

# CHAPTER 6

# ELECTRICAL SYSTEMS

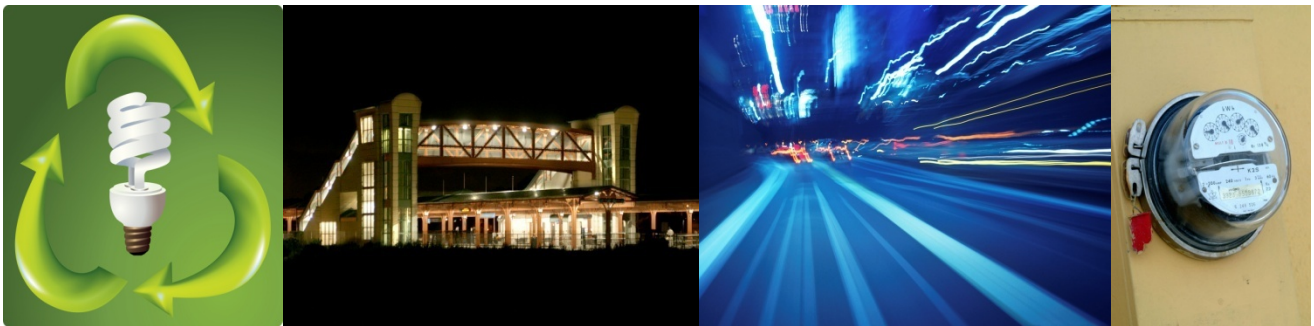


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## I. DESIGN INTENT

### I.A PURPOSE

Electrical work shall be designed in accordance with state and local codes, standards, and regulations.

Electric services shall be sized in anticipation of future loads, including special data and communications systems, which may not necessarily be installed at the time of station construction or rehabilitation.

Lighting levels shall be provided in a manner which provides safety and comfort for passengers, while enhancing the aesthetic character of the station.

## II. ELECTRICAL SYSTEMS

### II.A ELECTRICAL SERVICE

Incoming electric services should be located below grade, extended with cable in conduit from a property line manhole, and terminated at electric service equipment.

A single power source for each facility shall be installed from the Utility distribution system.

Normal power shall be distributed throughout the building for lighting, HVAC equipment, receptacles, and sundry loads. The power systems shall be distributed throughout the installations at 480/277V, 3 Phase, 4 Wire and 208/120V, 3 Phase, 4 Wire as required.

#### II.A.1 Program and Design Guidelines

If site conditions warrant, electric services may alternatively be extended overhead from utility poles, and terminated with weatherheads, mounted on a pole or exterior wall of a station building. Electric service would then extend with cable in conduit from the weatherhead to the service equipment.

Meters, service disconnect, and distribution equipment shall have sufficient capacity to accommodate both present and anticipated future loads, in accordance with **Table 6.1**. The design of such equipment shall also be in accordance with applicable utility requirements.

Where appropriate, separate metering facilities should be provided, as follows:

- i. Station including platforms, overpasses, elevators, stairways, walkways, and station buildings.
- ii. Tenant spaces such as concession/vendor spaces, or taxi stands
- iii. Parking area lighting, if subject to an agreement with a municipality or other third party.

#### II.A.2 Appearance Standards

Overhead utility equipment and cabling shall be designed as unobtrusively as possible, and discreetly located.

Outdoor above-ground utility equipment should be screened from view. Underground utility services are preferred, with metering, service disconnects and distribution equipment located in an enclosed, weathertight structure.

**Table 6.1 Recommended Electric Power Service at Stations**

Recommended incoming service capacity: Basic station configuration (includes platforms, walkways, stairways/overpass; assumes 2 elevators)	600 amp, 30, 4 wire, 120/208 volts
Parking Area Lighting, additional load (typical)	200 amp, 30, 4 wire, 120/208 volts
Station Building (where provided), additional load	100 amp, 30, 4 wire, 120/208 volts
Each additional elevator or escalator (where provided), additional load	200 amp, 30, 4 wire, 120/208 volts

### II.A.3 Materials and Performance

Electrical equipment shall be designed and installed in accordance with the National Electric Code, applicable state and local laws, codes, ordinances, standards, and the requirements of FPL.

