Fire Alarm System Design & Maintenance

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Agenda

• History of Fire Alarm Systems / Original & Current State Fire Codes pertaining to Multi-Housing in MN
• Typical Fire Alarm System Design – (3) Basic Types of Facilities for Multi-Housing
• Residential Space vs. Common Area
• Typical Sprinkler System Design
• Maintenance & Annual Inspections
History of Fire Alarm System Requirements for Multi-Housing Facilities in Minnesota

Original State Fire Codes:
• Manual Activation Only (1960’s – 1970’s)
• Automatic Heat Detection (1970’s – 1980’s)
• Automatic Smoke Detection (Mid 1980’s)
• ADA Requirements – Strobes (1990’s)

International Fire Code (IFC):
• Sprinkler System Exceptions (Mid 2000’s)
Early Fire Alarm Systems
No Alarm System - Yell Fire!

PREVENTION STRATEGY

- Fire Protection Systems
  - If your building is not equipped with a fire alarm system, occupants will need to communicate to others in the building by yelling “FIRE” as they exit the building, or by other means as defined in the building’s Emergency Action Plan.
Manual Activation Only (60’s – 70’s)
Automatic Heat Detection (70’s)
Automatic Smoke Detection (80’s)
Transition from Bells to Horns & Speakers for High-Rises (80’s)
ADA Legislation – Strobes (90’s)
75 Db Requirement - Mini-Horns in Living Rooms/Bedrooms (90’s)
Addressable Technology (90’s)

- Manual Pull Stations, Smoke/Heat Detectors, & Sprinkler Devices are all identified on a per point basis
- Verses the Traditional Zoned System (typically by Floor or Area of Building)
MN Adopts International Fire Code – IFC (early 2000’s)

• Sprinkler System Exception – Allows Manual Pull Stations & Smoke Detectors to be Eliminated in Buildings with 100% Sprinkler System (New Construction)

• (1) Manual Pull Station only at Main Panel

• Smoke Detectors only at Elevator Lobbies (elevator capture) & Door Holder Control
Present Fire Alarm System Design Requirements - Basic R-2 Occupancy

• Fire Alarm Systems required for any building 16 units or larger or 3 occupied levels or more

• 24/7 Fire Monitoring is required for all buildings with Sprinkler Systems regardless of size - Townhomes, etc.

• Independent Residential Smoke Detectors are required in Residents Living Space (not to be connected to central Fire Alarm System)
Non-Sprinklered R-2 Occupancy

• Manual Pull Stations at all exits
• Heat Detectors in boiler rooms, laundry rooms, storage rooms, & parking garages
• Smoke Detectors 30’ on center in all common corridors, at elevator lobbies, & door holders
• Horns & Strobes required in all common areas (corridors, restrooms, laundry rooms, etc.)
• Mini-Horns required in all resident bedrooms
Fully Sprinklered R-2 Occupancy

• Manual Pull Stations at exits (1) Only
• Heat Detectors in boiler rooms, laundry rooms, storage rooms, & parking garages (Sprinkler Heads monitored by Fire Panel)
• Smoke Detectors 30’ on center in all common corridors, at elevator lobbies, & door holders
• Horns & Strobes required in all common areas
• (corridors, restrooms, laundry rooms, etc)
• Mini-Horns required in all resident bedrooms
Typical Fire Alarm System & Design by Building Type
Building Type 1 - Townhomes R-2

Separate Resident Entrances & No Common Corridors or Areas

Sprinkler System with 24/7 Fire Monitoring Panel Required Only
Typical Townhome Outside Entrance to Sprinkler Room & Monitoring Panel
Building Type 2 – Low-Rise R-2

Common Entrance & Corridors to Resident Units (Typically 3 – 5 Floors)

Central Fire Alarm System Required per State IFC
Low-Rise R-2 – Non Sprinklered

1ST / 2ND / 3RD FLOORS - ALL IDENTICAL EXCEPT AS NOTED

SCALE: 3/32 = 1' - 0"

STAIRWAY

1ST FLOOR ENTRY ONLY
Low-Rise R2 – Sprinklered
Low Frequency Horns in Bedrooms
Building Type 3 – High-Rise R2

More Than 75 Feet Above Street Level (or Fire Dept. Access)
High-Rise R2 – Sprinklered Speakers in Bedrooms
Self-Contained Smoke Detectors Required in Residential Space
Smoke Detection Systems

Smoke particles enter the chamber reflecting infrared light toward the sensor to trigger the alarm.

Photoelectric Detector

Chamber
Photodiode Sensor
Infrared LED

Ionization Detector

Ionization Chamber
Screen
Metal Plates
Alpha Particles
Americium-241

Smoke particles enter the chamber interfering with the electric charge crossing between the metal plates. The drop in current triggers the alarm.
Typical Layout of Residential Self-Contained Smoke Detectors
New Construction
Residential Smoke Requirements

• **New Construction** – 120VAC with battery backup Interconnected & located in Hallways outside Bedrooms & in each Bedroom

• **Existing Buildings (after 8/1/89)** – 120VAC with battery backup & located in Hallways outside Bedrooms (No Interconnection)

• **Existing Buildings (before 8/1/89)** – Battery Operated OK & located in Hallways outside Bedrooms (No Interconnection)
Replacement Requirements for Residential Smoke Detectors

• If they Fail to Respond when Tested
• When they exceed 10 Years from the date of manufacture
• Must be replaced with same type of device: 120VAC with Battery
  Battery Only
  Interconnected
CO Detectors Required for Gas Appliances In Residential Space
CO Detector Exception

• In Buildings with centrally located gas appliances (boiler room, laundry rooms, etc.)
• CO Detectors can be installed at the location of the gas appliances only and not in each residential unit
• CO Detectors must be connected to the building fire alarm system and be monitored 24/7 by an outside monitoring service
Mini-Horns or Speakers required in Bedrooms of Residential Space
Typical Sprinkler Systems in Multi-Housing Buildings

Required to be connected to the Central Fire Alarm System with 24/7 Monitoring
Wet Sprinkler System
(Common Areas & Residential Space)
Dry Sprinkler System
(Unheated Garages & Attics)
Typical Sprinkler Riser Room (Fire Pump for High-Rises)
Maintenance & Annual Inspections
State IFC Requires Annual Inspections of Fire Alarm & Sprinkler Systems

• Fire Pumps (April – October in MN)
• Horns & Strobes must be activated
• Main Panel & Remote Panels Battery Load Test
• Monitoring Signals Verified with Central Station
Maintenance Items that should be included during Annual Inspection

• Smoke Detectors should be cleaned & tested for sensitivity levels (if addressable system)
• Batteries should be replaced if they fail the required load test (5-Year Replacement Plan)
• Main Panel should be tested for all alarm, trouble, supervisory, reset, & silence functions
• Main Panel should have manufacturers firmware upgrades installed
Smoke Detectors are the most active device = Problems if not Maintained
Protect Smoke Detectors Temporarily
Construction/Garage Cleaning
City Fire Inspector Variances on Maintenance & Inspections

- Generally Cities in MN enforce the State IFC and NFPA Testing Standards
- Some may require more than State IFC
- UL Certificates have been initiated by some Fire Marshals in the Metro Area
- UL requires more Documentation/1 Hour Alarm Response/4 Hour Trouble Response
- Higher Monitoring/Service Contract Costs
UL Certificate/Monitoring Cities

Brooklyn Center  Coon Rapids
Brooklyn Park     Eden Prairie
Burnsville       Golden Valley
Chanhassen       Maple Grove
Chaska           Plymouth
Shakopee