

A. General

1. Responsibilities

a. Panelboards

1. Provided by DPC

- a. Electrical distribution panelboards (with breaker provisions) and facilities for normal electrical power supply for Tenant spaces have been provided by DPC in DPC's electrical closets.
- b. DPC has provided conduit from DPC's electrical closet to the Tenant space.

2. Provided by Tenant

Tenants shall be responsible for installation of circuit breaker and power wiring from their spaces to the electrical closets.

b. Conduit

Each non-hold room Tenant space will be provided with one 2" diameter empty conduit to a 480/277 volt DPC electrical panel via a CT cabinet for metering.

c. Temporary lighting

1. Provided by DPC

Temporary lighting of the Tenant space is provided by the DPC.

2. Incorporated or returned by Tenant

- a. These temporary installations shall be completely removed and/or reconfigured as the permanent system as part of work completed by the Tenant.
- b. Unused temporary lighting shall be returned to the DPC.

d. Adjacent unoccupied Tenant areas

Tenants shall be responsible for maintaining temporary power, fire safety and security systems to adjacent, unoccupied Tenant areas as part of the configuration of the permanent Tenant system.

e. Emergency power for life-safety equipment

Emergency power for life-safety equipment will not be provided by the DPC. Tenant shall utilize unit equipment as required.

f. Kitchen equipment

1. Standard provisions

Standard electrical provisions will not support installation of kitchen equipment that is fully electric.

2. Tenant installs equipment

Kitchen equipment shall be installed by the Tenant

3. Tenant determines electrical supply

Tenant shall be responsible for determining actual capacity of electrical supply as related to kitchen equipment.

2. Submittals

a. Drawings and schedules

1. Lighting information requirements at 30% Submittal

At the 30% submission, the A/E shall submit the following:

- a. Layout drawing that shows the proposed lighting levels, in each area, in Foot-candles
- b. Preliminary schedule with catalog cuts of each luminaires
2. **Lighting plans**
Lighting plans shall include the following:
 - a. Demolition plans of existing lighting
 - b. Reflected ceiling plans of all areas to be lighted
 - c. Drawings that show switching and circuiting of the fixtures.
3. **Single line diagrams**
For 480 volt systems greater than 150 amps, provide the following:
 - a. Single line diagram as recognized by the IEEE
 - b. Include the following:
 - i. Equipment ratings
 - ii. Transformer connections symbols
 - iii. Short circuit ratings
 - iv. Relay symbols
 - v. Fuse size and type
 - vi. Surge arrestor ratings
 - vii. CT and PT ratios
 - viii. Ammeter and volt meter scales
 - ix. Motor horsepower
 - x. NEMA starter size
 - xi. Shunt trips
 - xii. Breaker frame size and longtime trips
 - xiii. Equipment identification numbers
 - xiv. Feeder sizes
 - xv. Conductor quantities
 - c. A power riser diagram may also be required.
4. **Power plans**
Power plans shall include the following:
 - a. Demolition of existing electrical work
 - b. Wiring to new equipment and receptacles
 - c. Raceway route for all raceways 1¼" and larger
 - d. Location of all equipment
 - e. Equipment areas, including all electrical closets that are laid out to scale and dimensioned
 - f. Feeder and cable type, size, ratings, insulation, and conduit size
 - g. Circuit breaker or Motor Control Center (MCC) cubicle to which the circuit terminates
5. **Lightning protection plans**
If a project includes a new roof or adds equipment to an existing roof, provide plans and elevations for modifications to and/or installation of the lightning protection system.
6. **Electrical panel schedules**
 - a. Provide circuit schedule for each panel board and motor control center to be installed on the project.
 - b. Identify the name of equipment served, voltage/amperes total, and breaker.
 - c. Include main and branch circuit breakers sizes and all connected load calculations.

- d. If a transformer is used, submit sizing calculation.
- e. Provide a complete typed directory for each panel.
7. Light fixture schedule
8. Details
 - a. Provide cable racking and splicing details.
 - b. Indicate details of duct bank reinforcement if required.
 - c. Provide mounting details for light fixtures, if required.
 - d. Provide equipment arrangement plans and elevations to scale.
 - e. MCC and substation elevations shall be included in the details.
 - f. Provide grounding and lightning protection details.
 - g. Include installation details for fire alarm, telephone and signaling systems.
9. System Controls

For control systems that are designed by the electrical engineer to be manufactured or installed by the electrical contractor, provide complete wiring diagrams showing interior and exterior wiring points that are clearly distinguished.
- b. Design calculations and data
 1. Systems less than 150 amps at 480 volt
 - a. Provide an electrical panel schedule(s) that includes main and branch circuit breakers sizes and all connected load calculations.
 - b. If a transformer is used submit sizing calculation.
 2. Systems greater than 150 amps at 480 volt
 - a. Provide calculations that show the available short-circuit currents at each bus and the voltage drop for each major cable run.
 - b. The calculations shall be submitted to DPC upon request.
 - c. During construction, provide a short-circuit and coordination study of new equipment's effects on electrical distribution. This study shall be conducted by an independent testing company.
 - d. Provide system load calculations for switchboards and MCCs.
 - e. Provide product and photometric data sheets for all fixtures specified in the design.
- c. Arc Flash Calculations and Labeling

