

PART III – CSU FACILITIES PLANNING, DESIGN AND CONSTRUCTION STANDARDS

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

Housing and Dining Facilities (HDS) has adopted amendments for all HDS facilities. Confirm applicable standards with Project Representative on a per Project basis. Refer to HDS amendments here – <https://housing.colostate.edu/about/construction/>.

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28 10 00 – ACCESS CONTROL

A. Coordination:

1. Architect, Electrical Engineer, and Contractor shall coordinate with the Facilities Management (FM) Access Services during design and construction phases to locate devices and assure access control work meets CSU Facilities Planning, Design and Construction Standards.
2. Finishes of access control hardware, including painted and plastic items shall be coordinated with project finishes for door frames, door hardware and other entry elements.
 - a. Submit complete product finish information and proposed device finish schedule to the Project Representative for review and approval.
3. Contractor shall complete System start-up and adjustment before submitting its Notice of Substantial Completion.
 - a. Inspection and approval by FM Access Services is required before any access control item will be permitted on the Pre-Acceptance Punchlist.

B. Panel:

1. Control panels shall be Software House, iStar Ultra, Istar Ultra SE, Istar Edge.
2. Power supply panel shall be Altronix Maximal 75 or approved equal by Colorado State University (CSU).
3. Location of panels and power supplies shall be located in the MDF or IDF rooms on a dedicated 4'-0" x 8'-0" plywood wall backboard.
 - a. Wall space may be used with approval of CSU Telecommunications obtained through the Project Representative.
 - b. All high voltage wiring for power supplies or control units shall be in metal conduit.
 - c. Pigtailed are prohibited.

C. Wiring Requirements:

1. Access control wiring for new construction shall be enclosed in metal conduit of minimum 3/4" diameter or cable trays approved for the project.
2. For retrofit projects where conduit or cable tray installation is not feasible, access control wiring shall be suspended every 4'-0" above drop ceiling by J-hooks.
3. Whenever cable trays are used, wiring must be enclosed in metal conduit of minimum 3/4" diameter from the point it exits the tray to its final destination.

D. Card Readers:

1. Software House International C-Cure 9000 software platform
 - a. Contact Project Representative for approved current version.

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2. Card Readers shall be Software House, iStar SWH 4000, 4100 or 4200 as applicable or approved equal by CSU.
3. All readers shall be mounted at 42" AFF to center on the latching side of the door.
4. Readers at doors with automatic operators shall be located a minimum 24" clear of the door swing to provide safe clearance for persons with limited mobility.
 - a. Readers shall be located on a pedestal if provided for automatic door operator.
5. Readers shall be hard-wired to the panel with composite cable unless otherwise approved by FM Access Services and Construction Services Low Volt.
6. All doors shall have a 4-11/16" junction box with single gang mud ring mounted horizontal 12" above door and below ceiling to serve as a node for all door device conduits.
7. Access to the junction box shall be within the secure area.
 - a. No junction boxes shall be installed outside the secure area without prior written approval by CSU.
8. CSU Card Access Systems utilize control hardware manufactured by Software House, including, but not limited to I-star Ultra, I-Star Ultra SE or I-star Edge Control hardware.
 - a. Software House readers SWH 4000, SWH 4100 or SWH 4200 are required.
 - b. All control hardware must be approved by CSU.
9. Power supply for current limited output switching shall be Altronix Maximal 75 or approved equal by CSU.
10. The proprietary MIFARE card format is registered exclusively to CSU.
11. To meet the CSU Facilities Planning, Design and Construction Standards, all programming of card access equipment must be programmed by Access Services.

E. Exit Devices:

1. Products shall be:
 - a. Egress Detector:
 - i. Bosch DS160
 - ii. Or approved equal
 - b. Alarm Controls:
 - i. TS-15 or TS-16 Pneumatic Time Delay Switch Push to Exit Button
2. The exit devices shall be mounted above the door in an area that will allow anyone exiting through the door to be sensed and the door lock to release and allow the person to exit.

F. Door Position Switch (Door Contact):

1. Contact Project Representative

G. Electrified Door Hardware: (New Construction)

1. Single with cylindrical locks:
 - a. Hes 4500 24 VDC doors

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2. Single doors with panic hardware:
 - a. Hes 9600 24 VDC
 - b. Hes 9500 24 VDC
 - c. Hes 9400 24 VDC
 - d. Hes 7000 24 VDC
3. Double doors with panic hardware:
 - a. Hes 9600 24 VDC
4. Double doors with panic hardware shall have two Hes units mounted on a Von Duprin KR9854 SP28 Keyed Removable Mullion.
5. Positive latching:
 - a. Sargent 10 line electric lever set

H. Electro–Magnetic Locks:

1. Magnetic Locks are prohibited without a written exception from the Project Representative.
2. Minimum holding force shall be 1,200 pounds.
3. Shear locks are prohibited.

