SECTION 262000 - SERVICE AND DISTRIBUTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work specified in this Section shall comply with the provisions of Section 260100.

B. Provide a complete electrical distribution system. The system shall include the service entrance, main switchboard, feeders, transformers, distribution panels, panelboards, busway, remote control switches, contactors, etc., to provide a complete system.

C. All distribution switchgear (branch circuit panelboards, switchboard, distribution panelboards, transformers, busway, etc.) shall be the unit responsibility of one manufacturer. All component parts of the above listed items shall be of the same manufacturer except where a written request for deviation from this requirement has been approved prior to bid date.

D. Shop drawings for equipment specified in this Section shall show that all specified requirements have been incorporated.

E. All floor mounted distribution equipment shall be mounted on a 4" high concrete pad.

1.2 ELECTRICAL SERVICE

A. Make all arrangements with the power company and pay all charges made by the power company for permanent electric service. In the event that the power company's charges are not available at the time the project is bid, the bids shall be qualified to notify the Owner that such charges are not included.

B. The power company will provide the underground primary service and the vault mounted transformer.

C. Provide the installation for the vault-mounted transformer in accordance with the power company specification.

D. The secondary service to the building shall be 277/480 volts, 3 phase, 4 wire, 60 Hertz AC. Provide all conduit and wire as specified from the secondary terminals of the transformer to the main switchboard.

1.3 METERING (From vault mounted transformer)

A. Metering equipment will be by the power company. The power company will furnish the meter cabinet for installation at a location as directed by the power company and as detailed at the vault-mounted transformer.

B. Provide a 1" conduit from the transformer to the meter cabinet as shown. The power company will provide the control wires to the meter.

PART 2 - PRODUCTS

2.1 BRANCH CIRCUIT PANELBOARDS

A. Panelboards (panels) shall be general purpose enclosures and shall be surface or flush mounted as indicated. Panels shall be of the automatic circuit breaker type, factory assembled by the manufacturer of the circuit breakers. Panels shall be for the voltage indicated with the quantity of poles and ampacity of circuit breakers shown.

B. Boxes and trim shall be made from code gauge steel. Boxes shall be sufficient size to provide a minimum gutter space of 4" on all sides. Boxes shall be minimum 20" width and 5 3/4" depth.

C. Hinged door covering all device handles shall be included in all panel trim. Doors shall have flush-type cylinder lock and catch, except that doors over 48" in height shall have auxiliary fasteners at top and bottom of door in addition to flush-type cylinder lock and catch. Door hinges shall be concealed. All locks shall be keyed alike. Directory frame and card having a transparent cover shall be furnished each panel door.

D. Trims for flush panels shall overlap the box by at least 3/4" all around. Surface trims shall have the same width and height as the box. Trims shall be mountable by a screwdriver without the need for special tools. After installation, trim mounting mechanism or hardware shall not be accessible when panel door is closed and locked.

E. All exterior and interior steel surfaces of the trim shall be cleaned and finished with gray paint over a rust-inhibiting phosphatized coating.

F. All interiors shall be completely factory assembled with protective devices, wire connectors, etc. All wire connectors, except screw terminals, shall be of the anti-turn solderless type and all shall be suitable for copper or aluminum wire.

G. Interiors shall be so designed that devices can be replaced without disturbing adjacent units and without removing the main bus connectors, and shall be so designed that devices may be changed without machining, drilling or tapping.

H. Bus bars for the mains shall be of copper sized in accordance with U.L. standards. Full size bars shall be included. Bus bar taps for panels with single pole branches shall be arranged for sequence phasing of the branch circuit devices.

I. Phase bussing shall be full height without reduction. Cross and center connectors shall be of the same material as the bus.

J. The neutral bus shall utilize setscrews to bond the neutral wire to the neutral bus through holes drilled in the neutral bar. A sheet copper neutral bus utilizing flathead screws to hold the neutral wires will not be acceptable.

K. Spaces for future devices shall be included as indicated and shall be bussed for the maximum rated device that can be fitted into them.