- i. Equipment located indoors shall be enclosed in metal cabinets fabricated of code gage galvanized steel, having a factory applied baked enamel finish. Equipment located outdoors shall be enclosed in NEMA-4 cabinets, fabricated of stainless steel. Cabinet doors shall be hinged and provided with locking mechanisms.
- ii. Convenience outlets, 110V, 20 amp, single-phase electrical service in lockable receptacles shall be located to allow full coverage of the platform with a 100 foot electrical cord. All outlets shall be provided with a lockable cover plate, be weather resistant, and meet NEC requirements.
- iii. Service disconnect, distribution equipment and panelboards shall be of dead-front design. Main service disconnects shall be of molded case, circuit breaker type. Panelboards shall be of the bolt-on circuit breaker type with copper bus. A minimum of 20% spare circuit breakers shall be provided.
- iv. During the performance of expansion or rehabilitation work, normal electrical services shall be continuously maintained throughout the station.

## II.B ELECTRIC EQUIPMENT & WIRING

Equipment design and installation shall be in accordance with the requirements of the National Electric Code and other applicable state and local codes, rules and regulations. Equipment shall be UL listed.

### II.B.1 Appearance Standards

Exposed equipment in areas accessible to the public shall be recess-mounted, with the face of the equipment flush with adjacent surfaces.

Raceway and conduit systems shall be installed below grade, cast into concrete slabs, or concealed within other construction, and concealed to the extent practicable.

### II.B.2 Materials and Performance

- i. **Conduit Systems:** Shall be continuous, integrated systems, as follows:
  - Schedule 80 PVC buried below grade or embedded in concrete slabs
  - RGS painted to match adjacent surfaces, if exposed indoors or outdoors.
  - RGS unpainted, if concealed within masonry construction or drywall partitions.
  - Galvanized steel EMT with compression type fittings, if concealed above suspended ceilings.
- ii. **Wire and Cable:** Shall have copper conductors and fittings. Aluminum conductors shall not be used. Insulation shall be selected to suit the type of service, location, and extreme temperatures expected for the application.
- iii. **Panelboards:** Panels serving exterior and parking area lighting, platforms, stairways, and overpass shall be equipped with integral 3 pole contactors, of ampere capacity equal to the panelboard bus rating. Contactors shall have a manually-operated mechanical ON-OFF-AUTO feature, and a 2-wire auxiliary control relay for photocell control. Contactors shall be UL listed and approved for use

with both fluorescent and HID lighting fixtures.

- iv. **Outlets:** Outlets shall be GFI type, installed in weatherproof cast aluminum housings. Housings shall be connected to steel conduits using dielectric couplings.

### III. LIGHTING

#### III.A INTENT

The lighting criteria contained herein are intended to give general guidance for the design of lighting of site areas and passenger stations.

All lighting fixtures should be selected for a combination durability and energy efficiency, in order to assist in meeting LEED EA credit 1, Optimize Energy Performance (and the Prerequisite).

Following are the general objectives for station lighting.

- i. **Define Uses:** Enhance the functionality of TRI-RAIL stations by defining areas such as site circulation routes, station entrances, revenue collection areas, and platforms.
- ii. **Promote Safety:** Promote passenger safety by properly illuminating public areas and elements of potential hazard, such as escalator landings and platform edges.
- iii. **Reinforce Communication:** Properly illuminate and reinforce the presentation of signs and graphics through appropriate selection and placement of lighting fixtures.
- iv. **Energy Conservation:** Fixture and lamp types shall be selected for maximum energy efficiency commensurate with the application. Light shall be a “white” with CRI of 65 or greater.

#### III.A.1 Station Elements

Lighting within stations shall comply with the following objectives:

- i. **General:** Lighting shall be coordinated with ceiling finishes and the structural module to form an integrated design. TVM areas shall have a higher level of illumination than surrounding areas, to enhance this important decision area as a destination. Lighting design shall avoid visual clutter that may distract from directional signs or distort images recorded by CCTV security systems.
- ii. **Circulation Areas:** Lighting shall emphasize decision points, such as junctions in passageways, escalator and stair landings, and passenger assistance facilities.
- iii. **Platforms:** Platform lighting shall define the limits of the waiting and boarding areas. Lighting elements shall extend the length of the platform, and shall emphasize potential hazards, such as the platform edge and escalator landing areas. Placement of fixtures shall not interfere with the legibility of PI system displays.
- iv. **Support Areas:** Station support areas shall have appropriate lighting to the expected use.

#### III.A.2 Station Site Areas

Illumination of station site areas may vary depending on the type of property development around the station.

