SECTION 28 4600

FIRE DETECTION AND ALARM

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LANL MASTER SPECIFICATION

This template applies to new and existing fire alarm systems and must be edited for each project.  In doing so, specifier must add job-specific requirements.  Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.  Once the choice is made or text supplied, remove the brackets.  The specifications must also be edited to delete specification requirements for processes, items, or designs that are not included in the project -- and specifier’s notes such as these.  To seek a variance from requirements in the specifications that are applicable, contact the Engineering Standards Manual [Fire](http://engstandards.lanl.gov/POCs.shtml#fire) POC. Please contact POC with suggestions for improvement as well.

When assembling a specification package, include applicable specifications from all Divisions, especially Division 1, General requirements.

Specification developed for ML-4 projects.  For ML-1, 2, and 3 applications, additional requirements and independent reviews should be added if increased confidence in procurement or execution is desired; see ESM Chapter 1 Section Z10 Specifications and Quality sections. .

Seismic: In order to edit this section for job-specific seismic requirements, refer to author notes that indicate “Seismic,” and the document, *Seismic Spec-Editing for Electrical/Fire Alarm Components* (“Guide,” posted under “REFERENCES” on the LANL Master Specifications [webpage](https://engstandards.lanl.gov/specs.shtml#top)) for guidance on properly editing this section.
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1. GENERAL
	1. SECTION INCLUDES
		1. Design, furnish, install, test, certify, and place into service a complete UL Listed/FM Approved, addressable fire alarm system. The system shall be complete with all hardware and software specifically tailored for this installation.
		2. Provide a fire alarm system consisting of, but not limited to, the following components:
			1. Fire alarm control panel (FACP)
			2. Conduit and wiring necessary to connect the FACP to alarm initiating devices, notification appliances, and auxiliary equipment

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Edit 3 through 14 to match project fire alarm system requirements. Where environmental conditions allow, and detection is needed, smoke detection is preferred where possible.

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* + - 1. Addressable manual fire alarm stations
			2. Addressable analog area smoke detectors
			3. Addressable analog duct smoke detectors
			4. Addressable analog heat detectors
			5. Connections to sprinkler water flow/pressure alarm switches
			6. Connections to sprinkler supervisory switches and tamper switches
			7. Audible and visual combination notification appliances
			8. Air handling systems shutdown relays
			9. Elevator recall/shunt relays (if the building has an elevator)
			10. Battery standby
			11. Conduit and Government-furnished equipment (GFE) cable to building’s main telecommunications room
			12. Knox Box supervisory/trouble switches
			13. Transfer switch for FACP electrical supply.
		1. Design the fire alarm system in accordance with the editions of (1) NFPA 72 *National Fire Alarm and Signaling Code*, (2) NFPA 70 *National Electrical Code*, and (3) ASME A17.1 *Safety Code for Elevators and Escalators* cited within the edition of the IBC currently adopted by LANL, or the most current edition of aforementioned documents. The edition of NFPA 90A *Standard for the Installation of Air-Conditioning and Ventilating Systems* should correspond to the same timeframe as codes stated above. Confirm the applicable code of record for the project with LANL Engineering Services–Fire Protection Group prior to beginning the design.

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Seismic: See Guide for editing guidance.

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* 1. related sections
		1. Section 01 8734, *Seismic Qualification of Nonstructural Components* (IBC), for requirements pertaining to [manufacturer’s certification] [and] [special certification].
		2. Section 26 0548.16, *Seismic Controls for Electrical Systems*, for [seismic-design criteria,] submittal requirements, devices for seismic restraint, and installation requirements for these devices.
	2. SYSTEM FUNCTIONAL DESCRIPTION

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Edit system functional description to match the project fire alarm system requirements. Projects with high explosives areas or NEC Article 500 hazardous locations will require additional specialized equipment and system characteristics not included in this specification.

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* + 1. The system shall identify all off normal conditions and log each into the system history as individual events.
			1. The system shall automatically display on the control panel the first event of the highest priority by type. The priorities and types shall include alarm, supervisory, trouble and monitor.
			2. The system shall have a queue operation, and shall not require event acknowledgment by the system operator. The system shall have a labeled color-coded indicator for each type of event.
			3. The user shall be able to review each event by selecting scrolling keys.
			4. New alarm, supervisory, or trouble events shall sound a silence-able audible signal at the control panel.
		2. Operation of any alarm-initiating device shall automatically:
			1. Update the control/display as described above.
			2. Audibly and visibly annunciate the alarm condition at the FACP.
			3. Activate all NAC appliances in accordance with the respective evacuation plan and matching functional matrix. The fire alarm evacuation tone shall be the three-pulse temporal pattern.
			4. Operate the alarm relay and initiate the transmission of an alarm signal to the LANL central station over a digital alarm communicator system.

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Delete 5 and 6 if an elevator is not part of the project scope of work.

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* + - 1. Operate control relay contacts to return all elevators that serve the floor of alarm initiation to the ground floor. If the alarm originates from the ground floor, operate control circuit contacts to return all elevators to the floor above or to a level as approved by the LANL Fire Protection Group.
			2. Shut down power to elevator equipment before sprinkler operation in the elevator equipment room or elevator shaft.
		1. Activation of a supervisory initiating device shall:
			1. Update the control/display as described for alarm initiating devices.
			2. Audibly and visibly annunciate the supervisory condition at the FACP.
			3. Operate the respective relay if applicable and initiate the transmission of a supervisory signal to the LANL Central Station over a digital alarm communicator system.
		2. The entire fire alarm system wiring shall be electrically supervised to automatically detect and report trouble conditions to the FACP. Any opens, grounds, or disarrangement of system wiring and shorts across wiring shall automatically:
			1. Update the control/display as described above.
			2. Initiate the transmission of a trouble signal to the LANL central station over a digital alarm communicator system.
			3. Visually and audibly annunciate a general trouble condition, on the FACP. The visual indication shall remain on until the trouble condition is repaired.
		3. The FACP shall have an optional LED Annunciator/Switch Card component installed and programmed for pre-defined disable groups particular to this installation. Disable groups shall consist of the following to facilitate routine inspection, testing, and maintenance (ITM):
			1. All control relays with the associated outputs, such as HVAC shutdown, PDU shutdown, damper/door closures, building automation system (BAS) outputs, elevator recall, and other emergency control functions .
			2. All notification appliances.
	1. SYSTEM DESIGN
1. System Design: Provide the services of a qualified factory trained fire alarm designer for the FACP to be installed on this project. The designer shall assure the completeness and correctness of the fire alarm system design by performing the following:
	* + 1. Prepare drawings of FACP indicating location of components, interconnection of components and connections to alarm initiating, indicating, and auxiliary circuits.
			2. Prepare a system input/output matrix to verify that the proper sequences occur for each initiating point or zone.
			3. Prepare drawings of fire alarm layout, conduit and wiring plans. Show location of all fire alarm appliances, conduit layout, quantity, and type of wires in each conduit, and interface with other systems for functions such as central station signaling, fan shutdown, damper operation, and elevator recall.
			4. Prepare terminal-to-terminal field wiring diagrams for alarm initiating, indicating and auxiliary circuits; detail the interfaces with other systems; indicate labeling of each fire alarm system conductor. Coordinate interfaces with controlled equipment and systems (e.g., elevators, HVAC systems, fire doors, fire/smoke dampers, etc.) for control relay locations and interface wiring details.
			5. Calculate conductor sizes for each alarm initiating, indicating, and auxiliary circuit; limit voltage drops so that they do not exceed the FACP manufacturer’s limitations, for the most electrically remote device on each circuit.
			6. Prepare battery load calculations for the FACP and any remote power supply panels and select proper battery size. System battery capacity calculations shall demonstrate that the batteries are sized to support the system operating in a “normal” (non-alarm) condition for not less than 24 hours plus a general alarm condition (all alarm notification appliances used for evacuation being activated) for not less than 10 minutes following the completion of the 24-hour period. Battery shall be sized to include an additional 50% safety margin above calculated system demand.
			7. Provide voltage drop calculations to demonstrate that the signal voltage at the most electrically remote notification appliance of each circuit will not be less than 10% above the notification appliance manufacturer’s minimum operating voltage when supplied by the minimum voltage from the fire alarm system
			8. Design each addressable and notification appliance circuit so device loading will not exceed 80% of circuit capacity to leave space for future devices.
			9. Calculate alarm signal in all spaces to comply with ADAAG requirements: minimum 15 dBA above average ambient sound pressure levels (public-mode signaling) at all locations, but not over 110 dBA at the minimum hearing distance.
			10. Provide notification appliances in the following locations:
				1. Corridors
				2. Conference rooms
				3. Mechanical equipment rooms
				4. Computer/Server rooms
				5. Common areas such as restrooms, kitchens, copy rooms, etc.
				6. In other areas specifically requested by LANL.
			11. Select alarm initiating, notification appliance, and auxiliary devices compatible with FACP.
	1. ACTION SUBMITTALS