L. All circuit breakers shall be manually operated, thermal-magnetic, automatic, of the ampacity and poles as indicated. They shall be quick-make, quick-break, both on manual and automatic operation. Breakers shall be over-the-center toggle operating type, with the handle going to a position between ON and OFF to indicate automatic tripping. All multi-pole breakers shall have internal common trip. The minimum interrupting capacity of the breakers furnished shall be 10,000 Amperes RMS symmetrical for 120/208 volt and 14,000 Amperes RMS symmetrical for 480/277 volt unless indicated otherwise on the riser diagram. The breakers furnished shall be determined by the specifications and by the minimum U.L. labeled RMS symmetrical amperes interrupting capacity at circuit voltage. All circuit breakers shall be bolted on and rigidly braced.

M. Panels having sub-feed lugs for feeding through shall have 8" minimum extra gutter space at the

lug end and on one side.

N. Each panel as a complete unit shall have a short-circuit current rating equal to or greater than the equipment rating indicated.

O. All circuit breakers feeding an emergency panel or main breaker for an emergency panel shall have solid state trip units that are insensitive to changes in ambient temperature and a push-to-trip button to mechanically check the trip mechanism or for the use under emergency trip conditions. Interchangeable rating plugs shall establish the continuous current rating of each breaker. An interlock in the rating plug shall trip the breaker if an attempt is made to remove the plug with the breaker in the ON position. With the plug removed, it shall not be possible to close the breaker.

P. The solid state trip breakers shall provide long delay and magnetic tripping similar to thermal magnetic breakers. In addition, the magnetic trip shall include a short time delay permitting coordination and selective tripping with downstream devices. It shall be possible to check the breaker electrically and mechanically while in service without dismantling equipment and with minimum down time.

Q. Panels shall be as manufactured by General Electric, Square D, Siemens, or Eaton.

2.2 DISTRIBUTION PANELBOARDS

A. Distribution panelboards (panels) shall be of the circuit breaker type, factory assembled by the manufacturer of the circuit breakers, complete with front door cover. The main breaker and the branch circuit breakers shall be as indicated. The main bus shall be 98% conductivity silver plated copper, rated as and of capacity equal to or greater than the rating or setting of the over-current protective device next back in the line. Panel shall be suitable for the voltage and phase indicated. Provide 25% ground bus.

B. Panels shall be flush or surface mounted as indicated, with baked-on enamel trim, adjustable trim clamps and door with chromium plated combination cylinder lock and catch, all locks keyed alike. Provide a specified nameplate for each device and a blank (not engraved) nameplate for each spare breaker or space.

C. The neutral bus shall utilize setscrews to bond the neutral bus through holes drilled in the neutral bar. A sheet copper neutral bus utilizing flathead screws to hold the neutral wires will not be acceptable.

D. All circuit breakers shall be manually operated, thermal-magnetic, automatic, of the ampacity and poles as indicated. They shall be quick-make, quick-break both on manual and on automatic operation. Breakers shall be over-the-center toggle operating type, with the handle going to a position between "ON" and "OFF" to indicate automatic tripping. All multi-pole breakers shall have internal common trip.

E. The minimum interrupting capacity of the breakers furnished shall be 10,000 Amperes RMS symmetrical for 120/208 volt and 14,000 Amperes RMS symmetrical for 480/277 volt unless indicated otherwise on the riser diagram.

F. All main circuit breakers shall be molded case and vertically mounted. All vertically mounted molded case circuit breakers shall be mounted so that the handle is up for "ON" and down for "OFF", when viewed from the normal standing position. All vertically mounted molded case main circuit breakers shall be UL approved for feeding in the bottom and out the top.

G. All circuit breakers, including any connectors to the main bus, shall be bolted and rigidly braced.

H. Spaces for future installation of molded case circuit breakers are specifically by range of trip rather than a single trip size or frame size. The spaces so scheduled shall be complete with all bus and required bus connectors such that future breakers can be installed without adding or changing bus connectors on the main bus and without using a larger (frame size) or more expensive breaker than the trip size and interrupting capacity would require. If the bus connectors furnished on the main bus will not cover the trip range specified, then duplicate sets of connectors shall be furnished on the main bus for each frame size required.