I. Key Override:

1. Key override switches must be approved by CSU.

28 20 00 – VIDEO SURVEILLANCE

A. General Requirements:

1. Conduits specified or scheduled for installation of fiber optic cables shall be configured with appropriate bending radii and bend requirements.
2. All Conduit and Cable Tray Systems shall be installed in compliance applicable codes and CSU Telecommunication Standards.
3. Conduit shall have not more than 180 degrees of bend between pull locations and shall have a minimum size of 1” in diameter.
4. Review sizing and bends with CSU Telecommunications and the Project Representative at Design Development Phase.

28 31 00 – INTRUSION DETECTION

A. Security Alarm Systems:

1. CSU has adopted the BOSCH Network as its standard for security, panic and Hold–Up Alarm Systems.
 - a. The University uses a BOSCH D6600 receiver supporting a modem 3a2 communication format and Ram V server software.
2. New construction projects requiring security, panic and/or Hold–Up Alarm Systems must use

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Bosch control equipment or approved equal by CSU.

3. Security alarm control equipment including:
 - a. Bosch G series B8512G for Systems from 1 – 99 zones
 - b. Bosch G series B9512G for Systems from 100 – 599 zones
 - c. Bosch B Series B5512 where network connectivity is not available per approval
4. Wireless equipment for Bosch B and G series control panels including:
 - a. Bosch B820 SDI2 Innovonics Interface Module
 - b. Innovonics EN4200 Serial Wireless Receiver
 - c. Innovonics EN Series devices:
 - i. EN 1233S Single Button Pendant Transmitter
 - ii. EN 1210W Door Window Transmitter with Reed Switch
 - iii. EN1260 Wall Mount Motion Detector
 - iv. EN 5040–T Wireless Repeater/High Power with Transformer
5. Control panel optional hardware including:
 - a. Bosch D8128D Octopopit zone expander
 - b. Bosch D8129 Octorelay
 - c. Bosch B299 SDI2 Popex expansion Module
 - d. Bosch D9127U Popit Module
 - e. Bosch D1640 Transformer
 - f. Bosch D8103 Universal Enclosure
 - g. B920 2–Line LCD Keypad

28 44 00 – REFRIGERANT DETECTION AND ALARM

- A. Provide detection, alarm, and exhaust systems where required.
 1. To reduce maintenance and calibration needs, detection with centralized sensors is preferred over systems using multiple sensors.
- B. On detection of a refrigerant leak event, exhaust systems shall be activated automatically, local visual and audible alarms enabled.
 1. Alarm shall be sent to the Campus–Wide Notifier Network (fire alarm).
 - a. Status of detection–unit and fan(s) shall be sent to the Building Automation System (BAS).
- C. Acceptable Products:
 1. MSA Chillguard
- D. Alarms from other gas detection monitors shall be discussed on a per–project basis.
- E. Refer to Division 23 – HVAC for more details about refrigerants.

28 46 00 – FIRE DETECTION AND ALARM

- A. Codes and Standards:
 1. Every item of the Fire Alarm System shall be new and listed as the product of a Fire Alarm System Manufacturer under the appropriate category by Underwriters Laboratory, Inc. (UL) and shall bear the UL label on all devices.
 2. The complete installation shall conform to the current Office of the State Architect (OSA) adopted

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edition of applicable codes, including but not limited to:

- a. International Building Code (IBC)
- b. International Fire Code (IFC)
- c. National Electrical Code (NEC)
- d. National Fire Alarm and Signaling Code – NFPA 72
- e. American National Standards Institute (ANSI)
- f. Life Safety Code – NFPA 101
- g. Americans with Disabilities Act (ADA)
- h. Other state applicable codes, as adopted by OSA

3. The complete installation shall conform to CSU Facilities Planning, Design and Construction Standards.
4. The complete installation shall conform to the manufacture recommendations.
5. The complete installation shall conform to the Shop Drawings approved by CSU.

B. Quality Assurance:

1. Designer Qualifications:

- a. Firm regularly engages in the design of fire alarm systems of types, sizes, and electrical characteristics compatible with the current campus systems.
- b. Firm's products have been in satisfactory use in similar service for not less than five years.
- c. The Firm's shall have the submittal design internally verified and stamped by a NICET III or higher in Fire Alarm Systems.

2. Installers Qualifications:

- a. Firm with at least five years of successful Fire Alarm Systems installation experience.
- b. All field wiring and installation shall be constantly supervised by NICET II or higher in Fire Alarm Systems.

3. System Authority:

- a. The Contractor is responsible for receiving written acceptance for both plan review and final acceptance by the following departments:
 - i. Facilities Management Fire Systems is responsible for the operation, service and maintenance of all Fire Alarm Systems on the CSU Fort Collins Campuses and the integration of all Building Fire Alarm Systems to the campus-wide network.
 - ii. This group shall be referred to as FM Fire Systems throughout this document.
 - iii. FM Fire Systems shall approve all Drawings before the construction commences. (Email address: fac_DL_fire_system_shop@colostate.edu).
 - iv. Poudre Fire Authority (PFA), whose review and approval is required for all Fire Safety Systems, shall be referred to as Fire Department or PFA throughout this document.

