16720-H: FIRE ALARM SYSTEMS

Applicability:
The information expressed herein is unique to UMHHC owned, operated, and leased facilities, and are intended to supplement portions, and to replace other significant portions of the University of Michigan’s Architecture, Engineering, and Construction (UMAEC), design guidelines 16720 in regards to Fire Alarm Systems. Those UMAEC design guidelines are located on website http://www.plantext.bf.umich.edu/for.archs/index.html. All information presented in the referenced UMAEC guideline applies to UMHHC facilities, unless explicitly stated otherwise below. Where differences and/or conflicts exist between the supplemental information noted below, and the information in the UMAEC guideline, this supplementary information shall take precedence.

The Design Professional (A/E) shall adhere to UMHHC Design Guidelines for all work at UMHHC facilities. Any requested deviations from these guidelines, shall be sent, in writing, to UMHHC’s Facilities Planning and Development (FP&D). Address the correspondence to the assigned FP&D engineer for the given project. The deviation shall not be incorporated into the construction documents until written approval of the deviation is received by the Design Professional.

The Design Professional is fully responsible for the professional quality, technical accuracy, code compliance, and overall coordination of the contract documents. Compliance with these guidelines shall not be construed so as to relieve the Design Professional of any of that responsibility.

This guideline shall apply to all renovated and new UMHHC buildings that have fire alarm systems reporting to Facility Control Center (FCC) in University Hospital, Room 1A203.

Other buildings not reporting to FCC shall follow the intent of these guidelines in essentially all matters other than the requirement to report to FCC. The buildings, not reporting to FCC, typically would be smaller off-campus buildings. The A/E shall assume, however, that the building being designed or renovated will need to report to FCC, unless the program statement specifically states otherwise.

Standards

General

1. All equipment is to be UL listed and labeled, and Factory Mutual listed for the purpose and occupancy.
2. The equipment and installation will be in full compliance with NFPA. 70, 72, 72E, 75, 99 and 101.
3. Inpatient, hotel, and educational occupancies shall also comply with Michigan Bureau of Fire Safety (BFS) requirements.
4. All systems shall be tested in accordance with NFPA 72.
5. All work is to be by a contractor certified by BFS.
6. Shop drawings for inpatient facilities, outpatient surgery facilities, and other occupancies noted in the program statement shall be submitted to BFS for review along with BFS form FM12A.
7. Shop drawings for other facilities will be submitted to the University of Michigan Fire Marshal – Ian Steinman.
8. Currently FCC has ‘head end’ equipment from Tyco/Simplex and Honeywell/Edwards. Any new system reporting to FCC shall be compatible to those two head ends.
9. In accordance with the latest version of NFPA 72, all wiring will be installed in dedicated raceways, and will be color coded consistently throughout, as to function. Do not run wiring in tray or as open wiring.

Note: Some existing buildings, such as UH, have fire alarm wiring in tray. All new wiring will be in conduit.
10. All cabinets, equipment enclosures, pull boxes, junction boxes and fittings or conduit are to be painted red. Boxes are to be clearly labeled as fire alarm (FA).

11. All fire alarm systems will normally be powered by the emergency power system in accordance with NFPA 70 and 72.

12. In general all systems will have 24-hour battery back-up, as required by NFPA 72, and will automatically revert back to AC operation when power is restored. Battery back-up is required in all buildings, including those with generator power. Buildings with two utility services and an emergency generator shall be allowed to have only an 8 hour battery backup.

13. A/E will design new systems to have a wiring style as follows:
   a. In most buildings a style similar in functionality to what was formerly known as Class A; to have solid state, multiplexed data transmission; and utilize low voltage (typically less than 30V) input and output controls.
   b. Extensions to existing systems will follow the same philosophy used in these existing systems, unless otherwise noted in program statement.
   c. New high rise building shall, and high rise building with fire alarms being replaced should, design the wiring plan to prevent a serious occurrence in one area from completely severing communications between the floors above or below that occurrence.