The criteria listed below apply to those parts of the station site used to transfer passengers from busses, cars, or other means of transport into the station.

- i. **General:** Site lighting shall articulate the site organization through the use of illumination levels, patterns, and colors. Major elements, such as entrances, shall be delineated by higher levels of illumination. Secondary elements, such as pedestrian walkways, may help improve patterns of lighting, to guide



pedestrians along the path to the station.

- ii. **Station Site Lighting:** Placement of lighting fixtures shall be coordinated with property development, support structures, and landscaping to ensure that these elements do not obstruct the light distribution pattern. Care shall be taken to minimize spill-over to adjacent properties. Light levels on access roads shall be coordinated with light levels on surrounding public roads.
- iii. **Pedestrian Access Lighting:** Pedestrian access lighting shall be adequate to safely delineate pedestrian footpaths, crosswalks, and vertical circulation elements.
- iv. **Landscaping:** Accent lighting of landscape elements may be included in the lighting design, if appropriate. The design intent of landscape accent lighting shall be site specific.
- v. **Canopy Lighting:** Lamps for platform and canopy fixtures shall be identical to maintain uniform illumination throughout the platform area. Canopy lighting shall be coordinated with the structural bays of the canopy, with fixtures uniformly located on or between framing members. Where platform and Site lighting are not sufficient for platform access pathways, ramps, stairs, elevators and bridges, separate light fixtures shall direct passengers to and from the platform.

### III.B LIGHTNING PROTECTION SYSTEM

Each Station shall be equipped with a complete lightning protection system as per the minimum requirements from the Lightning Protection Institute.

### III.C ELECTRIC ROOMS/CLOSETS

Each station and ancillary building shall have electric rooms and closets.

Layout of distribution equipment and egress doors shall be in accordance with the NEC, Article 110-16 through 110-34 and shall be submitted to TRI-RAIL for approval.

Electric rooms and closets shall not be sprinkled. Fire alarm devices shall be installed in lieu of piping system. Fire extinguishers of the proper type shall be installed in each electric room and closet.

#### III.C.1 Program & Design Guidelines

Station lighting systems should be durable, energy-efficient, and easy to maintain. Fixtures used in open areas shall be weatherproof and vandal-resistant.

The following general Requirements for the lighting of facilities shall be met:

- i. The lighting system installation shall minimize the frequency and expense of maintenance.
- ii. Lighting fixture locations shall permit accessibility for relamping and periodic cleaning.
- iii. Lighting shall satisfy security Requirements and provide lighting levels consistent with the EIS handbook.
- iv. All illumination shall be arranged so that the failure of any single lighting unit shall not leave an area in total darkness.
- v. Special care shall be taken to avoid "spill" light and objectionable glare, which might affect adjacent properties and roadways.
- vi. Illumination shall be provided for pedestrian walkways, sidewalks, ramps, and parking areas.

Table 6.2 STATION STANDARD ILLUMINATION LEVELS	
Element	Maintained Illumination Level
Platforms, Under Canopy	15fc avg., 10fc min.
Platform Areas with No Canopy	7.5fc avg., 5fc min.
Platform Edge	7.5fc min. , uniform
Passenger Waiting Areas	10fc avg. 7½fc min.
Overpasses	15fc avg., 10fc min.
Stairways	15fc avg., 10fc min.
Pedestrian Walkways	3fc – 7.5fc (5fc avg.)
Parking Areas	1fc - 3fc (2fc avg.)

- vii. All exterior lighting fixtures shall be heavy duty, vandal resistant, exterior quality, vapor-proof fixtures.
- viii. Parking area and station site lighting shall be pole-mounted. Parking area fixtures shall have a mounting height of 18 to 24 feet, and shall be uniform throughout.
- ix. Walkway and other site lighting fixtures shall have a mounting height of 10 to 12 feet.

### III.C.2 Emergency Lighting

Emergency lighting shall be provided in accordance with NEC for all buildings and Stations. The facility shall include luminaires equipped with emergency battery light pack, and shall define a path of egress to assist in safe and orderly evacuation. Emergency lighting systems shall be installed and maintained in accordance with NFPA 70, Article 700 "Emergency Systems," and shall provide a minimum illumination level of one foot-candle measured at the walking surface, unless otherwise specified.

All internally illuminated exit signs shall have two sources of power, one normal

power and one emergency power. These signs shall be in accordance with the Life Safety Code (NFPA 101) and OSHA regulations.

