SECTION 28 31 00
FIRE DETECTION AND ALARM SYSTEMS

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PART 1 GENERAL

1.1 DESIGN & ADMINISTRATIVE PROCEDURES

A. General:

1. Due to the wide variety of types of University projects, which include residential, office, instructional, research laboratory, and public assembly facilities, the University's fire protection requirements are often extensive and complex in scope. The project team shall take a careful and comprehensive approach to fire protection issues in general and shall attempt to identify specific fire protection requirements early in the schematic design phase. This will require a meeting with Stanford University Fire Marshal’s Office (SUFMO) and user group representatives to review the major design issues (Fire Alarm Control Panel [FACP] type, capacity, capability, evacuation zoning, FSD control, training, etc.) involved.

2. Designers shall work with the Stanford Project Manager (PM) to identify fire protection requirements and coordinate design review and approval between SUFMO, other project stakeholders, and jurisdictional authorities. Project design requirements shall include compliance with the Americans with Disabilities Act (ADA) guidelines.
3. In general, all fire protection design issues are subject to internal review and approval by SUFMO prior to the submission of working plans and specifications to the Santa Clara County Fire Marshal’s Office (SCCFMO) or other jurisdictions for plan check and permits.

B. Negotiations: If, during a project, special negotiation with jurisdictional authorities regarding fire code compliance is required, the PM is responsible for coordinating input from designers during the negotiation process. Therefore, designers shall immediately notify the PM when any such special circumstances arise, so that the PM can initiate the negotiation process through the appropriate University representatives that shall include SUFMO.

C. Quality Assurance

1. Installer and FACP Programming Qualifications: Parties responsible for creating a project team shall engage an experienced installer who is a factory-authorized service representative to perform the work of this section. It is expected the technicians performing the installation are certified fire/life safety technicians by the State of California, are factory trained on the system being installed, and have over 5 years of experience performing installations. NICET certification is not required, but it is desired. Technicians performing FACP programming shall have similar qualifications for the panels they are programming.

D. Related Work

1. General: Drawings and general provisions of Contract, including General and Supplementary Conditions and the following related Sections, apply to work of this Section.

2. Section 01 35 00: Environmental Health and Safety (includes Asbestos and Lead Management)

3. Section 01 33 00: Submission Requirement Guidelines

4. Section 33 10 00: Domestic and Lake Water Systems

5. Section 21 30 00: Fire Pumps

6. Section 21 13 00: Automatic Fire Sprinkler Systems

7. Section 14 21 00: Traction Elevator & Section 14 24 00: Hydraulic Elevator Specifications

8. Section 23 05 00: Common Work Results for HVAC

9. Section 26 05 00: Common Work Results for Electrical Systems 600V or Less

10. Section 28 10 00: ACES - Access Control Contractor Installation Guidelines

11. Section 28 13 00: ACES Card Access
12. Section 23 33 00 Air Duct Accessories

E. Existing Fire Alarm Systems

1. Do not remove any portion of the existing fire alarm system from operation while installing new work without written approval of SUFMO. A demolition permit is generally required by the Authority Having Jurisdiction (AHJ) prior to removal of any fire alarm system devices. This can be accomplished by including the alarm devices to be removed within the demolition drawings submitted separately or with the building permit drawings.

2. Prior to any demo or modification to the existing fire alarm system, a test shall be coordinated with SUFMO to document the operation of the existing system. Documentation shall include any existing trouble signals, presence of labels, activation delay of notification devices, Temporal-3 sound patterns and sync of visual devices.

3. Removal of the fire alarm system devices in the project area is required prior to asbestos abatement or demo work being done. The fire alarm system wiring shall be clearly identified and protected within the project area to ensure abatement and demo work do not cause unwanted alarm signals or accidental damage to fire alarm circuits. Otherwise, fire alarm circuits shall be re-routed around the project area.

4. Where existing fire alarm systems do not activate the notification devices within 10 seconds of the activation of the initiating device, it may be required to upgrade the fire alarm system to comply or for Stanford to provide a compliance agreement with the local jurisdiction within an agreed upon timeframe.

5. Fire Alarm System Impairment Protocol: Any contractor impairing any part of a fire protection system must submit a written procedure, stand alone or part of Site Safety and Logistics Plan, with details including but not limited to: a list of devices that will be impaired, dates and times of impairment, a detailed emergency evacuation plan if necessary, and a list of the technicians performing the impairment. Impairment signs/tags shall be posted on the FACP, annunciators, and components affected by the impairment. Signs/tags shall be installed and maintained by the contractor. Additional requirements may include a dedicated fire watch by security officers, providing air horns to qualified building occupants (i.e., building ERT), fire sprinkler system connected directly to AES Radio Alarm Transmitter (RAT), etc. These additional items will be determined by SUFMO.

6. Temporary locations of some existing and/or new equipment may be necessary. These temporary locations shall be reviewed/approved by SUFMO prior to submitting to AHJ for review and approval.

7. Where work on an existing system involves upgrading only the FACP, scope of work shall include providing new labeling of the existing devices and wiring as needed.
8. Where existing systems use 4-wire devices these circuits use 4 separate THHN conductors with different color codes as needed. When replacing 4-wire horn/strobes with 2-wire horn/strobes (but not speaker strobes) use the Yellow/Black circuit and mark the White/Purple as spare. Removing only (1) pair will cause damage to the pair that remains. If a traditional notification system is replaced with a voice system, existing wire may not be suitable because speaker circuits are typically twisted pairs or twisted and shielded pairs. The type of wire needed for speakers will need to be verified with the voice system manufacturer.

9. All wiring to be removed shall be pulled back to a junction box terminal strip. Abandoning wiring is prohibited.

10. Salvage of Obsolete Equipment: all obsolete fire alarm equipment to be removed and returned to SUFMO as spare parts shall be in good condition.

1.2 SCOPE OF WORK

A. General:

1. Connecting equipment to Fire Alarm System: only specific equipment as required by state/local codes and ordinances shall be connected to a building fire alarm system for monitoring and/or release/activation.

2. The fire alarm contractor shall furnish and install a complete fire detection and alarm system, including software programming, all wiring, power supplies, components, accessories, and wiring and connections to devices furnished by others, all tested and inspected as operable.