14. Zoning of building and fire alarms, and point reporting protocol of fire alarm system shall be clearly defined by A/E on their drawings and schedules.

15. A/E’s shall prepare contract documents to show, and to require the fire alarm contractor to be responsible to coordinate with all other systems and subcontractors that affect operation of the fire alarm system; i.e., flow switches are to be specified and installed to be compatible with fire alarm systems being installed. Other such equipment’s include, but are not limited to:
   a. Preaction alarm switches
   b. Tamper switches on (OS & Y) valves
   c. Stairwell pressurization and other smoke control systems
   d. HVAC duct smoke detectors
   e. Elevator Recall system shall be coordinated with elevator contractor
   f. Door hold-open devices
   g. Security system's electrified door hardware and magnetic locks
   h. Rolling fire shutters
   i. Chemical systems and controls
   j. Generator and fire pump monitoring required by NFPA and FM
   k. Building management/temperature control systems
   l. Smoke alarm, smoke containment, and smoke purge system

16. The A/E’s design shall clearly define interrelations and interfaces between fire alarm system, smoke control system, fire protection system, security system, and building management/temperature control systems. Define clearly which contractor supplies the various equipment, who installs and tests each type of equipment, and who warranties the overall system. Clearly define also the operation of system under all projected conditions.

17. Fire alarm system controls shall not require specially trained computer operators, i.e. required operations at the FACP and ‘node’ panels are to be obvious, and shall prompt the operator for needed actions,
   a. Point names are to be explicit, accurate, and consistent,
   b. Listing of point names shall be reviewed by UMHHC before the system is programmed and labeled.

18. New systems are to be of the intelligent type unless the project's program statement calls for non-intelligent systems. Intelligent in this context means each initiating, monitoring, and control device is monitored and reports separately. New systems shall be designed and installed per applicable Codes.

19. Training for operators, maintenance, and programmers shall be provided for all installations. Training shall, at minimum, cover operation, programming, preventive maintenance and triage maintenance.

20. A one-year warranty, from substantial completion date, with 8-hour maximum response time and 7-day/24-hour tech support/service shall be provided.

21. Preaction suppression systems are to have smoke detector mounted above panel. They also must report back to building alarm system TROUBLE, ALARM and SUPERVISORY signals.
22. All fire alarm system panels (including booster/NAC panels) shall have smoke detector mounted above it.

Facility Control Center (FCC) Connection

1. UMHHC buildings connect to Facility Control Center (FCC). They do not interconnect to, or report to, the MOSCAD transmitting unit used by UMAEC.
2. All fire alarm systems for buildings on the Ann Arbor campuses and other, larger, offsite locations, will be a proprietary system as defined in NFPA 72, and will also report to the Facility Control Center (FCC) in University Hospital room 1A201D. Smaller off-campus locations, as noted in their program statement, require monitoring by a UL-certified site. In general, point and alarm type information is preferred and shall be provided on any new building on the main campuses. Some existing buildings on campus, and some off-campus buildings, report zone and alarm type information while other buildings only report over general building alarm information. The exact level of interconnection is dependent upon the following factors:
   a. Program Statement
   b. Code requirements for the type of occupancy; i.e. inpatient versus office occupancy.
3. All connections to, and needed modifications in FCC, including associated programming or reprogramming of existing fire alarm computers and naming of point descriptors, shall all be part of the project. As noted above the point descriptors shall be reviewed with Hospital Security. No new system types, or additional equipment, will be introduced into FCC without written approval.