I. All circuit breakers feeding an emergency panel or main breaker for an emergency panel shall have solid state trip units that are insensitive to changes in ambient temperature and a push-to-trip button to mechanically check the trip mechanism or for the use under emergency trip conditions. Interchangeable rating plugs shall establish the continuous current rating of each breaker. An interlock in the rating plug shall trip the breaker if an attempt is made to remove the plug with the breaker in the ON position. With the plug removed, it shall not be possible to close the breaker.

J. The solid state trip breakers shall provide long delay and magnetic tripping similar to thermal magnetic breakers. In addition, the magnetic trip shall include a short time delay permitting coordination and selective tripping with downstream devices. It shall be possible to check the breaker electrically and mechanically while in service without dismantling equipment and with minimum down time.

K Distribution panels shall be as manufactured by General Electric, Square D, Siemens, or Eaton.

2.3 TRANSFORMERS

A. Branch circuit and distribution transformers shall be the dry type and shall have the ratings indicated.

B. Single phase transformers shall be 480 volt primary and 120/208 volt secondary. Three phase transformers shall be 480 volt delta primary and 120/208 volt grounded type secondary. Transformers 25 KVA and larger shall have a minimum of 4 1/2% full capacity primary taps.

C. Transformers shall have a U.L. recognized 220 degree insulation system and shall be designed so that under full load, the average conductor temperature rise does not exceed 115 degree C. rise above a 40 degree C. ambient and the enclosure does not exceed a 50 degree C. rise at any point.

D. Transformer coils shall be of the continuous wound construction and shall be impregnated with non-hygroscopic, thermosetting varnish. All cores to be constructed of high grade, non-aging silicon steel with high magnetic permeability, and low hystersesis and eddy current losses. Magnetic flux densities shall be kept well below the saturation point. The core laminations shall be clamped together with structural steel angles. The completed core and coil shall then be bolted to the base of the enclosure but isolated therefrom by means of rubber, vibration-absorbing mounts. There shall be no metal-to-metal contact between the core and coil and the enclosure. On transformers 500 KVA and smaller, the vibration isolating system shall be designed to provide a permanent fastening of the core and coil to the enclosure. Sound isolating systems requiring the complete removal of all fastening devices will not be acceptable. Sound levels shall be guaranteed by the manufacturer not to exceed the following: 25 to 50 KVA - 45 DB; 51 to 150 KVA - 50 DB; 151 to 300 KVA - 55 DB; 301 to 500 KVA - 60 DB.

E. Transformers 24 KVA and larger shall be in a heavy gauge, sheet steel, ventilated enclosure. The ventilating openings shall be designed to prevent accidental access to live parts in accordance with UL, NEMA, and National Electrical Code standard for ventilated enclosures. Transformers 25 KVA through 112.5 KVA shall be designed so that they can be either floor or wall mounted.

Above 112.5 KVA, they shall be floor-mounted design. The entire transformer enclosure shall be degreased, cleaned, phosphatized, primed and finished with a gray, baked enamel.

F. Transformers shall be compliant with the 2016 DOE efficiency standards:

Table I.6—Electrical Efficiencies for All Low-Voltage Dry-Type Distribution Transformer Equipment Classes

Equipment Class 3 (Single-Phase)		Equipment Class 4 (Three-Phase)	
kVA	%	kVA	%
15	97.70	15	97.89
25	98.00	30	98.23
37.5	98.20	45	98.40
50	98.30	75	98.60
75	98.50	112.5	98.74
100	98.60	150	98.83
167	98.70	225	98.94
250	98.80	300	99.02
333	98.90	500	99.14
		750	99.23
		1000	99.28