3. The fire alarm contractor shall furnish the system with bypass functions to disable the NACs, door holders, FSD and AHU shutdowns, elevator recall and power shunt trip as required, and any other function that may disrupt building occupants while testing. Minimum 20% spare capacity on the input circuits for new systems or major upgrades.

4. For new fire alarm systems, installation of the FACP and AES RAT shall be on the 1st floor or higher to ensure a strong, reliable radio signal to the Stanford furnished AES wireless radio subscriber unit.

5. It is intended that the fire alarm contractor shall furnish and install a fully functional fire alarm system. Any items, supplied by others, which are missing or defective, shall be brought to the attention of the Stanford PM immediately.

6. These standards are provided to obtain and maintain adequate, approved fire protection for Stanford University. Any questions regarding these standards shall be directed to SUFMO.

7. Prior to installation, all plans shall be approved by SUFMO prior to being submitted to SCCFMO or other jurisdiction for plan check and permit.
1.3 DESIGN REFERENCES

A. Fire alarm system, equipment, installation, and wiring materials and methods used shall comply with the following codes and standards:

1. California Code of Regulations (CCR), Title 24, currently adopted editions, of Building Code (CBC), Fire Code (CFC), and Mechanical Code (CMC)
2. CCR, Title 19, Division 1 State Fire Marshal
7. Santa Clara County Ordinance Code, Amendment NSI100.117 Title B Division B7 (for locations in unincorporated Santa Clara only – including main campus and School of Medicine)
8. Palo Alto Municipal Code, Title 15 (for locations within city limits only – including Stanford Medical Center, Hoover Pavilion, Welch Road)

1.4 SUBMITTALS

A. Procedure: Shop drawings, calculations, material data sheets, and California State Fire Marshal (CSFM) listings shall be submitted to SUFMO for review and approval prior to submission to the local jurisdiction and the purchase and/or installation of equipment. Submissions to SUFMO for review and approval are to be PDF only, unless otherwise approved.

Projects located within Santa Clara County involving no more than 10 fire alarm notification and/or initiating devices and affecting no control equipment may qualify as a Minor System Modification (MSM) which is an expedited permit process; SCCFMO plan review is not required. More information and required forms for MSM submittals can be found within SCCFMO’s office under “Permits and Clearances”.

B. Shop Drawings: Shop drawings shall be computer generated (AutoCAD compatible DWG format) drawings, compatible with Stanford requirements, and shall include all items required by the CFC and NFPA 72. Drawings shall show both the existing condition to be modified and new condition after installation. Additional items shall be shown:
1. Wiring diagrams indicating:
   a. FACP layout: (i.e., FACP elevation, power supply location, AES wireless radio location, auxiliary power supplies, etc.) Use AES radio details provided by SUFMO.
   b. All FACP and auxiliary equipment wiring terminations.
   c. Inter-module FACP wiring where appropriate.
   d. Arrangement of FACP modules in cabinets.
   e. Arrangement of annunciation and wiring terminations.
   f. Connection details for each device to be installed: smoke detector, horn, horn/strobe, duct detectors, interposing relays for fans, FSDs, shunt trip, elevator recall, door holders, smoke control, roll down doors, smoke guards etc. Each detail should be to the board level showing terminal connections and polarity requirements noted.
   g. Open cable wiring systems shall include details of strain relief used at connections, hanging method, protection at wall and floor penetrations and in-wall wire runs. Open cable wiring shall be shown as "loops" or "arcs" to clarify that wiring is not in conduit. Wiring in conduit shall be shown with straight lines.
   h. Riser diagrams showing size of conduit, conductor size and type, and the number of conductors in each conduit run. Shielded or other special types of conductors shall be indicated where required.
   i. All devices shall be labeled on the drawings along with a legend clarifying syntax of labeling method. Battery calculations and circuit voltage drop calculations.

2. System operation matrix with narrative or other approved means to clearly indicate output functions from each type of initiating device. This is to ensure field programming is consistent with the approved drawings.

3. Title block with SU building name, street address, and quad-building number (e.g., Herrin Labs, 385 Serra Mall, 07-400).

4. Dimensioned elevation view of wall mounted devices such as FACP, enclosures, "gutters", etc. to ensure device heights and clearances are appropriate.

5. Equipment legend summarizing symbols, description, device count, model number, CSFM listing number of ALL devices and components used for the project.

6. Plans shall clearly identify the supervising station as a remote supervising station on the drawings in accordance with the California Fire Code (CFC) requirements.

7. Plans shall clearly state design approach used for zoning of Signaling Line Circuit (SLC) and Notification Appliance Circuits (NACs), classifications of SLC/NAC pathways, and pathway survivability design used.

8. Plans shall indicate what contractors will be;
a. providing raceway,

b. providing conductors,

c. providing system components

d. programming the FACP.

C. As-built drawings in AutoCAD compatible format shall be submitted to SUFMO for review prior to final project submittal of record drawings to ensure all field conditions, project data, and SUFMO plan review comments have been incorporated into the final record set of drawings.

1.5 TRAINING

A. SUFMO on a project specific basis will request training sessions. This will be covered during the design phase of the project.

PART 2 PRODUCTS & INSTALLATION

2.1 MATERIALS AND EQUIPMENT

A. General:

1. FACP: The FACP type shall be one of the “acceptable” models. Panel type shall be determined based on building use, product reliability, availability, and cost.

2. For new systems, acceptable FACPs must be newer model Siemens, Notifier, or Potter panels suitable for the project scope as approved by SUFMO.

3. FACP supplier shall provide a letter of serviceability from the manufacturer stating the panel and all associated parts shall be available for 15 years from time of installation.

4. Provide a minimum of one (1) duplex 120VAC convenience outlet from the dedicated 120VAC FACP power circuit.

5. Where Siemens XLS panels are installed, an RPM module is required to be included to provide RS232 communication ability to an external device (like a laptop).

6. Document Cabinet: Fire Alarm System documents are required by NFPA 72 to be in a locked cabinet at the main FACP. The cabinet will be supplied by SUFMO (purchased by the project), mounted by the installing contractor.

