PART 1 GENERAL 1.01 ADMINISTRATIVE REQUIREMENTS

A. Coordination: 1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be voltage drop.

frame. Unless otherwise indicated, make connection at neutral installed, including adjustments for conductor sizes increased for (grounded) bus in source enclosure. 3. Provide bonding jumper to connect derived system grounded 2. Coordinate with electrical equipment installed under other sections conductor to nearest metal building frame and nearest metal water to provide terminations suitable for use with the conductors to be piping in the area served by the derived system, where not already

PART 2 PRODUCTS 2.01 CONDUCTOR AND CABLE APPLICATIONS A. Do not use conductors and cables for applications other than as

permitted by NFPA 70 and product listing. B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

C. Metal—clad cable is permitted only as follows: 1. Where not otherwise restricted, may be used: a. Where concealed above accessible ceilings for final connections

from junction boxes to luminaires. 2. In addition to other applicable restrictions, may not be used: a. Unless approved by Owner.

boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical b. Where exposed to damage. conductors/equipment or likely to become energized as indicated c. For damp, wet, or corrosive locations, unless provided with a PVC and in accordance with NFPA 70. jacket listed as suitable for those locations. 2. Provide insulated equipment grounding conductor in each feeder and

2.02CONDUCTOR AND CABLE GENERAL REQUIREMENTS A. Provide products that comply with requirements of NFPA 70. B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system. D. Conductor Material:

1. Provide copper conductors except where aluminum conductors are specifically indicated or permitted for substitution. Conductor sizes indicated are based on copper unless specifically indicated as aluminum. Conductors designated with the abbreviation "AL" indicate aluminum.

a. Substitution of aluminum conductors for copper is permitted, when approved by Owner and authority having jurisdiction, only for the following: 1) Services: Copper conductors size 1/0 AWG and larger.

b. Where aluminum conductors are substituted for copper, comply with the following: 1) Size aluminum conductors to provide, when compared to copper sizes indicated, equivalent or greater ampacity and

equivalent or less voltage drop. 2) Increase size of raceways, boxes, wiring gutters, enclosures, etc. as required to accommodate aluminum conductors. 3) Provide aluminum equipment grounding conductor sized

according to NFPA 70. 4) Equip electrical distribution equipment with compression lugs for terminating aluminum conductors.

2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.

3. Tinned Copper Conductors: Comply with ASTM B33. E. Minimum Conductor Size:

1. Branch Circuits: 12 AWG. a. Exceptions:

> 1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop. 2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.

3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop. 2. Control Circuits: 14 AWG.

F. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified. G. Conductor Color Coding: 1. Color code conductors as called for within the NEC or otherwise

required by the authority having jurisdiction. Maintain consistent color coding throughout project. PART 3 EXECUTION 3.01 EXAMINATION

A. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70. 3.02INSTALLATION

A. Circuiting Requirements:

1. Unless dimensioned, circuit routing indicated is diagrammatic. 2. When circuit destination is indicated without specific routing, determine exact routing required. 3. Arrange circuiting to minimize splices.

4. Maintain separation of Class 1, Class 2, and Class 3 remote—control, signaling, and power—limited circuits in accordance with NFPA 70.

5. Maintain separation of wiring for emergency systems in accordance with NFPA 70. 6. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch

circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit. B. Installation in Raceway:

1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.

2. Pull all conductors and cables together into raceway at same time. 3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.

4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer. C. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

D. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.

1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles. 2. Installation in Vertical Raceways: Provide supports where vertical

rise exceeds permissible limits. E. Install conductors with a minimum of 12 inches of slack at each

F. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack. G. Install firestopping to preserve fire resistance rating of partitions and

other elements, using materials and methods specified in Section 07 H. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as

required for a complete operating system. 2. SECTION 26 0526 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 PRODUCTS

1.01 GROUNDING AND BONDING REQUIREMENTS

A. Unless specifically indicated to be excluded, provide all required

components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding B. Where conductor size is not indicated, size to comply with NFPA 70

but not less than applicable minimum size requirements specified. C. Grounding Electrode System: 1. Provide connection to required and supplemental grounding

electrodes indicated to form grounding electrode system. 2. Metal Underground Water Pipe(s):

3. Metal In-Ground Support Structure:

in direct contact with earth in accordance with NFPA 70. 4. Concrete—Encased Electrode: 5. Ground Ring:

D. Separately Derived System Grounding:

6. Ground Rod Electrode(s): a. Space electrodes not less than 8 feet from each other and any other ground electrode.

a. Provide connection to metal in-ground support structure that is

1. Secure and support conduits in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by 7. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode the authority having jurisdiction. system bonding jumpers as permitted in NFPA 70. Connect 2. Provide independent support from building structure. Do not provide grounding electrode conductor provided for service—supplied system support from piping, ductwork, or other systems. grounding to this ground bar. C. Connections and Terminations:

1. Separately derived systems include, but are not limited to: a. Transformers (except autotransformers such as buck-boost transformers).

b. Uninterruptible power supplies (UPS), when configured as

used as a grounding electrode for the derived system. Make

4. Provide system bonding jumper to connect system grounded

connection at same location as grounding electrode conductor

conductor to equipment around bus. Make connection at same

ground on load side of separately derived system disconnect.