G. Transformers that are of the floor-mounted type shall be mounted on Korfund Vibration Eliminators of the pad type.

H. Transformers shall be as manufactured by General Electric, Square D, Siemens, or Eaton.

2.4 MAIN SWITCHBOARD

A. General

1. Provide where indicated, a front and rear accessible dead front type, completely metal enclosed, self-supporting structure independent of wall supports. It shall consist of the required number of vertical sections bolted together to form one rigid switchboard approximately 90" high incorporating switching and protective devices of the number, ratings and type noted herein or shown with necessary interconnections, instrumentation and control wiring. The sides, top and rear shall be covered with removable screw-on plates. Front plates shall be sectionalized and removable. All covers shall be secured by self-tapping screws. Ventilation openings shall be provided where required. The switchboard shall be vermin proof.
2. All sections of the switchboard shall be 20 inches deep except service sections containing large ampacity main circuit breaker or pressure contact type main fusible switch which may be deeper. All section of the switchboard shall align so that the back of the complete structure may be placed flush against a wall. Construction shall allow maintenance of incoming line terminations, main device connections and all main bus bolted connections to be performed with front and rear access.
3. The feeder or branch devices shall be removable from the front and shall be panel mounted with the necessary device line and load connections front accessible.
4. All exterior and interior steel surfaces of the switchboard shall be cleaned and finished with gray hard dried enamel over a rust-inhibiting phosphatized coating.
5. Small wiring, necessary fuse blocks and terminal blocks within the switchboard shall be

furnished when required. All groups of control wires leaving the switchboard shall be provided with terminal blocks with numbering strips.

B. Bussing

1. The bus shall be tin plated aluminum or silver plated copper adequately braced and supported to withstand mechanical forces exerted during short circuit conditions. The main horizontal bus bars shall be mounted on glass polyester insulators with all three phases arranged in the same vertical plane. The main bus shall be braced for short circuits up to the RMS ampere value as shown.
2. A ground bus shall be provided firmly secured to each vertical structure and shall extend the entire length of the switchboard. A ground lug shall be furnished attached to the ground bus in an accessible location.
3. Provide a removable link (solid bar) in the neutral bus where the main disconnect device is provided.
4. Provide a bonding strap from the neutral bus to the switchboard frame. The bonding strap shall be located on the line side of the removable neutral link.

C. Main Circuit Breaker

1. Circuit breaker shall be draw-out type [manually] [electrically] operated. Acceptable manufacturers are Square D Masterpact or equal by GE, Siemens, or Eaton.
2. The case of the circuit breaker shall be a polyester thermoset material providing high dielectric strength.
3. Interrupting rating shall be available up to 200,000 amperes RMS symmetrical without fuses.
4. All circuit breaker operating mechanisms are to be two-step, fully-stored energy devices for quick-make, quick-break operation with a maximum of a five-cycle closing time. Open-close-open (O-C-O) cycle shall be possible without recharging. Motor operator shall automatically charge when circuit breaker is closed. Actuation of the operating handle or an operation cycle of the circuit breaker motor is to charge the closing springs (step one) and operation of a local "close" button is to close the circuit breaker contact (step two). Closing the circuit breaker contacts shall automatically charge the opening springs.
5. Current-carrying components shall be completely isolated from the accessory mounting area and double insulated from the operator with accessory cover in place.
6. Each phase inside the circuit breaker shall be completely isolated from other phases and ground by polyester thermoset material.
7. Padlocking provisions shall be furnished to receive up to three padlocks when circuit breaker is in the disconnected position, positively preventing unauthorized closing of the circuit breaker contacts.
8. Provisions for up to two key locks shall be furnished allowing locking in the disconnected position. Provisions for locking in the connected, test and disconnected positions by padlock or key lock shall be available as an option.
9. Located on the face of the circuit breaker shall be buttons, with optional lockable clear cover, to open and close the circuit breaker and indicators to show the position of the circuit breaker contacts, status of the closing springs, and circuit breaker position in the cell. An indicator shall show "charged-not OK to close" if closing springs are charged but circuit breaker is not ready to close. Circuit breaker racking system must have positive stops at the connected, test, disconnected and withdrawn positions.
10. Circuit breaker must be equipped with an interlock to discharge the stored energy spring before the circuit breaker can be withdrawn from its cell. Circuit breaker must provide a

positive ground contact check between the circuit breaker and cell when the accessory cover is removed while the circuit breaker is in the connected, test or disconnected positions.

