment supplied shall be Underwriter's Laboratories Inc. listed and so labeled.

### 1.4 REFERENCED STANDARDS

A. National Electrical Code, NFPA 70.

B. EIA/TIA Standard 607

C. IEEE - Standard 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.

D. IEEE Standard 81 - Guide for Measuring Earth Resistivity.

## 1.5 SUBMITTALS

A. Samples: Provide samples upon specific request.

B. Submit product data under provisions of section 26 00 00 Electrical.

C. Provide closeout documents as required in Division 1.

## 1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver conductors and cable assemblies to the project in the manufacturer's standard reels or boxes marked with conductor material, insulation type, conductor size and U.L. Label.

B. Store conductors and cable assemblies in a clean, dry location to prevent damage from moisture, dust, personnel and equipment.

C. Handle conductors and cables in a manner to prevent damage to conductor, insulation, jackets, and identifying markings.

## 1.7 MANUFACTURERS

A. The materials shall be the products of a manufacturer with a minimum of ten years experience in the manufacture of similar material.

B. Acceptable manufacturers shall be as listed with the material descriptions.

## 1.8 WARRANTY

A. The material shall be warranted to be free from defect and in proper working order for a period of one year following the date of final acceptance.

# PART 2 - PRODUCTS

## 2.1 GROUND RODS

A. Standard ground rods shall be 3/4 inch diameter, 10 foot length, copper clad steel, equal to Thompson Company.

## 2.2 CONDUCTORS

A. Conductors buried in contact with the earth shall be bare copper, solid for sizes up to No. 6 AWG, concentric lay strand for sizes No. 8 AWG and larger.

B. Conductors for installation below raised access floor systems shall be bare copper, solid for sizes up to No. 6 AWG, concentric lay strand for sizes No. 8 AWG and larger.

C. All other grounding conductors shall be copper conductor, Type THWN 600 volt 90 Deg.C. thermoplastic insulation, green color where available.

## 2.3 CONNECTIONS

A. All connections made below grade, in inaccessible locations, and all connections and splices in the grounding electrode conductor system shall be made by exothermic weld process equal to Cadweld. Provide polyethylene inspection well covers and lids equal to Erico #T416B.

B. All other connections shall be hydraulically crimped irreversible connectors equal to Thomas and Betts 54000 Series.

C. Connections to raised access floor system pedestals shall be Thomas and Betts 38268 malleable iron mechanical clamp.

D. Connections to cable trays shall be Thomas and Betts 10105 malleable iron mechanical clamp.

E. Connections to domestic cold-water piping shall be Thomas and Betts GUV Series copper alloy U-bolt and mechanical clamp.

F. Connections to building structural steel shall be exothermic weld equal to Cadweld.

G. Connections which require flexibility for movement, expansion, or vibration shall be made with flexible flat conductor, multiple strands of 30 gauge copper conductors or equivalent circular mil area to the primary ground conductor. Protect ends with copper bolt hole end pieces.

## 2.4 CONDUITS

A. Provide malleable iron conduit grounding bushings where:

1. Metallic raceways terminate at metal housings without mechanical and electrical connection to housing.
2. At each end of metallic conductors for grounding conductors where conduits are electrically non-continuous.
3. At the ends of service entrance conduit.

# PART 3 - EXECUTION

## 3.1 GROUNDED CIRCUIT CONDUCTOR

A. Bond the grounding electrode system to the grounded circuit conductor (neutral conductor) at one location only, on the supply side of the service disconnecting means, with a neutral disconnecting link as required by the NEC.

## 3.2 EQUIPMENT GROUNDING CONDUCTORS

A. Bond the non-current carrying parts of the electric power system to the grounding electrode conductor at the service disconnecting means. From this point forward, all non-current carrying parts of the electric power system shall be electrically connected and continuous by means of:

1. Electrically continuous equipment enclosures, metallic boxes and metallic raceways connected with U.L. Listed connectors and couplings.
2. Equipment grounding conductors supplementary to metallic raceway systems where shown on the Drawings.
3. Equipment grounding conductors in non-metallic raceway systems and in flexible metal conduit systems.
4. Where permitted under other sections of the Specification, the insulated grounding conductor provided in Type MC cable will be considered an acceptable equipment grounding conductor.
5. Uninsulated grounding strips and spiral wrap provided in Type AC cable is not an acceptable grounding conductor.

## 3.3 TESTING

A. Grounding Electrode:

1. The earth resistance of the main ground electrode shall be not more than 5 ohms.
2. Perform a measurement of ground resistance by one of the means described in IEEE Standard 81, Guide for Measuring Earth Resistivity.
3. Provide written certification of the ground resistance measurements upon request.

B. Grounding Continuity:

1. Provide continuity tests and checks of equipment grounding and isolated grounding conductor systems to ensure electrical continuity.
2. Provide written certification of continuity checks upon requests.

**END OF SECTION**

## SECTION 26 05 29

## HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

### 1.1 REFERENCED DOCUMENTS

A. Comply with Division 1- General Requirements and related documents.

B. All sections of this Specification.

### 1.2 DESCRIPTION

A. Work Included: Provide miscellaneous materials for the supporting of electrical material and equipment.

B. Related work specified in other sections:

1. 26 00 00 - Electrical
2. 26 05 32 - Raceways
3. 26 05 33 - Boxes for Electrical Systems
4. 26 27 16 - Electrical Cabinets and Enclosures

### 1.3 QUALITY ASSURANCE

A. The equipment supplied and installed shall meet the requirements of the National Electrical Code and all applicable local codes and ordinances.

B. All equipment supplied shall be Underwriter's Laboratories Inc. listed and so labeled.

### 1.4 SUBMITTALS

A. Samples: Provide samples upon specific request.

B. Submit product data under provisions of section 26 00 00 Electrical.

C. Provide closeout documents as required in Division 1.

### 1.5 MANUFACTURERS

A. Listed with Materials.

B. Acceptable Manufacturers

1. Unistrut
2. Caddy
3. Thomas & Betts

## PART 2 - PRODUCTS

### 2.1 MATERIALS

A. Continuous Slotted Channel: #12-gauge steel, electrogalvanized, with zinc chromate, bases and dimensions as required for application.

B. Hanger Rods: Continuous thread, electrogalvanized, with zinc chromate, sizes as required for loads imposed.

C. Hex Head Cap Screws and Nuts: No. H-113 and No. H-114, respectively.

D. One-Hole Pipe Straps: Series HS-100, galvanized steel

E. Single Bolt Channel Pipe Straps: Steel, with machine screws and nut, Series C-105 and Series C-106.

F. Lay-In Pipe Hanger: Series C-149.

G. Conduit and Pipe Hanger: Series 6H.

H. Beam Clamps: Series 500, RC, EC, and PC for applications.

I. Concrete Inserts, Spot: Series D-256 or No. D-255.

J. Concrete Inserts, Channel: Series D-980 or Series D-986.

K. Riser Clamps: Series C-210.

L. Cable Supports: O-Z/Gedney Type S.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Carefully lay out and provide concrete inserts.

B. Securely fasten and support conduits and raceways to the building structure.

C. Suspend horizontal runs of conduit and raceways from the floor and roof construction by rod hangers spaced 10 feet on less on centers for sizes 2-1/2 inches and greater and 9 feet or less on centers for sizes 2 inch and smaller.

D. Fasten single runs of conduit to the structure with one-hole pipe straps and beam clamps or hang on rod hangers.

E. Support multiple runs of conduit and raceways from continuous channel inserts or from trapeze hangers constructed of rod hangers and channels.

F. Fasten single conduits to rod hangers with adjustable lay-in pipe hangers or for 2 inches and smaller conduits with Series 6H pipe hangers.

G. Fasten conduits to channels with pipe channel straps.

H. Support conduits and raceways within 3 feet of each end of each bend, of each termination, and at other intervals to maintain horizontal and vertical alignment without sag and deformation.

I. Do not use cable, strap, and wire hangers as fasteners.

J. Provide riser clamps for conduits at floor lines. Provide wire and cable supports in pull boxes for risers in accordance with NEC Section 300-19 and Table 300-19 (a).

K. Install supports to permit equally distributed expansion and contraction of conduits and raceways with expansion joints. Use guides or saddles and U-bolts and anchors designed for equal effectiveness for both longitudinal and transverse thrusts.

L. Do not support conduits and raceways for equipment connections.

M. Provide special supports with vibration dampers to minimize transmission of vibrations and noises.

N. Provide trapeze hangers for conduits and raceways where routing interferes with ducts.

O. Provide hangers, racks, cable cleats and supports for wires and cables in cable chambers and other locations to make a neat and substantial installation.

P. Provide angle iron and channel supports to the floor and structure for panelboards, cabinets, pull and junction boxes. Support independently from entering conduits and raceways. Provide supports as specified for conduits and raceways for outlet boxes and pull boxes 100 cubic inches and smaller.

Q. Provide supports sized for the ultimate loads to be imposed.

## 3.2 CLEANING

A. Clean surfaces to be painted.

**END OF SECTION**

# SECTION 26 05 32

# RACEWAYS

## PART 1 - GENERAL

### 1.1 REFERENCED DOCUMENTS

A. Comply with Division 1 - General Requirements and related documents.

B. Comply with all other Division 26 sections as applicable.

C. Refer to other Divisions for coordination of work with other portions of work.

### 1.2 DESCRIPTION

A. Work Included: Provide a mechanically and electrically complete conduit system.

B. Related work specified in other sections:

1. 26 00 00 - Electrical
2. 26 05 19 - Low Voltage Electrical Power Conductors and Cables
3. 26 05 29 - Hangers and Supports for Electrical Systems
4. 26 05 23 - Control Voltage Electrical Power Cables

### 1.3 QUALITY ASSURANCE

A. The equipment supplied and installed shall meet the requirements of the National Electrical Code and all applicable local codes and ordinances.

