



CLARK COUNTY FIRE DEPARTMENT  
Fire Hazard & Prevention Services  
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105.8a-6.1

**TITLE: FIRE ALARM SYSTEM REQUIREMENTS**

**SCOPE:** This guideline applies to Fire Department requirements regarding the design of fire alarm systems.

**PURPOSE:** Standardize Fire Department requirements relating to the design of fire alarm systems. Emphasize critical plan items required by the Clark County Fire Department in accordance with the 2005 Clark County Fire Code and the 2002 Edition of NFPA 72.

**PROCEDURE:** At the time of permit application, three (3) sets of plans, drawn to an indicated scale (1/4" or 1/8" scale preferred), must be submitted for review and approval. A minimum of two (2) sets of product data submittals, including the manufacturer information sheets for all control units, all initiating devices, all notification devices, all control/monitor modules, and all supplementary equipment shall be included. Permit fees for this type of submittal vary. The standard permit fee is due upon submittal. Please see the **Clark County Fire Department Permit and Service Fee Schedule** for specific information. Please check our website for plan status. Any additional fees will be indicated on the website. Once the plans have been approved and any outstanding fees have been paid, an inspection can be scheduled.

Our website is <http://www.accessclarkcounty.com/fire/firedept.htm> . To check on plan status, click on the "Plan Status" button and follow the instructions. To schedule an inspection, click on "Services" in the teal strip on the top. On the left side under **Inspection** click on "Fire Inspection" and follow the instructions.

Any submittals to document changes to the approved plans/permit will require revised plans to be submitted and approved (all revisions require a new permit and additional permit fees). A copy of the previously approved plan shall accompany the revision submittal to facilitate review. Any submittals to address plan review comments to rejected plans/permit will require full resubmittal. The rejected red line plan from the previous submittal shall accompany the resubmittal to facilitate review. For revisions and for resubmittals, all changes shall be indicated by cloud around the area of change with a delta number to signify the date of plan change.

If the project is provided with a fire protection report, provide a copy of the approved fire protection report (including all approved amendments) relating to the scope of work of the submittal.

**REQUIREMENTS:** The following items must be addressed within submittals for fire alarm system installation permits:

**PLAN ITEMS:**

- Project name, street address, and owner's name. This information must be included in the title block that appears on each plan sheet.
- Contractor's name, address, phone number, license numbers, license classification, and license limit. This information must be included in the title block that appears on each plan sheet.
- Wet signature of licensee, i.e. the contractor's Master or Qualified Employee.
- Wet signature of NICET Level II designer (or equivalent certification) who prepared submittal.
- Occupancy classification as defined by Section 216 of the Clark County Fire Code. Indicate the occupant load within the occupancy, and indicate the number of floors of the building.
- Fire alarm circuit classification, whether power-limited or non-power-limited. See Article 760 of the NEC.
- Class/style designation of all initiating device circuits (IDC), signaling line circuits (SLC) and notification appliance circuits (NAC) per NFPA 72, Section 6.4.
- Conductor type and size for each circuit. See the NEC.
- Provide a symbol legend.
- Floor plan shown to 1/8" or other suitable architectural scale. Floor plans must include:
  - a. North arrow.
  - b. Walls and doors throughout the protected premise.
  - c. Room use identification labels that clearly specify the purpose of the room protected.
  - d. Device type and locations. Devices must be provided with adjacent labels indicating the circuit number, number of device on the circuit, and system address, if applicable.
  - e. Conduit routing, with labels to indicate type and number of conductors contained
  - f. End-of-line resistor, if provided.
  - g. Identification of detection and notification zones.
  - h. Power panels and circuit connection.
  - i. Key plan.
  - j. Ceiling height for all areas covered by detection systems and where ceiling mounted notification appliances are provided.
  - k. Beam/joist/soffit and any other obstruction to fire alarm design. Height of the bottom of the obstruction with respect to the floor must be indicated.
  - l. Match lines on sheets.
- Detail on section view showing mounting for all wall-mounted devices with respect to height above the floor and height below the ceiling. See NFPA 72, Sections 5.6.3.1, 5.7.3.2.1, 5.12.4, 7.4.6.1, 7.4.6.3, and 7.5.4.

