

## SECTION 16000 - ELECTRICAL

### 1.1 CODES AND STANDARDS

A. Codes:

1. 2006 International Building Code (IBC)
2. 2006 International Fire Code (IFC)
3. 2008 National Electrical Code (NFPA 70)
4. ANSI/ASHRAE 90.1-2004 Commercial Building Energy Code
5. ICC A117.1-2003 Accessibility Code
6. Occupational Safety and Health Administration (OSHA)
7. Other Applicable Local Codes and Ordinances

B. Standards:

1. American National Standards Institute (ANSI)
2. American Society for Testing and Materials (ASTM)
3. Association of Edison Illuminating Companies (AEIC)
4. Certified Ballast Manufacturers (CBM)
5. Electrical Testing Laboratories (ETL)
6. Illuminating Engineering Society of North America (IESNA)
7. Institute of Electrical and Electronics Engineers (IEEE)
8. Insulated Power Cable Engineers Association (IPCEA)
9. National Electrical Manufacturers Association (NEMA)
10. National Fire Protection Association (NFPA)
11. Underwriters' Laboratories (UL)

## 1.2 DESIGN CRITERIA

### A. Load Densities: Lighting and Receptacles (watts/sq. ft.):

#### Connected

Lobbies:	Lighting and Receptacles	6.0	5.0
Open Parking Structure:	Lighting and Receptacles	0.5	-
Electrical, Telephone, Mechanical and Elevator Equipment Rooms:	Lighting and Receptacles	1.0	0.5
Service Areas, Corridors and Stairways:	Lighting and Receptacles	1.0	0.5
Toilets:	Lighting and Receptacles	1.5	1.0
Storage Rooms:	Lighting and Receptacles	1.0	0.5
Dock Area:	Lighting	1.0	-

### 1. Illumination Levels:

#### Average Maintained Footcandles

Office Areas:	6.0	5.0
Lobbies:	20	
<b>Open Parking Structure:</b>		
- Driving Lanes:	5	
- Parking Stalls:	5	
- Entrance Area:	5	
Electrical, Telephone, Mechanical and Elevator Equipment Rooms:	20	
Service Areas, Corridors and Stairways:	20	
Toilets:	20	
Storage Rooms:	15	
Dock Area:	30	
Exterior Perimeter:	5	

Roads and Exterior Parking::	1
Exterior Landscaping:	1

2. Load Densities: Heating
  - a. Perimeter Heating Element Along Exterior Walls/Windows:
    - (1) Office Areas - 150 watts/linear ft. of exterior walls/windows.
    - (2) Main Lobby - 500 watts/linear ft. of exterior walls/windows.

### 1.3 SYSTEMS

- A. Electrical Service:
  1. The local utility company will provide service to the new terminal via exterior pad mounted medium-to-low voltage transformer(s). The owner will provide secondary service cables between the utility owned transformer and the owner's 480 volt service switchgear.
  2. The electric utility company will provide fire pump services.
  3. Metering will be provided in accordance with the electric utility company's requirements.
  4. The electric utility company optional facilities charges (if any) will be billed directly to the Owner.
- B. Distribution - Separate wire in conduit will be provided for each of the following loads:
- C. Heating, Ventilation and Air Conditioning Systems - 480Y/277V, 3 phase, 4 wire, 60 hertz and 120V, 1 phase, 2 wire, 60 hertz.
- D. Elevators - 480V, 3 phase, 3 wire, 60 hertz and 120V, 1 phase, 2 wire, 60 hertz.
- E. Plumbing and Fire Protection Systems - 480V, 3 phase, 3 wire, 60 hertz.
- F. Lighting and General Purpose Receptacles - 208Y/120V, 3 phase, 4 wire, 60 hertz for lighting and general purpose receptacles and incandescent lighting.
- G. Commercial Areas and Restaurants - 480Y/277V or 208Y/120V, 3 phase, 4 wire, 60 hertz.
- H. Computer Equipment Areas:
  - a. 480Y/277V or 208Y/120V, 3 phase, 4 wire, 60 hertz.