### III.C.3 Equipment, Materials and Performance

All fixtures shall be suitable for operation at temperatures ranging from 0° F. to 120° F.

Except as otherwise noted herein, lighting for all station areas, including walkways, parking areas, platforms, stairways, and overpasses, shall be of Light Emitting Diodes (LED), photocell controlled, with lamps having a minimum Color-Rendering Index (CRI) of 25

Lighting for stairways, overpasses, TVM areas, and passenger waiting areas shall also be LED, and have a minimum CRI of 65.

- i. **Control:** All station lighting shall be photocell-controlled.
- ii. **Circuits:** Lighting circuits shall be wired "fail-safe", such that failure of any control mechanism (photocell, timer, or contactor) will result in the affected lights remaining "on".

- iii. Adjacent fixtures, or consecutive fixtures in a row, shall be wired to a minimum of 2 alternating panelboard circuits, to ensure at least partial lighting in the event of a circuit breaker tripping.
- iv. Fixtures located in stairways, overpasses, TVM areas, and passenger waiting areas shall be equipped with a "quartz-restrike" feature which will instantly restore partial lighting output from the fixture in the event of a momentary power interruption.
- v. Site lighting shall be controlled by electric photocells to limit hours of operation. Failure of control mechanisms shall result in lights remaining on to prevent inadequate lighting conditions. Off-hour operational lighting shall be furnished to provide reduced levels of illumination when Station is not in use.

#### III.C.4 Illumination Levels

Lighting levels shall help define and differentiate between task areas, decision points, and areas of potential hazard.

Luminaries shall be designed and located to provide the specified illumination levels with a minimum of glare. In no event shall any luminaries directly shine at passing trains. Refer to **Table 6.2** for Station Standard Illumination Levels.

Specified illumination levels shall be provided at floor, platform, walkways, and pavement surfaces as necessary.

## IV. PHOTOVOLTAIC POWER

### IV.A PHOTOVOLTAIC POWER GENERATION

Photovoltaic (PV) panels may be used at stations, parking garages or other ancillary structures when feasible.

#### VI.A.1 Design Considerations

PV panels shall provide power for all systems that require electricity to function.

A minimum of eighty percent (80%) of the power required for all system shall be generated by the PV panels, unless otherwise determined during design.

PV panels shall be located on surfaces that do not straddle right-of-ways or property lines, and in locations that have maximum sun exposure.

PV systems shall be grid-connected. Florida Power and Light (FP&L) meter shall be a “smart” type meter to record power consumed from the FP&L grid and power generated by the PV system contributed to the FP&L grid.

PV system shall have a real time 24/7 meter with remote reading capabilities via website to display and track performance.

#### VI.A.2 Materials and Performance

PV system shall be provided with all required components for a fully operational system including but not limited to DC to AC power inverters.

The solar PV system shall be a fully integrated, with UL rated system and components. Such system shall be grid-tied without battery back-up.

PV modules are manufacturer’s “A” grade modules that carry the maximum warranty

and are listed for the purpose. Cosmetically blemished modules that carry full warranties and are listed are not acceptable, unless written permission is obtained from SFRTA.

Mounting shall be in strict accordance with manufacturer’s recommendations and shall not void the manufacturer’s warranty for either the photovoltaic or the surface where it is mounted. Dedicated structural photovoltaic supports shall be provided as needed.



FIGURE 6.1

### SAMPLE SOLAR ROOF SYSTEMS

## V. BACK-UP POWER

### V.A EMERGENCY GENERATOR

The Emergency Generator shall provide power for 100% of the station service, and 50% of the site lighting, where feasible. One light per site lighting pole shall be connected to the emergency generator. Fuel capacity shall ensure continuous operation of the generator for a minimum of 48 hours.

Station generators shall be designed, tested, rated, assembled and installed in strict accordance with all applicable standards of ANSI, NEC, ISO, UL508, IEEE and NEMA.

All equipment shall be new, of current production. There shall be one source responsibility for warranty, parts and service through a local representative with factory trained service personnel.

#### V.A.1 Generator Requirements

The generator set shall be standby with KW rating determined during design; it shall include radiator fan, diesel fuel belly tank and all parasitic loads.

#### V.A.2 Generator Specifications

The synchronous generator shall be a single bearing, self-ventilated, drip-proof design in accordance with NEMA MG 1 and directly connected to the engine flywheel housing with a flex coupling.