Provide the following per project submittal procedures. See Appendix A for timing and summary.

* + 1. Certifications
			1. Within 30 days after Notice to Proceed (~60% submittal; see Appendix A), certifications of the qualifications of the fire alarm installing firm as described in the quality assurance paragraph of this Section.
			2. Within 30 days after Notice to Proceed (~60% submittal; see Appendix A), certifications of the qualifications of the fire alarm system technician as described in the quality assurance paragraph of this Section.
			3. Certification (upon request) from the fire alarm control manufacturer that proposed alarm-initiating devices, alarm appliances, and auxiliary devices are compatible with the FACP and other auxiliary equipment.
		2. Delegated Design Submittals
			1. Calculations: Submit the following with Design Drawings (~60%, 90%, 100% submittals; see Appendix A).
				1. System battery load calculations to demonstrate that backup batteries are sized appropriately.
				2. Voltage drop calculations.
			2. Design/Installation Drawings (~60%, 90%, 100% submittals)
				1. Prepare floor plan drawings in accordance with NFPA 72 requirements as outlined in “Shop Drawings” section using a minimum scale of 1/8" - 1'0" for plans and 1/4" = 1'-0" for details.
				2. Font size shall be a minimum of 3/16" and other lettering a minimum of 1/8" to permit reproduction.
				3. Show location of FACP, all fire alarm devices with associated addresses, conduit layout, quantity and type of wires in each conduit, notification appliance candela and dB settings, and interface with other systems for functions such as central station signaling, fan shutdown, damper operation, elevator recall, and other emergency control functions.
				4. Show layout of the FACP indicating location of components, interconnection of components, and connections to alarm initiating devices, notification appliances, and auxiliary circuits.
				5. Provide terminal-to-terminal wiring diagrams for alarm circuits, supervisory circuits, remote power supply panels, and interfaces with other systems such as HVAC and elevators.
				6. Submit with calculations at least 30 days prior to scheduled start of fire alarm system installation (~60%, 90%, 100% submittals; see Appendix A). Installation shall not proceed without 100% Submittal design approval by the LANL Fire Protection Group.

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Seismic: See Guide for editing guidance.

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* + - * 1. Required seismic design documentation:
			1. Include dimensioned representations or plans and elevations that identify the weight and the location of the center or gravity.
			2. Indicate field anchorage or mounting provisions to hold the component in place and resist forces derived from the criteria specified in [Section 01 8734] [Section 26 0548.16].
			3. Identify anchors and other mounting devices.
			4. Include information on the size, type, and spacing of factory-installed mounting brackets, holes, and other mounting provisions.
			5. Catalog Data: For all equipment furnished under this Section. See Appendix A for submittal schedule.
			6. Installation Instructions: See Appendix A for submittal schedule.
			7. Materials and Parts List: See Appendix A for submittal schedule.
			8. FACP Program
				1. Provide FACP input/output matrix and a copy of the proposed FACP program at least two weeks prior to the anticipated pre-test date of the fire alarm system.
				2. Provide final FACP input/output matrix and the final FACP program before requesting final tie-in/acceptance testing. See Appendix A for submittal schedule.
				3. Provide the central station report with the FACP program. See Appendix A for submittal schedule.
			9. Operations & Maintenance Manual
				1. Submit operating and instruction manuals (electronic format) with the 100% submittal of calculation and drawings (see Appendix A).
				2. Submit project-specific operating and maintenance instruction manuals (electronic format shall consist of all items combined into one pdf file) upon successful completion of testing. Provide complete, step-by-step testing instructions giving recommended and required testing frequency of all equipment, methods for testing each piece of equipment, and a complete trouble shooting manual explaining how to test the primary internal parts of each piece of equipment. Maintenance instructions shall be complete, easy to read, understandable, and shall provide the following information:

Provide instructions for replacing any components of the system, including internal parts.

Provide a list of recommended spare parts.

Provide instructions for periodic cleaning and adjustment of equipment with a schedule of these functions that at minimum, is compliant with NFPA 72.

Provide a complete list of all equipment and components with information as to the address and telephone number of both the manufacturer and local supplier of each item.