4. Meetings:

- a. Technical code and design review meetings shall be required with FM Fire Systems for project coordination and at 50% design, and any other meeting the Project Representative feels would benefit the project.
- b. FM Fire Systems shall be involved in any project meetings that involve PFA.

5. RFIs and ASIs:

- a. All proposed changes or additional information as related to the Fire Alarm System, shall also include FM Fire Systems.

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C. Products:

1. Fire Alarm Control Units (FACU):
 - a. Shall be sole sourced as Notifier, no substitutions.
2. All devices connected to the FACU shall be listed by the Manufacturer to be compatible. Due to the wide number of variables, to determine what control unit shall be acceptable for the Project, please contact FM Fire Systems at fac_DL_fire_system_shop@colostate.edu for clarification.
 - a. Notifier NFS2–3030 – Large Projects
 - b. Notifier NFS2–640 – Small and Medium Projects
 - c. Mass Notification System:
 - i. Shall be a combination Mass Notification and Fire Alarm System
 - ii. Audio Amplifiers shall be a Notifier DAA2 Series amplifier
3. Manual Pull Stations:
 - a. Shall be addressable unless environmental conditions prohibit their use.
 - b. Shall be a double action type.
 - c. Where conditions do not allow for addressable pull stations, pull stations shall have a monitor module to uniquely identify the device location and shall be located in an area not subject to the adverse environment.
 - d. One monitor module per pull station.
4. Smoke Detectors:
 - a. Smoke detectors shall be analog addressable and capable of alarm verification.
 - b. Smoke detectors shall have environmental compensation and provide a trouble at the FACU when the sensor’s value reaches a predetermined value.
 - c. Smoke detector/control unit shall be arranged so that the detector causes a signal at the control unit when its sensitivity is outside its listed range.
 - d. Photoelectric smoke detectors shall be the standard, this includes duct detectors.
 - i. Ionization detectors are prohibited.
 - e. Standard spot–type smoke detectors shall not be installed inside HVAC ducting.
5. Heat Detectors:
 - a. All heat sensors shall be of the addressable type unless environmental conditions prohibit their use.
 - b. If non–addressable detectors are used, the addressable module shall be located in an area not subject to the adverse environment.
 - c. Rate of rise detectors shall only be used with the pre–approval of FM Fire Systems.
6. Duct Detectors:
 - a. Shall be sole sourced as System Sensor, no substitutions.
 - b. Shall have duct sampling tubes, remote indicator and test switch.
 - i. Units shall be capable of being reset at the FACU.
 - c. Remote test switch shall be magnet activated.
 - i. Keyed units shall not be allowed.
 - ii. Shall be addressable
7. Notification:
 - a. All notification devices shall be System Sensor.
 - b. All audible notification shall be through 25 volt speakers, not horns.
 - c. All visible notification devices shall be marked with the word “ALERT”.
 - d. All notification devices shall be white with red lettering.
 - e. All devices shall be of a ceiling mount type, in areas with high ceilings or convoluted ceiling (such as mechanical rooms) wall mounted devices shall be permitted.

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8. Sprinkler Flow Switch:
 - a. Shall be of the delay type.
 - b. Zone flow switches shall be set for a 30 second delay before reporting.
 - i. The main flow switch shall be set for a 60 second delay before reporting.
 - c. Each building with a Fire Suppression System shall have a main flow switch that tracks waterflow.
9. Automated External Defibrillator (AED) cabinet:
 - a. Each AED shall be monitored through the Fire Alarm System.
 - b. The cabinet and pull apart switch required for monitoring shall be provided by the Contractor.
 - c. Cabinet shall comply with CSU Implementation Specifications
 - i. Refer to Division 10 – Specialties.
 - d. Pull apart switch shall be George Risk Industries (GRI) model #4704–A.
10. Fire Alarm Network:
 - a. The network monitoring equipment is provided by FM Fire Systems and is charged to the Project Budget through the Project Representative.
 - b. For university properties not located within the campus fiber network, the Contractor shall provide the necessary equipment and communication route to facilitate reporting to the nearest fire department.
 - c. FM Fire Systems must approve of the fire alarm reporting method.