11. Primary connectors that can be rotated to provide flexible vertical or horizontal connections shall be available as an option. Front connections shall also be available for shallow depth equipment designs.
12. Ready-to-close contact must be available to indicate remotely that the circuit breaker is "ready to close." The circuit breaker is ready to close when it is open, spring mechanism is charged, a maintained closing order is not present, a maintained opening order is not present, and the circuit breaker is in an operational position.
13. Secondary wiring shall be front accessible and available in cage clamp or ring terminal connections. Secondary wiring must not be accessible when switchgear door is closed.
14. Circuit breaker shall provide long service life. The 3200 A circuit breaker frame and those of lower ratings must be certified to perform a minimum of 10,000 operations without maintenance. The 4000 A and 5000 A frames must be certified to 5,000 operations without maintenance.
15. Circuit breaker shall be equipped with a visual contact wear indicator.
16. Low-voltage power circuit breaker arc chutes containing asbestos will NOT be accepted.
17. Circuit breaker trip system shall be an electronic trip unit.
18. All trip units shall be removable to allow for field upgrades.
19. Trip Units shall incorporate “True RMS Sensing”, and have LED long-time pickup indications.
20. Trip unit functions shall consist of adjustable long-time pickup and delay, optional short-time pickup and delay, instantaneous and ground-fault pickup and delay.
21. Adjustable long-time pickup (Ir) and delay shall be available in an adjustable rating plug that is UL Listed as field-replaceable. Adjustable rating plug shall allow for nine long-time pickup settings from 0.4 to 1 times the sensor plug (In). Other adjustable rating plugs shall be available for more precise settings to match the application. Long-time delay settings shall be in nine bands from 0.5–24 seconds at six times Ir.
22. Short-time pickup shall allow for nine settings from 1.5 to 10 times Ir. Short-time delay shall be in nine bands from 0.1–0.4 I^2t ON and 0–0.4 I^2t OFF.
23. Instantaneous settings on the trip units with LSI protection shall be available in nine bands from 2 to 15 times In. The instantaneous setting shall also have an OFF setting when short-time pick-up is provided.
24. All trip units shall have the capability for the adjustments to be set and read locally by rotating a switch.
25. Trip unit shall provide local trip indication.
26. Ground-fault protection shall be available for solidly grounded three-phase, three-wire or three-phase, four-wire systems. Trip unit shall be capable of the following types of ground-fault protection: residual, source ground return, and modified differential. Ground-fault sensing systems may be changed in the field.
27. Ground-fault settings for circuit breaker sensor sizes 1200 A or below shall be in nine bands from 0.2 to 1.0 times In. The ground-fault settings for circuit breakers above 1200 A shall be nine bands from 500 to 1200 A.
28. Trip units shall be available to provide real time metering. Metering functions include current, voltage, power and frequency. Metering accuracy shall be 1.5% current, 0.5% voltage, and 2% power. These accuracy’s shall be total system including CT and meter and shall be of reading not full scale in a range of 5 – 500%.
29. Provide energy reducing active arc flash mitigation system to comply with NEC 240.87 for

all breakers rated 1200 amps or can be adjusted to 1200 amps or higher.

D. Fusible Switches

1. The main service entrance disconnect device and other protective devices shall be fusible switches as scheduled. The switches shall be NEMA 1 construction and shall have provisions with clear indications that the device is in "ON" or "OFF". The switches shall be quick-make, quick-break mechanisms with a defeatable door interlock to prevent door from being opened when the operating handle is in the "ON" position.
2. Switches shall be operated by a lever-type handle extending through a door with provisions for padlocking in the closed position.
3. Switches of 30-600 amperes shall have plug-on line side connections. Switches of 30-100 amperes shall have built-in fuse pullers. Switches shall have a 200,000 ampere short-circuit rating. Switch enclosures shall have formed openings for maximum protection of load side cables.
4. Switches 800 amperes and larger shall be of the bolted pressure contact type with rating as shown. Pressure contacts are to be made by firmly bolting blades to both top and bottom stationary contacts. Switches shall have quick-make, quick break Kinematic-action mechanisms, interphase barriers and arcing equipment. Switches shall be manually operated and have an electric trip mechanism piloted by the output of ground fault sensing circuitry and other protection features. Power for the electric trip circuit shall be obtained from a control transformer connected from phase to phase on the line side of the switch. The electric trip coil shall be designed to operate at 55% of the rated voltage. Switches shall have an interrupting rating of 12 times continuous rating and have an operating mechanism that shall permit closure of the switch only after the opening mechanism has been charged, to assure that electrical tripping means shall immediately be in condition to open the switch.