5. Where the source and first disconnecting means are in separate

1. Provide bonding for equipment grounding conductors, equipment

branch circuit raceway. Do not use raceways as sole equipment

increase size of equipment grounding conductor proportionally in

4. Provide bonding for interior metal piping systems in accordance with

a. Metal water piping where not already effectively bonded to metal

3. Where circuit conductor sizes are increased for voltage drop,

underground water pipe used as grounding electrode.

1. Where isolated ground receptacles or other isolated ground

connections are indicated, provide separate isolated/insulated

1. Provide intersystem bonding termination at service equipment or

additional buildings or structures in accordance with NFPA 70.

1. Provide products listed, classified, and labeled as suitable for the

2. Provide products listed and labeled as complying with UL 467 where

1. Description: Connectors appropriate for the application and suitable

2. Unless otherwise indicated, use exothermic welded connections for

underground, concealed and other inaccessible connections.

connectors, or exothermic welded connections for accessible

C. Unless otherwise indicated, use mechanical connectors, compression

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

1. Provide all required hangers, supports, anchors, fasteners, fittings,

2. Where support and attachment component types and sizes are not

consideration for vibration, equipment operation, and shock loads

indicated, select in accordance with manufacturer's application

criteria as required for the load to be supported. Include

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the

D. Metal Channel (Strut) Framing Systems: Factory—fabricated

continuous—slot metal channel (strut) and associated fittings,

the anchor and fastener types indicated for the specified

A. Provide independent support from building structure. Do not provide

support from suspended ceiling support system or ceiling grid.

D. Do not penetrate or otherwise notch or cut structural members

B. Unless specifically indicated or approved by Architect, do not provide

C. Unless specifically indicated or approved by Architect, do not provide

A. Do not use conduit and associated fittings for applications other than

B. Unless otherwise indicated and where not otherwise restricted, use the

requirements. Where conduit type for a particular application is not

1. Use galvanized steel rigid metal conduit, PVC—coated galvanized

D. Concealed: Use galvanized steel rigid metal conduit, intermediate

E. Exposed, Interior, Not Subject to Physical Damage: Use galvanized

F. Exposed, Exterior: Use galvanized steel rigid metal conduit or

G. Connections to Luminaires Above Accessible Ceilings: Use flexible

2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal

A. Provide all conduit, fittings, supports, and accessories required for a

B. Provide products listed, classified, and labeled as suitable for the

not less than applicable minimum size requirements specified.

C. Where conduit size is not indicated, size to comply with NFPA 70 but

1. Conceal all conduits unless specifically indicated to be exposed.

2. Conduits in the following areas may be exposed, unless otherwise

3. Conduits installed underground or embedded in concrete may be

Route all other conduits parallel or perpendicular to building

routed in the shortest possible manner unless otherwise indicated.

structure and surfaces, following surface contours where practical.

steel rigid metal conduit, intermediate metal conduit (IMC), or electrical

one listed application applies, comply with the most restrictive

conduit types indicated for the specified applications. Where more than

support from piping, ductwork, or other systems.

C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes

accessories, and hardware required for field—assembly of supports.

E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.

1. Unless otherwise indicated and where not otherwise restricted, use

accessories, and hardware as necessary for the complete installation

for the conductors and items to be connected: listed and labeled

metering equipment enclosure and at disconnecting means for any

NFPA 70. This includes, but is not limited to:

location as grounding electrode conductor connection. Do not make

any other connections between neutral (grounded) conductors and

enclosures, provide supply—side bonding jumper between source and

ground busses, metallic equipment enclosures, metallic raceways and

separately derived systems.

first disconnecting means.

E. Bonding and Equipment Grounding:

grounding conductor.

b. Metal gas piping.

F. Isolated Ground System:

A. General Requirements:

applicable.

connections.

3. SECTION 26 0529

PART 1 PRODUCTS

A. General Requirements:

of electrical work.

where applicable.

F. Anchors and Fasteners:

applications.

PART 2 EXECUTION

support from roof deck.

4. SECTION 26 0533.13

PART 1 PRODUCTS

1.01 CONDUIT APPLICATIONS

C. Underground:

metallic tubing (EMT).