D. Installation Details:

1. Fire Alarm Control Unit (FACU):
 - a. The FACU shall at a height of no higher than 70” to the top of the cabinet.
 - b. The FACU shall be fully programmable by FM Fire Systems personnel and shall be supplied with all the necessary circuitry, passwords and software to facilitate local laptop programming.
 - c. Audible appliances shall be silenceable at the FACU, but strobes shall continue to flash until a System is reset at the FACU or annunciator(s).
 - d. An accessible 120–volt receptacle shall be installed within 6’–0” of the FACU.
 - e. Prior to programming the Fire Alarm System, the Contractor is responsible for verifying with FM Fire Systems that the System component firmware and/or software versions are consistent with the current CSU Campus–Wide System.
 - i. Only the software/firmware versions which are approved by FM Fire Systems shall be allowed.
 - f. The FACU shall be located in an area accessible to personnel performing repairs and not subject to; water damage, high volumes of dust, and temperatures outside of the manufacture recommendations.
 - i. The FACU shall not be located in areas of high traffic as these areas would not be considered accessible.
 - g. If the FACU is not visible from outside of the main entrance or where the building has more than one major entrance, either of which might be approached by the Fire Department in an emergency, a remote terminal mode annunciator(s) shall be located within sight of the entrance(s).
 - h. All programming of the Fire Alarm System shall be coordinated with FM Fire Systems, including device labels and CBE zones.
2. Mass Notification Systems:
 - a. All new buildings where a fire alarm control unit is required shall be provided with a combination Fire Alarm/Mass Notification System.

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- b. Speakers instead of horns are to be used, with the exception of the outside horn/strobe above the FDC used to track water flow.
 - c. Interior Emergency Voice/Alarm Systems shall have speakers installed in accordance with NFPA 72 Annex
 - d. Areas where voice intelligibility cannot be provided due to high ambient noise levels (i.e. mechanical spaces) shall be separately evaluated by the Engineer to determine appropriate design requirements.
 - i. To achieve intelligibility, design and installation of the System shall account for areas with Audio Systems and may need to include audio mute relays.
 - ii. One speaker circuit shall not be combined with more than two strobe circuits.
 - iii. The speaker circuits throughout the building are to be controlled in the same method.
 - a) Either all on-board speaker circuits or all control modules, combination on-board circuits and control modules are not acceptable.
 - iv. A paging microphone shall be installed inside the FACU.
 - v. A remote microphone shall be installed at each annunciator.
3. Duct Detectors:
- a. The use of duct detectors shall be minimized.
 - i. Where feasible, area detectors shall be employed to accomplish the objective.
 - b. Fan shutdown and fire smoke damper actuation shall be wired through Fire Alarm System relay modules and heavy-duty relays, not through relay contacts directly on the duct detector.
 - c. Duct detectors installed in a concealed location or more than 12'-0" above finished floor shall have remote test stations installed.
4. Remote Test and Indicating Stations:
- a. Shall be mounted in common areas and visible without using a ladder or opening up an access panel.
 - i. Common areas include hallways and mechanical areas.
 - ii. Remote test stations shall not be installed in bathrooms, offices or classrooms.
 - b. A wall mounted remote test and indicating station shall be at a height of 7'-0" above finished floor, and if ceiling mounted shall be no higher the 10'-0" above finished floor.
 - c. Initiating devices, including detectors and points of the Fire Alarm System monitors, that are installed in concealed locations or more than 20'-0" above finished floor shall have remote indicating stations installed.
 - i. Detectors in elevator pits and shafts shall not require indicating stations.
5. Fan/Smoke Control Systems:
- a. Each air handler that has duct detection or any type of smoke damper, shall have a fire alarm monitor module that is commanded by the BAS that the unit is "ready to run".
 - b. The unit shall report the status of "not ready to run" anytime the unit is not running, unless the fire alarm shutdown or fire alarm damper status relays are the reason for this unit not running.
 - c. A fire alarm shutdown relay shall be installed in series with the safety circuit for each required HVAC unit.
 - d. A fire alarm damper status relay shall also be installed in series with the safety circuit.
 - i. Any smoke damper or combination of smoke dampers that when closed and requires the HVAC System to shutdown, shall have the not open status of the damper(s) individually monitored by the Fire Alarm System.
 - ii. Any smoke damper or combination of smoke dampers that when closed and requires the HVAC System to shutdown, shall activate the fire alarm damper status relay.
 - e. Each smoke damper shall be individually controlled with a fire alarm relay