* + - * 1. Provide operating instructions prominently displayed on a separate sheet located next to the FACP in accordance with UL Standard 864.
		1. Test Reports
			1. Submit report of the pre-final tests demonstrating that the entire system has been tested in accordance with NFPA 72 requirements for initial acceptance testing and the fire alarm input/output matrix, and also indicating system status and corrective actions required before requesting the final acceptance tests.
			2. Submit test plan for the final acceptance tests of unique/special fire detection and alarm equipment such as UV/IR fire detectors, high-sensitivity smoke detection (HSSD) systems, linear fire detectors, and others having special manufacturer’s requirements and recommendations for acceptance testing, or if required by other project requirements before requesting the final acceptance test.
			3. Upon successful completion of final acceptance test, submit test reports and final “Record of Completion” as required by and in accordance with NFPA 72.
		2. Project Record Documents
			1. Provide updated drawings reflecting as-built conditions showing the work completed under this Section. Include notes on special systems or devices, new and existing, locations of equipment, actual conduit installation, wiring color-coding, wire tag notations, interconnections between all equipment, and internal wiring of the equipment. Include conduit size, conductor size, and number of conductors per conduit. Provide one full-sized drawing.
			2. Provide the updated drawings on electronic media in “.pdf” and AutoCAD “.dwg” formats.
			3. Provide “Record of Completion" and associated documentation for the completed system according to NFPA 72.
		3. Warranties: Warrant all equipment and wiring free from inherent mechanical and electrical defects for not less than one year (365 days) from the date of final acceptance, in writing.
	1. QUALITY ASSURANCE
		1. Qualifications of the design/installing firm:
			1. Be licensed by any state in the United States to engage in the design, fabrication, and installation of fire alarm systems.
			2. Have successfully designed and installed at least 20 fire alarm systems of equivalent nature and scope to the system described in this Section.
			3. Provide the services of a qualified fire alarm system technician who is NICET III or IV certified, to design the fire alarm system, support installation, and to test the completed system.
			4. Be a factory-certified representative of the manufacturer of the FACP that will be used on this project.
		2. Qualifications of the fire alarm system technician:
			1. Be factory trained in the theory, operation, installation, and troubleshooting of the FACP that will be used for this project.
			2. Have successfully installed at least 20 fire alarm systems of equivalent nature and scope to the system described in this Section.
			3. Have satisfactorily field-tested at least 20 fire alarm systems of equivalent nature and scope to the system described in this Section.
			4. Be NICET (National Institute for Certification in Engineering Technologies) Fire Alarm Certified, or certified by an equivalent organization acceptable to the LANL Fire Authority Having Jurisdiction.
	2. PRODUCT HANDLING
		1. Materials and Equipment: Protect from damage during shipping, storage, and installation.

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Add any special product handling requirements for the facility in which this system is to be installed.

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1. PRODUCTS

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Seismic: If Project Spec includes 26 0548.16, and this Section (i.e., 28 4600) includes devices that differ from those in 26 0548.16, then these products (i.e., the devices that differ) must be included in PART 2. And, if/when what’s been described is applicable, use the same terminology for these devices in PART 3 herein in order to identify the type of devices required for each application.

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* 1. GENERAL
		1. Provide materials and equipment that are new and unused, free of defects, specifically designed for the use intended, conform to the requirements of the NEC and NFPA 72, and are NRTL listed for the intended use.
		2. Provide products suitable for operation at an elevation of 7,500 ft.

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Seismic: See Guide for editing guidance. If either paragraph 2.2.A or 2.2.B applies and there are too many systems/components to list here, then list them in an appendix to this section, and then add a reference to that appendix in 2.2.A/ 2.2.B.

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* 1. SEISMIC PERFORMANCE REQUIREMENTS
		1. The [\_\_\_\_\_ ] shall remain in place without separation of any parts when subjected to the design-basis earthquake [per Section 01 8734, *Seismic Qualification of Nonstructural Components (IBC)*] [as represented by the seismic forces derived from the criteria indicated [on the drawings] [in Section 26 0548.16, *Seismic Controls for Electrical Systems*].
		2. The [\_\_\_\_\_] is a Designated Seismic System and, as such, shall remain in place and be fully operational following the design-basis earthquake [per Section 01 8734, *Seismic Qualification of Nonstructural Components (IBC)*] [as represented by the seismic forces derived from the criteria indicated [on the drawings] [in Section 26 0548.16, *Seismic Controls for Electrical Systems*].
	2. FIRE ALARM CONTROL PANEL
		1. The FACP shall incorporate all control electronics, relays, and necessary modules and components in a flush or semi-flush mounted cabinet (dependent on FACP mounting location). The operating controls and zone/supervisory indicators shall be located behind locked door with viewing window. All devices shall be labeled, and all zone locations shall be clearly identified. The assembly shall contain a base panel, system power supply and battery charger with additional modules to meet the requirements of these specifications.
		2. System circuits shall be configured as follows: Addressable analog loops Class B; Initiating Device Circuits (if used) Class B; Notification Appliance Circuits Class B; unless otherwise noted.
		3. The system shall store all basic system functionality and job specific data in non-volatile memory. The system shall survive a complete power failure intact.
		4. The system shall allow downloading of a job-specific custom program created by system application software. It shall support programming of any input point to any output point.
		5. The system shall support distributed processor intelligent detectors with the following features: integral multiple differential sensors, environmental compensation, pre-alarm, dirty detector identification, automatic day/night sensitivity adjustment, dual normal/alarm LEDs, relay bases, and isolation modules.
		6. The system shall supervise all addressable loop devices for placement, correct location, and operation. It shall allow swapping of “same type” devices without the need of addressing and impose the “location” parameters on replacement device. It shall initiate and maintain a trouble if a device is added to a loop and clear the trouble when the new device is defined in the system.
		7. The system shall have a nationally recognized testing laboratory (NRTL) listed detector sensitivity test feature, which will be a function of the smoke detectors and performed automatically.
		8. All panel modules shall be supervised for placement and initiate a trouble signal if damaged or removed.
		9. The system shall have a central processing unit (CPU) monitoring circuit to initiate a trouble signal should the CPU fail.
		10. The system evacuation signal rate shall be suitable to support audio-visual combination-type electronic three pulse temporal pattern sounder and strobe combination units.
		11. The system program shall meet the requirements of this project, applicable codes and standards, and satisfy the LANL Fire Authority Having Jurisdiction (ES-FP).
		12. Passwords shall protect any changes to system operations. Multiple levels of access shall be provided.
		13. The power supply shall be a high efficiency switch mode type with line monitoring to automatically switch to batteries for power failure or brown out conditions. The automatic battery charger shall have low battery discharge protection. The power supply shall provide internal power and 24 Vdc for notification appliance circuits. All outputs shall be power limited. The battery shall be sized to support the system for 24 hours of supervisory and trouble signal current plus general alarm for 10 minutes. Battery shall be sized to include an additional 50% safety margin above calculated system demand.
		14. The FACP shall have a high-contrast, alphanumeric display to show system status, alarm information, and supervisory information. The FACP shall have LED indicators for the following common control functions: AC power, alarm, supervisory, monitor, trouble, disable, ground fault, CPU fail, and test. There shall be control keys and visual indicators for; reset, alarm silence, trouble silence, and drill.
		15. Battery boxes, if required, shall be UL Listed for the purpose.
		16. The FACP shall have a digital alarm communicator transmitter (DACT) module to transmit detailed alarm, supervisory and trouble signals to a digital alarm communicator receiver (DACR) at a Central Monitoring Station.
			1. The DACT shall support dual telephone lines, “contact ID” communications format, and configured for dual-tone, multi-frequency (DTMF).
			2. The DACT shall be listed for “Central Station Fire Service” and for “Proprietary Station Fire Service” and shall be of the same manufacturer as the control panel.
			3. The DACT shall transmit the following information to the LANL Central Station:
1. Fire alarm per point addressable device (e.g., detector or water flow activation, manual pull stations, etc.)
2. Supervisory signal per addressable device (e.g., valve tamper)
3. General System Trouble (alarm panel trouble)
	* + - Loss of AC Power
			- Communication Line Failure (Primary and Backup)
			- Trouble per zone or point addressable device
			- Battery Failure
			1. Restoration of each signal condition identified above shall be transmitted to the LANL Central Station.
			2. The secondary telephone line shall only be utilized for signal transmission in the event that attempts to communicate utilizing the primary line are unsuccessful.
			3. The secondary telephone line shall have the same account code and communication format as the primary line.
			4. Loss of AC power shall be transmitted within 3 hours after the detected failure.
			5. A test signal shall be sent at least once every 24 hours or more often if required to meet the NFPA 72-2013 edition and newer requirements.
			6. For consistency, telephone wire color configuration shall be as follows:

Four-pair wire (preferred method)

|  |  |
| --- | --- |
| To DACT Line #1 | To DACT Line #2 |
| Pair 1 | Pair 2 | Pair 1 | Pair 2 |
| Tip 1 | Ring 1 | Tip 2 | Ring 2 | Tip 1 | Ring 1 | Tip 2 | Ring 2 |
| White/ Blue | Blue/White | White/ Orange | Orange/ White | White/ Blue | Blue/White | White/ Orange | Orange/ White |

* + 1. Manufacturers: Edwards EST3X or NOTIFIER NFS 2-640, no substitutions
	1. led annunciator/switch card
		1. Provide compatible components programmed per the pre-defined disable groups in Part 1 (*Paragraph 1.3.*E) particular to this installation.
		2. Manufacturers: Edwards EST 4X-12SR or NOTIFIER Annunciator Control Module ACM-24AT. no substitutions.
	2. ADDRESSABLE THERMAL DETECTORS
		1. Provide addressable, intelligent, fixed temperature or rate-of-rise thermal detectors that are compatible with and acceptable to the FACP manufacturer. The heat detection design documentation shall state the required performance objective of the system. The fire alarm system designer responsible for the strategy of the structure as a whole shall establish the “type” selection criteria.
			1. The detector shall be rated at 135° F and shall be spaced according to the detector manufacturer’s spacing guidance and the structure’s attributes. For applications requiring other than 135° F, consult the LANL Fire Protection Group. If no guidance from manufacturer is available follow NFPA 72 requirements.
		2. Manufacturers: Edwards EST SIGA-HFD or SIGA-HRD, or NOTIFIER FST-951T or FST-951R, no substitutions.
	3. ADDRESSABLE PHOTOELECTRIC DETECTORS
		1. Provide addressable, analog, intelligent, photoelectric type smoke detectors that are compatible with and acceptable to the FACP manufacturer.
			1. The photoelectric detector shall be rated for ceiling installation at a minimum of 30 ft. (9.1m) centers and be suitable for wall mount applications.
		2. Manufacturers: Edwards EST SIGA-PD or NOTIFIER FSP-951. no substitutions.
	4. DETECTOR MOUNTING BASES
		1. Provide standard bases suitable for mounting on 3-1/2” or 4” octagon box and 4” square box. The base shall contain no electronics and support all detector types. Removal of the detector shall not affect communications with other detectors.
		2. Manufacturers: Edwards EST SIGA-SB4 or NOTIFIER B300-6 Low profile base. no substitutions.
	5. DUCT SMOKE DETECTOR AND HOUSING
		1. Provide addressable photoelectric detectors compatible with and acceptable to the FACP manufacturer and listed for the maximum air flow velocity anticipated.
		2. Provide duct housing assemblies to facilitate mounting an intelligent analog photoelectric detector along with a standard relay or isolator detector mounting base. Provide duct detectors that are suitable for the air velocity and differential pressures measured for each air handling unit. Protect the measuring chamber from damage and insects. Provide an air exhaust tube and an air sampling inlet tube that extends into the duct air stream. Provide drilling templates and gaskets to facilitate locating and mounting the housing.
		3. Where a duct detector is installed in a concealed location, more than 10 ft above the finished floor, or in an arrangement where the detector alarm indicator is not readily visible to responding personnel, the detector shall be provided with a remote alarm indicator. Remote alarm indicator shall be installed in a readily accessible location and shall be clearly labeled to indicate its function.
		4. Provide detector wiring so that detector can be reset at FACP.
		5. Manufacturers: Edwards EST SIGA-SD or NOTIFIER DNR Series. no substitutions.
	6. AUTOMATIC SPRINKLER SYSTEM
		1. Refer to Section 21 1313, *Wet-Pipe Sprinkler Systems*, for pressure switches, flow switches and valve supervisory switches associated with the automatic sprinkler system.
		2. Automatic sprinkler system equipment required to interface with the fire alarm system shall be connected via Control Relays and/or Monitor Modules. Reference Sections 2.11 and 2.12, respectively.
	7. ADDRESSABLE MANUAL PULL STATIONS
		1. Provide addressable double-action, non-coded manual pull stations that are acceptable to the FACP manufacturer and are compatible with the FACP.
		2. The fire alarm station shall be of Lexan or metal construction with an internal toggle switch. Provide a key locked feature. Finish the station in red with white “PULL IN CASE OF FIRE” lettering. The manual station shall be suitable for mounting on 2-1/2” deep 1-gang boxes and 1-1/2” deep 4” square boxes with 1-gang covers.
		3. Provide the appropriate back boxes and mounting plates for flush-mounting or surface mounting (depending on the building construction).
		4. Manufacturers: Edwards EST SIGA 278 or NOTIFIER NBG-12LX. no substitutions.
	8. ADDRESSABLE CONTROL RELAY MODULES
		1. Provide modules acceptable to the FACP manufacturer that are compatible and Listed/Approved with the FACP.
		2. The control relay module shall provide one or two “Form C” dry relay contacts rated accordingly to control external appliances or equipment shutdown. The control relay shall be rated for releasing systems.
		3. Manufacturers: Edwards EST SIGA-CR, SIGA-CRH, SIGA-REL or NOTIFIER FRM-1, or FCM-1-REL, no substitutions.
		4. Provide additional relays with voltage and current ratings as required to perform required output or emergency control function.
	9. addressable monitor modules
		1. Provide modules acceptable to the FACP manufacturer that are compatible and Listed/Approved with the FACP.
		2. Provide intelligent single-input or dual-input modules as required to the addressable analog loop. Each input shall provide a supervised Class B initiating device circuit.

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Edit as needed if project requires fire alarm to meet Class A configuration. Notifier devices can be wired Class A or Class B but EST device will require use of a (SIGA-UM universal module). Work with ES-FP to determine appropriate substitute if needed.

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* + 1. Manufacturers: Edwards EST “SIGA-CT1” single-input or “SIGA-CT2” dual-input, or NOTIFIER “FlashScan Monitor Module FMM-1” or “FDM-1 FlashScan dual monitor module.” no substitutions.
	1. AUDIBLE AND VISUAL COMBINATION NOTIFICATION APPLIANCES
		1. Provide NRTL-listed 24 VDC audio-visual combination-type electronic three-pulse temporal pattern sounder and strobe combination units that are acceptable to the FACP manufacturer and are compatible with the FACP.
		2. Sounder shall include three-pulse temporal pattern generating electronics, audio transducer, and screw terminals housed in a red housing. Acoustical output shall meet requirements of UL 464. The audible signal shall be the “American National Standard Audible Emergency Evacuation Signal” (three-pulse temporal pattern) in accordance with ANSI S3.41, *Audible Emergency Evacuation Signal*.
		3. Strobe signal output and flash rate shall meet UL 1971 and ADAAG requirements. Unit shall have a xenon or LED enclosed in a clear Lexan lens with “FIRE” in white lettering, and shall produce a synchronized strobe flash. Provide strobes with flash output levels as required to meet NFPA 72 visual signal requirements for each space.