Existing Systems

1. Existing fire alarm systems will be retained or upgraded unless specific direction is given otherwise in the program statement. Exceptions would include:
   a. Existing system is out of production, and compatible parts are not available.
   b. The existing system violates current code requirements, and cannot be brought, economically, into compliance.
2. Work on existing fire alarms will be sequenced to minimize length of time any part of the system will be out of service. The contractor, in occupied building renovations shall be instructed to leave the building with an active system, each day at close of work, or that contractor shall arrange for and pay a fire watch till the system is reactivated.
3. All work on existing systems will be closely coordinated with UMHHC Security Services (734) 936-7890 and Maintenance Fire Alarm Group (734) 936-5081.
4. Precautions are to be taken to prevent false activation or disruption to the fire alarm during construction; i.e., install plastic covers over smoke detectors when high dust levels will be present. Plastic covers shall be removed during non-working hours. Alternately, a number of dust resistant heat detectors will be installed during the construction period. Before working on any portion of an existing fire alarm system, the contractor is to alert the UMHHC Project Manager so that UMHHC Security and Maintenance can take needed actions to minimize disruptions to UMHHC fire protection systems or false alarms.
5. All fire alarm components, for a given building, are to be of the same manufacturer and listed for operation with the installed system.

New Installations

New systems will operate as noted here:

1. A fire alarm is to be initiated by actuation of any manual pull station, area type smoke detector, heat detector, sprinkler water flow switch, Preaction sprinkler system and/or chemical fire extinguishing system.
2. Actuation of a single duct detector shall cause a supervisory signal at FCC. A second duct detector actuation, shall initiate an alarm signal.
3. The fire alarm system is to have the following response to an alarm condition:
   a. The system shall be installed to provide building-wide alarms. It shall also be capable of sounding the audio signal over the signaling devices on only the floor originating the alarm, the floor above, and the floor below. The system shall initially, however, be configured only for building-wide alarms.
i. The audio alarm shall consist of a mark-time, alert signal. The mark-time signal will be similar to the chime installed in University Hospital in period duration and tone. This mark-time type audible alarm will be installed in inpatient buildings and most outpatient buildings. Continuous tone devices may be installed in other occupancies or where non-intelligent systems are called for in the program statement. At no time shall the tone/chime duplicate any other signal, i.e. elevator chime, etc.

ii. When the AHJ allows, the system shall be easily converted to also be capable of initiating only a coded signal over the evacuation communication system to all other non-fire floors. This coded signal will alert the staff that a fire alarm has been activated on one of the non-adjacent floors. Reference NFPA 72.

iii. Audio tone shall be installed to sound a signal 15 dBA above normal daytime ambient noise levels.

b. Shall cause all visual alarm indicating devices to flash at a march time rate. Install ADA strobes in all sleeping areas (for hearing impaired persons) and common areas. The visual alarms shall also meet UFAS and UL requirements. This is not required in patient rooms or operating rooms (OR’s). In addition, visual alarms are not to be in line of sight of OR’s.

c. Shall display the alarm on the alphanumeric LCD type display, and printer, at the Fire Control Panel.

d. Shall initiate assigned control points through Event-Initiated-Programs, i.e., start stairwell pressurization fans, release hold-open doors, smoke containment and smoke purge.

e. Unless otherwise noted in the program statement, the fire alarm shall display all alarms and troubles on the system printer and monitor in FCC, each remote system printer and monitor, and (if applicable) the building’s Fire Command Center, the assigned English language message of the device in alarm. Message to give device type, building, floor, room, time, date and point number. It shall also sound an alarm tone at FCC.

f. The audible and visual alarm signals at the FACP are to pulse until the appropriate acknowledge switch is pushed. This will cause the audible to be silenced at the FACP only. The audio and visual alarm signals will continue to flash and sound. An alarm/audio (building) silence switch is to be provided. The visual signals continue to flash until the alarm is reset.

g. Release of all electrically held doors located on the floor originating the alarm, the floor above and the floor below if applicable. It shall also close any building-to-building separation doors.

h. Interact with security system components as needed to release the door latches in emergency doors.

i. Send signal to the Smoke Tower Pressurization or Smoke Control Panel or system that serves the specific building floor and zone in alarm.

j. For alarms initiated by duct detectors in HVAC units, send a signal to the respective fan motor starter and engage unit shutdown.

k. Audible or visual alarms are not to be within OR’s, but shall be installed at the nurses’ station/control room.