For all equipment rated above 240 volts, Tenant shall provide the following:

 1. Hazard study
 - a. Tenant shall perform an Arc-Flash Hazard study to comply with National Fire Protection Association Standard 70E, "Standard for Electrical Safety in the Workplace."
 - b. All results of the Arc-Flash Study shall be provided to DPC.
 2. Warning labels

Tenant shall furnish and install Arc-Flash warning labels to comply with National Fire Protection Association Standard 70E, "Standard for Electrical Safety in the Workplace."
- d. Electrical testing specification

The DPC will provide the A/E with a complete electrical testing specification.

 1. A/E modifications

- a. The A/E shall review and modify the specification to conform to the project requirements.
 - b. The A/E shall identify all system tests required and the acceptance criteria.
 - c. The A/E shall reference a specific test code or procedure.
2. A/E test procedure
If none is available, the A/E shall prepare a test procedure to verify proper operations of the system.

3. Equipment

a. Utilization voltages

The following guidelines shall be used in selecting utilization voltages for equipment, subject to the available utilization voltage in the building.

1. Lighting

- a. Fluorescent or HID 277 volts
- b. Incandescent or LED lamps 120 volts

2. Heating

- a. Above 3 kilowatts (KW) 277/480 volt, 3 phase
- b. Between 3 and 1.5KW 277 volt, single phase
- c. Less than 1.5KW 120 volts, 1 phase

3. Motors

- a. Motors 200 hp and above 2400/4160 or 13,200 volts
- b. Motors 1/2 hp and above 480 volts, 3 phase
- c. Motors 1/3 hp and below 120 or 208 volts
- d. Controls 120 volts
- e. Motors furnished at 277 volts single phase as integral part of variable air volume terminal units are acceptable for all horsepower ratings.
- f. Utilization voltage for fire pumps shall be approved by DPC prior to design.

b. Energy conservation

1. ASHRAE 90.1.

Refer to ASHRAE 90.1 for general guidelines.

2. Energy-efficient motors

The A/E shall specify energy-efficient motors.

- a. Motors rated between 1 and 20 horsepower shall be a minimum of 85 percent efficient at 85 percent power factor.
- b. Motors rated 25 horsepower and greater shall be 90 percent efficient at 90 percent power factor.

4. Equipment rooms

a. General

1. Locations

- a. All substations, switchboards, transformers, and, in general, panelboards, shall be installed in dedicated electrical rooms or closets.
- b. If outdoors, all substations, switchboards, transformers and panelboards shall be installed in areas protected against physical and water damage.
- c. Electrical rooms and closets shall be located central to the loads served.
- d. In special cases panelboards may be located in other rooms or areas near the load served.

2. Pipes

- a. Pipes shall not be routed through electrical rooms or closets.
- b. Pipes or mechanical ducts shall not be routed directly above electrical equipment.
3. **Emergency power**
Electrical outlets and lighting in electrical rooms and electrical closets shall be connected to emergency power, if available.
4. **Receptacles**
Each electrical room and electrical closet shall have at least one receptacle installed in it.
- b. **Electrical rooms**
 1. **Ceilings**
A finished ceiling is not required.
 2. **Clear space and ventilation**
 - a. Electrical rooms containing substations or switchboards shall be sized to provide the following minimum clear space around the equipment:
 - i. Not less than six feet in front
 - ii. Not less than three and one-half feet in the rear and at the sides'
 - b. Where located within buildings that are air conditioned, such rooms shall be air conditioned, as well, if practicable.
 - c. In other locations, the room shall be ventilated to maintain a temperature of not less than 45°F and not more than 104°F.
 - d. Ventilation shall be filtered forced air.
 - e. Adequate egress shall be provided for the installation and removal of equipment.
 - f. Columns shall not encroach on the required space around equipment.
 3. **Electrical closets**
 1. **Quantity and size**
Electrical closets shall be provided in adequate quantity, size, and location to allow for top and bottom conduit entry and exit from the closet.
 2. **Future conduit and equipment**
Space shall be provided in electrical closets for future conduit and equipment.
 3. **Cooling**
Where containing transformers or other heat producing equipment, adequate cooling shall be provided.
 - d. **Electrical identification**
 1. **Equipment name plates**
 - a. Equipment shall be identified with permanently attached, phenolic (black & white) nameplates as to name and/or function (distribution panels, lighting panels and miscellaneous power panels, transformer, motor starters, disconnect switches, dimming panels, cabinets, and push button stations).
 - b. Equipment nameplates shall also include Pier name and room number.
 - c. "Dymo Tape" type identification is not permitted.
 2. **Conduit labels**
 - a. All conduit beyond the leasehold shall be labeled every 20'0" and at every junction box.
 - b. The Label shall indicated space number, space name and usage.
Example: "TELECOMM SERVICE."