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Edit D to match project fire alarm system requirements.

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* + 1. Horn/strobe (H/S) shall mount to a 4” x 2-1/8” deep electrical box with single device cover. Provide weatherproof wall boxes for outdoor mounting.
		2. Manufacturers: EST “Genesis” series, Wheelock “Exceder” series, or System Sensor “P2RL” Series. no substitutions - Unless required for outdoor or explosion proof use.
		3. Voice Alarm Systems shall utilize System Sensor SpectrAlert series or EST Genesis Series appliances.
		4. Provide H/S units listed with the FACP for exterior and special purpose systems.
	1. NOTIFICATION BOOSTER POWER SUPPLIES
		1. Provide notification circuit booster power supplies (as needed) that are acceptable to the FACP manufacturer and are compatible with the FACP.
		2. Manufacturers: Edwards EST “BPS-10A” or NOTIFIER “ACPS-610.” no substitutions.
	2. raceways
		1. Install fire alarm wiring in raceways. Minimum raceway size shall be ¾ inch, unless otherwise approved.
		2. All EMT raceway fittings shall be of the compression type, unless otherwise approved.
		3. One-half (1/2) inch flex conduit is allowed in between addressable modules and controlled and monitored devices (not to exceed 6 feet in length).
		4. All interior fire alarm raceways shall be the color red, unless otherwise approved. All exterior fire alarm raceways should be red if readily available. Otherwise, apply outdoor rated UV resistant “Fire Alarm” labels at 10’ intervals. Note: Raceways do not include fittings, conduit bodies, junction boxes, or device boxes.
		5. Refer to Section 26 0533, *Raceway and Boxes for Electrical Systems*, for raceway systems.
		6. Use PVC, tape-wrapped IMC, or tape-wrapped RMC for underground work. Note: Must be installed per manufacturer recommendations.
		7. Use IMC or RMC for exposed outdoor raceways.
	3. JUNCTION BOXES
		1. Refer to Section 26 0533, *Raceway and Boxes for Electrical Systems*, for junction boxes.
	4. WIRING
		1. Color Code: Use the following color code for the fire alarm system wiring:

|  |  |
| --- | --- |
| Black, Red, or Blue |  120 Vac (ungrounded conductor – match color to color code of the building) |
| White |  120 Vac neutral wire (grounded conductor) |
| Green |  Equipment grounding conductor |
| Brown |  Negative connection for strobe device (if wired separately from horns) |
| Orange |  Positive connection for strobe device (if wired separately from horns) |
| Blue |  Negative connection for horn circuit or horn/strobe combination circuit |
| Yellow |  Positive connection for horn circuit or horn/strobe combination circuit |
| Gray |  Negative conventional alarm initiating device connection |
| Violet |  Positive conventional alarm initiating device connection |
| Black |  Negative circuit connection for duct smoke detector reset, HVAC interlock, and other auxiliary connections |
| Red |  Positive circuit connection for duct smoke detector reset, HVAC interlock, and other auxiliary connections |
| Black/Red Twisted Pair |  Addressable device data loop, evacuation speaker circuit |

Note: Under special circumstances existing wiring may be approved to be used. These wires shall be tested for integrity (Megger tested) and re-phased with the proper color code.

* + 1. Conductors: Provide alarm and supervisory signaling system conductors that meet the requirements of Article 760 in the NEC and are NRTL-listed for the type of service to which they will be subjected. Minimum conductor requirements:
			1. Interior/Dry Locations: Red-jacketed NEC type FPL cable with No. 16 AWG (minimum) twisted-pair conductors for Signaling Line Circuit (SLC)-addressable devices (shielded if required by the FACP manufacturer), and listed per UL1424.
				1. Low voltage binary signal conductors shall be type THHN, or THWN thermoplastic insulation, No. 16 AWG minimum, and solid copper conductor.
				2. Other low voltage conductors shall be type THHN, or THWN thermoplastic insulation, No. 16 AWG (minimum), solid copper conductor.
			2. Exterior/Wet Locations: Red or Black-jacketed NEC type FPL cable with No. 16 AWG (minimum) twisted-pair conductors for SLC-addressable devices (shielded if required by the FACP manufacturer), and listed for WET locations per UL1424. Manufacturers: West Penn Catalog #AQ225 or CSC Catalog #100475, or equivalent approved by LANL Engineering.
				1. Low voltage binary signal conductors shall be THWN-2 thermal plastic insulation, No. 16 AWG minimum, and solid copper conductor.
			3. Power conductors shall be type THHN/THWN-2, No. 12 AWG, thermoplastic insulation, and single solid copper conductor.
			4. Size conductors of the fire alarm systems as recommended by the manufacturer, based on the operating ampacity of the circuit and the permissible resistance and voltage drop characteristics that will allow proper operation of the equipment. Provide conductors selected to provide voltages within the manufacturer specification limits for the most remote fire alarm notification appliance or field device.
	1. TEST EQUIPMENT
		1. Provide any special test equipment manufactured by the fire alarm equipment manufacturer for maintenance, testing, or troubleshooting. NOTE: All test equipment shall be properly calibrated and shall include the calibration certification
	2. SURGE PROTECTION DEVICES (SPD)
		1. Provide a UL 1449 listed 120V surge protective device for the main FACP, each sub-FACP, and each booster power supply that has a 120V supply circuit.
			1. Device shall be capable of absorbing a maximum single pulse of at least 6,500 amperes.
			2. Clamping voltage shall not exceed 330 volts line-to-neutral when tested in accordance with ANSI/IEEE C62.31 category C1/B3.
			3. Manufacturer: EDCO Model “FAS-120AC” or as recommended by the FACP manufacturer.
		2. Provide a UL 497B listed surge protective device for each analog initiating device signaling circuit entering/leaving each building that is monitored by the FACP.
			1. Device shall be capable of absorbing a peak 8x20 microsecond current of 10,000 amperes at least 10 times.
			2. Clamping voltage shall not exceed 30 volts.
			3. Capacitance shall not exceed 50pf.
			4. Provide matching receptacle for plug-in surge protective devices.
			5. Manufacturer: EDCO model “PC642C-030LC” (protects 2 pairs) and “PCB1B” socket, or as recommended by the FACP manufacturer.
		3. Provide a UL 497B-listed surge protective device for each 24-volt initiating device circuit or control circuit entering/leaving each building that is monitored by the FACP.
			1. Device shall be capable of absorbing a peak 8x20 microsecond current of not less than 10,000 amperes at least 10 times.
			2. Clamping voltage shall not exceed 30 volts.
			3. Provide matching receptacle for plug-in surge protective devices.
			4. Manufacturer: EDCO model “PC642C-030” (protects 2 circuits) and “PCB1B” socket, or as recommended by the FACP manufacturer.
		4. Provide a UL 497B listed four-wire surge protective device for each FACP RS‑232 circuit entering/leaving each building monitored by the FACP.
			1. Device shall be capable of absorbing a peak 8x20 microsecond current of 10,000 amperes at least 10 times.
			2. Clamping voltage shall not exceed 20 volts for RS-232 applications.
			3. Provide matching receptacle for plug-in surge protective devices.
			4. Manufacturer: EDCO model “PC642C-020” with “PCB1B” socket, or as recommended by the FACP manufacturer.
		5. Provide a UL 497B listed four-wire surge protective device for each FACP RS‑485 circuit entering/leaving each building monitored by the FACP.
			1. Device shall be capable of absorbing a peak 8x20 microsecond current of 10,000 amperes at least 10 times.
			2. Clamping voltage shall not exceed 8 volts for RS-485 applications.
			3. Line to line and line to ground capacitance shall not exceed 50pf.
			4. Provide matching receptacle for plug-in surge protective devices.
			5. Manufacturer: EDCO model “PC642C-008LC” with “PCB1B” socket, or as recommended by the FACP manufacturer.
		6. Provide a UL 497B listed surge protective device for each 24-volt notification appliance circuit entering/leaving each building that is monitored by the FACP.
			1. Protective device shall have a series resistance not exceeding 0.2 ohms per pair and shall be capable of carrying a continuous current of 5 amperes.
			2. Device shall be capable of absorbing a peak 8/20 microsecond current of 5000 amperes and a 2000-ampere occurrence at least 50 times.
			3. Clamping voltage shall not exceed 43 volts.
			4. Provide matching receptacle for plug-in surge protective devices.
			5. Manufacturer: EDCO model “PHC-043” (protects 2 circuits) and “PCB1B” socket, or recommended by the FACP manufacturer.
		7. Provide a single-point ground bus for each enclosure containing one or more surge protective devices. Manufacturer: EDCO model “TER-BUS” or as recommended by the FACP manufacturer.
	3. 120-VAC transfer switch, Reliance Model Easy/Tran CSR201, NO SUBSTITUTIONS. Transfer switches will be used when alternate power sources (e.g., generators, etc…) are needed during planned or unplanned power outages.
	4. 125-VAC NEMA-5-15R duplex receptacles (for below each FACP/BPS).
1. EXECUTION