1.02 CONDUIT REQUIREMENTS

purpose intended.

PART 2 EXECUTION

a. Electrical rooms.

b. Mechanical equipment rooms.

c. Within joists in areas with no ceiling.

A. Conduit Routing:

B. Conduit Support:

2.01 INSTALLATION

complete raceway system.

intermediate metal conduit (IMC).

H. Connections to Vibrating Equipment:

1. Dry Locations: Use flexible metal conduit.

3. Maximum Length: 6 feet unless otherwise indicated.

Maximum Length: 6 feet.

without approval of Structural Engineer.

CONDUIT FOR ELECTRICAL SYSTEMS

as permitted by NFPA 70 and product listing.

specified, use galvanized steel rigid metal conduit.

steel rigid metal conduit, or rigid PVC conduit.

metal conduit (IMC), or electrical metallic tubing (EMT).

2.01 INSTALLATION

to be supported.

purpose intended.

accordance with NFPA 70.

equipment grounding conductors.

1.02 GROUNDING AND BONDING COMPONENTS

B. Connectors for Grounding and Bonding:

as complying with UL 467.

1.01 SUPPORT AND ATTACHMENT COMPONENTS

conduit or cable to be supported.

G. Communications Systems Grounding and Bonding:

strength and electrical continuity. c. Generators, when neutral is switched in the transfer switch. 2. Provide arounding electrode conductor to connect derived system grounded conductor to nearest effectively grounded metal building

conduit to another.

terminations to protect conductors.

1. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases. 2. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane. 3. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing

1. Use suitable adapters where required to transition from one type of

2. Provide insulating bushings or insulated throats at all conduit

3. Secure joints and connections to provide maximum mechanical

system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.

and other elements, using materials and methods specified in E. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation.

4. Install firestopping to preserve fire resistance rating of partitions

F. Provide grounding and bonding in accordance with Section 26 0526. 5. SECTION 26 0533.16 BOXES FOR ELECTRICAL SYSTEMS PART 1 PRODUCTS

1.01 BOXES A. General Requirements:

1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing. 2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and

equipment to be installed. 3. Provide products listed, classified, and labeled as suitable for the purpose intended. 4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

5. Provide grounding terminals within boxes where equipment grounding conductors terminate. B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes: 1. Use raised covers suitable for the type of wall construction and

device configuration where required. 2. Use shallow boxes where required by the type of wall construction. 3. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where

4. Boxes for Ganged Devices: Use multigang boxes of single—piece construction. Do not use field—connected gangable boxes unless specifically indicated or permitted. 5. Minimum Box Size, Unless Otherwise Indicated: a. Wiring Devices (Other Than Communications Systems Outlets): 4

inch square by 1-1/2 inch deep (100 by 38 mm) trade size. C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.

2. NEMA 250 Environment Type, Unless Otherwise Indicated: 3. Junction and Pull Boxes Larger Than 100 cubic inches: a. Provide screw-cover or hinged-cover enclosures unless otherwise

1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 26 2726; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation. PART 2 EXECUTION

2.01 INSTALLATION A. Box Locations:

1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 3100 as required where approved by the Architect. 2. Do not install flush-mounted boxes on opposite sides of walls back—to—back. Provide minimum 6 inches horizontal separation unless otherwise indicated.

3. Fire Resistance Rated Walls: Install flush—mounted boxes such that the required fire resistance will not be reduced. B. Install boxes plumb and level. C. Install firestopping to preserve fire resistance rating of partitions and

other elements, using materials and methods specified in Section 07 D. Close unused box openings. E. Install blank wall plates on junction boxes and on outlet boxes with no

devices or equipment installed or designated for future use. 4. 26 0533.23 SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 PRODUCTS 1.01 RACEWAY REQUIREMENTS

A. Provide all components, fittings, supports, and accessories required for a complete raceway system B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Do not use raceways for applications other than as permitted by NFPA 70 and product listing.

1.02 WIREWAYS A. Description: Lay—in wireways and wiring troughs with removable covers; listed and labeled as complying with UL 870. B. Where wireway size is not indicated, size to comply with NFPA 70 but

not less than applicable minimum size requirements specified. PART 2 EXECUTION 2.01 INSTALLATION A. Arrange wireways and associated raceway connections to comply with

NFPA 70, including but not limited to requirements for deflected conductors and wireways used as pullboxes. Increase size of wireway where necessary.