#### V.A.3 Insulation

The insulation material shall meet NEMA standards for Class H insulation and be impregnated in a polyester varnish or vacuum impregnated with epoxy varnish to be fungus resistant.

#### V.A.4 Automatic Voltage Regulator

The automatic voltage regulator (AVR) shall maintain generator output voltage within +/- 0.5% for any constant load between no load and full load.

The regulator shall be a totally solid state design, which includes electronic voltage buildup, volts per Hertz regulation, over excitation protection, shall limit voltage overshoot on startup, and shall be environmentally sealed.

#### V.A.5 Circuit Breaker

Provide a generator mounted circuit breaker, molded case or insulated case construction, thermal magnetic trip. Breaker shall be housed in a steel NEMA 1 enclosure mounted on a separate support stand vibration isolated from the engine / generator arrangement. Bus bars, sized for the cable type shown on drawing, shall be supplied on the load side of breaker.

#### V.A.6 Generator Mounted Control Panel

Provide a generator set mounted control panel for complete control and monitoring of the engine and generator set functions. Panel shall include automatic start/stop operation, cycle cranking, AC metering with phase selector switch, shutdown sensors and alarms with horn and reset, adjustable cool down timer and emergency stop push-button.

Critical components shall be environmentally sealed to protect against failure from moisture and dirt. Components shall be housed in a NEMA 1/IP22 enclosure with hinged door. The panel itself shall be mounted on a separate support stand isolated from the engine / generator arrangement. Panel / breaker arrangements mounted on the generator set in such a way that access to the AC Generator terminal box is restricted in any way whatsoever are not acceptable.

**V.A.7 Readouts**

- i. Provide the following readouts:
  - a. Engine oil pressure
  - b. Coolant temperature
  - c. Engine RPM
  - d. System DC Volts
  - e. Engine running hours
  - f. Generator AC Volts
  - g. Generator frequency
  - h. Generator AC Amps
  - i. Alarm NFPA 110
- ii. Provide the following indications for protection and diagnostics according to NFPA 110 level 1:
  - a. Low oil pressure
  - b. High water temperature
  - c. Low coolant level
  - d. Overspeed
  - e. Overcrank
  - f. Emergency stop depressed
  - g. Approaching high coolant temperature
  - h. Approaching low oil pressure
  - i. Low coolant temperature
  - j. Low battery voltage
  - k. Control switch not in auto position
  - l. Low fuel main tank
  - m. Battery charger failure
  - n. High battery voltage
  - o. Two (2) Spare
- iii. Provide the following control functions:
  - a. Terminals located inside the control panel for REMOTE EMERGENCY STOP

- b. ON / OFF / AUTO control switch
- c. Remote Annunciator NFPA 110

- iv. Provide a remote annunciator to meet the requirements of NFPA 110, Level 1.
- v. The annunciator shall provide remote annunciation of all points stated above and shall incorporate ring-back capability so that after silencing the initial alarm, any subsequent alarms will sound the horn.

**V.A.8 Cooling system**

The generator set shall be equipped with a rail-mounted, engine-driven radiator with blower fan and all accessories. The cooling system shall be sized by the supplier.

Provide with a factory-built scoop to deflect the radiator discharge in the upward direction. The scoop shall be provided with bird screen and drain plug.

**V.B FUEL SYSTEM****V.B.1 Fuel Piping**

All fuel piping shall be black iron or flexible fuel hose rated for this service.

- i. **Fuel Line Rating:** Flexible fuel lines rated 300 degrees F and 100 PSI.
- ii. **Double Wall UL Fuel Tank Base (Belly Tank):** A fuel tank base of forty-eight (48) hours continuous runtime capacity shall be provided. It shall be contained in a rupture basin with 110% capacity. A locking fill cap, a mechanical reading fuel level gauge, low fuel level alarm contact, and fuel tank rupture alarm contact shall be provided.

**V.B.2 Exhaust System**

A critical type silencer, companion flanges, and flexible stainless steel exhaust fitting properly sized shall be furnished and installed according to the manufacturer's



recommendation.

The silencer shall be mounted so that its weight is not supported by the engine nor will exhaust system growth due to thermal expansion be imposed on the engine. Exhaust pipe size shall be sufficient to ensure that exhaust backpressure does not exceed the maximum limitations specified by the engine manufacturer.