4. Voice Controlled Evacuation Communications System Operation:

a. All buildings on UMHS campuses shall have a voice communication system as part of the fire alarm system. Exceptions to this requirement will be noted in program statement.

b. The voice communication system is to be solid state, and is to provide voice communications and alarm tones between the Fire Control Panel and the installed audible devices. The FCC shall have the ability to access the voice channel of the fire alarm system. The FACP’s, audio input, however, shall have priority use of the systems audio channel, above the channel from FCC.

c. The voice communication portion of the system is to provide intelligible voice and signal reproduction, and incorporate the following:

   i. One-way voice communication from FACP, to each floor or compartment of the building, for selected evacuation.

   ii. One-way voice communication from FACP, to all or any combination of floors or compartments, for mass evacuation.
iii. The ability for FCC to make voice announcements to building occupants, preferably on a selected basis by compartment, or to the entire building.

d. The microphone is to be push-to-talk, dynamic noise canceling type with frequency response from approximately 200 to 4000 Hz. The microphone at the building's Fire Command Center (FACP) is to have priority over signals from Speaker Command Center in the Facilities Control Center (FCC).

e. Speaker positions will be indicated on the construction plans and on shop drawings, and will use speakers with a maximum axial volume of 100 dB measured at 4 feet with a (1-watt input.) In inpatient facilities, use more low volume speakers than a fewer number of high volume units.

5. Alarm Initiating Devices:

a. Manual Fire Alarm Stations:
   i. Semi-flush mounted dual action stations with break rod feature. Each station to have spare rod inside.
   ii. All manual pull stations to be installed at the same height throughout the facility. Mounting height shall be not less than 42” A.F.F. and not greater than 54” A.F.F.
   iii. Furnish 10% spare or twenty, whichever is less, glass rods to Owner as spares for each building.
   iv. Vandal resistant types with covers or requiring keys shall be installed in psychiatric, pediatric and other special locations when noted in program statement. Provide a common key for all stations. Supply 10 keys per station to UMHHC Fire Alarm Group.
   v. Provide metal bumper guards wherever pull stations might be damaged by moving equipment, carts. Guards shall be such that pull stations are unobstructed and accessible.
   vi. Provide cover and local alarm (Stopper II or equivalent) for those mounted in main corridors, in pediatric and psychiatric units and where the devices are subject to physical damage.

b. Area Type Photo-Electric and Ionization Smoke Detectors
   i. Are to give visual indication of normal operation and alarm condition.
   ii. Smoke detectors are to alarm within 2.0 to 2.5 percent obscuration.
   iii. Smoke/combustion products entry is to be 360 degrees.
   iv. Are to be of modular construction.
   v. Detector is to include base with alarm LED's visible 360 degrees around detector, and shall have remote LED output and alarm relay capability and 135 degree thermal element where specified or required.
   vi. Smoke detectors shall not be located within 3 feet of air supply (or return) diffusers. Following guidelines of NFPA 72E.
   vii. Use photoelectric detectors unless room use would indicate a need for ionization detectors (i.e. operating room).
   viii. Follow guidelines of NFPA-72 in placement of smoke detectors.

c. Duct Mounted Smoke Detectors:
   i. Complete with duct housing and sampling tubes.
   ii. To be provided by Fire Alarm contractor
   iii. Provide a remote-test-reset switch with alarm indicating light with each duct detector.

d. Area heat detectors for intelligent systems are to be auto reset i.e., not fusible and to be as follows:
   i. 135° F fixed element, also with rate of rise.
   ii. 190° F fixed element, also with rate of rise in equipment and other special use high heat areas.
   iii. Non-intelligent systems shall use fusible type detectors.
   iv. Follow guidelines of NFPA 72E and manufacturer specifications in placement of heat detectors.

e. Intelligent smoke/heat detectors. The following are additional requirements, for intelligent systems, to the information given in paragraphs 2, 3 and 4 above.
   i. Intelligent smoke detector heads are to have ability for remote, analog sensing/resetting of sensitivity in accordance with NFPA guidelines.
ii. Fire alarms system shall sense device type to ensure proper device is in place or bases shall be keyed to accept proper devices only.