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- f. Upon receiving the signal of “not ready to run” from the BAS System the Fire Alarm System shall close all associated dampers and activate the Fire Alarm damper status relay.
 - g. Upon receiving the signal of “ready to run” from the BAS System, the Fire Alarm System shall open all associated dampers.
 - i. The Fire Alarm damper status relay shall return to normal condition after the dampers have all proven open.
 - h. The second set of contacts on each fire alarm relay shall be used for binary inputs on the BAS System.
 - i. These shall be used so BAS can determine which fault condition caused the unit to stop running.
 - i. The Project shall plan meeting(s) after Fire Alarm Shop Drawings have been submitted with Project Electrical Contractor, Fire Alarm Contractor, Controls Contractor, HVAC Contractor, FM Fire Systems and FM Controls Shop to review the entire sequence of operations.
6. Detectors:
- a. Early warning detection shall be installed throughout the entire building, unless the building is to have a Sprinkler System throughout, then only in the following areas or other areas required by code:
 - i. In electrical, telecom, laundry and computer rooms.
 - ii. In dwelling/sleeping units and corridors serving these areas.
 - iii. In other high-risk areas defined by FM Fire Systems.
 - iv. At the location of each fire alarm control unit(s).
 - a) Control units include but are not limited to; the FACU, remote power supplies, network converters and audio amplifiers.
 - b) In the case where ambient conditions prohibit the installation of automatic smoke detectors, automatic heat detection shall be permitted.
 - b. All custodial closets and kitchens shall have thermal detectors, not smoke detectors.
 - c. Relay based detectors shall not be used.
 - d. Detectors shall not be installed until final construction clean-up is complete.
 - e. All detectors installed prematurely shall be required to be replaced with new detectors at the expense of the installing Contractor.
7. Manual Pull Stations:
- a. A manual pull station shall be located at each exit or means of egress of every level of the building.
8. Elevators:
- a. Shunt trip and Recall shall be activated only from Fire Alarm System relay modules, not contacts on the detectors.
 - b. A heat detector shall be install in each elevator pit within 2’-0” of sprinkler head to send the elevator to the highest recall level.
 - i. This detector shall activate elevator recall only, unless code also requires shunt trip.
 - c. The 120VAC power to the elevator shunt trip shall be supervised in compliance with AMSE A17.1.
9. Door Holders:
- a. Shall be non-supervised and release upon AC power loss or after a maximum 30-second delay.
 - b. Door holders shall be wired through Fire Alarm System relay modules.
10. Control Units:
- a. All remote power supplies, transponders, audio amplifiers and riser boxes shall be installed in either mechanical, electric or telecom rooms where feasible or other locations approved by FM Fire Systems.

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- b. All remote power supplies shall be individually monitored for trouble conditions.
- c. The first remote power supplies shall be triggered by a dedicated notification circuit, each subsequent power supply shall be triggered by the sync circuit from the previous power supply.
- d. Primary and secondary power supplies shall be capable of operating the System under quiescent load for a minimum of 24 hours and then shall be capable of operating the System during a fire or other emergency condition for a period of 15 minutes at maximum load.
 - i. These numbers shall include a 20% safety margin to the calculated amp-hour rating.

11. Fire Suppression:

- a. If the building is to be installed with a Suppression System, the tamper switches shall be programmed as a tracking supervisory.
- b. An outdoor water flow horn/strobe device shall be located above the Fire Department Connection (FDC):
 - i. The outdoor horn/strobe shall sound only upon detection of water flow. It shall silence automatically when the water flow ceases.
 - ii. The outdoor horn/strobe shall be located in a manner where it is easily visible to the responding fire trucks. PFA shall give the final approval.
- c. Each building shall have a main flow which shall be dually monitored for building alarm and waterflow tracking.
 - i. Water flow tracking shall not be accomplished by individual sprinkler zones.
- d. Each tamper valve shall be individually monitored.

12. Hood Systems:

- a. Shall be monitored by the Fire Alarm System and shall be programmed as directed by FM Fire Systems.

13. Rescue Assistance Systems:

- a. Shall be monitored by the Fire Alarm System for power, call made, and trouble conditions.
- b. Automated External Defibrillator (AED):
 - i. Each AED in the building shall be monitored by the Fire Alarm System and shall report as tracking supervisory signal.

14. Bi-Directional Amplifier Systems:

- a. If required by PFA, it is the responsibility of the Contractor to provide and install a Bi-Directional Amplifier System for emergency communications.
- b. Trouble conditions shall be individually monitored through the Fire Alarm System.

15. Fiber Splice Cabinet:

- a. Shall be provided to the Electrical Contractor by FM Fire Systems.
 - i. The Electrical Contractor shall install this cabinet.
- b. The cabinet shall be located in the telecom Main Distribution Frame (MDF), or a location specified by FM Fire Systems.

16. Wiring/Conduit:

- a. All cable and wiring shall be installed in a minimum of 3/4" red EMT conduit by a Colorado licensed electrician and in compliance with Division 26 – Electrical.
- b. Upon direction of the Project Representative and if acceptable by the Manufacturer of the conduit, in areas with exposed EMT it shall be permitted to paint the conduit to match the environment, as long as all junction box covers are red and labeled with circuits.
 - i. In residential wood construction 3/4" red ENT shall be allowed.
- c. Use only UL listed solid copper conductors.
- d. The wiring shall be as listed below for each type of circuit. If design requires variations to

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what is listed, coordinate with FM Fire Systems for approval prior to installation.