5. Metering of power and gas

Tenants shall locally meter all electrical and natural gas usage within the leasehold. Tenant space may not open for business until the electrical and natural gas (as applicable) is fully metered.

a. Provided by Tenant

At Tenant cost, the Tenant shall furnish and install a commercial digital electric metering system by Quad Logic.

1. Quad Logic model numbers

- a. Model RSM-5 (meter representative will clarify exact module to be used)
- b. Each meter shall be 3-phase, wye with KWH, KW demand and RS485 provisions.
- c. Model # RSM5 XXX CL10 RD D (Voltage and amps will vary among Tenant locations).

2. Gas meter

- a. A Quad Logic-compatible low-voltage gas meter shall be provided for each Tenant space consuming natural gas.
- b. This meter shall connect to RSM-5 module to obtain utility information from a single source within each leasehold.

3. Website

- a. Manufacturer web page:
<http://www.quadlogic.com/productsRSM5.html>.
- b. Cut sheets, brochures, installation instructions and specifications can be downloaded for inclusion on the project design documents.

4. Contact information

The local Cleveland representative for this system is: RA Strauss
(Contact: Mr. Archie Strauss – 216.276.2105, archie@clevelandpowerup.com)

1. DPC installs digital meter

After procurement, the electrical contractor shall turn the digital meter over to the DPC Construction Coordinator for installation in a DPC electrical closet that provides power to the Tenant space.

2. Gas meters

- a. Mount gas meter near the back-of-house door of leasehold inside leasehold.
- b. A low-voltage electrical feed in ¾" EMT from the Quad Logic-compatible gas meter to the Quad Logic electrical meter shall be run at Tenant cost.
- c. Coordinate access to the DPC electrical room with the DPC Construction Coordinator.
- d. Gas meter should be specified per this link (or an approved equal):
www.emon.com/products_gasmeters.html

6. Raceways

a. General

1. Locations

- a. Raceway systems shall be provided for all wiring as indicated in the "Communication Wiring and Cabling" section of Chapter 7 (Telecommunications).

- b. The exception is communications wiring in non-DPC owned/operated buildings.
- 2. **Orientation**

All conduit shall be installed parallel with the building features, except for conduit run in or under the slab.
- 3. **Installations not permitted**
 - a. Conduit shall not be installed in the slab on grade.
 - b. Conduit shall not be attached to box covers, except for 1/2" or smaller flexible conduit terminated on a flush mounted box cover.
 - c. Conduit shall not be run exposed on top of roof surfaces.
 - d. Except where expressly permitted, open wiring and direct burial of cables shall not be allowed.
- b. **Raceways within buildings**
 - 1. **Minimum size**
 - a. The minimum size conduit shall be 3/4" except as indicated for flexible conduit.
 - b. In facilities neither operated nor maintained by DPC, 1/2" conduit may be used for interior construction.
 - 2. **Fittings**

Fittings for metallic conduits shall be steel or malleable iron.
 - 3. **Conduit markings**

All conduits shall be marked every 150 feet indicating its use.
 - 4. **Conduit supports**

All conduit shall be supported independent of other systems and equipment and shall be supported with approved devices (tie-wire is not acceptable).
 - 5. **Rigid galvanized steel conduit**

Rigid galvanized steel conduit shall be used as follows:

 - a. In elevator shafts, all exterior areas, and other areas where physical damage is probable.
 - b. Where exposed within 8 feet of the finished floor level and be a point above 8 feet passed the vertical to horizontal transition.
 - c. All fittings shall be threaded.
 - d. Intermediate galvanized steel conduit may be substituted for rigid galvanized steel in certain locations with prior DPC approval.
 - 6. **PVC schedule 40 non-metallic conduit**

PVC schedule 40 non-metallic conduit shall be used as follows:

 - a. Below concrete floor slab on grade
 - b. Within concrete walls, or within floors above grade.
 - c. PVC conduit stubbed out of floors shall transition to rigid metal conduit prior to the point where the conduit is exposed (PVC conduit may stub up into freestanding equipment if not exposed)
 - d. Rigid galvanized steel conduit may be substituted for PVC schedule 40
 - 7. **Flexible metal conduit or MC cable**

Flexible metal conduit or MC Cable may be used as follows:

 - a. Where conduit is fished in existing walls
 - b. Where flexibility is required, such as connections to motors (maximum length shall be 18")
 - c. For fixture "whips" to recessed lighting fixtures (minimum size 3/8")