iii. Intelligent detectors should have intelligence in the base. If intelligence must be in head, its address (point number) shall be easily set when heads are switched out for maintenance cleaning.

iv. Smoke detectors shall be installed with or programmed for alarm verification, i.e., alarm needs to be present more than 15 seconds before alarm is processed. This alarm verification delay shall be bypassed if a second detector in same area goes into alarm at the same time.

f. Smoke and heat detectors shall be placed to be easily accessible by maintenance personnel on a step ladder or by permanent platforms with ladders in mechanical space.

g. Smoke and heat detectors, as well as other fire alarm devices mounted in dropped ceiling areas shall be supported from ceiling support systems, not by ceiling tiles. The support shall be secure enough to allow needed preventive maintenance to be performed easily. i.e., the devices are easy to remove and install with one hand.

h. Detectors for areas with vaulted ceilings, atriums, and other high ceiling areas shall use beam type detectors placed high enough to prevent false alarming, yet low enough to meet requirements of NFPA 72E. Provide remote test-reset button with status indicating light for beam detectors if not accessible.

6. Audible and Visual Alarm Signaling Devices:
   a. Electronic Horn/Light Combination Unit (Non-Patient areas)
      i. When possible, flush mounted combination unit with red face plate trim.
      ii. Electronic Horn/Warble/Siren
      iii. Sound level - measured at 10 feet on axis, adjustable by three taps from 90-100 dBA.
      iv. Visual alarm appliance shall meet UFAS requirements.
      v. White lens, with FIRE in red letters.
   b. Fire alarm speakers to be activated by coded chime alarm tone for audible alarms in patient areas.
   c. Audible system to be designed to meet code required loudness in all spaces (15 dB above normal daytime ambient). It is preferable to use a (reasonably) larger number of low volume units instead of a fewer number of high volume units...especially in inpatient units. Speakers shall be set at mid-range tap to provide the specified dB sound levels.
   d. Ceiling mounted devices, as noted in Paragraph #7 above, shall be supported from ceiling support systems, not ceiling tiles.
   e. All A/V devices shall be mounted at the same height. They shall not be mounted less than 80” and not greater than 96” A.F.F.
   f. Specify outdoor speaker/strobes outside main building entrances.

7. Connection of Associated Systems: All equipment noted in paragraph 1K on page 16720-3 shall be connected into/supported by the fire alarm system.

8. Audio system amplifiers are to be mounted at or near FACP or in communication rooms. Amplifier is to be sized to 125% of projected load. Interconnect audio signals into FCC as noted previously.

9. Interconnect fire alarm systems, of physically adjacent buildings, so that intervening doors will close for alarms in either building. If fire separation is less than 3 hours then audio/visual in adjacent buildings must also operate. Do not cascade alarms beyond adjacent buildings, to other buildings.

10. Wiring schemes laid out by contractor shall allow for future addition of devices. FACP shall have capability to pick-up additional areas/buildings as noted in program statement.

11. Systems shall have capability for isolating portions of the systems for maintenance, or construction. The system shall be easily programmable, from either the FACP or from FCC to disable audible and/or visual alarms for maintenance, smoke controls, and door hold opens. The system will report the points as being disabled.

12. Fire alarm system devices will all be labeled carefully and completely as noted elsewhere in these guidelines. Color code junction boxes, raceways, FACP, as also noted in these guidelines. Confirm all device, panel, and wire labeling requirements with the UMHHC Fire Alarm Shop.

13. Alarm verification functions shall be available for all intelligent, area type smoke detectors to minimize false alarms.
14. Air handling system shall only shut down upon operation of an associated duct smoke detector at that unit, or a duct smoke detector in the distribution system of that unit. Duct detectors shall not alarm (audio/visual) the building.

15. FACP panels shall be located near entry points of Fire Department, and shall be recessed into the wall for physical protection. Coordinate locations of FACP with Ann Arbor or appropriate local Fire Department.