7. Components (initiating, notification and auxiliary devices) shall be UL Listed and/or FM Approved, CSFM Listed, and compatible with the FACP to be used.
8. Spare parts shall be provided as required by the contract documents. These will generally be required for voice systems, and special components (UPS, non-listed approved devices, etc.)

9. Batteries: Batteries shall be provided based on the approved battery calculation and shall not be oversized.

10. Alarm Transmitting Equipment: Transmission of alarms to Palo Alto Dispatch will be accomplished by AES Radio Alarm Transmitter (RAT) supplied by SUFMO (purchased by the project). The Fire Alarm System designer shall incorporate the CAD compatible AES RAT wiring details provided by SUFMO into the shop drawings. Wiring between the FACP and RAT will be completed by SUFMO. AES enclosure is provided by Stanford and mounted by the installing contractor. The RAT will be furnished to the contractor without a power supply. SUFMO will power on the RAT. Provide a minimum of one (1) duplex 120VAC convenient outlet from the dedicated 120VAC FACP power circuit.

11. Sprinkler Waterflow and Valve Tamper Switches – Waterflow switches are Potter Electric VSR series with dual SPDT switches; PIV and Backflow Valve Tamper Switches shall be Potter PIV and OSY models.

12. Exterior Sprinkler Horn – Any compatible 120 VAC exterior weatherproof horn, red in color, with constant tone (not coded or temporal-3) rated at 95 dB at 10’ minimum.

13. Door Hold-Open Devices: - Electromagnetic devices, Rixson ASSA ABLOY FM 998, 24VDC/120 VAC.

14. Fire/Smoke Dampers (FSDs): shall be provided in accordance with the Stanford FDG and FDG drawing MM-26 and be ordered with their respective end-switch package and remote test panel with red/green lights. Ruskin FSDs shall use the MCP3 control panel, or approved equal, on a 1-1 basis for each FSD. Indicator lights shall be readily visible by a person standing at floor level.

15. Wiring & Conduit: All wiring shall meet manufacturer specifications and the following where allowed by the manufacturer:

a. Above Ground Wiring: unless specified differently by the manufacturer, unshielded twisted-pair solid copper conductors in EMT conduit is preferred for all designs and is required for new laboratory buildings or to match existing building design. "Open Cable" applications are allowed and shall use FPLP "red" jacket cable with solid conductors with appropriate colored inner conductor jackets following the standard SUFMO color code – see 2.2.E. Note: this type of FPLP cable is usually a special order with minimum quantities required. Larger gauge wires are acceptable to meet voltage drop requirements; 16 awg is acceptable for SLC circuits if allowed by the manufacturer. The contractor is required to provide details and material cut sheets for dedicated hangers and strain relief used for open cable applications.
b. For Open Cable "FPLP" strain relief shall be provided. Strain relief shall be by Arlington LCPG50 or approved equal.

c. Underground Wiring: All underground wiring shall be direct bury type for wet locations listed for underground use and run in conduit as specified in 2.2.B. This cable may be of the stranded type.

16. Xtralis XAS aspirating smoke detection shall be used to provide smoke detection within Elevator hoistways. This is required to maintain the integrity of fire rated hoistway enclosure and provide NFPA 72 compliant detection at the top of the hoistway.

2.2 DESIGN & INSTALLATION

A. Accessibility & Location:

1. All devices, FACPs AES RAT, and associated components shall be in a secure, above grade room directly accessible for maintenance and provided with 36” clearance to front, 18” to sides and 7’-0” in front of devices/panels, as applicable. All FACP and associated equipment doors shall be able to be fully opened unless approved by SUFMO.

2. Coordinate location of FACP, AES RAT, remote annunciator, power supplies, documentation and terminal cabinets with SUFMO prior to shop drawing submittal. The impact on building occupants by system trouble and supervisory indicators shall be considered during location selection.

   a. The AES RAT subscriber unit installation location shall be on the 1st floor level or higher to ensure a strong reliable radio signal is provided from the AES RAT subscriber unit to the Stanford Remote Supervising Station. Contact the Fire Systems Supervisor or lead SUFMO technician to verify proposed location is acceptable. It is very important that a suitable location is determined for optimum RF signal strength.

3. Room shall be clean, dry, vibration free, and adequately ventilated or temperature controlled so that the installed equipment will be maintained between 60 to 80 degrees F. An engineering analysis may be required to assure temperature compliance where room is shared with other heat producing equipment or the fire alarm system has voice amplifiers. Lighting shall be provided meeting an equivalent of 50 ft-cd measured 3’ above the finished floor not using dimmer or motion-activated switches. At least one light shall be on normal power and one light on emergency power where emergency power is available. Room shall be locked with a key acceptable to SUFMO. The room entry door shall be identified with a sign stating "FACP" in minimum 2” white letters on a red background.
4. Wall space shall be sized to accommodate the fire alarm contractor's equipment layout, preferably on a single wall. Provide ¾” x 8’ high fire rated plywood, with the certification label left visible on all sheets. This plywood shall be affixed in such a manner that it will support the weight of cable, terminals and other equipment. Use flush hardware and supports to mount plywood. The placement of the plywood shall be on top of the wall covering, i.e. sheet-rock, etc. and is not a substitute for the wall covering.

   a. The fire alarm designer shall include in their shop drawings a dimensioned equipment layout with FACU, battery boxes, AES radio, UD ACT, power supplies, amplifiers, module boxes, electrical conduit and wiring gutters for the FACU room.

5. Additional equipment locations. Power supplies and or speaker amplifiers may need to be distributed around the building. The locations will need to be clean, dry, vibration free and with temperature range within 60 to 80 degrees. Shared electrical distribution rooms are generally acceptable. A dedicated electrical circuit is required. The entry door shall be identified with a sign stating "FIRE ALARM EQUIP" in minimum 2” White letters on a Red back ground.

6. From the floor, the device shall be reachable by ladder. If a lift is required device location shall be specifically approved by SUFMO. Top of FACP, AES Radio Transmitter (aka, RAT) cabinets, terminal cabinets, and auxiliary & booster power supplies shall be installed at a nominal 6’ above finished floor. External battery enclosures shall be installed with the bottom of the enclosure being no lower than 2’ and no higher than 4’. Large battery enclosures (batteries heavier than 25lbs each) shall not be located higher than 4’ above finished floor.