- Riser diagram showing general arrangement of the system and type and circuits in each riser.
- Wiring diagram showing the interconnection of panels and devices, indicating the type and number of fire alarm system components/devices on each circuit.
- Provide CCFD General Notes as follows:
  - a. This installation conforms with all applicable Nevada State Statutes and Clark County Fire Codes and Ordinances which are in effect at the time of installation.
  - b. The contractor (or his designee) must provide testing equipment and perform all testing required by the Clark County Fire and Building Departments.
  - c. The contractor shall conduct a “pretest” of the entire system before scheduling an acceptance test.
  - d. Areas protected by audible alarms will achieve a minimum of 80db sound at any place within the protected property.
  - e. An acceptable performance test will be scheduled prior to final acceptance with a minimum of two (2) working days advance notice.
- Input and output matrix. Include all inputs, including duct detectors, kitchen hood systems, detectors at doors, etc. Specify all of the outputs from the FACP, including fire suppression systems, alarm activation, smoke control, kitchen hoods, doors, elevator dampers/fans, graphic and remote annunciators, etc.
  - a. Duct detectors output is supervisory, not fire alarm, such that fire alarms are not to be initiated for duct detector activation.
  - b. Elevators recall only on smoke detectors that are in elevator lobbies, elevator machine room, and top of shaft (if provided). In the matrix, indicate the primary level of recall, the alternate level of recall, and the floor level for the smoke detector causing alternate recall. In addition, the elevator machine room smoke detector and the top of shaft smoke detector (if provided) shall light the firefighter’s hat. Ensure this function is also reflected in the matrix.
  - c. For facilities with partial alarming such as high-rise buildings, where the activation of a device does not cause the entire building to alarm simultaneously, indicate for each initiating device the floor levels/areas where alarms will be activated.
- Indicate monitoring by an approved supervising station. All fire alarm systems are required to be monitored. Acceptable supervising stations are central station (NFPA 72, Section 8.2) and proprietary station (NFPA 72, Section 8.3); however, proprietary station monitoring is only allowed for major facilities that have sufficient staff to devote to supervising functions, and only upon express written approval of the use of proprietary monitoring by the Clark County Fire Department.
- Verify minimum 80 dB is produced throughout, and that the fire alarm produces a minimum of 15 dB above ambient. See Section 1006.3.3.8.3 of the Clark County Fire Code.
- In the general notes section, indicate that maintenance will be provided in accordance with code. See NFPA 72, Chapter 10 and SFM 477.

- On the plans, devices need to have an adjacent label indicating the circuit number and the device number on that circuit.
- If there is a voice alarm system, print the message(s) to be played during fire alarm activation. Identify the automatic message, and describe the scenarios where the other messages are used.
- Show that there is a dedicated disconnect for the fire alarm control panel, and that it is labeled as Fire Alarm system.
- Show connections to all building duct detectors, including the duct smoke detector and the relay to the fan.
- Show connections to all smoke dampers, including any in-duct smoke detectors, relays to dampers, and monitor modules for damper status for smoke control systems. Provide locations of all control relays and monitor modules on the plans.
- Provide a total device count on the cover page, and provide device count per sheet on every plan sheet.
- Indicate temporal pattern for horns and verify that strobes are synchronized.