- b. Branch circuit design will be based upon a maximum of 1,200 volt amperes per 15 ampere, 120 volt circuit and 1,600 volt amperes per 20 ampere, 120 volt circuit.
  - c. Motors of 1/2 horsepower and larger will be served at 480 volt or 208 volt, 3 phase, 3 wire. Motors less than 1/2 horsepower will be served at 277 volt or 120 volt service, 1 phase, 2 wire.
- I. Lighting:
  - a. Lighting of lobbies; open parking structure; electrical, telephone, mechanical and elevator equipment rooms; service areas; corridors; stairways; toilets; storage rooms; dock area; exterior perimeter; roads and exterior parking; exterior landscaping; elevator pits; fan plenums; roof hatches; exit signs; building director; etc., will be complete with fixtures, ballasts, lamps and accessories.
- J. Lighting switches, contactors, relays, devices, wiring and central control panel (CCP) will be provided for the following control requirements:
  - a. Lobbies - switched at CCP
  - b. Parking and Ramps - switched at CCP
  - c. Electrical, Telephone, Mechanical and Elevator Equipment Rooms - switched at door.
  - d. Service Areas - switched at door.
  - e. Corridors - switched at CCP.
  - f. Stairways - switched at panelboard
  - g. Toilets - switched at door, key type.
  - h. Storage Rooms - switched at door.
  - i. Dock Area - switched at CCP.
  - j. Exterior Perimeter, Roads and Exterior Parking, Exterior Landscaping - switched by photo-cells and/or time clocks.
  - k. Elevator Pits, Fan Plenums, Roof Hatches - switched at entrance.
- K. Receptacles - Receptacles for maintenance and any special equipment will be twistlock type.
- L. Emergency Power & Lighting - Emergency power and lighting will be provided in accordance with Code requirements. Source of supply for emergency power and lighting will be a 480V exterior diesel generator in a weatherproof enclosure.
- M. Grounding - System and equipment grounding will be provided. All switchgear, switchboards, transformers, motor control centers, motor starters, panelboards, busways, wiring systems, etc., will be effectively grounded.

- N. Electric Heating:
  - 1. Electric baseboard heating units will be provided with individual built-in thermostats and disconnect switches. These units will be connected to contactor controlled panels. (Refer to Mechanical Section for heating unit locations.)
  - 2. Connections will be made to electric unit heaters at electrical, telephone, mechanical and elevator equipment rooms; entrances; soffits; top floor ceiling plenums; air mixing plenums; etc. (Refer to Mechanical Section).
  - 3. Connections will be made to electric duct heaters/fan powered boxes. These units will be connected to contactor controlled panels. (Refer to Mechanical Section).
- O. Pipe Tracing - An electric heating system consisting of cables or tapes, conduits, outlets, thermostats, pressure fittings, taps, step down transformers, panels, automatic starting controls, low temperature alarms, etc., will be provided for all piping subject to freezing. Remote annunciation will be provided.
- P. Equipment Connections - Electrical power connections will be made to all elevators, electrically operated doors, drinking fountains, trash compactors, etc., including furnishing of all electrically associated devices such as disconnect switches, lock-out switches, etc.
- Q. Mechanical Equipment Connections - Electrical power connections will be made to all mechanical equipment, electric heating coils, domestic hot water heaters, unit heaters, duct heaters/fan powered boxes, thermostats, etc., including furnishing of all electrically associated devices such as disconnect switches, contactors, magnetic or manual starters, lock-out switches, etc., which are not furnished under the Mechanical, Plumbing and Fire Protection Sections.

#### **1.4 SPECIAL SYSTEMS**

- A. Fire Detection & Alarm Systems:
  - 1. Life Safety Systems will be provided in accordance with Code requirements, including, but not limited to:
  - 2. Supervised, zoned, fire alarm system, complete with control panel, annunciator panels (local and remote), product or combustion detectors (duct mounted type provided and wired by Electrical, but installed under Mechanical Section) thermal detectors, alarm horns with flashing indicator lights, etc.
  - 3. Connections to and supervision of mechanical air handling system product of combustion detectors.
  - 4. Stairwell door unlocking system.

5. Magnetic fire doors release.
6. Fire protection system annunciation, including water flow switches and valve position indicators.
7. Wiring between fire alarm system and central fan automatic control system for actuation of fire mode.
8. Provision for remote monitoring by telephone lines.
9. The elevator status and control system will be provided under the Elevator Section. The control panel will be located adjacent to the fire alarm panel.
10. The central fan status and control system will be provided under Mechanical Section. The control panel will be located adjacent to the fire alarm panel.
11. Refer to Mechanical Section for Sequence of Operations.

B. Security:

1. A raceway system will be provided for a security system.
2. A raceway system will be provided for a CCTV monitoring system.