7. Duct Detectors with sample tubes shall be used for shutdown of large supply and/or return fans. The sample tube shall be penetrating the opposite side of the duct and be accessible for testing purposes. Differential pressure tests are required to validate installation is within duct detector listing parameters.

8. Access doors shall be hinged type as large as the duct will allow located directly under the in-duct detector. Access is required for sample tubes to allow inspection of sample holes, etc. and may require similar hinge type hatches for accessibility. FSD access hatches and FSD position indicating test switches shall be fully coordinated with other trades including and approved by SUFMO prior to installation. The FSD position indicating test switches shall normally be installed below ceiling or recessed in a ceiling tile.

9. Exterior devices shall be avoided, but where required shall be weather-proof devices with no direct sunlight exposure. If a notification device is required outside, it shall be a horn only device. Where devices are installed in areas open to the environment (not within a full building enclosure such as “breeze-ways” and exterior elevator discharge areas) they shall be weather-proof devices. Where devices are subject to direct water spray (rain), the device shall be provided in a NEMA 4 enclosure.
10. Notification devices shall not be placed in walk-in storage coolers or freezers. These are considered non-common spaces and do not require visible notification. Provide a wall mounted horn installed on exterior wall of storage cooler/freezer directly outside the cooler/freezer.

   a. Temperature controlled rooms for laboratory work (i.e., non-storage) may require visible notification. This may be achieved by providing an adequately sized vision panel in the room entry door and coordinated with a wall mounted (ceiling mount prohibited) visible notification device located directly opposite and centered on the vision panel. If a visible and/or audible notification device are required in such rooms, wiring and conduit isolation shall strictly follow NEC requirements and be verified with a specific inspection by SUFMO prior to terminating the device.

11. Private offices (single or multiple persons) are not considered common spaces and shall not require visible notification.

12. All devices connected to the fire alarm system shall be resettable from the FACP or remote annunciator (where remote annunciator is provided).

B. Wiring:

   1. All new wiring for existing buildings shall match existing wiring, raceways, color coding, etc. unless approved by SUFMO.

   2. All wiring for new laboratory buildings shall be run in metal (EMT) conduit due to the high density of building systems typically above ceilings and the frequency of renovations. Non-laboratory buildings shall be run in metal (EMT) conduit or listed open "FPLP" cable as outlined in section 2.1 above. Conduit sizing, fill density, bends, hanging, routing (parallel and perpendicular to building structure), and strain relief shall be in accordance with the NEC, CEC, and this specification. Exceptions: wiring to remote alarm indicators mounted in ceiling tiles shall be plenum rated FPLP cable and be provided with a “service loop” to allow for movement of ceiling tiles for maintenance.

   3. Where open cable wiring is used above "hard-lid" ceilings, conduit pathways shall be provided for expediting repairs and minimizing disruption to building operations.

   4. Where wiring is to be routed in areas without ceilings, wire runs shall be in conduit for mechanical protection.

   5. Connection to PIV’s and Back-Flow Preventers (BFPs) shall be run in conduit with approved listed underground direct buried cable for wet locations. Work shall be coordinated with underground fire service installation subcontractor.
6. Underground conduit shall be Schedule 40, PVC at 24 inches, minimum, below grade and rigid steel, wrapped with 20 mil tape at less than 24 inches. Risers from underground conduits to exterior devices shall be rigid steel (from the elbow at the base to above grade). Underground conduits shall be 3/4 inch trade size minimum, and weatherproof grommets shall be used at connections to junction boxes and switch cases.

7. Wiring shall be continuous from device to device. Where continuous loops are not possible, splicing shall be accomplished by use of approved Euro-Style, 2 screw barrier terminal strips/blocks terminal blocks in cabinets. Use of other means such as "Waygo" type connectors requires SUFMO approval on a case-by-case basis. Wire nuts are only allowed on 120V AC power splices.

8. Wire to initiating devices shall be minimum 16 awg and notification devices shall be minimum 14 awg, solid core conductors unless required otherwise by manufacturer's guidelines. All wiring must comply with the manufacturer’s specifications.

9. All FACP wiring shall be fully dressed and bundled with nylon tie wraps. Bundled wiring shall be routed parallel to terminal strips within FACPs, with individual conductors turned out at 90-degree angles to their associated terminal connections. AC power conductors shall be bundled and routed separately from low voltage conductors. A minimum 2-inch separation shall be maintained between AC power conductors and low voltage conductors wherever possible. All control cabinets shall be sized to accommodate the requirements of this section.

10. Each conductor terminating within a FACP shall be uniquely numbered with durable plastic tags or uniquely identifiable by a combination of numbers and color codes. These conductor numbers shall be shown on the record (As-Built) drawings in a manner allowing ready identification of any field wiring conductor in any FACP.

11. All connections and end-of-line devices shall be accessible for inspection, testing and servicing.

C. Routing:

1. All fire alarm system conduits/wire shall be run either parallel or perpendicular to building structural members. Open cable applications should use the building structure for protection per NEC and be run either parallel or perpendicular to building structural members. Open cable applications shall be shown as "loops" or “arcs” on drawing to clarify conduit is not being used.

2. Circuit and zone layout shall minimize the number of risers used to facilitate isolation of areas on the same floor without affecting other floors. Risers shall be run in common areas wherever possible (not in private offices, dorm rooms, etc.), to reduce impact to occupants during troubleshooting. Isolation modules, Class A wiring, etc. shall be provided to limit failure to a single zone on the SLC circuit caused by a single fault.
3. All exposed conduit penetrations of walls shall be provided with escutcheon plates on either side of the wall.

4. All conduit penetrations of walls, floors, and ceilings shall be sealed around the conduit, restoring the walls, floors and ceilings to their original fire resistance and integrity.

5. Conduit shall be concealed except where shown on the drawings.

6. All conduit, raceways, junction boxes, FACPs, electrical enclosures, relays and device back boxes shall be concealed in ceiling spaces, electrical shafts or closets in all finished areas.

7. Conduit, raceways, junction boxes, FACPs, electrical enclosures, relays and device back boxes may be exposed in unfinished areas.