7. SECTION 26 0553 IDENTIFICATION FOR ELECTRICAL SYSTEMS PART 1 PRODUCTS 1.01 IDENTIFICATION REQUIREMENTS

B. Close unused raceway openings.

A. Identification for Equipment: 1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components. 2. Service Equipment:

a. Use identification nameplate to identify each service disconnecting b. For buildings or structures supplied by more than one service, or any combination of branch circuits, feeders, and services, use identification nameplate or means of identification acceptable to authority having jurisdiction at each service disconnecting means to identify all other services, feeders, and branch circuits

supplying that building or structure. Verify format and descriptions with authority having jurisdiction. 3. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.

b. Industrial control panels. c. Motor control centers. d. Elevator control panels. e. Industrial machinery.

PART 1 PRODUCTS

a. Service equipment.

B. Identification for Conductors and Cables: 1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.

1.02 IDENTIFICATION NAMEPLATES AND LABELS A. Identification Labels: 1. Materials: Use self—adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant. 2. Text: Use factory pre-printed or machine-printed text. Do not use

handwritten text unless otherwise indicated. 1.03 UNDERGROUND WARNING TAPE A. Materials: Use non-detectable type polyethylene tape suitable for

direct burial, unless otherwise indicated. B. Exception: Use foil—backed detectable type tape where required by serving utility or where directed by Owner. 8. SECTION 26 0583 WIRING CONNECTIONS

1.01 MATERIALS A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.

1. Colors: Comply with NEMA WD 1. 2. Cord Construction: NFPA 70, Type SJ0, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in

3. Size: Suitable for connected load of equipment, length of cord,

A. As indicated in equipment schedules on drawings or as indicated on

A. Make conduit connections to equipment using flexible conduit. Use

liquidtight flexible conduit with watertight connectors in damp or wet

B. Connect heat producing equipment using wire and cable with insulation

C. Provide receptacle outlet to accommodate connection with attachment

D. Provide cord and cap where field—supplied attachment plug is required.

E. Install suitable strain—relief clamps and fittings for cord connections at

F. Install disconnect switches, controllers, control stations, and control

H. Coolers and Freezers: Cut and seal conduit openings in freezer and

A. Description: NEMA ICS 2, AC general purpose magnetic contactor.

G. Install interconnecting conduit and wiring between devices and

and rating of branch circuit overcurrent protection.

damp locations.

1.02 EQUIPMENT CONNECTIONS

PART 2 EXECUTION

2.01 ELECTRICAL CONNECTIONS

suitable for temperatures encountered.

cooler walls, floor, and ceilings.

ENCLOSED CONTACTORS

1.01 GENERAL PURPOSE CONTACTORS

B. Configuration: Electrically held.

4. SECTION 26 0919

PART 1 PRODUCTS

1.02 LIGHTING CONTACTORS

outlet boxes and equipment connection boxes

devices to complete equipment wiring requirements.

equipment to complete equipment wiring requirements.

D. Poles: As required to match circuit configuration and control function. E. Contact Rating: Match branch circuit overcurrent protection. considering derating for continuous loads. F. Enclosure: NEMA ICS 6, Type 1. 10. SECTION 26 0923 LIGHTING CONTROL DEVICES

A. Description: NEMA ICS 2, magnetic lighting contactor.

C. Coil operating voltage: 120 volts, 60 Hertz.

PART 1 PRODUCTS 1.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS A. Provide products listed, classified, and labeled as suitable for the purpose intended. 1.02 VACANCY SENSORS

A. All Vacancy Sensors: 1. Description: Factory—assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for manual on, automatic off control of load indicated. 2. Sensor Technology:

occupancy by sensing movement of thermal energy between b. Ultrasonic Vacancy Sensors: Designed to detect occupancy by sensing frequency shifts in emitted and reflected inaudible sound

a. Passive Infrared (PIR) Vacancy Sensors: Designed to detect

c. Passive Infrared/Ultrasonic Dual Technology Vacancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies. d. Passive Infrared/Acoustic Dual Technology Vacancy Sensors: Designed to detect occupancy using a combination of both

passive infrared and audible sound sensing technologies. 3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units. 4. Operation: Unless otherwise indicated, vacancy sensor to be manual on by pushbutton to turn load on and automatic off to turn load off when no occupant presence is detected during an adjustable

turn-off delay time interval. 5. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements

B. Wall Switch Vacancy Sensors: 1. All Wall Switch Vacancy Sensors:

a. Description: Vacancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode. b. Manual—Off Override Control: When used to turn off load while in automatic—on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed—off time

1.03 TIME SWITCHES

A. Digital Electronic Time Switches: 1. Description: Factory—assembled solid state programmable controller with LCD display, listed and labeled as complying with UL 916 or UL

2. Schedule Capacity: Not less than 16 programmable on/off

3. Provide automatic daylight savings time and leap year compensation. 4. Provide power outage backup to retain programming and maintain 5. Manual override: Capable of overriding current schedule both

permanently and temporarily until next scheduled event.