- d. When used in wet or damp locations, liquid-tight flexible metal conduit shall be used. The above length and size restrictions shall still apply.
- 8. **Electrical Metallic Tubing (EMT)**
Electrical Metallic Tubing (EMT) may be used as follows:
 - a. Where allowed by code in all other interior spaces.
 - b. All fittings used with EMT shall be compression type.
 - c. MC Cable may be substituted for EMT in some instances, subject to the approval of the DPC.
- 9. **Steel modular raceway**
Steel modular raceway may be used in offices, laboratories, and similar applications where appropriate.
- 10. **Underfloor raceway**
Underfloor raceway may be used at ticket counters, inspection counters, offices and similar facilities.
- 11. **Cable tray**
Cable tray may be used as follows:
 - a. For concealed communications and control wiring
 - b. For racking medium voltage cabling (subject to the approval of the DPC).
- c. **Underground raceways**
 - 1. **PVC or RGS**
 - a. All underground conduit shall be PVC or rigid galvanized steel (RGS).
 - b. PVC electrical conduit for underground runs shall be a minimum of type EB if concrete encased, schedule 40 if direct buried, and schedule 80 if direct buried beneath a roadway.
 - 2. **Concrete encasement**
Conduits shall be concrete encased when buried underneath roadways or when used for medium-voltage.
 - 3. **Minimum size for conduits**
 - a. Minimum size for conduits used for medium-voltage shall be 5".
 - b. Generally, conduits serving exterior pole-mounted lighting fixtures shall be 2" size.
 - 4. **Direct-buried conduit**
 - a. Direct-buried conduit is acceptable for electrical systems rated 600 volts and below.
 - b. Rigid steel may be direct buried if coated with an asphalt paint or PVC coating.
 - 5. **Markings**
 - a. Marking tape indicating "Electrical Cable Buried Below" shall be installed in accordance with section 4.5 ("Underground Utility Marking").
 - b. All empty ducts shall be provided with a 1/8" minimum diameter nylon dragline for pulling future cables.
 - 6. **Sealing ducts**
All ducts shall be sealed to prevent water seepage into the hand hole or manhole.
 - 7. **Pulling cable**

Prior to pulling cable into any conduit (whether new or existing), the conduit shall be cleaned with a wire brush $\frac{1}{2}$ " larger than the duct and rodded with a mandrel $\frac{1}{4}$ " smaller than the duct to test the integrity of the duct.

7. Wire, cable and wiring devices

a. Wire and cable

1. Material

All wire and cable shall be copper.

2. Raceways

All wiring shall be run in raceways, except for communications cabling in non-DPC owned buildings as indicated in the "Communications Wiring and Cabling" section of this document.

3. Open wiring and direct-buried wiring

Except as expressly permitted in the above referenced section, open wiring and direct buried wiring are not permitted. Abandoned wiring and conduit shall be removed.

b. Boxes and wiring devices

1. Material

Boxes for interior electrical systems shall be hot dipped galvanized steel or malleable iron and shall be compatible with the raceway system.

2. Duplex receptacles

a. Duplex receptacles shall be rated at 20 amperes, 125 volts, and be polarized parallel blade type with ground and NEMA 5-20R configuration.

b. The mounting brackets shall be extra- heavy and the terminals shall be copper alloy.

c. The receptacle shall be side wired.

3. Cover plates

Cover plates for receptacles, switches and boxes shall be steel.

4. Color coding

a. Receptacles shall be identified according to regular power, emergency power or data with isolated ground.

b. The color-coding shall be as follows:

i. Regular Power Brown or Ivory

ii. Emergency Circuit Red

iii. Isolated Ground Orange

c. Verify that color-coding matches that in the current DPC IT/Electrical specifications.

5. Toggle switches

Toggle switches used to control lighting shall be rated for use on 120 and 277 volt circuits and shall be rated for a minimum of 20 amperes.

6. GFI protection

a. All exterior receptacles, bathroom receptacles, wash-bay receptacles, and other locations specified in the National Electrical Code shall have Ground Fault Interrupter (GFI) protection installed.

b. GFI receptacles shall not be wired to protect downstream receptacles except in indoor installations where the downstream receptacles are in the same room.

B. Systems

1. Emergency and standby systems

a. Emergency loads

Emergency loads are those which are considered necessary for life safety. They shall be wired separately from other loads and provided with an emergency bus with emergency generator or battery "back-up" power. Items and systems requiring emergency power shall include the following:

1. Emergency egress lighting
2. Security and intrusion alarm systems
3. Egress signage
4. Communication systems
Communication systems including airport public address
5. Fire alarm systems
6. Fire suppression systems
Fire suppression systems, such as deluge systems, CO₂ extinguishing systems, kitchen hood fire extinguishing systems, etc. shall be supplied with emergency power if it is available in the building.
7. Fire pumps
 - a. The requirement for emergency power for fire pumps shall be determined individually for each case, as required by NFPA 20.
 - b. The designer shall make a recommendation, which shall be submitted, for approval of the DPC.