8. Open cable (FPLP) @ Walls and Floors: install cable in flex or EMT conduit where cable runs vertically concealed in walls. Where vertical run is not concealed in a wall and runs through the floor it should be sleeved in conduit or in a fire rated assembly as required for the floor penetration. Where a horizontal run penetrates walls and is routed below 7 feet, it should be sleeved in conduit.

9. Open Cable Hanging & Strain Relief: Provide submittals to SUFMO for approval prior to purchase and plan submittal. Strain relief is required where cable enters a can or j-box (Arlington LPCG50 or approved equal); cable should not be self-supported. Provide details on the drawings.

D. Mounting, Labeling of Devices, and Locking:

1. All fire alarm devices shall be rigidly mounted, using appropriate back boxes, to building structural members, permanent walls, ceilings or fixtures designed for the purpose.

2. All junction box and pull box covers shall be painted red. The use of red conduit is highly encouraged especially in large or complex occupancies.

3. All devices shall be labeled with device address or device count as appropriate as shown on the approved drawings. Label shall be sticky back type self-adhesive, minimum ¼” font size width attached to base of device. Label identification shall be consistent with as-built drawings. Devices behind access panels or above ceilings shall also have a label placed on the access door or on the T-bar ceiling.

4. All locks for Fire Alarm Control Units, terminal cabinets, battery cabinets and other cabinets associated with the Fire Alarm System shall be keyed alike, and shall be compatible.

E. Color Coding and Wire Numbering:

1. All conductors entering and leaving terminal cabinets and junction boxes shall be numbered in a logical and consecutive manner.
2. All conductors shall be color-coded. Color coding shall be by wire insulation, not taping or banding. The numbering and color-coding shall be continuous for each circuit wire. Where Open Cable "FPLP" is being used, outer red jacket is acceptable, but inner jackets of the individual conductors shall be color codes as stated in the table below.

3. Wires shall be numbered at each connection, termination, and junction point. Wire numbering tags shall be Brady Perma-Code, Westline, or equal.

4. Color coding shall be as follows, except color coding in existing (E) buildings shall be maintained:

<table>
<thead>
<tr>
<th>CIRCUITS</th>
<th>COLOR CODES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm Initiating Circuits</td>
<td>Blue (+) and Brown</td>
</tr>
<tr>
<td>Waterflow Switch</td>
<td>Blue (+) and Brown</td>
</tr>
<tr>
<td>Horns, Strobes, and Horn/Strobes</td>
<td>Yellow (+) and Black</td>
</tr>
<tr>
<td>Speakers</td>
<td>Red (+) and Black</td>
</tr>
<tr>
<td>System AC Power</td>
<td>Black (+) and White</td>
</tr>
<tr>
<td>Sprinkler Horn – 120V AC</td>
<td>Black (+) and White</td>
</tr>
<tr>
<td>Sprinkler Horn – 24V DC</td>
<td>Red (+) and Black</td>
</tr>
<tr>
<td>Valve Supervision (Tamper Switch)</td>
<td>Yellow (+) and Orange</td>
</tr>
<tr>
<td>DC Power</td>
<td>Red (+) and Black</td>
</tr>
<tr>
<td>Synchronization cable</td>
<td>Yellow (+) and Black</td>
</tr>
<tr>
<td>Remote Alarm Indicators (RLI)</td>
<td>Red (+) and Black</td>
</tr>
<tr>
<td>PAD-3 Activation from FACP</td>
<td>Yellow (+) and Black</td>
</tr>
<tr>
<td>Voice: Speaker Circuit</td>
<td>Red(+) and Black – (Red Jacketed)</td>
</tr>
<tr>
<td>Voice: Strobe Circuit</td>
<td>Yellow(+) and Black</td>
</tr>
</tbody>
</table>

F. FACP Software:

1. Prior to writing the FACP system program, the installing contractor shall coordinate a meeting with SUFMO to confirm messaging, control functions, by-passes, message descriptions, etc. The system programmer for the installing contractor shall attend the meeting. The initial draft of the programming shall be approved prior to initial upload of the system software to the FACP.

2. Messages for all initiating devices shall be formatted as follows:

   a. Single Building: [FLOOR][AREA DESCRIPTION][ROOM NUMBER],
   b. Multiple Buildings: [BUILDING NUMBER OR NAME][FLOOR][AREA DESCRIPTION][ROOM NUMBER].
   c. Examples:

      1) 1ST FLR NORTH CORRIDOR BY RM 103
      2) STAUFFER 3 1ST FLR N. CORRIDOR BY RM 103

   d. Abbreviations used in messages must make sense to responding Fire Department personnel and are subject to SUFMO approval and changes.
e. Confirm room numbers prior to programming that match the Permit approved drawings.

3. All devices shall point report to the SUFMO Remote Supervising Station via Contact ID format.

4. The FACP software file shall be submitted to the SUFMO Fire Systems Supervisor at least 5 days prior to uploading into the FACP.

5. Functions shall be programmed into the FACP to allow bypass of door holders, elevator recall, FSD’s, Fan Shutdown, NACs, and others as needed. This should be complete at time of SUFMO Pre-Test and tested for functionality.

6. All changes to FACP software shall be tested per NFPA 72. This testing shall include all new or modified devices and functions. The testing shall also include up to 10% of existing devices (not to exceed 50) at the discretion of SUFMO and/or SCCFMO.

7. Alarm verification shall not be used unless specifically approved by SUFMO.

8. All notification devices shall be silenceable at the FACP and remote annunciator where a remote annunciator panel is provided.

G. Elevator Recall and Shunt Trip:

1. Xtralis XAS aspirating smoke detection shall be used for smoke detection within Elevator hoistways.

2. Primary floor recall shall be at street level (ground or 1st floor) unless otherwise specified by Palo Alto Fire Department (PAFD) or local AHJ and coordinated with SUFMO.

3. Alternate floor recall shall be either the basement where provided, or the 2nd floor unless otherwise specified by PAFD or local AHJ and coordinated with SUFMO.