B. All equipment supplied shall be Underwriter’s Laboratories Inc. listed and so labeled.

### 1.4 SUBMITTALS

A. Samples: Provide samples upon specific request.

B. Submit product data under provisions of section 26 00 00 Electrical.

C. Certificates:

1. Labels of Underwriters' Laboratories, Inc. affixed to each item of material.
2. If materials are by manufacturers other than those specified submit certification that material meets applicable Underwriters' Laboratories, Inc. Standards.

D. Provide closeout documents as required in Division 1.

### 1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Protect conduits and finishes from damage.

## 1.6 MANUFACTURER

A. The materials shall be the products of a manufacturer with a minimum of ten years experience in the manufacture of similar equipment.

B. Acceptable Manufacturers

1. Metallic Conduits: Allied, and Wheatland.
2. Nonmetallic Conduits: Cantex, and SEDCO.

## 1.7 WARRANTY

A. The materials shall be warranted to be in proper working condition for a period of one year following the date of final acceptance.

# PART 2 - PRODUCTS

## 2.1 MATERIALS

A. Rigid Metal Electrical Conduit: Hot-dipped galvanized steel with zinc coated threads and an outer coating of zinc bichromate, complete with one coupling and one end thread protector. Intermediate metal conduit (IMC) is not allowed.

B. Electrical Metallic Tubing: Welded, electro-galvanized thin wall steel tubing.

1. Conduit for power wiring shall be natural electro galvanized.
2. Conduit for other systems shall be color coded in accordance with Section 26 05 23 - Control Voltage Electrical Power Cables.

C. Flexible Metal Electrical Conduit: Hot-dipped galvanized steel strip core with integral copper ground wire on sizes 1-1/4" and smaller.

D. Liquidtight Flexible Metal Electrical Conduit: Hot-dipped galvanized steel strip core with extruded polyvinyl jacket.

E. Rigid Nonmetallic Electrical Conduit: Schedule 40 heavy wall polyvinylchloride, high impact resistant.

F. Elbows and Bends:

1. All Types: Size 1-1/4 inch and larger shall be factory manufactured.

G. Bushings:

1. 1-1/4" and Smaller: Same material as the conduit with which they are installed.
2. 1-1/2" and Larger: Hot-dipped galvanized with thermosetting phenolic insulation, 150 Deg.C.

H. Locknuts:

1. 1-1/2" and Smaller: Zinc plated heavy stuck steel, O-Z/Gedney.
2. 2" and Larger: Cadmium plated malleable iron, O-Z/Gedney.

I. Hubs: Cadmium plated malleable iron, tapered threads, neoprene "O" ring, insulated throat, O-Z/Gedney.

J. E.M.T. Compression Connectors: Gland compression type, zinc plated steel body, cadmium plated, malleable iron nut, insulated throat, O-Z/Gedney.

K. E.M.T. Compression Couplings: Gland compression type, zinc plated steel body, cadmium plated malleable iron nut, O-Z/Gedney.

L. Liquidtight Conduit Connectors: Cadmium plated malleable iron body and nut, cadmium plated steel ferrule, insulated throat, integrally cast external ground lug, O-Z/Gedney.

M. Seals for Watertight Wall and Floor Penetrations: Malleable iron body, oversize sleeve, sealing ring, pressure clamp and rings and sealing grommet, hex head cap screws, O-Z/Gedney.

N. Seals for Penetrations through Existing Walls: Thunderline Corporation Link-Seal watertight sleeves, complete with wall and casing seals.

O. Fire Seals: Galvanized iron pipe sleeves sealed with approved foam type fireproofing.

P. Expansion Fittings: Hot-dipped galvanized malleable iron with bonding jumpers selected for linear or linear with deflection, as required.

Q. Accessories: Reducers, bushings, washers, etc., shall be cadmium plated malleable iron on the forms and dimensions best suited for the application.

R. Identifying Tape for Underground Conduits: Polyethylene tape, 6 inches wide, with continuous printing along length, Brady Identoline:

1. For Electric Power Conduits: Yellow with black letters.
2. For Other Services: Green with black letters.

S. Sleeves: 22 gauge galvanized steel sleeves where conduits pass through walls and floors. Standard galvanized steel pipe where conduits pass through beams, outside walls, or structural members.

## PART 3 - EXECUTION

### 3.1 INSPECTION

A. Examine surfaces to which conduits are to be secured for:

1. Defects which will adversely affect the execution and quality of work.
2. Deviations from allowable tolerances for the building material.

B. Do not start work until defects and deviations are corrected.

## 3.2 INSTALLATION

A. Size conduits as indicated on the drawings and as required by the NEC for the number and sizes of wires to be drawn into conduit. Do not use conduit sized less than 3/4" unless specified otherwise.

B. Conceal conduits from view in all areas except mechanical and electrical equipment rooms and crawl spaces. Should it appear necessary to expose any conduit:

1. Bring to the attention of the Architect, immediately, and
2. Rearrange the work to facilitate an approved installation.

C. Install all conduits at elevations and locations to avoid interference with grading of other work, the structure, finished ceilings, walls. Avoid causing cutting of masonry units.

D. To prevent displacement, securely support and hold in place all conduits installed in advance of other work and to be concealed in the building structure.

E. Carefully lay out conduits run within the structure, such as floors, beams, walls, to avoid densities excessive for the construction. Relocate those conduits when excessive densities occur.

F. Ream, remove burrs, and swab inside conduits before conductors are pulled in.

G. Cap or plug conduits with standard manufactured accessories as soon as the conduits have been permanently installed in place.

H. Bends and offsets in 1" and smaller conduits may be done with approved bending devices. Do not install conduits which have had their walls crushed and deformed and their surface finish damaged due to bending.

I. Where space conditions prohibit the use of standard ells, elbows, and conduits, use cast ferrous alloy fittings of such forms and dimensions as best required for the application.

J. Make all conduit joints mechanically tight, electrically continuous, and watertight. Pitch conduits in a manner to avoid creating moisture traps.

K. Install insulated throat threaded hubs on conduits entering enclosures without threaded hubs where exposed to damp or wet locations.

L. Connect and couple E.M.T. with compression type fittings. Do not use indentor and set screw fittings.

M. Install and neatly rack exposed conduits parallel with and perpendicular to the building walls. Do not install exposed diagonal conduit runs.

N. Route and suspend conduits crossing expansion joints to permit expansion, contraction, and deflection utilizing approved fittings to prevent damage to the building, conduits, and supporting devices in accordance with the National Electrical Code.

O. Do not run conduits exposed on the roof unless approval is obtained prior to installation.

P. Do not place conduits in close proximity to equipment, systems, and service lines, such as hot water supply and return lines, which could be detrimental to the conduit and its contents. Maintain a minimum 3" separation, except in crossing, which shall be a minimum 1".

Q. Conduit sleeves shall be sized to permit insertion of conduit with adequate clearance for movement due to expansion and contraction. Where conduits pass through outside walls, watertight fittings, as specified herein, shall be used.

R. All stub-ups of PVC conduit runs shall be made with rigid galvanized steel conduit with protective wrapping. Provide corrosion resistant protective wrapping from where the galvanized conduit begins to 4” above the finished floor.

## 3.3 USES PERMITTED

A. Rigid Metal Conduit:

1. Exterior conditions above grade.

B. Schedule 40 PVC:

1. Below grade exterior to the building.

C. Electrical Metallic Tubing:

1. All uses above grade interior to the building, except as limited elsewhere in this section.

D. Flexible Metal Conduit:

1. Final connection to vibrating or adjustable equipment.
2. Connection to vibrating equipment shall contain one 90 degree bend.

E. Liquid tight Flexible Metal Conduit:

1. All uses permitted for flexible metal conduit.
    a. Exterior to the building.

**END OF SECTION**

## SECTION 26 05 33

## BOXES FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

### 1.1 REFERENCE DOCUMENTS

A. Comply with Division 1 - General Requirements and related documents.

B. Comply with all of the Division 26 sections as applicable.

C. Refer to other Divisions for coordination of work with other portions of work.

### 1.2 DESCRIPTION

A. Work Included: Provide outlet boxes for the installation of wiring devices, lighting fixtures, and power and control connections.

B. Related work specified in other section:

1. 26 00 00 - Electrical
2. 26 27 26 - Wiring Devices
3. 26 05 23 - Control-Voltage Electrical Power Cables

### 1.3 QUALITY ASSURANCE

A. The equipment supplied and installed shall meet the requirements of the National Electrical Code and all applicable local codes and ordinances.

B. All equipment supplied shall be Underwriter's Laboratories Inc. listed and so labeled.

### 1.4 SUBMITTALS

A. Samples: Provide samples upon specific request.

B. Submit product data under provisions of section 26 00 00 Electrical.

C. Provide closeout documents as required in Division 1.

### 1.5 MANUFACTURERS

A. Listed with Materials.

1. Appleton Electric Company
2. Raco
3. Steel City
4. Crouse Hinds

5. Hubbell
6. Raceway Components
7. Walker

## PART 2 - PRODUCTS

### 2.1 MATERIALS

A. Flush Mounted Outlet Boxes: Standard, stamped galvanized steel with factory conduit knockouts, one piece and welded construction:

1. Series 4S and 4S0 square boxes with covers.
2. Series M1, M2, M3 - 250 and Series M1, M2, M3 - 350 masonry boxes with covers.
3. Series 2G and GC-5075 switch boxes with covers.
4. Series OCR concrete rings with Series OCP and OCP-3/8 back plates.
5. Series 40 and 40D octagonal boxes with raised covers.
6. Series SX expandable bar hangers.

B. Surface Mounted Outlet Boxes: Cast metal with threaded hubs. Type FS and FD with covers of form suited to the application.

## PART 3 - EXECUTION

### 3.1 INSPECTION

A. Examine building structure to which outlet boxes are to be secured for defects which affect the execution and quality of work.