### **CALCULATIONS:**

- Provide battery calculations for all control panels and power supplies (see sample in NFPA 72, Exhibit 4.1). Verify that the battery calculations include a minimum derating factor of 20%. When calculating the required current draws for the notification appliances when in alarm, verify that the current draws utilized for each notification device is the UL maximum draw at the minimum listed voltage for each notification appliance per the manufacturer's cut sheets.
- Provide circuit load calculations, indicating the total load, in amperes, for each circuit. Verify that the current draws for the notification appliance circuits utilize the UL maximum draw at the minimum listed voltage for each notification appliance per the manufacturer's cut sheets.
- When installing a voice evacuation system, calculate the wattage requirements for each speaker circuit and for each amplifier.
- Voltage drop calculations shall be performed utilizing either the point-to-point method or the lump sum calculation method. The point-to-point method requires a math-intensive method where the voltage drop between each notification appliance is reiterated. Below are the steps to use when utilizing the lump sum calculation method (the preferred method).
  - a. Calculate the voltage drop using one of these formulas:  $V_D = I * ((R * 2 * L)/1,000)$  **OR**  $V_D = (2 * K * I * L)/CM$ .
  - b. Subtract this calculated voltage drop from 20.4 volts ( $V_S$ ) in order to get the voltage value at the end of the circuit ( $V_S - V_D = V_{EOL}$ ). The value for  $V_{EOL}$  shall be a minimum of 16 volts (the minimum operating voltage required for a listed 24vdc notification device).
- $V_D$  = Voltage Drop
- $V_S$  = Starting voltage (20.4vdc, or the end of useful battery life)
- $V_{EOL}$  = Voltage at the end-of-line resistor
- $I$  = Total load of the circuit in amperes utilizing current draws for each notification appliance @ 16vdc (the UL maximum draws at the minimum listed voltage).
- $R$  = Resistance in ohms per 1,000 feet, with respect to conductor

- **K** = 10.64 ohms (the constant representing the mil-foot resistance of copper wire)
- **L** = length of circuit in feet (distance from panel to end-of-line resistor for class B circuits)
- **CM** = circular mill of wire, with respect to conductor.

Wire	R	CM
No 18	7.95	1,620
No 16	4.99	2,580
No 14	3.14	4,110
No 12	1.98	6,530

### **PANELS / ANNUNCIATORS:**

- A remote annunciator is required at the main entrance into the building in a publicly accessible area. See NFPA 72, 4.4.6 and Section 1006.3.3.7.1 of the Clark County Fire Code.
- Verify a secondary response point for buildings that would normally require a fire command center. Refer to CCFD guideline. Secondary response points require a remote annunciator, an all-call microphone for all voice circuits, a fire phone jack for communication to the FCC, and a fire phone receiver panel for communication with fire phones in the facility.
- A zoning indicator panel (zone directory) is required for high-rise buildings, covered mall buildings, and any other building when required by the fire protection report. (Please note that the panel does not have to be a separate panel from the FACP, as long as it provides the required information). The panel shall utilize LED for annunciation. LED shall indicate the specific device activated, and the floor level on which the device type has activated. Each floor shall have individual LED for each device type. LED for device type indication shall not be shared for multiple floor levels. The panel needs to comply with Section 1006.3.3.7.1 of the Clark County Fire Code.
- Verify that the fire alarm panels are contained outside of the stair and vestibule enclosures per the IBC. Verify that the main FACP is located on the first floor at an area acceptable to the AHJ.

### **SMOKE CONTROL SYSTEMS:**

- Show detection zone limits with respect to smoke control zones or in accordance with NFPA 72, Section 4.4.6.1.2.
- Show notification zone limits with respect to smoke control zones or in accordance with NFPA 72, Section 6.8.6.2 and 6.9.8.
- Show all connections to all smoke control fans, including relays to fans, method of monitoring fan power, and method of monitoring fan operation. Provide locations of all control relays and monitor modules on the plans.
- Show connection to variable frequency drives for smoke control fans with the VFD's, indicate the method of setting VFD to smoke control function.