## V.C ENCLOSURE

### V.C.1 Standard Weather Protective Enclosure

- i. A weather resistant enclosure of HR4P steel with electrostatically applied powder coated baked polyester paint. It shall consist of a roof, side walls, and end walls.
  - ii. Number of doors on enclosure shall be as required so that all normal maintenance operations, such as lube oil change, filter change, belt adjustment and replacements, hose replacements, access to the control panels, etc., may be accomplished without disassembly of any enclosure components.
  - iii. Access doors shall be of the same material as the enclosure walls and shall be reinforced for rigidity. Handles shall be key-lockable, all doors keyed alike, and hinges shall be zinc die cast or stainless steel.
  - iv. Fasteners shall be zinc plated or stainless steel. Doors shall be of a lift off design allowing one person to remove door if necessary.
  - v. Lube oil and coolant drains shall be extended to the exterior of the enclosure and terminated with drain valves. Radiator access shall be through a hinged, lockable cover on enclosure.
- Cooling fan and charging alternator shall be fully guarded to prevent injury.
- vi. Lifting points shall be provided on base frame suitable for lifting combined weight of base tank, generator set and enclosure.

### V.C.2 Automatic Transfer Switches

- i. The transfer switch shall be rated for the voltage, ampacity and the number of poles included in the system and shall have insulation on all parts in accordance with NEMA standards.
- ii. The current rating shall be a continuous rating when the switch is installed in an unventilated enclosure, and shall conform to NEMA temperature rise standards.
- iii. Designs which require cabinet ventilation are unacceptable. The ATS cabinet shall conform to NEMA standards for an exterior exposed outdoors installation.
- iv. The unit shall be rated based on all classes of loads, i.e., resistive, tungsten, ballast and inductive loads. Switches rated 400 amperes or less shall be UL listed for 100% tungsten lamp load.
- v. As a precondition for approval, all transfer switches complete with accessories shall be UL listed, under Standard UL 1008 (automatic transfer switches) and approved for use on emergency systems.
- vi. The withstand current capacity of the main contacts shall not be less than 20 times the continuous duty rating when coordinated with any molded case circuit breaker established by certified test data.
- vii. Temperature rise tests in accordance with UL 1008 shall have been conducted after the overload and endurance tests to confirm the ability of

the units to carry their rated currents within the allowable temperature limits.

- viii. Transfer switches shall comply with the applicable standards of UL, CSA, ANSI, NFPA, IEEE, NEMA and IEC.

## V.D CONSTRUCTION PERFORMANCE

### V.D.1 Transfer Switch

The automatic transfer switch shall be of double throw construction operated by a reliable electrical mechanism momentarily energized. There shall be a direct mechanical coupling to facilitate transfer in 6 cycles or less.

- i. The normal and emergency contacts shall be mechanically interlocked such that failure of any coil or disarrangement of any part shall not permit a neutral position.
- ii. For switches installed in systems having ground fault protective devices, and/or wired so as to be designated a separately derived system by the NEC, a 4th pole shall be provided. This additional pole shall isolate the normal and emergency neutrals. The neutral pole shall have the same withstand and operational ratings as the other poles and shall be arranged to break last and make first to minimize neutral switching transients. Add-on or accessory poles that are not of identical construction and withstand capability are not acceptable.
- iii. The contact structure shall consist of a main current carrying contact, which is a silver alloy with a minimum of 50% silver content. The current carrying contacts shall be protected by silver tungsten arcing contacts on all sizes above 400 Amps.
- ii. All relays shall be continuous duty industrial type with wiping contacts. Customer interface contacts shall be rated 10 amperes minimum. Coils, relays, timers and accessories shall be readily front-accessible.
- iii. The control panel and power section shall be interconnected with a harness and keyed disconnect plugs for maintenance.
- iv. Main and arcing contacts shall be visible without major disassembly to facilitate inspection and maintenance.
- v. A manual handle shall be provided for maintenance purposes with the switch de-energized. An operator disconnect switch shall be provided to defeat automatic operation during maintenance, inspection or manual operation.
- vi. The switch shall be mounted in a NEMA enclosure rated for outdoors, exposed conditions.
- vii. Switches composed of molded case breakers, contactors or components thereof not specifically designed as an automatic transfer switch will not be acceptable.
- viii. The automatic transfer switch shall be warranted against defects in material or workmanship for a period of two years from the date of shipment.
- ix. To afford the advantage of a single source of supply to the owner, the automatic transfer switch shall be supplied by the manufacturer of the engine generator set and covered under the same warranty program.