B. Do not start work until defects are corrected.

### 3.2 PREPARATION

A. Carefully measure and lay out exact locations in conference with the Construction Manager.

B. Owner may change outlet box locations a distance of 5 feet before rough-in without additional cost.

### 3.3 INSTALLATION

A. Provide the appropriate cover plate for all boxes in all applications. No unused boxes shall be provided without a cover plate.

B. In dry walls for single and two gang outlets provide 4S and 4D boxes; for 3 or more outlets use masonry boxes.

C. In exposed work, exterior of the building, in wet locations, and flush in non-waterproofed walls below grade provide FS and FD boxes.

D. Submit for approval special boxes for special devices and applications. Size according to device and application in accordance with NEC.

E. Install outlet boxes finished to within 1/8 inch of finished surfaces.

F. Install center of box at heights above finished floor:

1. Wall Switches: 45 Inches
2. Convenience Outlets: 18 Inches
3. Telephone/Data Outlets: 18 Inches
4. Boxes Indicated Above Counters: 4 Inches above backsplash and trim, unless otherwise indicated.

G. Provide standard manufactured plugs in unused openings of boxes.

H. Provide boxes at the terminal of conduit runs to outlets and devices.

I. Provide plaster rings and covers where required by the building structure.

J. Label all junction boxes with circuit information or as to its use for special system equipment. Labels shall be typewritten, adhesive backed printed labels. Lettering shall be minimum 18-point type in basic black font.

## 3.4 CLEANING

A. Clean surfaces to be painted.

**END OF SECTION**

## SECTION 26 05 53

## IDENTIFICATION FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

### 1.1 REFERENCE DOCUMENTS

A. Comply with Division 1 - General Requirements and related documents.

B. Comply with all of the Division 26 sections as applicable.

C. Refer to other Divisions for coordination of work with other portions of work.

### 1.2 DESCRIPTION

A. Provide identification of electrical equipment.

B. Provide identification of over current devices.

C. Provide identification of branch circuits, outlets, and wiring devices.

D. Provide identification of required clear working spaces for electrical equipment.

E. Provide identification of rooms and spaces for access by qualified personnel.

F. Related work specified in other section:

1. 26 05 33 - Boxes for Electrical Systems.
2. 26 24 16 - Panelboards.
3. 26 27 16 - Electrical Cabinets and Enclosures
4. 26 28 16 - Enclosed Switches and Circuit Breakers
5. 26 36 23 - Automatic Transfer Switches
6. 26 36 25 – Generator Temporary Docking Station

### 1.3 QUALITY ASSURANCE

A. Signs and placards shall meet the requirements by OSHA.

### 1.4 SUBMITTALS

A. Submit literature describing all labels, signage and marking materials to the Architect for approval prior to installation.

B. Samples: Provide samples upon specific request.

C. Submit product data under provisions of section 26 00 00 Electrical.

D. Provide closeout documents as required in Division 1.

## PART 2 - PRODUCTS

### 2.1 PLACARDS

A. Placards shall be engraved phenolic name plates with engraved lettering engraved. Lettering shall be minimum 24-point type in basic block font.

B. Placards shall be securely and permanently adhered to the equipment enclosures without fasteners or penetrations into the enclosures.

C. Placards shall be color coded white placard with black lettering.

### 2.2 LABELS

A. Labels shall be typewritten, adhesive backed printed labels. Lettering shall be minimum 18-point type in basic black font.

### 2.3 MARKING MATERIALS

A. Materials for marking of required working clearance shall be adhesive backed yellow tape, equal to 3M Company 471 Series. Clean and prepare floor surface in accordance with manufacturer's instructions.

## PART 3 - EXECUTION

### 3.1 SERVICE ENTRANCE EQUIPMENT

A. Provide a placard for each service entrance equipment identifying:

1. The name of the equipment.
2. The utility company available fault current.
3. The supply system voltage.

### 3.2 AUTOMATIC TRANSFER SWITCH

A. Provide each automatic transfer switch with a placard identifying:

1. The name of the equipment.
2. The supply system voltage.
3. The name of the equipment supplying the primary feeder.
4. The name of the equipment supplying the standby feeder.

### 3.3 LIGHTING AND APPLIANCE PANELBOARDS

A. Provide each panelboard with a placard identifying:

1. The name of the equipment.
2. The supply system voltage.

3. The name of the equipment supplying the switchboard or panelboard.
4. The circuit number of the overcurrent device supplying the panelboard.

B. Provide each panelboard with a typewritten circuit directing card describing the name of the load served and the room number (3) where the devices are located. Reference the room number(s) actually installed at the project, not the room numbers for Architectural construction documents.

## 3.4 OTHER EQUIPMENT INCLUDING DISCONNECT SWITCHES

A. Provide other electrical and mechanical equipment with placards identifying.

1. The name of the equipment.
2. The name of the supply source equipment.
3. The circuit number of the overcurrent device supplying the equipment.

## 3.5 OUTLET BOXES, JUNCTION BOXES AND WIRING DEVICES

A. Provide labels affixed to the outside cover for each outlet box, junction box, and wiring device identifying the panel name and branch circuit numbers for the overcurrent devices supply the circuits.

**END OF SECTION**

## SECTION 26 05 73

## ELECTRIC POWER SYSTEM ANALYSIS

## PART 1 - GENERAL

### 1.1 REFERENCED DOCUMENTS

A. Comply with Division 1 - General Requirements and related documents.

B. Comply with all other Division 26 sections as applicable.

### 1.2 DESCRIPTION

A. Provide a computer-based fault current study utilizing industry accepted standards, practices, and analysis tools.

1. Equipment with interrupting or withstand ratings of less than the available fault current shall be identified.
2. Equipment which requires series ratings of components in order to provide adequate interrupting ratings shall be identified.

B. Provide a computer-based overcurrent protective device coordination study utilizing industry accepted standards, practices, and analysis tools.

1. Components which cannot achieve full coordination shall be identified.
2. Adjustable protective devices shall be set based on the results of the study.
3. Replaceable protective devices including fuses shall be verified to be the value, rating and speed required based on the results of the study.

C. Provide a computer-based arc flash hazard analysis of the electrical distribution system equipment utilizing industry accepted standards, practices and analysis tools.

1. Provide and install arc flash hazard warning labels as specified on equipment enclosures.

D. For new facilities, the scope of the system shall include the equipment shown on the one-line power diagram, specified feeder types, and equipment and devices as described in the approved equipment submittal drawings. Feeder lengths shall be appropriately estimated from scale floor plan drawings.

1. The Owner shall provide a one-line power diagram completely illustration the system or portions of the system to be included in the analysis.
2. The Owner shall provide copies of the approved submittal drawings or approved operating and maintenance manuals completely describing the equipment and component devices with electrical ratings, manufacturer, and model numbers.

E. For existing facilities, the scope of the system shall be ascertained by field survey of the existing system, to include the equipment listed below as may be present on the particular site.

1. Device manufacturer, type, and ratings shall be determined by field survey.
2. Feeder sizes and types shall be determined by field survey.
3. Feeder lengths shall be appropriately estimated by field dimensions.
4. Provide the services of qualified field technical personnel to operate, de-energize and record data which may not be readily observable.
5. Obtain the Owner's permission to de-energize equipment as required and perform those activities on times and dated specified by the Owner.

## 1.3 QUALITY ASSURANCE

A. All elements of the studies and analysis shall be performed under the direct supervision and control of a Professional Electrical Engineer licensed in the state where the project is located.

B. The Professional Engineer shall be experienced in the application of the software employed for a period of not less than three years and shall be able to provide evidence of having performed successful studies of similar magnitude and complexity for electrical distribution systems employing similar devices.

## 1.4 REFERENCED STANDARDS

A. IEEE 399 - Recommended Practice for Industrial and Commercial Power Systems Analysis.

B. IEEE 242 - Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.

C. IEEE 1584 - IEEE Guide for Performing Arc Flash Hazard Calculations.

## 1.5 DELIVERABLES

A. Provide two bound copies of complete study and analysis including:

1. Single line power diagrams of the electrical power distribution system utilizing nomenclature consistent with the study input data forms.
2. Fault Current Study:
    a. Study input data in tabular form.
    b. Fault current available at each bus or item of equipment, listed in tabular form.
    c. Required equipment fault current ratings at each bus or item of equipment, listed in tabular form.
    d. A listing of all components for which the fault current available exceeds the equipment fault current ratings.

3. Coordination Study:
    a. Coordination study time current curves on log-log axis graphs.
    b. A listing of all components for which clear coordination cannot be achieved.
    c. A listing of all components which are not protected within their component ratings.
    d. Pickup and time delay settings for all adjustable devices in tabular form.
    e. Fuses elections, ratings and speeds for all replaceable protective devices.
4. Arc Flash Hazard Analysis:
    a. A listing of the flash protection boundary, incident energy, working distance and hazard risk category for each item of equipment in tabular form.
    b. Copies of all Arc Flash Information labels provided for the facility.

## PART 2 - PRODUCTS

### 2.1 COMPUTER SOFTWARE DEVELOPERS

A. Subject to compliance with requirements, companies offering computer software programs that may be used in the Work included, but are not limited to, the following:

1. Easy Power.
2. SKM Systems Analysis, Inc.

### 2.2 COMPUTER SOFTWARE PROGRAM REQUIREMENTS

A. Comply with IEEE 399.

B. Analytical features of fault-current-study computer software program shall include “mandatory”, “very desirable”, and “desirable” features as listed in IEEE 399.

C. Computer software program shall be capable of plotting and diagraming time-current-characteristics curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

D. Computer software shall be capable of printing Arc Flash information labels for installation on facility electrical equipment enclosures.