1.04 OUTDOOR PHOTO CONTROLS A. Stem-Mounted Outdoor Photo Controls: 1. Description: Direct—wired photo control unit with threaded conduit mounting stem and field—adjustable swivel base, listed and labeled

as complying with UL 773A. B. Button Type Outdoor Photo Controls

1. Description: Direct-wired photo control unit complying with ANSI C136.24 with weatherproof gasketed wall plate where required or indicated, listed and labeled as complying with UL 773A.

PART 2 EXECUTION 2.01 INSTALLATION

control devices.

A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of lighting control devices provided under this section.

B. Install lighting control devices in accordance with manufacturer's

C. Outdoor Photo Control Locations: 1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east, west, or down.

2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by the photo control itself. 2.02FIELD QUALITY CONTROL

A. Test occupancy sensors to verify proper operation, including time

delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals. B. Test time switches to verify proper operation. C. Test outdoor photo controls to verify proper operation, including time

D. Test daylighting controls to verify proper operation, including light level measurements and time delays where applicable. Record test results in written report to be included with submittals. E. Correct wiring deficiencies and replace damaged or defective lighting

2.03ADJUSTING A. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect. B. Adjust position of directional occupancy sensors and outdoor motion sensors to achieve optimal coverage as required.

C. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion D. Adjust time switch settings to achieve desired operation schedule as indicated or as directed by Architect. Record settings in written report

11. SECTION 26 2100 LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE PART 1 PRODUCTS 1.01 ELECTRICAL SERVICE REQUIREMENTS

A. Provide new electrical service consisting of all required conduits,

to be included with submittals.

conductors, equipment, metering provisions, supports, accessories, etc. as necessary for connection between Utility Company point of supply and service entrance equipment. a. Products Furnished by Contractor: Comply with Utility Company

12. SECTION 26 2200 LOW-VOLTAGE TRANSFORMERS

PART 1 PRODUCTS 1.01 MANUFACTURERS

requirements.

A. ABB/GE; www.geindustrial.com/#sle. B. Eaton Corporation; www.eaton.com. C. Schneider Electric; Square D Products: www.schneider-electric.us/#sle. D. Siemens Industry, Inc; www.usa.siemens.com/#sle.

1.02 TRANSFORMERS — GENERAL REQUIREMENTS A. Description: Factory—assembled, dry type transformers for 60 Hz operation designed and manufactured in accordance with NEMA ST 20 and listed, classified, and labeled as suitable for the purpose intended. B. Core: High grade, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Keep magnetic flux densities substantially below saturation point, even at 10 percent primary overvoltage. Tightly clamp core laminations to prevent plate

movement and maintain consistent pressure throughout core length.

1.03 GENERAL PURPOSE TRANSFORMERS A. Description: Self—cooled, two winding transformers listed and labeled as complying with UL 506 or UL 1561; ratings as indicated on the

B. Insulation System and Allowable Average Winding Temperature Rise: 1. Less than 15 kVA: Class 180 degrees C insulation system with 115 degrees C average winding temperature rise. 2. 15 kVA and Larger: Class 220 degrees C insulation system with 150 degrees C average winding temperature rise. C. Coil Conductors: Continuous aluminum windings with terminations brazed or welded.

D. Winding Taps: 1. 3 kVA through 15 kVA: Two 5 percent full capacity primary taps below rated voltage. 2. 15 kVA through 300 kVA: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.

3. 500 kVA and Larger: Two 2.5 percent full capacity primary taps above and two 2.5 percent full capacity primary taps below rated E. Energy Efficiency: Comply with 10 CFR 431, Subpart K. F. Mounting Provisions: 1. Less than 15 kVA: Suitable for wall mounting.

2. 15 kVA through 75 kVA: Suitable for wall, floor, or trapeze

a. Larger than 75 kVA: Suitable for floor mounting. 13. SECTION 26 2416 PANELBOARDS PART 1 PRODUCTS

indicated on the drawings.

with UL 50 and UL 50E

mounting.

1.01 MANUFACTURERS

A. ABB/GE; www.geindustrial.com/#sle. B. Eaton Corporation; www.eaton.com/#sle. C. Schneider Electric; Square D Products; www.schneider-electric.us/#sle. D. Siemens Industry, Inc; www.usa.siemens.com/#sle.