b. Standby loads

1. Description

Standby loads are loads for which it is desired to provide backup power in case of loss of power from the utility for one of the following reasons:

- a. To prevent damage to the facility,
 - b. To aid in rescue or evacuation or
 - c. To aid in continuing operation of the airport in a limited capacity.
- ##### 2. Legally required by FAA requirements
- a. Airport control tower, navigational aids, etc.
 - b. Airfield Lighting
- ##### 3. Optional items
- a. Sewage ejector systems
 - b. Additional lighting
 - c. Elevators, Passenger Boarding Bridge, Airline Operating System
 - d. Electrical outlets and lighting in electrical rooms and electrical closets

2. Interior lighting systems

Lighting levels shall be designed to meet but not exceed the levels given in the Illuminating Engineering Society (IES) Lighting Handbook.

a. Energy conservation

1. ASHRAE 90.1.

Refer to ASHRAE 90.1 for general guidelines.

2. Energy-efficient fixtures

- a. The A/E shall specify energy-efficient transformers and lighting fixtures.
- b. Lighting power densities in general shall not exceed 1.0 W/SF except in dining spaces which shall not exceed 1.5 W/SF.

- b. **Calculation of light levels**
The zonal cavity method may be used for calculating the design light levels, computer calculations are preferred.
 - c. **Fluorescent lighting**
 - 1. **Locations**
 - a. General office areas
 - b. Mechanical and electrical equipment rooms
 - c. Corridors, and similar applications.
 - 2. **Lamp types**
 - a. Where available, fluorescent fixtures utilizing T-8 "Octron" type lamps shall be specified.
 - b. Ballast's shall be high-efficiency, class P, minimum 90% power factor.
 - c. Where available, electronic solid-state ballasts shall be used.
 - d. Solid-state ballasts shall have a maximum total harmonic distortion of less than 20 percent.
 - e. All fluorescent lighting shall have tube guards or lens covers; in mechanical areas, fluorescent light fixtures shall have cage guards.
 - d. **Incandescent lighting**
Incandescent lighting shall not be used except by special permission of the DPC.
 - e. **Lighting controls**
 - 1. **Photoelectric**
Photoelectric control shall be provided for interior spaces where natural lighting is available.
 - 2. **Occupancy**
Occupancy controls shall be utilized in public areas where feasible, such as hold-rooms, bag-claim areas, and lavatories.
 - 3. **Circuit breakers**
 - a. Where automatic control of lighting is not provided, control of lighting in indoor public areas shall be from circuit breakers in panelboards.
 - b. Where contactors are used, they shall be mechanically held.
 - 4. **Wall switches**
Lighting in service areas including maintenance, electrical and mechanical rooms shall be manually controlled by wall switches.
3. **Fire alarm systems**
- a. **General**
 - 1. **Integrated system**
 - a. A complete and integrated fire alarm, detection, control and monitoring system shall be installed throughout all airport facilities.
 - b. All Tenants' fire alarm subpanels shall be connected to the Airport system to be fully integrated.
 - 2. **Modifications**
 - a. Any modification to the existing Cleveland Airport System's fire alarm system shall require updating of the graphical interface.
 - b. Tenants shall be responsible for all costs associated with modifying the existing fire alarm system and graphical interface.
 - 3. **Base building fire alarm system**

- a. Base building fire alarm system is based on a 4100u addressable system by Simplex/Grinnell and reporting to the Fire Rescue and Operations
 - b. Base building fire alarm system shall be provided by a company that carries a valid State of Ohio Fire Alarm license. All Tenant systems shall be coordinated by DPC and Simplex/Grinnell.
 - c. The base building fire alarm system provides for both visual (strobe lights) and audible (horns) notification.
 - d. When Tenant construction requires removal/relocation of the existing smoke detectors and/or fire alarm devices, Tenants shall be responsible for all costs associated with the relocation and re-connection to the base building Fire alarm system.
4. **Smoke detectors**
- a. Smoke detectors are provided by the Tenant within the Tenant space as a part of the base building.
 - b. The installation of additional smoke detectors and/or fire alarm devices shall be the Tenant's responsibility.
 - c. All smoke detectors and/or fire alarm devices shall be by the same manufacturer as the base building.
 - d. Tenant shall coordinate with the fire alarm vendor, Simplex/Grinnell (216-214-2959).
- b. **Submittals**
1. **General**
 - a. All fire alarm system shop drawings and calculations shall be stamped by a licensed professional engineer who is registered in the State of Ohio.
 - b. All fire alarm system shop drawings and calculations shall be prepared by draftsman or engineer possessing at least NICET (National Institute for Certification in Engineering Technologies) Level IV certification in sprinkler system design.
 - c. All work shall be performed in accordance with NFPA Standards except where directed otherwise.
 - d. All drawing symbols shall be in accordance with NFPA 170, Fire Protection Symbols for Architectural and Engineering Drawings.
 - e. The drawings shall be on uniformly sized sheets. The standard size is 22"x34" but a sheet size of up to 30"x42" is allowed.
 2. **Design drawings**
 - a. Separate drawings shall be provided as required.
 - b. Design drawings shall as a minimum include a comprehensive system riser diagram; annunciator layout; input/output operating/mapping matrix and all equipment/device locations.
 - c. The requirements for CADD production of design documents are described elsewhere.
 3. **As-built drawings**
 - a. As-built drawings shall show the system as installed, including all deviations from the approved shop drawings.
 - b. As-Built fire alarm systems drawings shall be produced using CADD systems.
- c. **Codes and standards**
The system shall be designed, installed, configured, programmed, commissioned and tested in accordance with the following:

1. **Ohio Basic Building Code**
Ohio Basic Building Code except as modified by this manual
2. **NFPA 72 Series codes**
NFPA 72 Series codes except as modified by this manual
3. **Standardized fire alarm acceptance-testing procedure**
 - a. DPC's standardized fire alarm acceptance-testing procedure be provided to A/E as required.
 - b. This procedure shall be modified for specific and/or special project requirements with advance approval of DPC during the A/E design process.
- d. **Fire alarm system**
 1. **Manufacturer's components**
System components (specific model numbers shall be provided by Simplex/Grinnell) shall include the following:
 - a. Microprocessor fire alarm control panel (FACP)
 - b. Addressable manual stations
 - c. Addressable ionization smoke detectors
 - d. Addressable photoelectric smoke detectors
 - e. Addressable combination smoke/heat detectors
 - f. Addressable duct detectors
 - g. Duct detector remote location lamps
 - h. Addressable heat detectors
 - i. Standard detector bases
 - j. Detector bases with auxiliary relay
 - k. Horn/strobe alarm signals
 - l. Alarm noise suppressors
 - m. Door holders with addressable interface modules
 - n. Programmable relay driver
 - o. Remote graphic annunciators'
 - p. System printer
 - q. Sprinkler flow and tamper switches with individually addressable monitoring modules
 - r. Individually addressable interface modules for associated monitoring and ancillary control functions.
 2. **Fire alarm system wiring**
 - a. **System wiring**
 - i. System wiring shall be class 'B' two-wire.
 - ii. Class 'A' wiring may be required in some projects.
 - iii. Multiple 'T-tapping' is allowed in class "B".
 - b. **Fire alarm wiring**
 - i. Fire alarm wire shall be solid copper conductors.
 - ii. Stranded wire shall not be allowed.
 - iii. Wire installation shall be in strict accordance to manufacturer's published installation recommendations and Article 760 of the NEC.
 - c. **Initiating and indicating circuits**
 - i. Minimum wiring size for initiating circuits shall be AWG #16 or larger and for indicating circuits shall be AWG #14 or larger.
 - ii. Positive wires shall be colored coded - RED
 - iii. Negative wires shall be colored coded - BLACK

- iv. Initiating and indicating circuits shall not use the same raceway unless the initiating circuit is shielded.
 - d. No wiring other than that directly associated with fire alarm system shall be permitted in fire alarm raceways.
 - e. In shell areas or buildings awaiting Tenant fit out, ceiling detectors shall be provided with sufficient flexible conduit to eventually allow mounting on the finished ceiling.
3. **Fire alarm system coverage**
System coverage shall include the following:
- a. Manual pull stations located as per NFPA 72 and Ohio Basic Building Code (OBBC). Not more than 200 feet of occupant travel shall be required to reach a manual pull station.
 - b. Audible/visual devices located to accomplish audio/visual coverage as per NFPA 72.
 - c. Duct smoke detectors located as per NFPA 72 and 90.
 - d. Sprinkler system monitoring as per NFPA 13 and 72.
 - e. Monitoring of fire pump system as per NFPA 72 and 20, if required.
 - f. Monitoring of special independently controlled fire suppression systems such as halon, CO₂, deluge systems and water spray fixed systems, as required.
 - g. Smoke detectors:
In buildings fully equipped with automatic sprinkler protection, limited smoke/heat detection shall be provided per NFPA 72 and located as follows:
 - i. In open areas over 700 square feet on 700 square foot spacing
 - ii. At intersections of major corridors over 30 feet
 - iii. In corridors over 60 feet on 30 foot spacing
 - iv. In all workshops, storage and mercantile areas
 - v. In elevator lobbies
 - vi. In other hazardous locations as required
 - vii. At top of all elevator shafts and in elevator control/mechanical rooms
 - h. Combination smoke/heat detectors:
In buildings fully equipped with automatic sprinkler protection, limited smoke/heat detection shall be provided per NFPA 72 and located as follows:
 - i. At top of all shafts extending over three stories
 - ii. In all electrical and mechanical rooms
 - i. Heat detectors:
In buildings fully equipped with automatic sprinkler protection, limited Smoke/heat detection shall be provided per NFPA 72 and located as follows:
 - i. In all kitchen and cooking areas.
 - ii. At top of all elevator shafts and in elevator control/mechanical rooms.
 - j. For belt conveyors, smoke detectors shall be provided at 30 foot spacing along the routing of conveyor for sensing smoke and stopping the conveyor baggage at five (5) feet from the door in accordance with NFPA 72, Smoke Detector for Door Release.