### 2.3 ARC FLASH LABELS

A. Arc flash labels shall be printed on self-adhesive durable material resistant to fading, moisture, or peeling.

## PART 3 - EXECUTION

### 3.1 POWER SYSTEM DATA

A. Gather and tabulate the following input data to support coordination study:

1. Product Data for overcurrent protective devices involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective submittals, input and output data, and recommended device settings.
2. Impedance of utility source of supply.
3. Electrical Distribution System Diagram:
    a. Circuit breaker and fuse current ratings and types.
    b. Relays and associated power and current transformer ratings and rations.
    c. Transformer kilovolt amperes, primary and secondary voltages, connection type, impedance, and X/R rations.
    d. Generator kilovolt amperes size, voltage, and source impedance.
    e. Feeders: Conduit material, sizes of conductors, conductor material, insulation, and length.
    f. Busway ampacity and impedance.
    g. Motor horsepower and code letter designation according to NEMA MG 1.
4. Data sheets to supplement electrical distribution system diagram, cross-reference with tag numbers on diagram, showing the following:
    a. Special load considerations, including starting inrush currents and frequent starting and stopping.
    b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
    c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
    d. Generator thermal-damage curve.
    e. Ratings, types, and settings of utility company's overcurrent protective devices.
    f. Special overcurrent protective device settings or types stipulated by utility company.
    g. Time-current-characteristic curves of devices indicated to be coordinated.
    h. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
    i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ration for overcurrent relays.

j. Panelboards, switchboards, motor-control center ampacity, and interrupting rating in ampere rms symmetrical.
k. Motor controller ratings including reduced voltage types, variable frequency drive ratings, and motor controller bypasses.

## 3.2 FAULT-CURRENT STUDY

A. Calculate the maximum available short-circuit current in amperes rms symmetrical at busses and at circuit breaker positions of the electrical power distribution system. The calculation shall be for a current immediately after initiation and for a three-phase bolted short circuit at each of the following:

1. Service main equipment.
2. Switchgear and switchboards.
3. Transformers.
4. Distribution switchboards.
5. Distribution panelboards.
6. Motor-control centers
7. Motor starters and controllers
8. Branch circuit panelboards

B. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for the project. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.

C. Calculate momentary and interrupting duties on the basis of maximum available fault current.

D. Show calculated X/R rations and equipment interrupting rating (1/2-cycle) fault currents on electrical distribution system diagram.

E. Equipment Evaluation Report:

1. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1.2-cycle symmetrical fault current.
2. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to ½-cycle symmetrical fault current.
3. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

## 3.3 COORDINATION STUDY

A. Perform coordination study using approved computer software program. Prepare a written report using results of fault-current study. Comply with IEEE 399.

1. Calculate the maximum and minimum 1/2-cycle short-circuit currents.
2. Calculate the maximum and minimum interrupting duty (5 cycles to 2 seconds) short-circuit currents.
3. Calculate the maximum and minimum ground-fault currents.

B. Transformer Primary Overcurrent Protective Devices:

1. Device shall not operate in response to the following:
    a. Inrush current when first energized.
    b. Self-cooled, full load current or forced-air-cooled, full load current, whichever is specified for that transformer.
2. Device settings shall protect transformers from fault currents.

C. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA-P-45-482, and conductor melting curves in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

D. Coordination-Study Report: Prepare a written report indicating the following results of coordination study:

1. Tabular Format of Settings Selected for Overcurrent Protective Devices:
    a. Device tag.
    b. Relay-current transformer ratios; and tap, time-dial, and instantaneous-pickup values.
    c. Circuit-breaker sensor rating; and long-time, short-time, and instantaneous settings.
    d. Fuse-current rating and type.
    e. Ground-fault relay-pickup and time delay settings.
2. Coordination Curves: Prepared to determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exits between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:
    a. Device tag.

b. Voltage and current ration for curves.
c. Three-phase and single-phase damage points for each transformer.
d. No damage, melting, and clearing curves for fuses.
e. Cable damage curves.
f. Transformer inrush points.
g. Maximum fault current cutoff point.

E. Provide completed data sheets for setting of overcurrent protective devices.

## 3.4 ARC FLASH HAZARD ANALYSIS

A. Perform an arc flash hazard analysis for the electric power distribution system at each of the following:

1. Service main equipment
2. Switchgear and switchboards
3. Transformers
4. Distribution switchboards
5. Distribution panelboards
6. Motor control centers
7. Motor starters and controllers
8. Branch circuit panelboards

B. Arc flash hazard labels shall be provided and be installed on each item of equipment and shall include the following:

1. “Arc Flash Information” banner
2. Flash protection boundary in inches
3. Incident energy in Ca1/Cm2
4. Working distance in inches
5. PPE Category per NFPA 70E
6. Shock hazard when cover is open
7. Limited approach in inches
8. Restricted approach in inches
9. Prohibited approach in inches
10. Equipment name
11. Arc flash study date

**END OF SECTION**

# SECTION 26 24 16

# PANELBOARDS

## PART 1 - GENERAL

### 1.1 REFERENCED DOCUMENTS

A. Comply with Division 1 - General Requirements and related documents.

B. Comply with all other Division 26 sections as applicable.

C. Refer to other Divisions for coordination of work with other portions of work.

### 1.2 DESCRIPTION

A. Provide lighting and appliance branch circuit panelboards, circuit breakers and accessories.

B. Related work specified in other sections:

1. 26 00 00 - Electrical

### 1.3 QUALITY ASSURANCE

A. The equipment supplied and installed shall meet the requirements of the National Electrical Code and all applicable local codes and ordinances.

B. All equipment supplied shall be Underwriter's Laboratories Inc. listed and so labeled.

### 1.4 REFERENCED STANDARDS

A. NEMA PB 1 - Panelboards

B. NEMA PB1.1 - Instructions for Sate Installation, Operation and maintenance of Panelboards Rated 600 Volts or Less.

C. NEMA AB 1 - Molded Case Circuit Breakers

D. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)

E. UL 50 - Enclosures for Electrical Equipment

F. UL 67 - Panelboards

G. UL 98 - Enclosed and Dead-front Switches

H. UL 489 - Molded-Case Circuit Breakers and Circuit Breaker Enclosures

I. Federal Specification W-P-115C - Type Class 1

J. Federal Specification W-C-375B/Gen - Circuit Breakers, Molded Case, Branch Circuit and Service.

## 1.5 SUBMITTALS

A. Submit product data under provisions of section 26 00 00 Electrical.

B. Submit Shop Drawings including:

1. Voltage Ratings.
2. Main lug or breaker rating and location voltage ratings.
3. Main Bus Rating.
4. Neutral Bus Rating and location.
5. Ground Bus Rating and location.
6. Thru-feed or sub-feed lug ratings and location.
7. Overall Panelboard Dimensions.
8. Interior Mounting Dimensions.
9. 1/4" scale layout of proposed equipment location including required working clearances, interference with other equipment and available recessing depth where applicable.
10. Location and arrangement of branch breakers.
11. Number of poles, trip ratings, and interrupting ratings of branch breakers.
12. Top and bottom conduit entries and knockouts.
13. Enclosure NEMA Type.
14. Panel deadfront, trim, door, hinge and locking provisions.
15. Manufacturer's literature describing circuit breakers and trip units for each type and frame employed.

C. Provide closeout documents as required in Division 1.

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Equipment shall be included and off loaded in accordance with the manufacturer's published instructions.

B. Upon arrival, inspect equipment for damage incurred in shipping.

C. Store in a clean, dry environment. Maintain factory packaging and, if required, provide an additional heavy canvas or heavy plastic cover to protect enclosure(s) from dirt, water, construction debris, and traffic.

D. Conform to NEMA PB2 service conditions during and after installation of panelboards.

## 1.7 MANUFACTURER

A. The equipment shall be the product of a manufacturer with a minimum of ten years experience with the manufacturer of similar equipment.

B. Acceptable Manufacturers:

1. ABB / GE.
2. Eaton / Cutler-Hammer.
3. Square D Company.

## 1.8 WARRANTY

A. The equipment shall be warranted to be in proper working order for a period of one year following the date of final acceptance.

# PART 2 - PRODUCTS

## 2.1 GENERAL

A. Interior:

1. Shall be equal to Square D type NF panelboard for 480 volt and Square D NQOB for 208 volt. Continuous main current ratings, as indicated on drawings.
2. Minimum Short Circuit Rating:
    a. 65,000 rms symmetrical amperes at 480Y/277V or as indicated on the Drawings.
    b. 25,000 rms symmetrical amperes at 208Y/120V or as indicated on the Drawings.
    c. All panelboard components shall be fully rated for the required short circuit interrupting rating. Series rating of devices is not permitted.
3. Provide one (1) continuous bus bar per phase. Each bus bar shall have sequentially phased branch circuit connectors limited to bolt-on branch circuit breakers. The bussing shall be fully rated. Panelboard bus current rating shall be determined by heat-rise tests conducted in accordance with UL 67. Bussing shall be plated aluminum. Bus bar plating shall run the entire length of the bus bar. Panelboards shall be suitable for use as Service Equipment when application requirements comply with UL 67 and NEC Articles 230-F and -G.
4. All current-carrying parts shall be insulated from ground and phase-to-phase by high dielectric strength thermoplastic.
5. A solidly bonded aluminum equipment ground bar shall be provided. An additional aluminum isolated/insulated ground bar shall also be provided as indicated on the Drawings.

6. UL Listed panelboards with 200% rated solid neutral shall be plated aluminum for non-linear load applications. Panelboards shall be marked for non-linear load applications.
7. Interior trim shall be dead-front construction to shield user from energized parts. Dead-front trim shall have filler plated covering unused mounting space.
8. Nameplate shall contain system information and catalog number or factory order number. Interior wiring diagram, neutral wiring diagram, CSA/UL Listed label and short circuit current rating shall be displayed on the interior or in a booklet format.
9. Interiors shall be field convertible for top or bottom incoming feed. Main lug interiors up to 400 amperes shall be field convertible to main breaker. Interior leveling provisions shall be provided for flush mounted applications.
10. Interior phase bus shall be pre-drilled to accommodate field installable options (i.e., Sub-Feed Lugs, Sub-Feed Breakers, and Thru-Feed Lugs).
11. Interiors shall accept 125 ampere breakers in group mounted branch construction.