1.02 PANELBOARDS - GENERAL REQUIREMENTS A. Short Circuit Current Rating: 1. Provide panelboards with listed short circuit current rating as

2. Listed series ratings are acceptable, except where not permitted by motor contribution according to NFPA 70. 3. Label equipment utilizing series ratings as required by NFPA 70 B. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A. C. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

requirements. 1. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor. 2. Provide separate isolated/insulated around bus where indicated or

D. Bussing: Sized in accordance with UL 67 temperature rise

where isolated grounding conductors are provided. E. Conductor Terminations: Suitable for use with the conductors to be installed F. Enclosures: Comply with NEMA 250, and list and label as complying

1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations: 2. Boxes: Galvanized steel unless otherwise indicated. a. Provide wiring gutters sized to accommodate the conductors to

be installed. 3. Lockable Doors: All locks keyed alike unless otherwise indicated. G. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

H. Multi-Section Panelboards: Provide enclosures of the same height. with feed—through lugs or sub—feed lugs and feeders as indicated or as required to interconnect sections. I. Load centers are not acceptable. J. Provide the following features and accessories where indicated or where

1. Feed—through lugs. 2. Sub-feed lugs. 1.03 OVERCURRENT PROTECTIVE DEVICES

required to complete installation:

A. Molded Case Circuit Breakers: 1. Description: Quick-make, quick-break, over center toggle, trip—free, trip—indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where

applicable; ratings, configurations, and features as indicated on the 2. Interrupting Capacity: a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated.

b. Fully Rated Systems: Provide circuit breakers with interrupting

capacity not less than the short circuit current rating indicated. 3. Multi—Pole Circuit Breakers: Furnish with common trip for all poles. 4. Provide the following circuit breaker types where indicated: a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel. b. Ground Fault Equipment Protection Circuit Breakers: Designed to

trip at 30 mA for protection of equipment. c. Arc—Fault Circuit Interrupter (AFCI) Circuit Breakers: Combination type listed as complying with UL 1699. d. 100 Percent Rated Circuit Breakers: Listed for application within

the panelboard where installed at 100 percent of the continuous e. Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let—through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.

6. Do not use handle ties in lieu of multi-pole circuit breakers. 7. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70. 8. Provide the following features and accessories where indicated or where required to complete installation: a. Shunt Trip: Provide coil voltage as required for connection to

5. Do not use tandem circuit breakers.

indicated trip actuator.

OFF position.

PART 2 EXECUTION 2.01 INSTALLATION A. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70. B. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches

b. Handle Pad—Lock Provision: For locking circuit breaker handle in

above the floor or working platform. C. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor. D. Install all field—installed branch devices, components, and accessories. E. Provide filler plates to cover unused spaces in panelboards.

F. Provide circuit breaker lock—on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following: 1. Emergency and night lighting circuits. 2. Fire detection and alarm circuits.

4. Intrusion detection and access control system circuits.

3. Communications equipment circuits.

c. Video surveillance system circuits.

14. SECTION 26 2713

ELECTRICITY METERING PART 1 PRODUCTS

B. Provide products listed, classified, and labeled as suitable for the

C. Provide electricity metering systems and associated components

under the service conditions at the installed location.

enclosures in accordance with Section 26 0533.16

specified for the following installation locations:

1. Comply with IEEE C57.13, where applicable.

compatible with the equipment and associated circuits to be metered.

1. Where not furnished by manufacturer, provide required cabinets and

Provide shorting terminal blocks for connection of secondaries where

4. Potential Transformers: Include primary and secondary fuses with

2. Environment Type per NEMA 250: Unless otherwise indicated, as

3. Finish: Manufacturer's standard unless otherwise indicated.

2. Select suitable ratio, burden, and accuracy as required for

A. Provide wiring devices suitable for intended use and with ratings

D. Provide tamper resistant receptacles for receptacles installed in

F. Provide GFCI protection for receptacles installed in kitchens.

G. Provide GFCI protection for receptacles serving electric drinking

B. For single receptacles installed on an individual branch circuit, provide

C. Provide weather resistant GFCI receptacles with specified weatherproof

E. Provide GFCI protection for receptacles installed within 6 feet of sinks.

H. Provide isolated ground receptacles for receptacles serving computers

general—use snap switches with silver alloy contacts, complying with

where applicable, FS W-S-896; types as indicated on the drawings.

actuated binding clamp for back wiring with separate ground

C. Momentary Contact Wall Switches: Commercial specification grade, 20

momentary contacts; single pole double throw, off with switch actuator

A, 120/277 V with toggle type three position switch actuator and

A. Wall Dimmers - General Requirements: Solid-state with continuous

full—range even control following square law dimming curve, integral

WD 1 and NEMA WD 6, and listed as complying with UL 1472; types

and ratings suitable for load controlled as indicated on the drawings.