### **MISCELLANEOUS ITEMS:**

- Verify two power supplies per code. See NFPA 72, Section 4.4.1.4.1, Section 4.4.1.5, Section 4.4.1.5.3.1 for minimum power supply requirements.
- Verify that fire phones are provided as required by code. In high-rise buildings, fire phones are required in every stair, not just high-rise stairs. See Section 1006.2.12.3 of the Clark County Fire Code, and NFPA 72, Section 6.9.9. (Approved radio systems may be utilized in place of the fire phones). A fire phone is required in the fire pump room and in the generator room if applicable.
- Appliances subject to mechanical damage shall be suitably protected per NFPA 72 Section 7.3.4. If guards or covers are employed, they shall be listed for use with the appliance.
- Identify any disconnect switches required for fire alarm system testing. These include relays that release fire suppression systems, etc.
- For occupancies with music and lighting controls, such as show rooms, theaters, etc., verify control relay to shut off music, shut off light effects, and increase lighting to minimum lighting levels required for egress.

### **INITIATING DEVICES & NOTIFICATION DEVICES:**

- Provide a manual pull station at the fire control panel or at a location acceptable to the AHJ per NFPA 72 Section 6.8.5.1.2 and as required by the authority having jurisdiction.
- Smoke detectors are required at the FACP (NFPA 72 Section 4.4.5), where required for fire safety function (NFPA 72 Section 5.14 and Section 6.15) and for occupancy requirements (Clark County Fire Code Section 216 and Section 1006).
- Where smoke detectors are installed for specific hazards such as elevators, doors, panels etc, the smoke detector shall be installed on the ceiling at the highest available height within the distance required by code. Where significant ceiling height changes occur in close proximity to the outer limits of the spacing requirements for special hazards, the preferred approach is to exceed the spacing requirements from the particular hazard in order to install the smoke detector at the highest available point.
- For corridors that are less than 20 feet wide, visible notification appliances shall be located not more than 15 feet from the end of each corridor with a separation not greater than 100 feet between appliances.
- Wall-mounted visible appliances shall be mounted such that the entire lens is not less than 80" and not greater than 96" above the finished floor per NFPA 72 Section 7.5.4. For sleeping rooms, if the visible appliance is not part of a smoke alarm/smoke detector, and the unit is to be wall-mounted, it must be located between 80" and 96" above the floor; if that places it within 24" of the ceiling, it must have a 177 candela rating, and if it is 24" or more from the ceiling, it can be a 110 candela rating. For spacing for wall and ceiling mounted visible devices according to this chart, reference NFPA 72 Tables 7.5.4.1.1 (a) and 7.5.4.1.1 (b).

Device Rating (cd)	Orientation	Protection in front of device (ft)	Protection to each side of device (ft)
15	Wall	20	10
30	Wall	28	14
15/75	Wall	20	22.5
60	Wall	40	20
75	Wall	45	22.5
110	Wall	54	27
177	Wall	60	30
15	Ceiling, 10' max ht	Na	10
30	Ceiling, 10' max ht	Na	15
60	Ceiling, 10' max ht	Na	20
75	Ceiling, 10' max ht	Na	20
95	Ceiling, 10' max ht	Na	25
110	Ceiling, 10' max ht	Na	25
115	Ceiling, 10' max ht	Na	25
15	Ceiling, 10' - 20'	Na	Na
30	Ceiling, 10' - 20'	Na	10
60	Ceiling, 10' - 20'	Na	15
75	Ceiling, 10' - 20'	Na	15
95	Ceiling, 10' - 20'	Na	20
110	Ceiling, 10' - 20'	Na	20
115	Ceiling, 10' - 20'	Na	25
177	Ceiling, 10' - 20'	Na	25
15	Ceiling, 20' - 30'	Na	Na
30	Ceiling, 20' - 30'	Na	Na
60	Ceiling, 20' - 30'	Na	10
75	Ceiling, 20' - 30'	Na	15
95	Ceiling, 20' - 30'	Na	15
110	Ceiling, 20' - 30'	Na	15
115	Ceiling, 20' - 30'	Na	20
177	Ceiling, 20' - 30'	Na	25

Prepared by \_\_\_\_\_

Date \_\_\_\_\_

Approved by \_\_\_\_\_

Date \_\_\_\_\_