4. It is Stanford's intention to set up passenger elevator hoistways’ and machine rooms without sprinkler protection so shunt trip auxiliary functions are not required as allowed by CBC. Where shunt trip function is provided it shall be initiated using restorable type, fixed temperature Heat Detectors.

   a. Where elevators are provided with heat detector-controlled shunt trip, signage (generally installed by others) shall be placed immediately adjacent to each elevator call station and inside each elevator car immediately adjacent to the emergency key switch or car operation buttons stating the following:

   **CAUTION: THIS ELEVATOR EQUIPPED WITH HEAT DETECTOR-CONTROLLED POWER SHUT OFF**

   Lettering shall be at least ¼” high on contrasting background.
H. FSD Control and Fan Shutdown:

1. Laboratory buildings - Area smoke detection shall be used to control FSDs. Area detection minimizes disruptions to research activities during maintenance and troubleshooting. Exception: FSDs serving vivarium areas (see 2.2.P below).

2. Non-laboratory buildings - In-duct detection or exterior mounted duct detection with sample tubes where used shall be provided with remote alarm indicators.

3. Selection of detection type shall consider access requirements. Access to detectors shall not require specialized equipment or excessive building occupant interruption without SUFMO approval.

4. In-duct detectors that are not in plain view such that it is unclear which device is in alarm shall be provided with remote indicators. Remote alarm indicators are additional devices installed in plain view near the detector to indicate device location for fire emergency response personnel. FSD position indicator test switches may act as remote alarm indicators if visible from the floor and the FSD is closed only by the associated detector.

5. When fan units (supply and/or return) are required by applicable codes to be shut down by smoke detection, they shall restart automatically after the associated FACP is in normal status. The preferred method for large supply and return fan detection is to use externally mounted duct detectors inside a NEMA rated weatherproof enclosure. Where fan units are small and serve up to 2 rooms, use area smoke detection in the room(s) to monitor the fan and provide the required shutdown functions.

   a. Humidification: Air Handling Units that have integrated humidification systems may require special detection means and methods and assistance by the mechanical engineer of record will be required. Shop drawing submittal shall include appropriate details and product data to conduct a complete review of the detection design to ensure unwanted alarms will not occur. Field testing and confirmation may be required as part of final approval.

I. Remote Indicators

1. See Section H.1 - “FSD Control and Fan Shutdown. Duct Detection with Remote Indicators” Remote indicators, where installed shall normally be on or below ceilings and visible from the floor.

J. Main Waterflow Switch

1. Generally, water flow switches are furnished under the specification covering the automatic fire sprinkler installation. The electrical connection, programming and testing is completed under the fire alarm scope of work.

2. Provide a waterflow switch at the base of the sprinkler riser piping or basement inlet and at all floor control valve assemblies.
K. Fire Sprinkler Valve tamper switches

1. Wire the 2 tamper switches for the OS&Y sprinkler control valves on the BFP in series using 1 monitor module.

L. Exterior Sprinkler Horn:

1. The exterior sprinkler horn is a weatherproof 120V AC or 24V DC device. This device is generally furnished under the specification covering the automatic fire sprinkler installation. The electrical connection and testing of the device is completed under the fire alarm scope of work.

2. The device shall be mounted on the exterior of the building at a location approved by SUFMO. It shall be installed in plain view and sound a constant tone (not temporal-3).

3. This device shall only be wired directly from and activated by the main waterflow switch.

4. The source of power for this device shall be a dedicated 120V AC circuit with separate breaker.

M. Synchronization:

1. If 2 or more visual appliances can be viewed at the same time, they must either be synchronized or located far enough apart so that their intensity at the viewer’s location is low enough to be considered safe in accordance with NFPA 72. In order to prevent any compliance issues SUFMO requires that all new strobe devices be synchronized.

N. Electrical and Mechanical Rooms

1. Electrical Rooms – Install smoke detection in the building's main electrical room. This is where the main distribution switchgear is located.

O. Residential Smoke Alarms

1. The CFC requires the interconnection of room smoke alarms to the building fire alarm system. This shall be done by using monitor modules programmed to monitor activation; multiple smoke alarms can be monitored by a single module, but no more than 8 rooms per module. A supervisory signal shall be received at the remote supervising station with automatic messages sent by the supervising station to R&DE maintenance and building accessibility staff for response.

2. Shop drawings shall include a letter between Stanford and County Fire Marshal's Office outlining signal and response protocols for all Stanford Residences with such in-room smoke alarm monitoring by the building fire alarm system. This letter can be requested through SUFMO.
P. Vivarium Areas: These areas are very sensitive to certain types of lights (like on smoke detectors and modules) and noise. An alternate means and methods application shall be required to be submitted for approval to the AHJ as part of the fire alarm system design package. Design elements should include:

1. Dedicated NAC Circuits & Bypass Functions: Notification devices will require dedicated circuits so devices can be bypassed to reduce impact to these areas.

2. Notification Appliances: Notification devices shall be strobes only, with red colored lenses. These devices shall be CSFM listed emergency devices. Devices will be required to be field marked with "FIRE" in an approved permanent manner.

3. Smoke Detection: Where area smoke detection is not permissible or practical, in-duct detection shall be used for FSD control functions.

4. Lighting Interface: In specific cases where LED lights are specified their brightness, these lights can render the flashing red lens strobes ineffective for occupant alarm notification. An interface to reduce lighting levels may be required to allow devices to provide the required flashing intensity for occupant notification.

5. Evacuation Signage: Evacuation maps within vivarium areas will need to specifically identify the red lens strobe devices, lack of audible devices, and reduced lighting levels upon alarm activation. Evacuation maps shall be placed at the entrances to the vivarium areas. These will be provided by the same vendor responsible for evacuation signage in all other parts of the building.

PART 3 INSPECTIONS & ACCEPTANCE

3.1 FIELD INSPECTIONS

A. All installations are subject to inspection and approval by SUFMO prior to final approval by the SCCFMO or other local AHJ as appropriate.

B. Rough-In (or "First-In") Inspection: After materials arrive at the jobsite and soon after installation begins, all wiring and devices installed shall be inspected by SUFMO to ensure installation and materials are in accordance with the approved drawings.

Coordination of the rough-in inspection shall be by the fire alarm contractor providing at least 1-week advance notice.