B. Provide accessory wall switches to match dimmer appearance when

A. Description: 120 V AC, solid-state, full-range variable speed, slide

control type with separate on/off switch, with integral radio frequency

memory, complying with NEMA WD 1 and NEMA WD 6, and listed as

A. Receptacles — General Requirements: Self—grounding, complying with

NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and

1. Wiring Provisions: Terminal screws for side wiring or screw actuated

binding clamp for back wiring with separate ground terminal screw.

where applicable, FS W-C-596; types as indicated on the drawings.

20A, 125V, NEMA 5-20R; single or duplex as indicated on the

weather resistant type complying with UL 498 Supplement SE

tamper resistant type; single or duplex as indicated on the

1. GFCI Receptacles — General Requirements: Self—testing, with

specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as

feed—through protection and light to indicate ground fault tripped

condition and loss of protection; listed as complying with UL 943,

1. Configuration: One piece cover as required for quantity and types

B. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with

A. Description: Service fittings compatible with floor boxes provided

under Section 26 0533.16 with components, adapters, and trims

A. Description: Assembly comprising floor service fitting, poke-through

component, fire stops and smoke barriers, and junction box for

conduit termination; fire rating listed to match fire rating of floor and

A. Verify that outlet boxes are installed in proper locations and at proper

A. Coordinate locations of outlet boxes provided under Section 26 0533.16

Where multiple receptacles, wall switches, or wall dimmers are

2. Locate wall switches on strike side of door with edge of wall plate

B. Where required, connect wiring devices using pigtails not less than 6

C. For isolated ground receptacles, connect wiring device grounding

branch circuit equipment grounding conductor.

installed at the same location and at the same mounting height,

3 inches from edge of door frame. Where locations are indicated

otherwise, notify Architect to obtain direction prior to proceeding

inches long. Do not connect more than one conductor to wiring device

terminal only to identified branch circuit isolated equipment grounding

D. Provide GFCI receptacles with integral GFCI protection at each location

indicated. Do not use feed—through wiring to protect downstream

F. Install vertically mounted receptacles with grounding pole on top and

G. G. Install blank wall plates on junction boxes and on outlet boxes

E. Do not share neutral conductor on branch circuits utilizing wall

horizontally mounted receptacles with grounding pole on left.

with no wiring devices installed or designated for future use.

conductor. Do not connect grounding terminal to outlet box or normal

as required for installation of wiring devices provided under this

gang devices together under a common wall plate.

A. Provide extension rings to bring outlet boxes flush with finished

mounting heights and are properly sized to accommodate devices and

hinged lockable cover and corrosion—resistant screws; listed as suitable

for use in wet locations while in use with attachment plugs connected

3. Weather Resistant Convenience Receptacles: Commercial

4. Tamper Resistant Convenience Receptacles: Commercial

interference filtering, fan noise elimination circuitry, power failure preset

A. Wall Switches — General Requirements: AC only, quiet operating,

1. Wiring Provisions: Terminal screws for side wiring and screw

B. Standard Wall Switches: Commercial specification grade, 20 A,

or four way as indicated on the drawings.

installed adjacent to each other.

covers for receptacles installed outdoors or in damp or wet locations.

D. Service Conditions: Provide electricity meters suitable for operation

for measurements specified.

purpose intended.

F. Instrument Transformers:

connected devices.

disconnecting means.

15. SECTION 26 2726 WIRING DEVICES

applicable.

PART 1 PRODUCTS

dwelling units.

1.02 WALL SWITCHES

terminal screw

in center position.

1.04 FAN SPEED CONTROLLERS

complying with UL 1917.

B. Convenience Receptacles:

drawings.

C. GFCI Receptacles:

1.06 WALL PLATES

or duplex as indicated on the drawings.

as indicated on the drawings.

A. Wall Plates: Comply with UL 514D.

of corresponding wiring devices.

and identified as extra-duty type.

required for complete installation.

suitable for floor thickness where installed.

conductors in accordance with NFPA 70.

1.07 FLOOR BOX SERVICE FITTINGS

1.08 POKE-THROUGH ASSEMBLIES

PART 2 EXECUTION

2.01 EXAMINATION

2.02PREPARATION

surface.

2.03INSTALLATION

with work.

16. SECTION 26 2813 FUSES

PART 1 PRODUCTS

1.03 WALL DIMMERS

1.05 RECEPTACLES

1.01 WIRING DEVICE APPLICATIONS

adequate for load served.

and electronic cash registers.

A. Service Entrance: 1. Fusible Switches up to 600 Amperes: Class RK1, time-delay. 1.01 EQUIPMENT FOR OWNER ELECTRICITY METERING A. Provide microprocessor—based digital electricity metering systems including all instrument transformers, wiring, and connections necessary

2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay. 1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.