- i. Strobes:
 - a) 14/2, white jacket, FPLP, unshielded
 - ii. Speakers, Sync and Com:
 - a) 14/2, red jacket, FPLP, unshielded
 - iii. SLC and IDC:
 - a) 16/2, red jacket, FPLP, unshielded
 - iv. 24V:
 - a) 14/2, red jacket with purple strip, FPLP, unshielded
 - v. DAL:
 - a) Comtram 8706, 16/2, red jacket, FPLP, unshielded OR Single mode fiber
 - vi. Remote Test:
 - a) 16/4, red jacket, FPLP, unshielded
 - vii. Annunciator 485 and RDP:
 - a) 16/2, red jacket with yellow strip, FPLP, shielded
 - viii. Remote Microphone and ACS:
 - a) 16/2, red jacket with black strip, FPLP, shielded
- e. Wire schedule to be included with Shop Drawings and submitted to FM Fire Systems for approval.
 - i. Single conductors, such as THHN, are not acceptable.
 - f. Install wire, cables, and conduit in accordance with the Manufacturer's recommendations and in compliance with the NEC.
 - g. A 1" minimum EMT conduit for fiber optic cable installed with pull string, sweep bends only and no LB connectors shall be routed from the top right of the FACU to the top right fiber splice cabinet.
 - h. All junction boxes for fiber optic shall be a minimum size of 8" X 8".
 - i. In addition, a 3/4" EMT conduit shall be routed from the fiber splice cabinet to the ladder rack in the telecom MDF or to a location specified by FM Fire Systems.
 - i. T-tapping of the SLC is acceptable only within junction boxes.
 - i. T-tapping of notification circuits is not acceptable.
 - ii. All connection locations shall be indicated on As-Built blueprints and coincide with labels on junction box covers.
 - j. Indicating Device Circuits (IDC), Signaling Line Circuits (SLC), and Notification Appliance Circuits (NAC) associated with the Fire Alarm System shall have "Class-B" addressable performance characteristics as described in NFPA 72.
 - k. Contractor shall not pull wire through existing raceways with live circuits without prior approval from FM Fire Systems and shall only be pulled through existing fire alarm conduit and not share a conduit with other control or communications circuits.
17. Junction Boxes:
- a. All junction boxes 8" x 8" or larger shall be provided with labeled terminal strips with all wires labeled and landed on corresponding terminals.
 - i. Only one conductor per terminal shall be allowed.
 - ii. Only one extension ring is allowed on any junction box, conduit is to not be installed on the extension ring.
 - b. All notification devices shall be installed in a 4" x 4" junction box with a depth of 3" or greater.
 - i. This can be achieved with an extra deep four square or by adding an extension ring.
18. Identification/Labeling:
- a. Labels shall be at least 3/8" high lettering, black on a white background printed from a label maker or on a permanently mounted professional name badge.
 - b. Labels shall be in a place where they are visible from the ground. Where a device is located above the ceiling a label shall also be located on the ceiling grid or access door.

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- c. All initiating and notification devices shall be labeled:
 - i. Notification appliances shall be labeled with circuit(s). (ex. NAC 1 – #, NAC 2 – #, S1 – 1 – #, S1 – 2 – #, S2 – 1 – #, V – 1 – #). # equals the location of the device within the circuit, where 1 would be the shortest wiring pathway to the circuit source.
 - ii. Where used, End-Of-Line Resistors shall be labeled “EOL” on the device.
 - iii. Each initiating, monitoring and control device shall be labeled with the device address and if applicable the function the device serves.
- d. The FACU shall be labeled with electrical panel location, panel number, and circuit number.
 - i. Any circuit breaker associated with the Fire Alarm System shall be painted red.
- e. All Remote Power Supplies and Audio Amplifiers shall be labeled with the unit number, electrical panel location, panel number and circuit number.
- f. All electrical circuits that are controlled by the Fire Alarm System shall be labeled on the device with electrical panel location, panel number and circuit number.
- g. All new and reused junction boxes shall be red and labeled “FA” and with the circuits and splices that are enclosed within the junction box.
 - i. This is the only case where it shall be acceptable to use a felt tipped marker.
- h. No device, detector, panel or J-box shall have maintenance access blocked by pipes, ducts, conduits, and cable trays or installed in any manner that they cannot be easily serviced.
 - i. Inaccessible or blocked access, as determined by FM Fire Systems, shall be remediated at Contractor cost.

19. Delivery, Storage, and Handling:

- a. Store fire alarm equipment in a clean, dry place.
- b. Only new equipment is to be installed, do not install damaged equipment or components; replace with new.
- c. All equipment, installed or not, needs to be protected from weather, dirt, fumes, water, construction debris and physical damage.
- d. Equipment subject to adverse conditions, as determined by FM Fire Systems, shall be replaced at the expense of the Contractor.

20. Extra Material:

- a. Contractor shall provide spare/replacement detectors amounting to 10% of the quantity installed by the Project, but not less than two of each type of detector.
- b. Contractor shall provide spare/replacement detector bases amounting to 10% of the quantity installed by the Project, but not less than one of each type of detector base (including duct detector housings).
- c. Contractor shall provide spare/replacement modules amounting to 10% of the quantity installed by the Project, but not less than two of each type of module.
- d. Contractor shall provide spare/replacement notification appliances amounting to 10% of the quantity installed by the Project, but not less than two of each type of notification appliance.

21. Painting/Patching:

- a. Contractor shall paint exposed conduit to match adjacent surfaces.
- b. All surfaces or finishes damaged as a result of work shall be properly patched, painted, and/or repaired by trained craftsmen of the trade involved.