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Seismic: If Project Spec includes 26 0548.16, and this Section (i.e., 28 4600) includes requirements associated w/ installation, testing, and inspection of mounting and/or anchorage devices that differ from those in 26 0548.16, then the differing requirements must be included in PART 3 herein. \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* 1. FIELD CONDITIONS
		1. Prior to installation carefully inspect the installed work of other trades, whether pre-existing or part of this project and verify that such work is complete to the point where the installation of the fire alarm system may properly commence.
		2. Notify the LANL Subcontract Technical Representative (STR) if conditions exist, not resulting from work of this project, that prohibit the installation from conforming to applicable codes, regulations, standards, and the original, approved design.
	2. INSTALLATION
		1. General:
			1. Install the fire alarm system in accordance with the NEC, NFPA 72, and this specification.

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Seismic: If the entirety of the FAS is exempt from seismic design then only Sect. 26 0529 in the following subparagraph is applicable.

If some of the components in the FAS are exempt then Sects. 26 0529 & 26 0548.16—or 01 8734—are applicable.

Regarding the applicability of Sect. 260548.16 or 01 8734, see Guide for editing guidance.

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* + - 1. Follow [Section 26 0529, *Hangers and Supports for Electrical Systems*,] [and] [Section 26 0548.16, *Seismic Controls for Electrical Systems]* for anchorage requirements. [The anchorage requirements for the components in Section 01 8734, *Seismic Qualification of Nonstructural Components (IBC)*, shall be in accordance with that Section.].
			2. Verify dimensions in the field. Lay out work in the most direct and expeditious manner to avoid interference.
			3. Coordinate necessary shutdowns of existing systems by notifying the LANL STR a minimum of seven working days before rendering such systems inoperative. Do not render inoperative any system without the prior approval of the LANL STR. The LANL STR will initiate and submit the LANL Utility Outage Request for Fire Protection.
			4. Coordinate fire alarm detectors and associated equipment with existing ceiling or roof materials, lighting, ductwork, conduit, piping, suspended equipment, structural and other building components.
			5. Coordinate installation of fire alarm system with work of other trades. Protect fire alarm equipment with suitable coverings until completion of Project.
			6. Install 120 VAC transfer switch in-line with the dedicated 120 VAC circuit that serves the FACP and/or respective booster power supplies. Coordinate installation of 120VAC transfer switch so that it is at readily accessible location above or adjacent to the FACP and/or booster power supplies. The transfer switch shall be located before the AC surge suppressor
			7. Install a 125 volt NEMA-5-15R duplex receptacle below each FACP/BPS. Circuit specified shall be served by a circuit from a different source panel board (if available) than the panel board providing power to the FACP/BPS.
		1. Device Mounting Heights:
			1. Install manual pull stations with the operating portion (handle to pull, etc.) not less than 42 inches and not more than 48 inches (preferably at 44”) above the finished floor (A.F.F.).
			2. Install wall-mounted combination audible/visual notification appliances and wall-mounted strobe-only appliances shall be mounted such that the entire lens of the visible notification portion is not less than 80 inches and not greater than 96 inches (preferably at 84”) above the finished floor. Where low ceiling heights do not permit wall mounting at a minimum of 80 inches, wall mounted visible appliances shall be mounted within 6 inches of the ceiling, although strobe coverage will be reduced by twice the difference between the 80 inch minimum allowed height and the actual lower mounting height (see NFPA 72). Any deviations from these heights require approval from the LANL AHJ.
			3. Control relays for control of interfaced equipment shall be installed within 3 feet (nominal) of the emergency control function component, unless otherwise note or approved by ES-FP. Where such an installation creates an access, operational/environmental, or safety issue, the control relay(s) shall be installed in a routinely accessible location between 60” and 72” A.F.F as close as practical to the component controlling the emergency control function as approved by ES-FP.
			4. Comply with ADA and ABA [Accessibility Guidelines](https://www.access-board.gov/guidelines-and-standards/buildings-and-sites/about-the-ada-standards/background/ada-aba-accessibility-guidelines-2004) for device mounting heights and locations.

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Seismic: See Guide for editing guidance.