16. All programming of hard, soft or firmware points and graphic programming at the building and FCC shall be included in project.

17. All shop drawings and as-builds will be given to Owner in AutoCAD and PDF format. When doing renovations, update existing drawings whenever possible. At building turnover, a set of the most up-to-date mark-ups shall be handed over to Owner.

18. Audio and visual systems batteries, if not mounted in the FACP, or amplifier rack, shall be securely mounted on a floor mounted rack, or wall mounted shelving unit. Protect batteries with removable metal screening if mounted in an area where the battery may be damaged by normal or emergency maintenance, or through operations of adjacent equipment. All battery racks shall conform to current OSHA requirements.

Installation Guidelines

Follow the guidelines in quantity and placement of initiating and indicating devices as required specified by the NFPA and AHJ requirements, Factory Mutual Guidelines, or manufacturer recommendations. Also, meet the following additional requirements:

1. Mechanical, electrical and communication rooms, and janitor closets, shall have heat detectors. In general use 135° Fahrenheit units, mechanical rooms, however, may require 190° units.

2. Corridors shall have smoke detectors.

3. Stairwells will have fire alarm speakers and shall not have visual devices.

4. High ambient noise areas may need high output horn type speakers or additional strobes.

5. Speakers shall be placed to allow occupants to hear fire alarm signals and to understand spoken messages given by FCC or Fire Chief. As noted previously, a system designed with a larger number of lower output audible devices is preferred over a system with a fewer number of high-output devices.

6. Elevator capture systems installed by Elevator contractor shall supply one trouble output contact from elevator capture system. In general, however, the elevator capture system is an entirely separate system provided and installed by elevator contractor.

7. Door-hold-open devices in new buildings shall typically be 24 volt. In existing buildings duplicate existing system configurations - i.e., THC and MCHC have 120 volt systems.

8. All door-hold circuits shall be fused and supervised to isolate faulted parts of system.

9. Intelligent-loop-wiring systems shall have fault modules to isolate faulted portions of system. Install fault detectors to enable user to logically isolate building sections from each other.

10. Alarm reporting at Fire Command Station and FCC.
    a. Alarm messages at Fire Command Station, and FCC shall clearly show the following information on all alarms and allow for other information to be added as needed:
        i. Building
        ii. Floor
        iii. Room number (or system name)
        iv. Type of alarm
        v. Time and date of alarm
        vi. Point number
    b. Trouble alarms shall be formatted in a manner similar to alarms.
    c. Change-of-state-alarms shall be minimized at FCC and at Fire Command Station. If needed, install a remote printer in maintenance to receive change-of-state alarms.
    d. Hard copy, printed record is required, either at Building Fire Command Center, or at FCC - preferably both locations.
    e. A remote printer (thermal) shall be installed as part of the FACP.

11. Fire alarm contractor shall be instructed to carefully coordinate with Building Management System Electrical and Temperature Controls contractors, Security contractor, and Hardware contractor, to ensure proper operation of overall Fire Alarm Systems. This coordination is to ensure proper monitoring and controlling of:
    a. Area smoke detectors
    b. Duct smoke detectors
c. Operation of smoke dampers during fires  
d. Operation of electrically operated fire dampers during fires  
e. Activation of smoke control systems in proper zones/areas/floors  
f. Activation of stairway pressurization  
g. Flow switches, tamper switches, and fire pump alarms and monitoring points  
h. Generator alarms and monitoring points  
i. Security locking systems  
j. Door hold-open and automatic door operator systems  
k. Elevator capture systems  
l. Any other systems noted in program statement or required to meet Codes  

12. Whenever possible, the FACP shall be equipped with simple control switches or buttons to bypass area smoke detectors, duct smoke detectors, flow switches, smoke control, door hold opens or audible/visual devices for maintenance reasons. These maintenance functions switches or buttons will allow easier maintenance of the systems. Whenever equipment is in bypass, they will show as troubles on the FACP and at the terminal in FCC. This function shall be password/pass code protected for security reasons.