B. Main Circuit Breaker:

1. Main circuit breakers shall have an overcenter, trip-free, toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have a permanent trip unit with thermal and magnetic trip elements in each pole. Each thermal element shall be true rms sensing and be factory calibrated to operate in a 40 Deg.C. ambient environment. Thermal elements shall be ambient compensating above 40 Deg.C.
2. Two- and three-pole circuit breakers shall have common tripping of all poles. Circuit breakers frame sizes above 100 amperes shall have a single magnetic trip adjustment located in the front of the breaker that allows the user to simultaneously select the desired trip level all poles.
3. Circuit breaker handle and faceplate shall indicate rated ampacity. Standard construction circuit breaker shall be CSA and UL Listed for reverse connection without restrictive line or load markings.
4. Circuit breaker escutcheon shall have international I/O markings, in addition to standard ON/OFF markings. Circuit breaker handle accessories shall provide provisions for locking handle in the ON or OFF position.
5. Lugs shall be UL Listed to accept solid or standard copper and aluminum conductors. Lugs shall be suitable for 75 Deg.C. rated wire.
6. The circuit breakers shall be UL Listed for use with the following accessories: Shunt Trip, Under Voltage Trip, Ground Fault Shunt Trip, Auxiliary Switch, Alarm Switch, Mechanical Lug Kits, and Compression Lug Kits.

C. Branch Circuit Breakers:

1. Circuit breakers shall be UL Listed with amperage ratings, interrupting ratings, and number of poles as indicated on the drawings.
2. Molded case branch circuit breakers shall have bolt-on type bus connectors.
3. Circuit breakers shall have an overcurrent toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have thermal and

magnetic trip elements in each pole. Two- and three-pole circuit breakers shall have common tripping of all poles.

4. The exposed faceplates of all branch circuit breakers shall be flush with one another.
5. Lugs shall be UL Listed to accept solid or stranded copper and aluminum conductors. Lugs shall be suitable for 75 Deg.C. rated wire.
6. Breakers shall UL Listed for use with the following factory installed accessories: Shunt Trip, Auxiliary Switch, and Alarm Switch.
7. Breaker shall be UL Listed with the follow ratings: (15-125A) Heating, Air Conditioning, and Refrigeration (HACR), (15-30A) High Intensity Discharge (HID), (15-20A) Switch Duty (SWD), (15-50A) Equipment Protection Device (EPD) (480Y/277Vac maximum).

D. Enclosures:

1. Type 1 Boxes
    a. Boxes shall be hot zinc dipped galvanized steel constructed in accordance with UL 50 requirements. Unpainted galvanized steel not acceptable.
    b. Boxes shall have removable endwall with knockouts located on one end. Boxes shall have welded interior mounting studs. Interior mounting brackets are not required.
    c. Box width shall not exceed 20" wide.
2. Type 1 Fronts
    a. Front shall meet strength and rigidity requirements per UL 50 Standards. Shall have ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.
    b. Mounting shall be flush, or surface as indicated on the Drawings.
    c. Front shall have flat latch type lock with catch and spring-loaded stainless-steel door pull. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock. A clear plastic directory card holder shall be mounted on the inside of door.
    d. Fronts shall be hinged door-in-door construction with front trim connected to enclosure with continues piano hinge and latch to access all wiring and termination without removing the door from the enclosure. A separate door, hinge and latch shall be provided to access the deadfront compartment to provide access to main and branch breaker operating handles with no exposure to energized parts.
3. Type 3R, 5 and 12
    a. Enclosures shall be constructed in accordance with UL 50 requirements. Enclosures shall be painted with ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.

b. All doors shall be gasketed and equipped with a tumbler type vault lock and two (2) additional quarter turn fasteners on enclosures 59 inches or more in height. All lock assemblies shall be keyed alike. One 91) key shall be provided with each lock. A clear plastic directory card holder shall be mounted on the inside of door.
c. Maximum enclosure dimensions shall not exceed 21" wide and 9.5" deep.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Install panelboards in accordance with manufacturer's written instructions, NEMA PB 1.1 and NEC standards.

B. Provide panelboard supports to the building structure independent of raceways.

### 3.2 FIELD QUALITY CONTROL

A. Inspect complete installation for physical damage, proper alignment, anchorage, and grounding.

B. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads within 20% of each other. Maintain proper phasing for multi-wire branch circuits.

C. Check tightness of bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written specifications.

### 3.3 IDENTIFICATION

A. Provide engraved panelboard nameplate permanently affixed to the panel boor, giving panelboard name designation, system voltage, and name of the panelboard supply source.

B. Provide a neatly typewritten circuit directory card in card holder inside panel door describing the name and location of devices served by each branch breaker using numbers finally established at the project.

### 3.4 FUTURE PROVISIONS

A. From each flush mounted panelboard section, provide a minimum of two 1" conduits stubbed into the accessible ceiling and/or crawl space, as may be available, for future branch circuit wiring.

B. Provide a pull cord in all future conduits with identifying tags on both ends.

## 3.5 COORDINATION OF LOADS SERVED

A. Confirm that all branch circuit breakers are of the proper type and configuration for the loads finally connected:

1. HCAR Rated.
2. HID Rated.
3. GFCI Rated.
4. AFCI Rated.
5. Three pole common trip breakers for multi-wire branch circuits.

B. Reconnect loads, rearrange branch circuit breakers of provide new breakers as required to ensure branch circuit breakers are proper type and properly rated for the loads finally connected.

## 3.6 CLEANING

A. Throughout the construction period, maintain panelboards and interiors free of dust, debris, wire trimmings, etc. Provide heavy duty plastic barriers as required.

B. Before final acceptance, thoroughly clean panelboards and interiors and vacuum clean to a dust free condition.

## 3.7 TRAINING

A. Provide eight hours of training for the Owner's personnel in the operation and maintenance of the equipment.

**END OF SECTION**

# SECTION 26 27 16

# ELECTRICAL CABINETS AND ENCLOSURES

## PART 1 - GENERAL

### 1.1 REFERENCE DOCUMENTS

A. Conditions of the Contract and Division 01 - General Requirements are hereby made a part of this section.

B. All sections of this specification.

### 1.2 DESCRIPTION

A. Work Included: Provide cabinets for the installation of wiring and equipment.

B. Related work specified in other section:

1. 26 00 00 - Electrical
2. 26 24 16 - Panelboards
3. 26 28 16 - Enclosed Switches and Circuit Breakers
4. 26 05 23 - Control Voltage Electrical Power Cables

### 1.3 QUALITY ASSURANCE

A. Source Quality Control: Tests to meet applicable Underwriters' Laboratories, Inc. Standards.

B. Reference Standards:

1. Underwriters' Laboratories, Inc. applicable Standards.
2. National Electrical Code.

C. Design Criteria: National Electrical Manufacturer's Association construction types based on environment.

1. Indoor: NEMA Type 1
2. Outdoor: NEMA Type 3R

### 1.4 SUBMITTALS

A. Submit product data under provisions of section 26 00 00 Electrical.

B. Shop Drawings shall include dimensions, knockout sizes and locations, material types and gauges, finishes, and installation methods.

C. Certificates shall include labels of Underwriters' Laboratories, Inc., and National Electrical Manufacturer's Association affixed to each item.

D. Provide closeout documents as required in Division 1.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

A. ABB/GE.

B. Eaton.

C. Square D Company.

### 2.2 MATERIALS

A. For Panelboards:

1. Same manufacturer as panelboard, boxes of code gauge steel, welded with edges turned to receive trim, and galvanized.
2. Trim and doors No. 12 gauge steel minimum, hinged door, flush tumbler lock and catch keyed alike throughout the work, factory enamel finish, suitable for field color coat.
    a. Flush: Overlap minimum 3/4 inches top, bottom, and sides.
    b. Surface: Same size as cabinet.

## PART 3 - EXECUTION

### 3.1 INSPECTION

A. Examine structure to which cabinets are to be secured for defects which affect the execution and quality of work.

B. Do not start work until defects are corrected.

### 3.2 PREPARATION

A. Carefully measure and lay out exact locations.

B. Provide supports.

### 3.3 INSTALLATION

A. Provide cabinets where indicated and where necessary.

B. Provide flush type in finished areas centered in paneling and other Architectural features.

C. Provide surface type in equipment rooms, above accessible finished ceilings, and in crawl spaces.

D. Install lighting and power cabinets with tops 6 feet 6 inches above finished floor.

E. Install cabinet trim and doors straight and plumb.

## 3.4 CABINET IDENTIFICATION

A. Cabinets for all panelboards, switchboards, disconnect switches, transformers, motor starters, and electrical equipment furnished shall be provided with engraved phenolic lamacoid plastic name plates with 1/2-inch block engraving.

B. Name plates shall give equipment designation as scheduled on the drawings, circuit number designation, and voltage and phase of service.

## 3.5 ADJUSTMENT AND CLEANING

A. Adjust trims and doors for vertical and horizontal alignment.

B. Clean surfaces to be painted.

**END OF SECTION**

# SECTION 26 28 16

# ENCLOSED SWITCHES AND CIRCUIT BREAKERS

## PART 1 - GENERAL

### 1.1 REFERENCED DOCUMENTS

A. Comply with Division 1 - General Requirements and related documents.

B. Comply with all other Division 26 sections as applicable.

C. Refer to other Divisions for coordination of work with other portions of work.

### 1.2 DESCRIPTION

A. Work Included: Provide disconnect switches and enclosed circuit breakers for branch circuit, motor circuits, and items of equipment.

B. Related work specified in other sections:

1. Division 23
2. 26 00 00 - Electrical
3. 26 28 13 - Fuses

### 1.3 QUALITY ASSURANCE

A. The equipment supplied and installed shall meet the requirements of the National Electrical Code and all applicable local codes and ordinances.