C. Drawings Maintained On Job Site: Maintain and keep up-to-date a complete record set of approved shop drawings, corrected daily to show every change to the SCCFMO (or other AHJ) approved shop drawings. Keep this set of prints on the job site and use only as a record set. Do not make changes in the approved layout without instructions from the Stanford PM.
3.2 SYSTEM ACCEPTANCE

A. It is the intent of SUFMO that all alarm testing should not start until construction is completed. Building status should include doors and windows being installed and closed, and the completion of all ceiling tiles, carpeting/flooring, painting, finishes and any sound absorbing systems. HVAC systems should be complete and operating at design levels.

1. Smoke Detectors: Where detectors are installed but not yet operational, they shall remain covered to protect them from construction debris, dirt, etc. until final system testing.

B. Required Tests:

1. Sensitivity Tests: Detectors shall be tested to verify they are operating within the listed sensitivity or they shall be replaced prior to system acceptance tests.

2. Audibility Tests: Audibility levels shall be measured and recorded on record drawings for all areas when the building is near completion. A minimum of 2 audible readings (ambient reading and alarm reading) shall be recorded in each room to ensure code required levels are met. For sleeping rooms, additional alarm reading should be taken at the pillow level. Results should be included on the approved record drawing "as-built" set submitted at the completion of work as outlined in 3.2.B

3. Differential Pressure Tests: All duct detectors with sample tubes will require a differential pressure test across the sample tube inlet and return to verify that installation meets manufactures’ listing requirements. This test is usually completed by the mechanical contractor installing the associated HVAC ductwork.

4. Tests: After complete installation of the equipment and with the FACP reading "Normal", the fire alarm contractor shall perform 3 complete tests of the system.

   a. Test #1 (Contractor’s Test):

      1) Shall be performed by the installing contractor and manufacturer’s representative if applicable. The test shall include proper operation of the fire alarm system, including remote annunciators, initiating/notification/auxiliary devices and control sequencing in accordance with factory recommended procedures and approved plans. Audible and differential pressure testing as outlined in 3.2.A (1) (2) should be completed or scheduled for completion as soon as the building construction allows prior to the final inspection (Test #3).

      2) Send email confirmation to SUFMO addressing the following:

         ● FACP is in normal status
         ● The latest revision of the FACP software has been given to the Fire Systems Supervisor so updates can be made in the remote monitoring station software database. All software updates should be provided to supervisor at least 2 to 5 business days in advance.
All the fire alarm devices and auxiliary devices are installed, tested, and functioning per manufacturer’s installation instructions and approved plans.

b. Test #2 (SUFMO Test):

1) Shall be performed by the installing contractor and manufacturer’s representative in the presence of SUFMO representatives. Coordination of testing shall be by the contractor providing at least **1-week advance notice** to SUFMO:

2) The test shall include proper operation of the complete fire alarm system including control functions, as in Test #1, but shall include verification of the remote supervising station alarm signals.

3) A punch list will be developed by SUFMO and the contractor shall correct punch list items prior to the final acceptance test (Test #3). There will be a re-inspection of punch list items. If additional re-inspections are found necessary to assure compliance with the contract, they shall be made at the contractor's expense.

c. Test #3 (Final Test):

1) After Test #1 and #2 have been completed, the contractor shall request a final acceptance inspection by coordinating the final test with the PM, SUFMO representatives and the SCCFM (or other AHJ as appropriate). Coordination of testing shall be by the contractor providing at least **1-week advance notice** to SCCFM and SUFMO.

2) 24 hours prior to the final test date, SUFMO will remove or witness removal of AC power from the FACP and auxiliary power supplies to facilitate the battery test during the final test.

3) The test shall include proper operation of the fire alarm system and control functions, as in test #1 and #2, but shall include audible/visible testing of all notification devices on battery power for 5 minutes. A copy of the contractor's audibility tests, differential pressure tests, as-built drawings, and record of completion shall be made available to the AHJ during this test. Duct detectors shall be tested under full airflow (dynamic) conditions. Operation of the AES wireless radio reporting to the remote supervisory station including receipt of the appropriate signals at the Palo Alto Communications Center (or other agency responsible for emergency services dispatch) will be at the discretion of the AHJ. A complete report of SUFMO Test will be provided to the AHJ.

4) After the successful completion of the final test with the approval of the AHJ, the system shall be placed online reporting to Palo Alto 911 Emergency Dispatch Center or other agency responsible for emergency services dispatch. SUFMO will coordinate with the General Contractor (GC) ensuring proper building keys are installed in the Knox Box. Fire alarm contractor shall provide the FACP key to the GC to be placed in the Knox Box.
5) The FACP software program file shall be provided to the onsite SUFMO technician directly after the completion of the final test and the system has been placed online. The SUFMO technician will provide a USB flash drive to copy the file to.

6) The record of completion as required by NFPA 72.

5. FACP Turnover – Upon successful completion of the final test (Test #3) the control of the FACP will turn over to SUFMO. Further construction work that requires shutdown of fire alarm system devices or placing the system on test will be done by a SUFMO technician after coordinating with SUMFO directly.

C. Record Drawings and Maintenance Manuals

1. Upon completion of the work and approval of the “as-built” drawings by SUFMO, the contractor shall turn over to the Stanford PM and SUFMO 1 set each of the following:

   a. Full size set of approved “as-built” drawings.
   b. 2 sets of CAD (AutoCAD compatible) files (1 for SUFMO, 1 for LBRE Maps and Records).
   c. Maintenance manuals when required by SUFMO.
   d. Letter of warranty.