## VI. FIRE DETECTION

### VI.A FUNCTIONAL REQUIREMENT

The fire detection and alarm systems shall detect presence and provide warning of smoke, excessive heat, rapid temperature increase, or water flow in the fire suppression system in any facility power supply room, and other buildings and facilities.

The fire detection, alarm and suppression systems shall be electrically supervised, closed circuit, non-coded, and continuously self-monitoring.

#### VI.A.1 Fire Alarm Control Panels

- i. **Fire Detectors:** Where fire suppression systems are installed, smoke or heat detection devices shall be provided.
  - ii. Alarm systems where required must be both audible and visual and shall conform to applicable codes and standards. Alarm systems shall provide notification to local fire authorities.
  - iii. Auxiliary lamp panels shall be provided as required. The lamps shall be of the LED type.
  - iv. Each FACP shall be associated with an integral or separate equipment module which is capable of operating the complete fire detection system. The equipment module shall include the following:
    - a. Sealed storage battery with capacity to carry the system on standby for 24 hours with the ac power off.
    - b. Battery charger operating on local ac single phase branch circuits required, capable of recharging the battery from full discharge to full charge in 24 hours, while carrying the normal system load.
- c. Circuit supervision, detection, and indication modules.
  - d. A module indicating battery voltage and charging current.
  - v. Conduits, wires and cables for the fire alarm system shall comply with the requirements of the National Electrical Code (NEC), and National Electrical Safety Code (NESC), as well as, those described in the facilities electrical Requirements.

### VI.B FIRE PROTECTION SYSTEMS

#### VI.B.1 General

The following types of fire protection systems shall be provided as required by applicable Governmental Rules:

- i. Automatic sprinkler systems (wet and dry)
- ii. Standpipe systems with fire hose valve cabinets where indicated.
- iii. Portable fire extinguishers, and
- iv. Approved clean agent fire suppression system

#### VI.B.2 Automatic Sprinkler Systems

- i. Automatic sprinkler systems shall consist of all components required to provide a functioning system in conformance with applicable Governmental Rules and standards including the Uniform Construction Code (UCC).
- ii. Automatic sprinkler systems shall comply with Installation of Sprinkler Systems (NFPA 13), NFPA 130, and the following design criteria:

- a. Sprinkler density and area coverage for office areas, trash rooms and mechanical rooms shall be in compliance with NFPA 13.
- b. Electronics and electrical equipment rooms shall have no sprinklers. These rooms shall be provided with a clean agent fire suppression system or by other means allowable under applicable State and municipal regulations.

### VI.B.3 Standpipe Systems

Standpipe systems shall conform to the requirements of “Installation of Standpipe and Hose Systems” (NFPA 14) and as delineated and specified by class type in the Uniform Construction Code. Standpipe systems shall be provided in locations required by applicable Governmental Rules in a manner described below. Wet standpipe systems shall not be combined with sprinkler systems.

### VI.B.4 Fire Hose Valve Cabinets

Fire hose valve cabinets equipped as required shall be provided to achieve coverage of all the areas specified in NFPA 14 Installation of Standpipe and Hose Systems (NFPA 14).

### VI.B.5 Fire Hydrants

- i. Fire hydrants shall be provided at a maximum spacing of 300 feet along the access roads to Stations, or closer if required by code.
- ii. The piping shall be installed with a post indicator valve to form a loop with the feed connection to the municipal water supply. Where post indicator valves cannot be used, underground gate valves may be used, provided their locations and direction of turning to open are plainly marked. Operating tools for underground valves shall be provided.

- iii. Blue fire hydrant reflectors (reflective pavement markers) shall be installed at the centerline of the roadway opposite to each fire hydrant, as required by the local authority having jurisdiction.

### VI.B.6 Use of a Fire Pump

As a single source of water supply, an automatically controlled fire pump (in accordance with NFPA 20) which takes water from a water main of adequate capacity may, under certain conditions, be acceptable to the local authority having jurisdiction.

Where a pump is the only means of supplying water, the pump shall be centrifugal and shall be provided with the supervisory service from an approved proprietary system or equivalent. This supervisory system shall provide the means for a positive indication that the pump has operated normally. This arrangement shall be in addition to the supervision of power supply and any other features required by the local authority having jurisdiction.

The fire pump shall be connected to a continuous power source or an emergency power generation source, and shall have its own auto-transfer switch. Overload relays to protect the pump motor shall not be provided.