E. Distribution Circuit Breakers

1. Electrical circuits shall be protected by molded case circuit breakers. Each pole shall provide inverse time delay and instantaneous circuit protection.
2. Circuit breakers shall be operated by a toggle type handle and shall have a quick-make, quick-break overcenter switching mechanism that is mechanically trip free from the handle so that the contacts cannot be held closed against short circuits and abnormal circuits. Tripping due to overload or short circuit shall be indicated by the handle automatically assuming a position midway between ON and OFF positions.
3. Breakers must be completely enclosed in a molded case. Non-interchangeable trip breakers shall have the trip unit sealed to prevent tampering. Ampere ratings shall be clearly visible. Contacts shall be of the non-welding silver alloy. Arc extinction must be accomplished by means of arc chutes.
4. All circuit breakers with frame sized 600 amps and larger shall have solid state trip units that are insensitive to changes in ambient temperature and a push-to-trip button to mechanically check the trip mechanism or for the use under emergency trip conditions. Interchangeable rating plugs shall establish the continuous current rating of each breaker. An interlock in the rating plug shall trip the breaker if an attempt is made to remove the plug with the breaker in the ON position. With the plug removed, it shall not be possible to close the breaker.
5. The solid state trip breakers shall provide long delay and magnetic tripping similar to thermal magnetic breakers. In addition, the magnetic trip shall include a short time delay permitting coordination and selective tripping with downstream devices. It shall be

possible to check the breaker electrically and mechanically while in service without dismantling equipment and with minimum down time.

F. Ground Fault Protection

1. An adjustable ground fault protection system shall be provided as an integral part of the main circuit breaker or main fused switch, designated feeder breakers and fused switches.
2. The ground fault protection system shall consist of a current sensor enclosing all phase and neutral conductors of the circuits to be monitored, appropriate relaying equipment to provide the desired ground current sensitivity and time-current response characteristics, and equipped to function in conjunction with the other elements of the system.
3. The current sensor shall be of sufficient size to encircle the phase and neutral conductors of the circuit to be monitored. Current sensor output shall be coordinated with the required input to the delay. The current sensor shall have a ground fault current pick-up range of 200 to 1200 amperes. A test winding shall be included to simulate the flow of ground fault current through the sensor to test the operation of the ground fault protection system. The frame of the current sensor shall be constructed so that one leg can be opened to allow removal or installation around cable without disturbing that cable.
4. The ground fault relay shall be solid state construction, except that a coil operated output relay may be provided to control 120 volt power to operate a fusible bolted pressure contact switch. The relay shall have an adjustable current sensitivity for ground fault pick-up currents from 200 amperes to 1200 amperes.
5. Provide a monitor panel on the switchboard, including a push-to-test button for the test circuit and a red ground fault indicator light to indicate the circuit interrupter has opened due to a ground fault condition. The unit shall operate on a 120 volt AC source.
6. Provide a pulsating audible horn that is activated when a ground fault condition occurs. Horn shall stop when ground fault protection system is reset. Horn shall operate during testing of ground fault protection system.

G. Short Circuit Current Rating

1. The switchboard as a complete unit shall be given a single short circuit current by the manufacturer of the rating as shown. Such a rating shall be established by actual test in accordance with U.L. specifications.

H. Provide integral digital meter in the switchboard to display at a minimum the following measured values: Real-Time readings, Energy Readings, Demand Readings, and Harmonics. The meter shall have an Ethernet Communications device.

I. Provide ammeter with selector switch and voltmeter with selector switch and all associated internal wiring. Ammeter, voltmeter and associated selector switches shall be flush mounted on front of switchboard.

J. Main switchboards shall be as manufactured by General Electric, Square D, Siemens, or Eaton.

2.5 BUSWAY

A. Provide aluminum, totally enclosed, non-ventilated plug-in or feeder busway as shown, three-phase, of the ratings scheduled or shown. When a neutral bus is specified, the neutral shall be full size unless designated otherwise. Busway shall be of the low impedance type. The busway shop drawings shall show in detail the design of the totally enclosed busway including in detail, the design of the joint connection. Perforated ventilating housings will not be acceptable.