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* + 1. Install flexible connections for [\_\_\_\_\_\_\_\_\_] where shown on drawings.
		2. FACP/BPS Installation
			1. Install FACP/BPS following manufacturer’s written instructions, NFPA 72, and the NEC.
			2. Locate the FACP in the main building lobby or entry vestibule so fire department personnel entering the building can readily access it. Coordinate location of FACP with the LANL Fire Protection Group.
			3. Unless otherwise approved, install FACP/BPS with top of cabinet trim 66 inches above finished floor. Refer to manufacturer’s recommended installation height.
			4. Mount FACP/BPS plumb and rigid without distortion of the box. Mount flush cabinets uniformly flush with wall surfaces.
			5. Install filler plates in unused spaces in FACP.
			6. Train conductors in cabinet gutters neatly in groups; bundle and wrap with cable ties after completion of testing.
			7. Tighten electrical connectors and terminals, including grounding connections, according to the manufacturer’s published torque‑tightening values (typically marked on the equipment). Where manufacturer values cannot be located, refer to NEC (2017) Annex I.
		3. Wiring Installation
			1. Install fire alarm system wiring in conduit raceway.
			2. Do not pull wire or cable until the conduit system is complete between pull points.
			3. Bundle conductors in panels and boxes into groups by service and destination.
			4. Run electronic cable continuous between termination points. No splicing is permitted without prior approval from the LANL AHJ. Where splicing is approved, use terminal strips that are acceptable to the LANL Fire Protection Group. Wire nuts are not approved and shall not be used.
			5. Do not install AC current-carrying conductors in the same raceway with the DC or digital fire alarm detection and signaling conductors.
			6. Minimize the number of T-taps in fire alarm addressable data circuits and adhere to the manufacturer requirements/limitations. Make no T-taps in notification appliance circuits. T-taps shall only be made on device terminals or on terminal strips that are acceptable to the LANL Fire Protection Group. Wire nuts are not approved and shall not be used.
			7. Make allowances in conductor length at panels and other enclosures to permit forming the conductors neatly within the enclosures. Where wiring troughs are not provided with the enclosures, neatly cable and adequately support the wiring.
			8. Ring out and identify power and control conductors before terminal connections are made. Check polarity and phasing and make changes as required before making terminal connections.
			9. Test conductors for continuity and for freedom from shorts or unintentional grounds.
			10. Underground conduit shall be swabbed prior to installing respective conductors.
		4. Junction Box and Conduit Installation: Refer to Section 26 0533, *Raceway and Boxes for Electrical Systems*, requirements.
		5. Install audible/visual or visual only notification appliances in the following locations to obtain an audible signal level that is at least 15 dB above ambient noise levels, but does not exceed 120 dBA at any location or 110 dBA at the minimum hearing distance:
			1. Corridors
			2. Conference rooms
			3. Mechanical equipment rooms
			4. Computer/Server rooms
			5. Enclosed offices where minimum dBA levels may be below minimum requirements
			6. Common areas such as restrooms, kitchens, copy rooms, etc. (strobes only)
			7. In the vicinity of the FACP use a strobe-only device unless approved by LANL Fire Protection Group.
		6. Surge Protective Device Installation
			1. Install a 120V SPD for the main FACP, each sub-FACP, and each booster power supply.
			2. Install an SPD for each initiating device circuit, notification appliance circuit, data, and signaling line circuit entering/leaving each building that is monitored by the FACP.
			3. SPDs shall be installed between 44” and 72” A.F.F. so that they are readily accessible for servicing.
			4. If permitted by the FACP manufacturer, install SPDs in the FACP cabinet.
			5. If the FACP manufacturer does not allow SPDs to be installed within the FACP cabinet, install one or more metal enclosures near the protected fire alarm equipment. Provide separate enclosures for 120V and signal voltage devices, or provide one enclosure with a metal partition to separate the 120V from the signal voltage devices.
			6. Install a single-point ground bar in the enclosure for the SPD. Bond the ground bar to the enclosure and to the power circuit equipment-grounding conductor. Connect each SPD to the ground bar with a separate 12 AWG solid, green-insulated ground wire. Keep ground wires as short and straight as possible.
			7. Install SPDs in accordance with manufacturer’s instructions, keeping leads and ground conductors as short and straight as possible.
		7. Identification
			1. Follow Section 26 0553, *Identification for Electrical Systems*, for all system components.

Note: For field labelling purposes, FCP is the required acronym for FACPs.

* + - 1. Label each conductor at each terminal point. Use wire markers specified in Section 26 0553, *Identification for Electrical Systems*. On wire markers indicate the type of fire alarm circuit. SLC circuits shall be identified by the loop number indicated on the riser diagram (e.g. SLC-1). NAC circuits shall be identified by the source and circuit number indicated on the riser diagram (e.g. BPS1-1, FACP1-2). Ancillary system circuits (e.g. BAS, HVAC) shall be identified by component ID of the system being monitored/controlled and the prefix FA (e.g. FA BAS-PNL-001, FA HVA-001)
			2. Label fire alarm junction boxes and condulets with 2-1/4” x 1/2” (minimum size) pressure sensitive vinyl markers having “FIRE ALARM” in red letters on a white background.
			3. Where terminal points are located in fire alarm junction boxes, label boxes with 2-1/4” x 1/2” (minimum size) pressure sensitive vinyl markers having “FIRE ALARM – TERMINAL BLOCK” in red letters on a white background.
			4. Label all devices with address/zone information as shown on the drawings. Label all notification appliances with candela values as shown on the drawings. Use self-adhesive vinyl labels with 3/4 inch (minimum) lettering easily visible from floor level.
			5. Where a circuit breaker is the disconnecting means for FACP normal AC power, provide a breaker locking device per NFPA 72 Section 10.6.5.4. Use the appropriate type of lock for the breaker.

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Painting is at the direction of the FOD (based on aesthetics, environmental conditions, etc.) If not required by FOD, delete the following article and any other references to painting in this document.

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* 1. PAINTING
		1. Exposed Surfaces: Paint/patch and clean exposed walls that were affected by the installation/demolition, with an approved matching paint.
			1. Refinishing: Thoroughly clean and touch up shop-primed or finish-painted surfaces including walls, damaged in handling or installation with an approved matching paint.
	2. EQUIPMENT INSTALLATION
		1. Install devices or equipment not specifically covered by these specifications in accordance with manufacturer's instructions.
	3. CONNECTION TO LANL CENTRAL STATION
		1. Install 6 x 6 x 4 electrical enclosure adjacent to the FACP with a conduit to the appropriate factory knockout.
		2. Install a 1” inch conduit with measuring pull tape from the 6 x 6 x 4 electrical enclosure to the backboard located in the main telecommunications room.
		3. Install three (3) red GFE Category 5e telecommunications cables in the conduit.
		4. LANL will terminate two of the three telecommunications cables on two 8-pin RJ-31X telephone outlet jacks in a 2-port outlet that is mounted inside the 6 x 6 x 4 enclosure. LANL will label one jack as “primary,” and the other as “secondary.” The third cable is “spare”.
		5. LANL will terminate the telecommunications cable pairs to two separate lines (numbers) at the telecommunications room, selecting dedicated numbers or low-usage (lobby, conference room, etc.), voice-grade, loop-start DTMF numbers that provide timed-release disconnect.
		6. LANL will connect the “primary” and “secondary” number ports on the DACT to the corresponding telephone outlet jacks.
		7. Route the third telecommunications cable to the nearest open telecommunications switch in the building but do not terminate.  (It will be used for a future Ethernet dialer located adjacent to the FACP).  This telephone switch location may differ from the telecommunications room to which the other two cables are routed, in which case route in separate conduit (versus paragraph C above). Coordinate with the LANL Telecommunications Group to ensure proper location.

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Delete article 3.6 if a BAS is not part of the project scope of work.