END OF SECTION
APPENDIX - A

SUFMO Protocol for Working on Existing Fire Alarm Systems at Stanford University

Contractors working on any fire alarm system in an occupied building at Stanford will need to:

- Have prior approval from a SUFMO Fire Protection Engineer (FPE) of the work being performed.
- Schedule 48 hours in advance by phone (not show up unannounced) with Frank Gardner or Mo Miranda (650) 725-2129 when a qualified technician will be on campus to work on any given system. For qualifications see NFPA 72 2013 (10.5.2).
- After providing notice and discussing the work by phone, follow up with an email to Frank, Mo and the SUFMO engineer this work was approved by; confirming the dates and times, description of the work to be done, and the name of the tech on site that will be responsible for impairment procedures and fire watch – see further details below.
- Before working on a system, call our office at (650) 725-2129 to put the system on test. When you call, be specific as to whether the entire system (no fire department response) or just trouble signals (no SUFMO Tech response) need to be on-test.
- Provide an impairment procedure including the placement of tags on any FACP being worked on including all annunciators. These tags must include the areas being affected, the on-site contact’s name and phone, and the dates and times of the impairment.
- A qualified technician shall always be monitoring the FACP on site while the system is on test unless approved otherwise by SUFMO.
- Take full responsibility to ensure that if there is an actual fire emergency in the building and the fire alarm system is activated, the appropriate action is taken. If the entire system is on-test, this includes investigating the alarm (or trouble), calling the fire department (911) or (650) 329-2413, or SUFMO on-call if appropriate, and activating the NACs to notify the occupants.
- Test to make sure the changes to the system did not adversely affect the functionality of the system in any way. Confirm activation of the horns/strobes has been approved by the Facility Manager
- Schedule with Frank or Mo to test with a SUFMO Tech and Engineer per normal procedures.
- Call our office before leaving the building (for any reason) to make sure the system shows normal and the monitoring is back online to Palo Alto Dispatch.
# APPENDIX – B

## Approved Abbreviations for FACP Program Device Messages

<table>
<thead>
<tr>
<th>Name</th>
<th>Abbrev</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Handler Unit</td>
<td>AHU</td>
<td></td>
</tr>
<tr>
<td>Alternate</td>
<td>ALT</td>
<td>Alternate Elevator recall</td>
</tr>
<tr>
<td>Antenna</td>
<td>ANT</td>
<td></td>
</tr>
<tr>
<td>Basement</td>
<td>BSMT</td>
<td></td>
</tr>
<tr>
<td>Building</td>
<td>BLDG</td>
<td></td>
</tr>
<tr>
<td>Corridor</td>
<td>CORR</td>
<td></td>
</tr>
<tr>
<td>Distributed Antenna System</td>
<td>DAS</td>
<td>aka, Emergency Responder Radio System, ERRCS</td>
</tr>
<tr>
<td>Duct Detector</td>
<td>DUCT</td>
<td>DET</td>
</tr>
<tr>
<td>East</td>
<td>EAST</td>
<td>Do Not Abbreviate</td>
</tr>
<tr>
<td>Electrical</td>
<td>ELECT</td>
<td>Panel will annunciate device separately as well</td>
</tr>
<tr>
<td>Elevator</td>
<td>ELEV</td>
<td></td>
</tr>
<tr>
<td>Emergency Responder Radio System</td>
<td>ERRCS</td>
<td></td>
</tr>
<tr>
<td>Fire Command Center</td>
<td>FCC</td>
<td></td>
</tr>
<tr>
<td>Floor</td>
<td>FL</td>
<td></td>
</tr>
<tr>
<td>Heat Detector</td>
<td>HD</td>
<td></td>
</tr>
<tr>
<td>Mechanica l</td>
<td>MECH</td>
<td></td>
</tr>
<tr>
<td>North</td>
<td>NORT H</td>
<td>Do Not Abbreviate</td>
</tr>
<tr>
<td>Plumbing</td>
<td>PLUMB</td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>PRI</td>
<td>Primary Elevator recall</td>
</tr>
<tr>
<td>Room</td>
<td>RM</td>
<td></td>
</tr>
<tr>
<td>Smoke Detector</td>
<td>SD</td>
<td></td>
</tr>
<tr>
<td>South</td>
<td>SOUTH</td>
<td>Do Not Abbreviate</td>
</tr>
<tr>
<td>Way</td>
<td>WY</td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>WEST</td>
<td>Do Not Abbreviate</td>
</tr>
</tbody>
</table>
## APPENDIX – C

**Rooms requiring strobe devices**

<table>
<thead>
<tr>
<th>Name</th>
<th>Need Strobe Coverage?</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Break Rooms</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Cold Storage Rooms</td>
<td>No</td>
<td>These are not common spaces</td>
</tr>
<tr>
<td>Cold Work Rooms</td>
<td>Yes</td>
<td>AHJ has required strobes in these areas</td>
</tr>
<tr>
<td>Computer Cluster Rooms</td>
<td>Yes</td>
<td>These are considered common rooms</td>
</tr>
<tr>
<td>Conference Rooms</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Cubicle Office Areas</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Curtained Partitions Areas</td>
<td>Yes</td>
<td>These are generally work or laser lab areas</td>
</tr>
<tr>
<td>Dining Rooms</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Equipment Rooms (non-shop)</td>
<td>Yes/No</td>
<td>Only if ambient noise levels are high enough to require strobe coverage</td>
</tr>
<tr>
<td>Fume Hood Rooms</td>
<td>Yes</td>
<td>Ambient noise generally requires strobe coverage</td>
</tr>
<tr>
<td>Kitchens</td>
<td>No</td>
<td>These are not common spaces</td>
</tr>
<tr>
<td>Lab Support Rooms</td>
<td>Yes</td>
<td>These are considered common rooms</td>
</tr>
<tr>
<td>Labs</td>
<td>Yes</td>
<td>These are considered common rooms</td>
</tr>
<tr>
<td>Large Storage Rooms</td>
<td>Yes</td>
<td>Larger storage rooms accessed by many people</td>
</tr>
<tr>
<td>Meeting Rooms</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Microscope Rooms</td>
<td>Yes</td>
<td>These are considered common rooms</td>
</tr>
<tr>
<td>Private Assigned Offices</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Reception/Lobbies</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Restrooms</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>RF &amp; Acoustic Chambers</td>
<td>No</td>
<td>These are not common spaces</td>
</tr>
<tr>
<td>Servery</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Shop Areas</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Small Storage Rooms</td>
<td>No</td>
<td>These are not common spaces</td>
</tr>
<tr>
<td>Student Residences - Hearing</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Student Residences - Hearing</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Tissue Culture Rooms</td>
<td>Yes</td>
<td>These are considered common rooms</td>
</tr>
<tr>
<td>Work Rooms</td>
<td>Yes</td>
<td>These are considered common rooms</td>
</tr>
</tbody>
</table>