22. Graphic Map:

- a. A graphic map shall be located at the FACU and at any annunciator(s).
- b. All graphics shall include initiating devices, room numbers, indication of north and the current building footprint.
- c. In residential buildings graphic maps located in hallways and common areas, shall not

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include the room numbers of dwelling units.

- i. Room numbers of dwelling units shall only be included on graphic maps located in staff areas or other such limited access areas.
- d. The graphic map shall be updated for any additions and/or changes that are made to the Fire Alarm System or to the building footprint.
- e. Graphic maps shall be installed prior to CSU Test and Verification.

23. Impairments, Fire Watch and Shut Down Requirements:

- a. In any case where a fire alarm or Fire Suppression System is impaired, an outage shall be requested and approved.
 - i. Outage requests are to be completed through FM and shall be requested a minimum of 48 hours in advance.
 - ii. This includes disabling detectors because of welding, brazing, painting, sanding and other such activities.
- b. Except for replacement of control equipment or remote power supplies, at no time during construction shall the notification devices be disabled.
- c. In any case, where a functioning Fire Alarm System or portion of the System is out of service, a fire watch and safety plan shall be conducted in accordance to FM Global standards as facilitated by FM Fire Systems.
 - i. The Contractor shall be responsible for any portion of the building with an impaired fire alarm or Fire Suppression System as a result of construction.

24. Deviations:

- a. If the Contractor believes that a specific situation requires a deviation from these standards, a request shall be made in writing clearly stating the situation and the proposed solution.
 - i. All requests shall be approved by FM Fire Systems prior to the deviation being made.
- b. All unapproved deviations from these standards shall be corrected at the expense of the Contractor prior to final inspection.

E. Plan Review and Submittals:

1. A plan review shall be completed by PFA and FM Fire Systems for each phase of the fire alarm and fire suppression design.
2. Fire Alarm Drawings shall be separate from other building Drawings.
 - a. Refer to Division 01 – General Requirements regarding responsibility for review fees.
3. Paper Drawings and electronic AutoCAD files must be submitted to FM Fire Systems within 30 days after the award of Agreement.
4. Drawings and electronic files shall be received by the Project Representative and distributed to the following:
 - a. FM Fire Systems (one paper set and electronic file).
 - i. Electronic AutoCAD files emailed to fac_DL_fire_system_shop@colostate.edu
 - b. CSU Design and Construction (one paper set and electronic file)
 - c. PFA (current requirements)
5. Shop Drawings shall include the following:
 - a. A floor plan that indicates the use of all rooms
 - b. Location of initiating devices
 - c. Location of alarm notification appliances, including candela ratings and speaker tap for

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- notification appliances
 - d. Location of fire alarm control unit, transponders, and notification power supplies.
 - e. Annunciator(s)
 - f. Power connection
 - g. Battery calculations
 - h. Conductor types and sizes
 - i. Voltage drop calculations
 - j. Manufacturer's data sheets indicating model numbers and listing information for equipment, devices and materials
 - k. Details of ceiling height and construction
 - l. The interface of fire safety control functions and external equipment, an input/output matrix and a sequence of operations
 - m. One line diagram for the complete System including device addresses and room numbers
6. All changes, including device address deletions, additions or other changes shall be coordinated with FM Fire Systems and approved in writing prior to the changes being made.
7. No changes to the program can be made later than five days prior to the CSU test and verification, unless otherwise arranged with specific written acknowledgement by FM Fire Systems.
- a. The Contractor shall be responsible for all costs associated with the additional work.
8. Record Drawings in PDF and DWG files shall be received no later than ten days prior to the CSU test and verification and distributed to FM Fire Systems. Two sets of As-Built Drawings shall be received by the Project Representative during the same time frame, which shall be distributed to the following:
- a. FM Fire Systems (one paper set and electronic file).
 - i. Electronic AutoCAD files emailed to fac_DL_fire_system_shop@colostate.edu
 - b. PFA (one set) – This set shall remain on-site to be used during final inspection.
9. As-Built/Record Drawings shall include the following:
- a. Updated floor plan that indicates the use of all rooms and details of ceiling height and construction
 - b. Updated location of initiating devices and monitoring devices
 - c. Updated location of alarm notification appliances including; candela ratings, speaker wattage, and end-of-line resistors
 - d. Updated location of fire alarm control unit, transponders, and notification power supplies
 - e. Updated annunciator location(s)
 - f. Electrical panel and circuit number for device that are interfaced or connected to the Fire Alarm System including; fire control units, transponders, amplifiers, remote power supplies, damper motors, shunt trip breakers
 - g. Updated battery, amplifier, and voltage drop calculations
 - h. Updated conductor types and sizes
 - i. Updated conduit pathways and junction box locations
 - j. Updated graphic map(s) shall be provided
 - k. Manufacturer's data sheets indicating model numbers and listing information for equipment, devices and materials
 - l. Details of ceiling height and construction
 - m. Updated interface of fire safety control functions and external equipment, an input/output matrix and a sequence of operations
 - n. Updated one line diagram for the complete System including device addresses and room numbers