B. All equipment supplied shall be Underwriter's Laboratories Inc. listed and so labeled.

### 1.4 REFERENCED STANDARDS

A. UL 50 Cabinets and Boxes

B. UL 98 Enclosed and Deadfront Switches

C. UL 489 Molded Case Circuit Breakers

D. UL 977 Fused Power Circuit Devices

E. NEMA AB1 Molded Case Circuit Breakers and Molded Case Switches

F. NEMA KS1 Enclosed Switches

### 1.5 SUBMITTALS

A. Submit product data under provisions of section 26 00 00 Electrical.

B. Submit shop drawings including:

1. Enclosure outline drawings and dimensions.
2. Nameplate schedule.
3. Assembly ratings including:
    a. Main lug ratings and location.
    b. Voltage ratings.
    c. Short circuit ratings.
4. Conduit entry and exit locations, dimensions, and knock-outs.
5. Cable terminal sizes.
6. Fuse types and ratings.
7. Manufacturer's literature describing circuit breakers and trip units.

C. Provide closeout documents as required in Division 1.

## 1.6 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and off loaded in accordance with the manufacturer's published instructions.

B. Upon arrival, inspect equipment for damage insured in shipping.

C. Store and protect equipment from moisture and dust by storing in a clean, dry, heated space. Provide additional heavy plastic cover to protect the equipment and components. Provide auxiliary heating in the sections in accordance with the manufacturer's recommendations.

## 1.7 MANUFACTURER

A. The equipment shall be the product of a manufacturer with a minimum of ten years experience with the manufacture of similar equipment.

B. Acceptable Manufacturers:

1. ABB/GE.
2. Eaton.
3. Square D Company.

## 1.8 WARRANTY

A. The equipment shall be warranted to be in proper working order for a period of one year following the date of final acceptance.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

A. Enclosed Switches

1. Provide enclosed switches where indicated on the drawings or required by NEC.
2. Switches shall be NEMA Type HD, heavy duty, rated 600 volts, with quick-make, quick break switch units and external operator, rated 100,000 A.I.C.
3. Switches shall be fused or unfused as shown on the drawings and as required by NEC, capacity and number of poles as indicate don the drawings.
4. Enclosures shall be provided with interlocks to prevent opening the enclosure without first opening the switch and to prevent operating the switch with the enclosure open.
5. Enclosures shall be provided with a means for pad locking in the open position.
6. Enclosures shall be provided with an equipment grounding lug.
7. Enclosures for use on four wire shall be provided with an insulated neutral bus.
8. Line side and load side terminals shall be provided with insulating cover to prevent accidental contact.
9. Indoor locations shall be provided with NEMA Type 1 Enclosures.
10. Outdoor locations shall be provided with NEMA Type 3R Enclosures and watertight threaded hubs for conduit entry.

B. Enclosed Circuit Breakers

1. Provide enclosed circuit breakers or molded case switches where indicated on the drawings or required by the NEC.
2. Enclosed circuit breakers shall be service entrance rated with a neutral to ground disconnecting link.
3. Circuit breakers shall be molded case, 100% rated, electronic trip, microprocessor based, true RMS sensing, with adjustable, defeatable instantaneous pickup.
4. Units shall be 600 volt or 250 volt as required and unless noted otherwise shall be 42,000 A.I.C.
5. Enclosures shall be provided with a means for pad locking in the open position.
6. Enclosures shall be provided with and equipment ground bus.
7. Enclosures for use on four wire systems shall be provided with an insulated neutral bus.
8. Line side and load side terminals shall be provided with insulating covers to prevent accidental contact.
9. Indoor locations shall be NEMA Type 1 Enclosures.
10. Outdoor locations shall be NEMA Type 3R enclosures and watertight hubs for threaded conduit entry.

## PART 3 - EXECUTION

### 3.1 INSPECTION

A. Inspect building structure to which disconnects are to be secured for defects which affect the execution and quality of work.

B. Do not start work until defects are corrected.

### 3.2 PREPARATION

A. Carefully measure and lay out exact locations maintaining working clearances required by the National Electrical Code.

### 3.3 INSTALLATION

A. Provide disconnects where indicated and where required by the National Electrical Code and all equipment where integral disconnects are not provided by the manufacturers.

B. Provide disconnects mounted to building structure ahead of flexible conduit final connection to each fan powered terminal box.

C. Install within sight of equipment served.

D. Provide final connection to equipment served.

E. Provide engraved lamicoid name plate secured to cabinet with designation of equipment served, operating voltage, and circuit designation.

**END OF SECTION**

## SECTION 26 36 23

## AUTOMATIC TRANSFER SWITCHES

### PART 1 - GENERAL

### 1.1 REFERENCED DOCUMENTS

A. Comply with Division 1 - General Requirements and Related Documents.

B. Comply with all other Division 26 sections as applicable.

C. Refer to other Divisions for coordination of work with other portions of work.

### 1.2 DESCRIPTION

A. Work Included: Provide the automatic transfer switches as shown on the drawings. Three or four pole and with voltage and continuous current ratings shall be as shown on the Drawings.

B. The complete transfer switch assembly shall be factory tested to ensure proper operation and compliance with the specification requirements.

### 1.3 QUALITY ASSURANCE

A. All equipment supplied and installed shall meet the requirements of the National Electrical Code and all applicable local codes and regulations.

B. All equipment supplied shall be Underwriter's Laboratories, Inc. listed and so labeled. Any equipment which is not so listed shall be provided with a listing acceptable to the Authority Having Jurisdiction or provided with independent agency testing and certification acceptable to the Authority Having Jurisdiction.

### 1.4 REFERENCED STANDARDS

A. The automatic transfer switches and controls shall confirm to the requirements of:

1. UL 1008 - Standard for Transfer Switch Equipment.
2. IEC 947-6-1 Low-voltage Switchgear and Control gear; Multifunction equipment; Automatic Transfer Switching Equipment.
3. NFPA 70 - National Electrical Code.
4. NFPA 99 - Essential Electrical Systems for Health Care Facilities.
5. NFPA 110 - Emergency and Standby Power Systems.
6. IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industries Applications.
7. NEMA Standard ICS10-1993 (formerly ICS2-447) - AC Automatic Transfer Switches.

8. UL 508 Industrial Control Equipment.
9. CSA C22.2 No. 178 Certification.

## 1.5 SUBMITTALS

A. Submit product data under provisions of section 26 00 00 Electrical.

B. Manufacturer's Data: Submit copies of the manufacturer's literature, completely describing the automatic transfer switch and controls.

C. Shop Drawings: Submit copies of shop drawings completely describing automatic transfer switch dimensions and wiring diagrams.

D. Provide closeout documents as required in Division 1.

## 1.6 PRODUCT HANDLING

A. The transfer switch assembly shall be delivered to the project on the manufacturer's shipping pallet and enclosed in a dust and moisture proof enclosure.

B. Maintain the manufacturer's protective enclosure until the installation location is weather resistant, clean, and dust free.

## 1.7 MANUFACTURER

A. The transfer switch shall be provided by the manufacturer of the standby generator.

B. The equipment shall be provided by a manufacturer who has produced this type of equipment and capacity for a period of ten years and who maintains a service organization twenty four hours a day throughout the year.

C. The equipment shall be provided by provided by a manufacturer who is 1S0 9001 certified for the design, development, production and service of its complete product line.

D. Acceptable manufacturers include:

1. ABB / Zenith.
2. Automatic Switch Company (ASCO).
3. Other manufacturers will be considered with pre-approval by the Engineer of Record.

## 1.8 PARTS AND SERVICE QUALIFICATIONS

A. Service Facility:

1. The manufacturer shall maintain a Parts and Service Center available twenty-four hours a day throughout the year within 50 miles of the project location. The center shall stock parts as required to support the equipment provided under this

specification, with sufficient inventory to supply no less than 80% of parts within 24 hours and 95% of parts within 48 hours.

B. Service Personnel:

1. The manufacturer shall maintain a local service organization that is factory trained and certified in the service of the equipment provided under this specification. The service organization shall be on call twenty-four hours a day throughout the year and shall commit to having qualified personnel on site within six hours notice at any time.

## 1.9 WARRANTY

A. One year Warranty:

1. The manufacturer's standard warranty shall in no event be for a period of less than one (1) years from the date of final acceptance of the system and shall include repair parts, labor, and reasonable travel expense necessary for repairs at the job site.

# PART 2 - PRODUCTS

## 2.1 CONSTRUCTION AND PERFORMANCE

A. Mechanically Held Transfer Switch:

1. The transfer switch shall be electrically operated and mechanically held with double throw construction, and operated by a momentarily energized solenoid-driven mechanism. Main operators shall include overcurrent disconnect devices; linear motors or gears shall not be acceptable.
2. The switch shall be positively locked and unaffected by momentary outages, so that contact pressure is maintained at a constant value and contact temperature rise is minimized for maximum reliability and operating life.
3. All main contacts shall be silver composition. Switches rated 600 amperes and above shall have segmented, blow-on construction for high withstand and close-on capability and be protected by separate arcing contacts.
4. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. Switches rated 600 amps and higher shall have front removable and replaceable contacts. All stationary and moveable contacts shall be replaceable without removing power conductors and/or bus bars.
5. Designs utilizing component of molded-case circuit breakers, contactors, or parts thereof, which are not intended for continuous duty, repetitive switching or transfer between two active power sources, are not acceptable.
6. Where neutral conductors are to be solidly connected as shown on the plans, a neutral conductor plate with fully rated AL-CU pressure connectors shall be provided.
7. Where neutral conductors are connected to a fourth pole switched neutral, contacts shall overlap for continuous connection to the grounded circuit conductor.

## 2.2 ENCLOSURE

A. The ATS shall be furnished in a NEMA 1(A) enclosure.

B. All standard door mounted switches and indicating lamps shall be integrated into a flush-mounted, interface membrane or equivalent in the enclosure door. The panel shall be capable of having manual locking feature to allow the user to lockout all membrane mounted control switches to prevent unauthorized tampering. The cover shall be mounted with hinges and have a latch that may be padlocked.