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* 1. CONNECTION TO FACILITY BUILDING AUTOMATION SYSTEMS (BAS)
		1. Install required binary signal conductors between control relay and the fire alarm shutdown/notification terminals (safety circuit) located in the BAS panel.
	2. CLEANING
		1. Blow out junction boxes and fire alarm equipment not hermetically sealed with clear, dry, oil-free (15 psig maximum) air to remove dust and dirt prior to energizing.
	3. FIELD QUALITY CONTROL
		1. Provide the services of a qualified factory trained and certified technician for the FACP installed on this project. The factory technician shall assure the completeness and correctness of the installation by performing the following:
			1. Prepare as-built documentation of FACP indicating location of components, interconnection of components, and connections to alarm initiating, indicating and auxiliary circuits.
			2. Field-verify and mark as-built drawings of fire alarm layout, conduit and wiring plans, and point-to-point field-wiring diagrams.
			3. Verify correct labeling of fire alarm system conductors.
			4. Verify that conductor sizes are adequate for each alarm initiating, notification, and auxiliary circuit.
			5. Prepare as-built battery load calculations. Battery shall be sized to include the additional 50% safety margin above calculated system demand.
			6. Measure and adjust audible alarm signal in all spaces to comply with audible signaling requirements and design drawings.
			7. Test all devices for proper supervision and alarm operation.
			8. Test all interlocks with HVAC, elevator systems, etc… for proper operation in normal and by-pass modes.
			9. Perform pre-final acceptance inspections and tests of the fire alarm system modifications.
			10. Prepare final acceptance test plan/report when required (*see Paragraph 1.5.C.2*).
		2. After the pre-final test, provide a report detailing the pre-final acceptance inspections and test of the fire alarm system to the LANL Project Leader indicating the status of the fire alarm system and any corrective actions required before the acceptance tests.
		3. Submit a detailed test plan for the final acceptance test.
			1. Submit the final approved test plan (when required, see *Paragraph 1.5.C.2*) not less than 10 working days before the planned final acceptance date.
			2. Follow test methods outlined in NFPA 72.
		4. Submit FACP program at least 10 working days prior to final acceptance test. Larger projects may require program submittal to be provided at a timeline defined by ES-FP.
		5. Submit final drawings, calculations, and manufacturer’s data at least ten working days prior to final acceptance test. Larger projects may require program submittal to be provided at a timeline defined by ES-FP.
		6. Coordinate date of final acceptance test with installer, LANL Project Leader, LANL Fire Protection Group representative, and sub tier Subcontractors for HVAC, sprinklers, and elevator controls. Make corrective actions before final acceptance test date.
	4. FINAL ACCEPTANCE TEST
		1. Notify lANL STR at a minimum of 10 working days in advance of final acceptance tests. The more advance notice will help minimize scheduling conflicts and delays. Perform final acceptance tests in the presence of authorized representatives of LANL’s STR, Fire Protection Division, and Facility Operations Director (FOD).
		2. Before the final acceptance test begins, present a preliminary copy of the Record of Completion to the authorized representative of the LANL Fire Protection Group.
			1. Preliminary Record of Completion shall be of the form required by NFPA 72.
			2. Indicate on the preliminary Record of Completion that the pre-final inspections and tests have been performed and all corrective actions have been completed.
			3. The final acceptance test shall not proceed before the Record of Completion is presented to the authorized representative of the LANL Fire Protection Group.
		3. Perform final acceptance tests on the completed fire alarm system:
			1. Follow the approved test plan and comply with NFPA 72 requirements.
			2. Test FACP and the connected initiating, alarm, and auxiliary devices.
			3. LANL will perform 24-hour discharge test on the FACP and booster power supply batteries.
			4. LANL Fire Protection will perform tests on connections made by other LANL groups.
			5. LANL Telecommunications Group will perform the acceptance test of the telephone lines from the modular plug connectors, to verify telephone line continuity and switch features before turning lines over to the LANL Fire Protection Group.
		4. At the final acceptance test, have marked-up shop drawings and point-to-point wiring diagrams available for review and verification. Final acceptance test will not proceed without these as-built documents. If LANL verification of the as-built documents reveals errors, re-verify the complete fire alarm raceway and wiring system in the presence of a LANL Fire Protection Group representative.
		5. Correct deficiencies discovered in the final acceptance test and re-test fire alarm system until satisfactory test results are obtained.
		6. Upon successful completion of acceptance tests, submit final “Record of Completion” As-built drawings and “Inspection and Testing Form”, etc…, as required per Appendix A and “recommended spare parts” list (*ref. Paragraph 1.5.B.7.B.ii)*.
	5. SYSTEM IDENTIFICATION PLACARD
		1. Furnish and install a permanently mounted placard in or adjacent to the fire alarm control cabinet that is capable of withstanding the environmental conditions at the panel.
		2. Provide the following information typewritten or engraved on the placard:
			1. Name, address and telephone number of installing Subcontractor.
			2. Reference to the standards, including date of issue to which the system conforms (e.g. NFPA 72 20XX edition and NFPA 70, 20XX edition).
			3. Circuit number of power supply to FACP and location of the electrical panel board.
			4. Location of fire alarm system Operating and Maintenance Instructions if they are not stored in the FACP cabinet.
			5. Location of fire alarm system as-built documents.

END OF SECTION

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Do not delete the following reference information.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

THE FOLLOWING STATEMENT IS FOR LANL USE ONLY

This project specification section is based on LANL Master Specification Section 28 4600 Rev. 2, dated May 22, 2019.

Each deliverable shall be provided in a pdf format except where noted.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Deliverable | Spec Ref. | Design Maturity/Review | 4Ten working days(min) before pre-test | Before requesting final test | Upon Completion of Testing |
| 160% | 290% | 3100% |
| Certifications | 1.5.A | X |  |  |  |  |  |
| Design Submittal Drawings including:CalculationsFloor PlansWiring DiagramsSystem Input/Output Matrix | 1.5.B | XXXX | XXXX | XXXX | X |  | XXXX |
| Catalog Data | 1.5.B.3 | X |  |  |  |  | X |
| Installation Instructions | 1.5.B.4 |  |  | X |  |  | X |
| Materials and Parts List | 1.5.B.5 | X | X | X |  |  | X |
| 5FACP Program | 1.5.B.6 |  |  | X | X |  | X |
| Central Station Reports | 1.5.B.6.c |  |  |  |  |  |  |
| Operations & Maintenance Manual | 1.5.B.7 |  |  | X |  |  | X |
| Test Reports:Pre-final Test Report(when requested)Test plan/Test Report for Final Test (when requested)Record of Completion(when requested) | 1.5.C |  |  |  |  | XX X | X |
| Project Record Documents (6as-builts of all submitted items) | 1.5.D |  |  |  |  | X | X |
| Warranties | 1.5.E |  |  |  |  |  | X |

1. Shall be 2 full size drawings unless determined 11 x 17 is acceptable during design scoping.

2. Typically 11 x 17 drawings will suffice unless full size required by ES-FP reviewers.

3. 11 x 17 drawings will suffice.

4. Larger projects may require additional review time.
5. Shall be provided in the format required per panel type.

6. One full size set shall be delivered to the STR.