C. Telephone Raceways:

1. Conduits, cable trays, conduit sleeves, pull boxes, outlet boxes, telephone terminal boards, etc., will be provided for the telephone system, in accordance with the telephone company's requirements.
2. Conduits will be provided to interconnect telephone closets, as required.
3. A grounding system will be provided at the main telephone room and at each telephone closet for the telephone equipment.
4. One power outlet and four (4) duplex receptacles, each on a dedicated circuit, will be provided in the main telephone room. One duplex receptacle on dedicated circuit will be provided at each telephone closet.

D. Lightning Protection:

1. A Master Label lightning protection system will be provided.
2. Roof mounted air terminals will be provided with tinned copper conductors and exothermically bonded to all roof drains and roof mounted equipment. Down conductors will be run the entire height of the building and will be exothermically bonded to the perimeter counterpoise conductors, with connections to each column and to the perimeter grounding rods.

## 1.5 MATERIALS

- A. 480Y/277 volt Switchgear and Switchboards:
1. The 480Y/277 volt switchgear will be a rear-accessible, ANSI rated metal enclosed switchgear line-up with drawout ANSI rated power circuit breakers in an integrated system constructed to ANSI C37.20.1 standards. The circuit breakers used in the assemblies shall be drawout type with electronic trip units. Circuit breakers shall have interrupting, close and latch, and 3-cycle withstand ratings that meet the application requirements.
  2. All bus bars in the switchgear lineup shall be braced and labeled to withstand the short circuit mechanical forces. The main bus in the switchgear lineup shall be made of copper and shall be rated and labeled to handle an electrical load as shown in project drawings.
  3. Low voltage metal enclosed switchgear system lineup shall be completely factory assembled and shall contain upper, lower and side metal compartmentalized units for removable circuit breakers. The low voltage power circuit breakers (air circuit breakers) shall be UL listed per UL 1006 and built to pertinent ANSI specifications.
  4. Provision will be made for electric utility company metering transformers and meters.
  5. The 480Y/277 volt switchboards will be completely assembled, class 3, free standing, with copper bus bars, full neutral bus, and separate ground bus. All bus work will be braced to withstand 65,000 amperes RMS symmetrical. Protective devices will be provided with approved barrier between sections and extended load terminals. Protective devices will be individually mounted circuit breakers. All devices will be fully rated for available fault current.
- B. Transformers (480 - 208Y/120V, 3 Phase, 4 Wire):
1. Dry type, ventilated, 150EC insulation system temperature class.
  2. NEMA standard voltage taps.
  3. NEMA standard sound ratings.
  4. Shielded type as indicated.
- C. Starters, and Controls:
1. All temperature control, fire detection, alarm, control and mechanical equipment interlock wiring, raceways and associated devices will be provided under the Mechanical Section. All alarms; plumbing and fire protection control and equipment interlock wiring, raceways and associated devices will be provided under this Section. All fire detection and alarm wiring, raceways and associated devices will be provided under this Section.

2. Magnetic starters will be complete with 3 sets of N.O. and 3 sets of N.C. auxiliary contacts, 3 overload relays, individual fused control transformer, hand-off-automatic selector switch or start-stop push button, and pilot lights.
  3. Motor starters will be horsepower rated.
  4. Combination starters will be of the circuit breaker type with motor circuit protectors.
  5. Magnetic starters will have size 1 minimum rating.
  6. Reduced voltage (Wye/Delta, closed transition) starter will be provided for motors 100 horsepower and larger. Time delay start will be provided for motors 50 horsepower and larger.
- D. Branch Circuit Panel boards:
1. 480/277 volt panel boards will be equal to Square D/Schneider Electric "Model NF".
  2. 208Y/120 volt panel boards will be equal to Square D/Schneider Electric "Model NQOD".
  3. Main breakers and directories will be provided in each panel board.
  4. 25% spare protective devices will be provided in each panel board.
- E. Distribution Panel boards:
1. 480Y/277, 208Y/120, 480 or 208 volt panel boards will be equal to Square D/Schneider Electric "Model I-Line" with circuit breakers.
  2. 25% spare circuit breakers with a minimum of three circuit breakers will be provided in each panel board.
- F. Cables, Wiring and Raceways:
1. Cables and wiring will be 75EC rated insulation, except as noted below, copper conductors and color coded. 60EC ampacity of conductors will be used for #1 AWG and smaller, 75EC ampacity will be used for #1/0 AWG and larger.
  2. Lighting and receptacle branch circuit wire will be type "TW", minimum #12 AWG size. Control wiring may be #14 AWG, type "TW".
  3. Heating branch circuit wires will be type "THW" or "THHW".
  4. Feeder wires will be type "THW".
  5. Fixture wires will be type "AF".