- k. In buildings not fully equipped with automatic sprinkler protection, complete smoke/heat detection shall be provided and installed in accordance with NFPA 72.
- 4. **Fire alarm system operation**

The manual or automatic operation of an alarm-initiating or supervisory operating device shall cause the FACP to transmit activate appropriate signals as follows:

 - a. General alarm that initiates audible and visible alarm signals throughout the building, unless otherwise coordinated with the Fire Chief
 - b. Signals to ancillary control functions such as fire/smoke door release, elevator recall/capture, baggage conveyer shutdown, HVAC/fan shutdown, smoke control initiation and special power shutdowns as required
 - c. Interconnection to security Air Operations Area (AOA) doors to accomplish fire/security "fail-safe" operation
 - d. Notification of system troubles
 - e. Special design for elevators: Elevator recall shall be in accordance with ASME A17.1
 - f. Supervisory alarms such as sprinkler valve tamper, fire pump power, low water and low-batteries as required
 - g. Transmission of alarm or supervisory signals to Fire Department
- 5. **Telephone/public address system**

For public areas of the Terminal buildings, a Fire Department telephone/public address system shall be provided as follows:

 - a. **Zones**
 - i. A Fire Department telephone/public address system panel shall be installed at all locations next to Fire Alarm Annunciator Panels.
 - ii. The panel shall provide the capability for selecting public address zones individually, in any combination, or total building.
 - iii. The Fire Department telephone/public address system zones shall correlate with the audible/visual device signaling zones.
 - iv. Buildings shall be divided into audible/visual device signaling zones.
 - v. The zones shall be coordinated with the Fire Marshal.
 - b. **Pre-recorded message**
 - i. The Public Address System shall be capable of broadcasting pre-recorded messages.
 - ii. In the event that an immediate, total building evacuation is required, a pre-recorded evacuation message, which can be manually activated from any of the fire alarm annunciator panels by the Fire Department Incident commander or his/her designee would continuously repeat the following: Message - "There is a fire emergency in the building. Please evacuate by using the nearest fire exit"
 - iii. This capability serves as a back-up in the event that a total, immediate evacuation is required without the need for instructions from the Fire Department.
 - iv. A timer device shall be provided as part of the Fire Alarm System which can be programmed to activate the alarm message automatically after a time interval coordinated with the Fire Chief?

6. Non-sprinkled buildings

In buildings not fully equipped with automatic sprinkler protection, complete smoke/heat detection shall be provided and installed in accordance with NFPA 72. Non-sprinkled buildings shall provide for the following:

- a. Fire Alarm Annunciator Panels
 - i. The location of the Fire Alarm Annunciator Panels shall be coordinated with the Fire Marshal.
 - ii. Each panel shall be capable of providing the same functions (i.e., alarm annunciation, reset, voice communications, etc.) at each location.
 - iii. Each panel shall be capable of being secured to prevent unauthorized entry.
 - b. All fire alarm system initiating devices shall be marked with device address on both base and device.
 - c. Junction and pull boxes for fire alarm shall be painted red.
 - d. Junction and pull boxes shall be sized according to the National Electrical Code.
 - e. All box covers shall be marked with the circuit numbers.
 - f. Fire alarm conduits shall be identified with red marking every twenty feet.
- e. Fire alarm and control panel (FACP)
1. General description
 - a. The main Fire Alarm and Control Panel (FACP) shall be sized and configured to accommodate the proposed system plus a fifty percent expansion capability.
 - b. FACP shall include all required operating modules and accessories.
 - c. All FACP modules, components and devices shall be of the manufacturer's latest version.
 - d. FACP shall provide power, annunciation, supervision and control for the complete detection, alarm, and monitoring and control system.
 - e. FACP shall operate from a three-wire 120 volt supply from an emergency source if available and be provided with internal 24 volt uninterruptible power supply (UPS) and back-up battery.
 - f. FACP shall be configured to provide interconnection to existing TrueSite Graphical Annunciators at Fire Rescue and Operations.
 2. FACP hardware
The following FACP hardware shall be provided:
 - a. Power Limited base panel with beige cabinet and door, 120 VAC input power
 - b. 2,000 point capacity where (1) point equals (1) monitor (input) or (1) control (output)
 - c. 2,000 points of Network Annunciation at FACP Display when applied as a Network Node
 - d. From all battery charging circuits in the system provide battery voltage and ammeter readouts on the FCP LCD Display
 - e. One Auxiliary electronically resettable fused 2A @24VDC Output, with programmable disconnect operation for 4-wire detector reset
 - f. One Auxiliary Relay, SPDT 2A @32VDC, programmable as a trouble relay, either as normally energized or de-energized, or as an auxiliary control