## 2.3 CONTROLLER DISPLAY AND KEYPAD

A. An LCD display and keypad shall be an integral part of the controller for viewing all available data and setting desired operational parameters. Operational parameters shall also be available for viewing and limited control through the communications interface port. The following parameters shall only be adjustable via a password protected programming on the controller (dip switches shall not be acceptable):

1. Nominal line voltage and frequency.
2. Single or three phase sensing.
3. Operating parameter protection.
4. All instructions and controller settings shall be easily accessible, readable and accomplished without the use of codes, calculations, or instruction manuals.

## 2.4 VOLTAGE, FREQUENCY AND PHASE ROTATION SENSING

A. Voltage (all phases) and frequency on both the normal and emergency sources shall be continuously monitored, with the following pickup, dropout, and trip setting capabilities (values shown as % of nominal unless otherwise specified):

| Parameter | Dropout/Trip | Pickup/Reset |
|---|---|---|
| Under Voltage | 75 to 98% | 85 to 100% |
| Over Voltage | 105 to 135% | 95 to 100% of trip |
| Under frequency | 85 to 99% | 95 to 99% |
| Over frequency | 105 to 120% | 101 to 105% |
| Voltage unbalance | 5 to 20% | 3% to 18% |

B. Repetitive accuracy of all settings shall be within + 0.5% over an operating temperature range of -20 Deg. F. to 70 Deg. C.

C. An adjustable dropout time for transient voltage and frequency excursions shall be provided. The time delays shall be 0.1 to 9.9 seconds for voltage and .1 to 15 seconds for frequency.

D. Voltage and frequency settings shall be field adjustable in 1% increments wither locally with the display and keypad or remotely via the communications interface port.

E. The controller shall be capable of sensing the phase rotation of both the normal an emergency sources. The source shall be considered unacceptable if the phase rotation is not the preferred rotation selected (ABS or BAC). Unacceptable phase rotation shall be indicated on the LCD; the service required LED and the annunciation through communication protocol and dry contacts. In addition, the phase rotation sensing shall be capable of being defeated, if required.

F. The controller shall be capable of detecting a single phasing condition of a source, even though a voltage may be regenerated by the load. This condition shall be considered a failed source.

G. Source status screens shall be provided for both normal & emergency to provide digital readout of voltage on all 3 phases (phase to phase and phase to neutral), frequency, and phase rotation.

## 2.5 TIME DELAYS

A. An adjustable time delay of 0 to 10 seconds shall be provided to override momentary normal source outages and delay all transfer and engine starting signals. Capability shall be provided to extend this time delay to 60 minutes by providing an external 12 or 24 VDC power supply.

B. A time delay shall be provided on transfer to the emergency source, adjustable from 0 to 60 minutes, for controlled timing of transfer of loads of emergency.

C. A time delay shall be provided on retransfer to normal. The time delays shall be adjustable from 0 to 60 minutes. Time delay shall be automatically bypassed if the emergency source fails and the normal source is acceptable.

D. A time delay shall be provided on shut down of engine generator for cool down, adjustable from 0 to 60 minutes.

E. A time delay activated output signal shall also be provided to drive external relay(s) for selective load disconnect control. The controller shall be capable of controlling a maximum of 9 individual output time delays to step loads on after a transfer occurs. Each output may be individually programmed for their own time delay of up to 60 minutes. Each sequence shall be independently programmed for transferring from normal to emergency and transferring from emergency to normal. The controller shall also include the following built-in time delays for the following operations:

1. 0 to 60 minute time delay on failure to acquire the acceptable electrical parameters from the emergency source.
2. 0 to 60 minute time delay for a failure to synchronize on an in-phase operation.

3. 60 minute time delay for the load disconnect position for delayed transition operation.

F. All time delays shall be adjustable in 1 second increments.

G. All time delays shall be adjustable by using the display and keypad or with a remote device connected to the communications interface port through a security-password system.

H. Each time delay shall be identified and a dynamic countdown shall be shown on the display.

I. The controller shall have three levels of security. Level 1 shall allow monitoring of settings and parameters only. The Level 1 shall be capable of restricted with the use of a lockable cover. Level 2 shall allow test functions to be performed and Level 3 shall allow setting of all parameters.

J. Membrane-type switches shall be provided for the test functions and be maintained until the end test function is activated. The test function shall be allowed through password security. It shall be possible to defeat the password requirement by way of a circuit board mounted dip switch setting. The test function shall be load, no load or auto test. The auto test function shall request an elapsed time for test. At the completion of this time delay the test shall be immediately ended and retransfer shall occur if the emergency source fails and the normal source is acceptable.

K. A SPDT contact, rated 5 amps at 30 VDC, shall be provided for a low-voltage engine start signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output, and run for the duration of the cool down setting, regardless of whether the normal source and restores before the load is transferred.

L. Auxiliary contacts, rated 10 amps, 250 VAC shall be provided consisting two contacts, closed when the ATS is connected to the normal source and two contacts closed, when the ATS is connected to the emergency source.

M. LED indicating lights shall be provided; one to indicate when the ATS is connected to the normal source (green) and one to indicate when the ATS is connected to the emergency source (red).

N. LED indicating lights shall be provided and energized by controller outputs. The lights shall provide true source availability of the normal (green) and emergency sources (red), as determined by the voltage, frequency and phase rotation sensing trip and rest settings for each source.

O. A membrane switch shall be provided on the membrane panel to test all indicating lights and display when pressed.

P. Provide the ability to select “commit/no commit to transfer” to determine whether the load should be transferred to the emergency generator if the normal source restores before the generator is ready to accept the load.

Q. Terminals shall be provided for a remote contact which opens to signal the ATS to transfer to emergency and for remote contacts which closes to inhibits transfer to emergency and/or retransfer to normal. Both of these inhibit signals can be activated through the keypad of the communications interface port. A “not-in-auto” LED shall indicate anytime the controller is inhibiting transfer from occurring.

R. An in-phase monitor shall be a standard feature in the controller. The monitor shall control transfer so that motor load inrush currents fo not exceed normal starting currents, and shall not require external control of power sources. The in-phase monitor shall be specifically designed for and be the product of the ATS manufacturer. The in-phase monitor shall be capable be being enabled or disabled for the user interface.

S. Engine Exerciser - The controller shall provide an internal engine exerciser. The engine exerciser shall allow the user to program up to 21 different exercise routines based on a calendar mode. For each routine, the user shall be able to:

1. Enable or disable the routine.
2. Enable or disable transfer of the load during routine.
3. Set the start time:
    a. Time of day.
    b. Day of week.
    c. Week of month (1st, 2nd 3rd, 4th, alternate or every)
4. Set the duration of the run.
5. At the end of the specified loaded exercise duration the switch shall transfer the load back to normal and run the generator for the specified cool down period. All loaded exercises shall be immediately ended and retransfer shall occur if the standby source fails. The next exercise is active. It shall be possible of ending the exercise event with a single button push.

T. Date and Time: The date shall automatically adjust for leap year and the time shall have the capability of automatically adjusting for daylight saving and standard times.

U. System Status:

1. The controller shall have a default display the following on:
    a. System status.
    b. Date, time and type of the next exercise event.
    c. Average voltage of the preferred and standby sources
2. Scrolling through the displays shall indicate the following:
    a. Line to line to neutral voltages for both sources.

b. Frequency of each source.
c. Load current for each phase.
d. Single or three phase operation.
e. Type of transition.
f. Preferred source.
g. Commit or no commit modes of operation.
h. Source/source mode (Utility/Gen; Gen/Gen; Utility/Utility)
i. In phase monitor enable/disable.
j. Phase rotation.
k. Date and time.

V. Self-Diagnostics: The controller shall contain a diagnostic screen for the purpose of detecting system errors. The screen shall provide information on the status input signals to the controller which may be preventing load transfer commands from being completed.

W. Communications Interface: The controller shall be capable of interfacing, through a standard communications with a network of transfer switches and generators. It shall be able to be connected via an RS-485 serial communication (up to 4000 ft. direct connect or multi-drop configuration), an Ethernet connectivity (over standard 10 baseT Ethernet networks utilizing a RJ-45 port or remotely utilizing a dial-up modem). This module shall allow for seamless integration of existing or new communication transfer devices and generators. Monitoring software shall allow for the viewing, control and setup of parameters of the genset and transfer switch network through a standard personal computer utilizing current Microsoft operating systems. Separate and specific transfer switch software interfaces shall not be acceptable.

X. The transfer switch shall also be able to interface 3rd party applications using Modbus RTU and Modbus TCP/IP open standard protocols utilizing Modbus register maps. Propriety protocols shall not be acceptable.

Y. The controller shall contain a USB port for downloading the controller's parameters and settings; exercise event schedules; maintenance records and event history. The file designator shall be the unique serial number of the transfer switch.

Z. Data Lodging: The controller shall have ability to log data and to maintain the last 2000 events, even in the event of total power loss. The following events shall be time and date stamped and maintained in a non-volatile memory. The controller shall be able to display up to the last 99 events. The remaining events shall be downloaded to be displayed on a computer.

1. Event Logging: Data, date and time indication of any event.
2. Statistical Data:
    a. Total number of transfers.*

b. Total number of fail to transfers.*
c. Total number of transfers due to preferred source failure.*
d. Total number of minutes of operation.*
e. Total number of minutes in the standby source.*
f. Total number of minutes not in the preferred source.*
g. Normal to emergency transfer time.
h. Emergency to normal transfer time.
i. System start date.
j. Last maintenance data.

The statistical data shall be held in two registers. One register shall contain data since start up and the second register shall contain data from the last maintenance reset.

## PART 3 - EXECUTION

### 3.1 APPROVAL

A. As a precondition for approval, the manufacturer of the automatic transfer switches shall verify that the complete transfer switch assembly is listed by Underwriters Laboratories, Inc., standard UL-1008, for use on emergency systems, Nema standard ICS-2-447, and conform to the requirements of NFPA 70, NFPA 99 and NFPA 110.