6. Wires connected to motors and dry type transformers will be copper type "THW", and will be stranded, regardless of size. Flexible conduits will be used for connections to vibrating and rotating equipment. Flexible sealite conduits will be used for all connections to vibrating and rotating equipment in wet locations.
  7. Wire size #10 AWG and smaller will be solid copper. Wire sizes larger than #10 AWG will be stranded copper.
  8. All wires, including telephone cables in plenum area, will be in conduits.
  9. Raceways will be rigid galvanized steel, intermediate metal conduits with threaded fittings, and electrical metallic tubing with compression fittings.
  10. Cable and conduit supports, couplings and fittings, pillboxes and other wiring materials and devices will be provided as required.
- G. Parallel Conductors: - Cable limiters will be provided at each cable end when more than two parallel-conductors-per-phase are used.
- H. Lighting Fixtures:
1. Lighting fixtures will be as follows:
    - a. Lobbies: - Type - Recessed incandescent, "A" lamp open reflector down light, and/or matching washers.
  2. Electrical, Telephone, Mechanical and Elevator Equipment Rooms:
    - a. Type - Fluorescent industrial reflector, 430 ma.
    - b. Manufacturer - Benjamin, Columbia, Gibson
  3. Service Areas:
    - a. Type - Fluorescent industrial reflector 430ma.
    - b. Manufacturer - Benjamin, Columbia, Gibson
  4. Corridors:
    - a. Type - Recessed incandescent, "A" lamp, open reflector downlight.
    - b. Manufacturer - Omega, Lightolier
  5. Stairways: - Type - Fluorescent, 2-lamp, 40W, and wall mounted, with shield.
  6. Manufacturer - Alkco, Northern Light.
  7. Storage Rooms:
    - a. Type - Fluorescent industrial reflector 430ma.
    - b. Manufacturer - Benjamin, Columbia, Gibson.

8. Dock Area:
  - a. Type - Fluorescent or H.I.D., enclosed fixture, UL damp labeled.
  - b. Manufacturer - Benjamin, Columbia, Gibson
9. Elevator Pits, Fan Plenums, Roof Hatches:
  - a. Type - Vapor tight incandescent with globe and guard.
  - b. Manufacturer - Appleton "VP" Series, Crouse-Hinds.
10. Exit Signs:
  - a. Type - LED.
  - b. Manufacturer - Alko edgeglow.
  - c. Lighting fixtures in plenum ceiling will conform to Code requirements.
  - d. Ballasts will be full output, high power factor, low energy, rapid start, as manufactured by Universal "SLH" type or equal. Outdoor ballasts will be suitable for -20EF operation.
11. Lighting Switches, Receptacles and Plates:
  - a. Lighting switches will be equal to Hubbell #1221 Series.
  - b. Duplex receptacles will be equal to Hubbell #5252 Series. Maintenance receptacles will be equal to Hubbell #4792 Series.
  - c. Floor boxes will be flush mounted, equal to Steel City Series #640.
  - d. Plates for wall devices will be #302 stainless steel .040" thick, brush finish. All plates for multiple gang requirements will be one piece combination.
  - e. Poke-through devices, when used, will be UL approved for the floor slab rating.
  - f. Floor service fittings will be combination type (duplex receptacle and telephone service), back-to-back design, 3-piece, extruded aluminum, as manufactured by RCI.
12. Electric Baseboard Heaters - Pedestal or wall mounted type will be continuously or individually mounted with special covers to match the finish of the window wall. Baseboard heaters will be as manufactured by American Stabilis "DBF" Series for floor mounted, and "DBT" Series for wall mounted.
13. Concrete Pads, Supports, Access and Sealing - Concrete pedestals, bases, pads, vibration isolation, curbs, anchor blocks, anchor bolts, slab inserts, hangers, channels, cradles, saddles, gratings, access doors, etc., will be provided for electrical equipment in the building and for the pad mounted electric utility company switching equipment and transformers. Floors, walls and ceiling openings will be sealed to prevent air and liquid movement and noise transmission from floor to floor and from room to room.

**END OF ELECTRICAL**