- g. Where required provide Intelligent Remote Battery Charger for charging up to 110Ah batteries
 - h. Power Supplies with integral intelligent Notification Appliance Circuit Class B for system expansion
 - i. Remote Unit Interface: supervised serial communication channel for control and monitoring of remotely located annunciators and I/O panels
 - j. Service Port Modem for dial in passcode access to all fire control panel information
- f. **Formal testing and acceptance protocol**
- 1. **General**
 - a. Formal testing and acceptance protocol shall be in accordance with the fire alarm guide specifications, AIA MasterSpec Section 16721.
 - b. System acceptance testing shall be performed in accordance with NFPA 72 and the DPC Standardized Fire Alarm Acceptance Testing procedures outlined below.
 - 2. **Fire alarm acceptance testing procedure**
 - a. All project submittals, drawings, specifications, certifications, test results and current as-builts/record drawings shall be available at test location.
 - b. Fire Department alarm/dispatch office, building management and occupants shall be notified by installation contractor.
 - c. Provide system printer and forms for systematic recording of acceptance test results.
 - 3. **Visual inspections**
 - a. All components are installed in a workmanlike manner.
 - b. All components are securely mounted.
 - c. Manual station mounting heights are 42" to 60".
 - d. All device locations are per project plans and specifications:
 - i. Pull stations/card holders
 - ii. Audible/visual signaling devices
 - iii. Smoke and heat detectors
 - iv. Duct detectors
 - v. Sprinkler flow and tamper switches
 - vi. Post indicating valves
 - vii. Door controls
 - viii. Remote/auxiliary annunciation panels
 - e. Wiring is in compliance with NEC (NFPA 70), project plans, specifications, color coding and manufacturer's recommendations.
 - f. Fire system raceways contain only fire alarm system circuits.
 - g. Wire-nuts are not present on any system wiring.
 - h. All equipment is listed and installed in approved manner.
 - i. All hidden duct detectors are marked/signed for location.
 - 4. **Fire Alarm Control Panel (FACP)**
 - a. Power is present to panel.
 - b. All lamps are operational.
 - c. FACP is properly and completely addressed.
 - d. FACP has no unidentified disconnected wires.
 - e. All wiring in FACP is coded or marked.
 - f. FACP integral/local audible function is operational.
 - g. All FACP switches operate and are fully functional.
 - h. Installed CSG program matches the submittal CSG program

- i. System drain wires and conduit grounding properly installed per manufacturer's recommendations.
 - j. Audible suppression devices installed per manufacturer's recommendations.
 - k. All smoke detectors have been adjusted to maximum stable sensitivity setting.
5. Supervision tests
- a. FACP is free of supervision faults.
 - b. Test for FACP supervision monitoring is completed by inducing disconnects and ground-fault defects at random locations in a least one-third of both the SLC and signal loops.
 - c. FACP is tested for all supervision monitoring.
 - i. Electrical power
 - ii. Battery power
 - d. Initialize the system and confirm communication between all system components from a non-powered condition.
6. Power tests
- a. Battery power is present to FACP.
 - b. FACP and total system is operated on battery power for twenty-four hours. At the end of this period, all alarm and output devices are operated on battery power for five minutes.
 - c. System operates from a dedicated or locked power circuit.
 - d. Power circuit disconnect breaker is accessible only to authorized personnel and clearly marked "Fire Alarm Control Circuit".
7. Initiating circuit tests
- a. At least two devices in each SLC loop are randomly tested for correct addresses.
 - b. At least two devices in each SLC loop are randomly tested for incorrect type.
 - c. All other ancillary control and/or monitoring features such as fire pumps, low pressure/water and AOA emergency/panic door releases have interface modules attached and are verified or tested as required.
8. Alarm response tests
- a. All detector devices, manual pull stations, duct detectors, sprinkler flow and taper switches in each SLC loop are tested per NFPA 72H.
 - b. Fire department location/ID test are confirmed for each device.
 - c. All sprinkler flow switches have interface modules attached and are tested by actual water flow via the inspector test valves.
 - d. All fire suppression systems activation is tested.
 - e. All audible/visual devices are checked for response.
 - f. FACP, all remote annunciators, and central reporting system at fire station are verified for each system activation.
 - g. All other ancillary control activation's such as fire door release, HVAC shutdown and elevator capture are verified as required.
 - h. System scrolling is tested for at least ten multiple alarm activation's.
 - i. All system outputs remain in alarm/activation until system has been reset.
9. Audible signaling device audibility
- a. All audible sounding devices are tested by meter for sound levels and recorded as per NFPA 72G.
 - b. Complete "Central Station Signaling System Certification" per NFPA 71.

- c. Comply with maximum operating time requirements per NFPA 72D.

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