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F. System Testing and Acceptance:

1. Three different System tests shall be completed on any and all Fire Alarm Systems.
 - a. Preliminary Testing:
 - i. A preliminary test shall be completed by the installers to ensure proper operation of the Fire Alarm System without the assistance of CSU or PFA.
 - b. CSU Test and Verification:
 - i. This 100% System test, which entails testing and verifying every input and output, shall be completed by FM Fire Systems in the presence of the installation Contractors per NFPA 72 testing procedures.
 - ii. All associated external equipment, including air handlers and fire smoke dampers, must be completely installed and programmed prior to the CSU Test and Verification so their functional interface and control by the Fire Alarm System can be tested.
 - iii. Prior to scheduling this test, the preliminary testing shall be completed.
 - iv. Prior to scheduling this test, the NFPA 72 Record of Completion shall be provided to FM Fire Systems.
 - v. Prior to scheduling this test, As-Built Drawings, updated AutoCAD files and O&M Manuals shall be received by necessary parties.
 - vi. The Contractor shall submit a written request for this inspection to the Project Representative and FM Dispatch at least five business days in advance.
 - a) Occupied buildings may need to have final inspection scheduled during early morning or weekend hours so that the test does not interfere with normal building operations.
 - b) Building Proctor and Project Representative shall have the knowledge for when these tests shall be completed.
 - c) The Project Representative shall coordinate and schedule the inspection with FM Fire Systems and the Building Proctor.
 - vii. The Contractor shall have all Subcontractors scheduled to be in attendance on the day of inspection that shall be needed in order to complete a 100% System test.
 - viii. In cases where a System was remodeled or added to, all new devices shall be 100% tested and a representative quantity of existing devices shall be re-tested to ensure proper operation of the System.
 - a) FM Fire Systems shall designate a reasonable quantity of existing devices in conjunction with NFPA 72.
 - ix. The Contractor shall furnish all test equipment necessary to complete the testing.
 - c. PFA Test and Verification:
 - i. Prior to scheduling the Final Acceptance Test, the NFPA 72 Record of Completion shall be completed and signed off by FM Fire Systems.
 - ii. All associated Subcontractors, the Notifier factory representative, FM Fire Systems and PFA shall be present for this final acceptance test.
 - iii. In cases where a System was remodeled or added to, all new devices shall be 100% tested and a representative quantity of existing devices, as determined by NFPA 72 and PFA, shall be re-tested to ensure proper operation of the System.
 - iv. The Contractor shall furnish all test equipment necessary to complete the testing.

G. Warranty and Training:

1. The Contractor shall guarantee all equipment and wiring free from inherent mechanical, electronic or electrical defects for a period of three years from the date of acceptance as set forth in the general conditions.
2. The Contractor shall guarantee an on-site response, if requested by FM Fire Systems, for all warranty related issues of no longer than 24 hours.

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- a. Work to correct the warranty issue shall begin no later than 48 hours starting from the initial on-site response, unless approved in writing by FM Fire Systems.
3. Any part of the warranty shall not be made void due to any required inspection, operation or programming of the System performed by FM Fire Systems during the warranty period.
4. Failure to comply with all contractual obligations resulting in costs incurred by the Project Representative shall result in those costs being transferred to the appropriate Contractor for payment.
5. Contractor shall be financially responsible for all fees incurred to the Project Representative and all lost research due to false alarms as a result of construction or Contractor error, from the beginning of construction until final inspection form is signed.
6. The Contractor shall conduct training as required for FM Fire Systems technicians on all normal maintenance, operation and troubleshooting procedures down to circuit board level of equipment included in the Agreement (up to eight hours per new System and up to four hours for remodeled Systems).
 - a. This training shall consist of a Project walkthrough with person from the installing company most familiar with the field wiring and installation.
7. For all Projects installing a NFS2–3030 FACU, the Contractor shall also sponsor one FM Fire Systems technician for one week of factory training for each fire alarm panel.
 - a. The Contractor shall coordinate with FM Fire Systems to determine what type of factory training is needed.
 - b. Training may either be at the factory or in Colorado and shall be scheduled within four months of completion of the Project and training complete within one year.

H. Existing Buildings:

1. Building Upgrades:
 - a. All buildings involved in a major remodel shall be upgraded to meet all the current standards set forth within this document, the extent of which shall be reviewed and approved by FM Fire Systems.
2. New Additions:
 - a. All new additions shall be constructed to meet all the current standards set forth within this document.
 - b. All major additions shall have the entire building upgraded to meet all the current standards set forth within this document subject to the review and approval of FM Fire Systems.
3. Fire Alarm System Replacement:
 - a. If feasible, the System replacement shall meet all the standards set forth within this document.
 - i. This determination shall be made by FM Fire Systems.
 - b. At a minimum, all new fire alarm control units are required to be compatible with a combination Fire Alarm/Mass Notification System so that the System is more readily convertible to a Combination System during future upgrades.

END OF DIVISION