2. Fusible Switches Larger Than 600 Amperes: Class L, time—delay. C. General Purpose Branch Circuits: Class RK1, time-delay. 17. SECTION 26 2816.16 ENCLOSED SWITCHES

PART 1 PRODUCTS 1.01 ENCLOSED SAFETY SWITCHES

A. Description: Quick—make, quick—break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings. B. Enclosed Safety Switches Used for Service Entrance: Listed and

labeled as suitable for use as service equipment according to UL 869A.

C. Provide safety interlock to prevent opening the cover with the switch in

2. Coordinate the placement of luminaires with structural members,

ductwork, piping, equipment, diffusers, fire suppression system

the ON position with capability of overriding interlock for testing

18. SECTION 26 5100 INTERIOR LIGHTING

PART 1 GENERAL 3. Current Transformers: Compatible with connected meters; replace 1.01 ADMINISTRATIVE REQUIREMENTS meters damaged by connection of incompatible current transformers. A. Coordination:

A. Shop Drawings:

1.01 APPLICATIONS

1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.

components, and other potential conflicts installed under other sections or by others. 3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under

other sections or by others. receptacle with ampere rating not less than that of the branch circuit. 4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work. 1.02 SUBMITTALS

> 1. Provide photometric calculations and comparitive pricing where luminaires are proposed for substitution upon request. B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with

all proposed features. PART 2 PRODUCTS 2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and B. Substitutions: Equivalent products, except where individual luminaire types are designated with substitutions not permitted. Submit

comparative pricing with all luminaire substitutions.

2.02LUMINAIRES 120/277 V with standard toggle type switch actuator and maintained A. Manufacturers: contacts; single pole single throw, double pole single throw, three way, 1. As listed in Luminaire Schedule.

> B. Provide products listed, classified, and labeled as suitable for the purpose intended. C. Unless otherwise indicated, provide complete luminaires including

lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light. D. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, radio frequency interference filtering, power failure preset memory, air accessories, etc. as necessary for a complete operating system. gap switch accessible without removing wall plate, complying with NEMA

> F. Hazardous (Classified) Location Luminaires: Listed and labeled as complying with UL 844 for the classification of the installed location. G. LED Luminaires:

E. Provide products suitable to withstand normal handling, installation, and

service without any damage, distortion, corrosion, fading, discoloring,

H. Track Lighting Systems: Provide track compatible with specified track heads, with all connectors, power feed fittings, dead ends, hangers and canopies as necessary to complete installation. I. Luminaires Mounted in Continuous Rows: Provide quantity of units

1. Tested in accordance with IES LM-79 and IES LM-80.

required for length indicated, with all accessories required for joining and aligning. 2.03EMERGENCY LIGHTING UNITS A. Manufacturers:

1. As listed in Luminaire Schedule.

2. Substitutions: See Section 01 6000 - Product Requirements. 1. Standard Convenience Receptacles: Commercial specification grade, B. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying 2. Isolated Ground Convenience Receptacles: Commercial specification Deration: Upon interruption of normal power source or brownout

grade, 20A, 125V, NEMA 5-20R, with ground contacts isolated from condition exceeding 20 percent voltage drop from nominal, solid-state mounting strap; isolated ground triangle mark on device face; single control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power specification grade, 20A, 125V, NEMA 5—20R, listed and labeled as D. Battery: suitable for installation in damp or wet locations; single or duplex

1. Sealed maintenance—free lead calcium unless otherwise indicated. 2. Size battery to supply all connected lamps, including emergency remote heads where indicated. E. Diagnostics: Provide power status indicator light and accessible

integral test switch to manually activate emergency operation. F. Provide low-voltage disconnect to prevent battery damage from deep G. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated;

provide indicator light(s) to report test and diagnostic status. 2.04EXIT SIGNS A. Manufacturers — Powered and Self-Luminous Signs:

the installed location

1. As listed in Luminaire Schedule. B. Description: Internally illuminated exit signs with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924. 1. Number of Faces: Single or double as indicated or as required for

2. Directional Arrows: As indicated or as required for the installed location. C. Self-Powered Exit Signs: 1. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal,

integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source. 2. Battery: Sealed maintenance—free nickel cadmium unless otherwise

solid-state control automatically switches connected lamps to

3. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation. 4. Provide low-voltage disconnect to prevent battery damage from deep discharge. 5. Self—Diagnostics: Provide units that self—monitor functionality and

provide indicator light(s) to report test and diagnostic status.

automatically perform testing required by NFPA 101 where indicated;

D. Accessories: shields where indicated.

1. Provide compatible accessory high impact polycarbonate vandal 2. Provide compatible accessory wire guards where indicated.

SPECIFICATIONS

24.0808

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