B. The transfer switch withstand and closing values must be at least equal to the interrupting rating of the circuit breaker and/or fuse that is specified to protect the circuit.

C. When coordinated with circuit breakers, the automatic transfer switch shall have the following short circuit withstand capability: 50,000 RMS amperes symmetrical. During the withstand there shall be no contact welding or damage. The tests shall be performed on identical samples without the use of current limiting fuses. Oscillograph traces across the main contacts shall verify that contact separation has not occurred. Test procedures shall be in accordance with UL-1008 and testing shall be certified by Underwriters Laboratories or any nationally recognized independent testing laboratory.

D. When conducting temperature rise tests to UL-1008, the manufacturer shall include post-endurance temperature rise tests to verify the ability of the transfer switch to carry full rated current after completing the overload and endurance tests.

### 3.2 START UP AND TESTING

A. Provide the services of the manufacturer's factory trained service personnel on site as required during startup and testing of the automatic transfer switch to perform:

1. Verification of Contractor's installation and connection of field wiring.

2. Settings of sensing and time delay parameters as selected by the Owner's representative.
3. Verification of all operating sequences and time delays after setting.
4. Downloading of the transfer switch settings and parameters to a USB storage device to be included in operation and maintenance information.

## 3.3 OPERATION AND MAINTENANCE MANUALS

A. Provide two hard copies and two compact disk copies to the Owner of all required operation and maintenance data.

B. Operation and Maintenance Manuals shall include:

1. Approval submittal documents.
2. Complete instructions on the transfer switch including:
    a. Operation sequence
    b. Control panel operations
    c. Periodic maintenance requirement
    d. Preventative maintenance requirements
3. Final as-built wiring interconnect diagrams.

## 3.4 TRAINING

A. Provide the services of the manufacturer's factory trained technical service personnel to provide training to the Owners operation and maintenance personnel for the generator set to include eight hours of instruction for each generator.

**END OF SECTION**

## SECTION 26 36 25

## GENERATOR TEMPORARY DOCKING STATION

### PART 1 - GENERAL

### 1.1 REFERENCED DOCUMENTS

A. Comply with Division 1 - General Requirements and Related Documents.

B. Comply with all other Division 26 sections as applicable.

C. Refer to other Divisions for coordination of work with other portions of work.

### 1.2 DESCRIPTION

A. Work Included: Provide the dual-purpose automatic transfer switch and temporary generator docking stations as shown on the drawings. Three or four pole and with voltage and continuous current ratings shall be as shown on the Drawings.

B. The complete transfer switch and docking station assembly shall be factory tested to ensure proper operation and compliance with the specification requirements.

### 1.3 QUALITY ASSURANCE

A. All equipment supplied and installed shall meet the requirements of the National Electrical Code and all applicable local codes and regulations.

B. All equipment supplied shall be Underwriter's Laboratories, Inc. listed and so labeled. Any equipment which is not so listed shall be provided with a listing acceptable to the Authority Having Jurisdiction or provided with independent agency testing and certification acceptable to the Authority Having Jurisdiction.

### 1.4 REFERENCED STANDARDS

A. The automatic transfer switches and controls shall confirm to the requirements of:

1. UL 1008 - Standard for Transfer Switch Equipment.
2. NFPA 70 - National Electrical Code.
3. NFPA 110 - Emergency and Standby Power Systems.
4. IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industries Applications.
5. UL 508 Industrial Control Equipment.
6. CSA C22.2 No. 178 Certification.

## 1.5 SUBMITTALS

A. Submit product data under provisions of section 26 00 00 Electrical.

B. Manufacturer's Data: Submit copies of the manufacturer's literature, completely describing the automatic transfer switch and controls.

C. Shop Drawings: Submit copies of shop drawings completely describing automatic transfer switch dimensions and wiring diagrams.

D. Provide closeout documents as required in Division 1.

## 1.6 PRODUCT HANDLING

A. The transfer switch assembly shall be delivered to the project on the manufacturer's shipping pallet and enclosed in a dust and moisture proof enclosure.

B. Maintain the manufacturer's protective enclosure until the installation location is weather resistant, clean, and dust free.

## 1.7 MANUFACTURER

A. The equipment shall be provided by a manufacturer who has produced this type of equipment and capacity for a period of ten years and who maintains a service organization twenty-four hours a day throughout the year.

B. The equipment shall be provided by provided by a manufacturer who is 1S0 9001 certified for the design, development, production and service of its complete product line.

C. Acceptable manufacturers include:

1. Power Temp Systems
2. Trystar

## 1.8 PARTS AND SERVICE QUALIFICATIONS

A. Service Facility:

1. The manufacturer shall maintain a Parts and Service Center available twenty-four hours a day throughout the year within 50 miles of the project location. The center shall stock parts as required to support the equipment provided under this specification, with sufficient inventory to supply no less than 80% of parts within 24 hours and 95% of parts within 48 hours.

B. Service Personnel:

1. The manufacturer shall maintain a local service organization that is factory trained and certified in the service of the equipment provided under this specification. The

service organization shall be on call twenty-four hours a day throughout the year and shall commit to having qualified personnel on site within six hours' notice at any time.

## 1.9 WARRANTY

A. One year Warranty:

1. The manufacturer's standard warranty shall in no event be for a period of less than one (1) year from the date of final acceptance of the system and shall include repair parts, labor, and reasonable travel expense necessary for repairs at the job site.

# PART 2 - PRODUCTS

## 2.1 GENERAL REQUIREMENTS

A. Enclosure

1. NEMA 3R Rain-Tight Aluminum Enclosure
    a. Pad-lockable front door shall include a hinged access plate at the bottom for entry of temporary cabling that prevents unauthorized tampering while in use.
    b. NEMA 3R Integrity shall be maintained while temporary cabling is connected during use.
    c. Front and Side shall be accessible for maintenance.
    d. Top, Side, and Bottom shall be accessible for permanent cabling.
2. Powder coat
    a. Paint after fabrication shall be Hammer tone Gray.

B. Phase, Neutral, and Ground Busbar

1. Material: Silver-plated Copper
2. Equipment Ground Bus: bonded to box.
3. Isolated Ground Bus: insulated from box.
4. Ground Bus: 50% of phase size.
5. Neutral Bus: Neutral bus rated 100 percent of phase bus.

C. Temporary generator connectors shall be Camlok style mounted on gland plate.

1. Camlok shall be 16 Series model and color coded according to system voltage requirements.
2. Camlok connections shall be Bus Bar Style, Cabling or Double Set Screw is not acceptable.
3. Camlok connection shall be protected against accidental contact while not in use.

D. Permanent Connection shall be factory installed broad range set-screw mechanical type, located behind a physical barrier.

E. Transfer Switch Configuration

1. Docking Station shall have integrated Manual Transfer Switch (MTS).
    a. MTS shall have two source positions – Normal and Emergency Line
    b. MTS shall be located behind pad lockable door to prevent any tampering by unauthorized personnel.

F. Short Circuit & Withstand Rating

1. Shall be a minimum of 65 KAIC unless otherwise indicated on drawings.

G. Voltage & Amperage

1. 400 amperes
2. 208Y/120V, 3PH, 4W

H. Factory Installed Phase Rotation Monitor Device:

1. Phase monitoring relay to be Siemens 3U4512-1AR20 or equal and factory installed.

I. Service Rated Circuit Breaker Disconnects as Indicated on Project Drawings and Manufacturer Submittal Drawings:

1. Must be UL 489 Listed Breaker
2. Breakers shall be removable for service and maintenance.
3. Service Entrance Rated

J. Additional accessories shall be included in submittal drawing as follows:

1. Two Wire Auto Start
2. Battery Charger Receptacle 20A GFCI 125V
3. Block Heater Receptacle 30A L5-30 125V
4. Kirk Key Door Interlock
5. Listed Monitoring Device

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine elements and surfaces to receive Generator Docking Station for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

A. The equipment shall be installed per the manufacturer's recommendations and all NEC and local code requirements.

B. Surface, Flush or Base Mounted: Determined by Application

C. Install anchor bolts to elevations required for proper attachment to Generator Docking Station.

## 3.3 IDENTIFICATION

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

B. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.

C. Label each enclosure with engraved metal or laminated-plastic nameplate.

## 3.4 FACTORY TESTING

A. Standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of UL and NEMA standards.

## 3.5 FACTORY COMMISSIONING

A. Upon completion of the installation, the docking station shall be commissioned by the Manufacturer’s factory authorized technician.

B. SCOPE OF WORK SHALL INCLUDE:

1. Review and verify the installation of all docking station components and verify the correct electrical flow as depicted on the one-line drawings.
2. The Manufacturer’s authorized technician will set the long time, short time, instantaneous and ground fault protection settings on the Generator Docking Station circuit breaker(s) in accordance with the engineer’s specifications or as provided as part of the coordination study.
3. Factory training (minimum of two hours on each site) for on-site personnel to educate them on how to connect the GDS to a portable generator.
4. The Manufacturer’s factory authorized technician shall, upon completion of the commissioning, provide a written report to the electrical contractor and electrical engineer indicating the completion of the work.
5. Any issue that is found during the start-up that is determined at that time to be a warranty issue will be covered by Manufacturer. Any issues that are specific to the scope for the electrical installing contractor are the sole responsibility of the installing contractor.
6. Upon successful completion of the commissioning, manufacturer will provide a 12-month warranty extension, above and beyond the 12-month manufacturer warranty.

## 3.6 FIELD QUALITY CONTROL

A. Third Party Tests and Inspections to include the following:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

B. Prepare test and inspection reports, including a certified report that identifies Generator Docking Station and that describes scanning results. Include notation.

## 3.7 TRAINING

A. Provide the services of the manufacturer's factory trained technical service personnel to provide training to the Owners operation and maintenance personnel for the generator set to include eight hours of instruction for each generator.

**END OF SECTION**