B. When a ground bus is specified, it shall be sized in accordance with the National Electrical Code based on the overcurrent protective device.

C. The aluminum bus bars shall be tin plated over their entire surface. All bolted connections shall be equipped with Belleville type spring washers. The temperature rise at full rated amperage at any point in the duct shall not exceed 55 degrees C. above ambient temperature.

D. Access shall be required to only one side of the busway for tightening joint bolts. It shall be possible to remove any one length without disturbing the two lengths to which it connects. On feeder busway, tap-offs shall be made with sections specifically designed for that purpose. In these cases, plug-in busway sections shall not be used.

E. The ampere ratings, approximate footage, fittings, etc., are shown. Final field measurements shall be made prior to release of the busway for fabrication. The responsibility for routing the duct as shown shall be included in this Section.

F. The busway shall be securely supported at intervals not exceeding 10'-0". The busway shall be complete with all elbows connectors, expansion joints, floor and wall flanges and offsets shown or required to meet job conditions. Wall flanges shall be provided at each wall and floor flanges at each floor where busway passes through. The openings between the flanges and the floor or wall should be caulked with suitable insulation material. Expansion joints shall be provided at building expansion joints, at least one in each horizontal run of 100'-0" and a maximum of 150'-0" apart throughout the busway length.

G. The busway shall be Underwriter's Laboratories approved for mounting in any position with derating. The short circuit stress bracing shall be 100,000 amperes RMS symmetrical.

H. Busway shall be of the same manufacturer as the main switchboard where connected to switchboard. Busway not connected to switchboard shall be General Electric, Square D, Siemens, or Eaton.

2.6 SINGLE PHASE PROTECTION

A. Provide Taylor Electronics Model #PND-3, 6, 9, 12 ADJ-REM LED’s, or equal, single phase relay behind hinged panel in switchboard. Provide green and amber LED’s on a plug in cable for mounting on face of switchboard. Provide snap on lenses and labels identifying the green LED as “SYSTEM NORMAL” and the amber LED as “SINGLE PHASE CONDITION”.

B. Provide shunt trip coils on all main devices, operated by the phase failure relay.

C. Provide capacitive trip unit to guarantee relay and shunt trip operation during a single phase occurrence.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide a typewritten directory under plastic for all panelboards with spares marked in pencil. Circuit identification shall include sufficient detail to allow each circuit to be distinguished from all others. Include specific tenant suite numbers in multi-tenant buildings in the circuit description. Provide a label on each breaker in a switchboard or distribution panelboard with the same level of circuit identification details.

B. Provide all necessary hardware to level and secure the switchgear as required by the manufacturer's instructions. Make all electrical connections for supply and load circuits and leave in operating condition.

C. Clean enclosure of all switchgear of all foreign matter, including dust.

D. Remove all rust marks and repaint to leave switchgear in new condition.

3.2 STUDIES

A. As a requirement for the project documents to be delivered by the contractor, provide a complete short circuit and selective coordination study from the service entrance to all end devices. The study shall be provided by the switchgear manufacturer or their vendor and shall utilize time current curves that are developed by the gear manufacturer selected for use in the building. The study shall be made available for review by the engineer and local code enforcement authorities no later than at the times they deem necessary for certificates of occupancy to be issued. Obtain critical dates from the inspections department of the local code enforcement department during the inspection process to determine when presentation of the selective coordination study to the inspections department is necessary for timely issuance of the certificate of occupancy.

B. The selective coordination study shall be broken into parts where the systems described in NEC Articles 700.27, 701.18, 708.54 and 620.62 are isolated in the report to simplify the review of those isolated systems.

C. As a minimum requirement for the details that are necessary in the selective coordination study, refer to the requirements for selective coordination in the NEC Articles 700.27, 701.18, 708.54 and 620.62.

D. The minimum NEC requirement for the selective coordination study is applicable to the systems described in NEC Articles 700.27, 701.18, 708.54, 620.62, and as indirectly referenced for essential electrical systems in Article 517. The minimum project requirement described in A. above shall not be scaled back to the minimum NEC code requirement unless agreed to by all parties associated with the construction of the project including, but not limited to, the owner, architect, engineer, developer, etc.

END OF SECTION 262000