As required by the local authority having jurisdiction, provisions shall be made to test the fire pump on a periodic basis. If hose outlets are provided for this purpose, they shall be located outdoors and their intended use clearly marked. The location and type of testing facility shall be coordinated with the local authority having jurisdiction.

### VI.B.7 Fire Department Connections

- i. One or more connections shall be provided through which the local fire department can pump water into the sprinkler, standpipe, or other system

furnishing water for the fire protection system. There shall be no shutoff valve between the fire department connection and the system feed mains.

- ii. In each fire department connection line, an approved check valve shall be installed. The valve shall be located as close as practical to the point where it joins the system.
- iii. The sprinkler pipe and standpipe systems between the check valve and the fire department connection shall be equipped with an approved automatic drip arranged to discharge to a proper place. The fire hose threads shall comply with the local fire departments hose threads.
- iv. Fire department connections shall be provided at the access-road side of buildings and shall be located and arranged so that the hose lines can be readily and conveniently attached to the inlets without interference with any nearby objects, including buildings, fences, posts, other fire department connections, or street traffic.
- v. Fire department connections shall be designated by a sign having raised letters at least 1 inch in size and cast on a plate or fitting reading "AUTO-SPKLR," OPEN SPKLR," OR "STANDPIPE," whichever is appropriate. The sign shall also have a chrome finish.

#### VI.B.8 Portable Fire Extinguishers

- i. Portable fire extinguishers with a minimum rating of 4A60B.C ABC multi-purpose dry chemical, 10-pound capacity and UL approved shall be provided in accordance with the requirements of Portable Fire Extinguishers (NFPA 10).
- ii. Fire extinguishers shall be mounted in cabinets in finished spaces.

Extinguishers shall be surface mounted in unfinished spaces.

- iii. Portable fire extinguishers, 10-pound capacity, carbon dioxide type, shall be provided in rooms housing electrical or electronic equipment in addition to ABC extinguishers.
- iv. The maximum travel distance to the nearest group of extinguishers shall be 50 feet.

#### VI.B.9 Vibration Isolation

All equipment that produces vibrations shall be isolated from the structure by vibration isolators. All piping attached to rotating equipment shall be isolated from such equipment by flexible connections. Inertia blocks shall be provided as required.

## VII. GREEN DESIGN

The following LEED prerequisites and credits apply to this Chapter. These criteria shall be implemented on each project as applicable, and as far as the budget allows. Criteria to meet each prerequisite and credit shall be in accordance to the latest version of LEED New Construction and Major Renovations.

### VII.A SUSTAINABLE SITES (SS)

#### VII.A.1 SS Credit 8: Light Pollution Reduction

The intent of this credit is to minimize light trespass from the building and site.

### VII.B INDOOR ENVIRONMENTAL QUALITY (IEQ)

#### VII.B.1 IEQ Credit 6.1: Controllability of Systems - Lighting

The intent of this credit is to provide a high level of lighting, which can be individually controlled to promote comfort and well being.

### VII.C ENERGY & ATMOSPHERE (EA)

#### VII.C.1 EA Credit 1: Optimize Energy Performance

The intent of this credit is to increase energy efficiency performance.

#### VII.C.2 EA Credit 2: On-site Renewable Energy

The intent of this credit is to encourage use of renewable sources of energy for

consumption of the stations and ancillary structures.

#### VII.C.3 EA Credit 2: On-site Renewable Energy

The intent of this credit is to encourage use of renewable sources of energy for consumption of the stations and ancillary structures.

#### VII.C.4 EA Credit 6: Green Power

The intent of this credit is to encourage the development and use a grid-source, renewable energy technology to provide a minimum of 35% of the station and ancillary structures' energy demand for a minimum of 2 years.

### VII.D MATERIALS & RESOURCES (MR)

#### VII.D.1 MR Credit 4: Recycled Content

The intent of this credit is to incorporate the requirement to use recycled materials, or the recycled material content in the design and specifications.

#### VII.D.2 MR Credit 5: Regional Materials

The intent of this credit is to encourage and increase the use of local materials by reducing impacts due to transportation.

#### VII.D.3 MR Credit 6: Rapidly Renewable Materials

The intent of this credit is to encourage the use of rapidly renewable materials, such as bamboo, cotton, linoleum, and cork.

#### VII.D.4 MR Credit 7: Certified Wood

The intent of this credit is to encourage environmentally responsible forest management, by utilizing certified wood.

## END OF SECTION