DESIGN GUIDELINES
AND
TECHNICAL STANDARDS

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DIVISION 28 – SECURITY

SECTION 28 0000 – SECURITY DESIGN CRITERIA

1. General: This section outlines general requirements for security systems.

2. Design Considerations:

   a. Raceways:

      i. Security conductors are to be routed in blue metal raceways.

      ii. Minimum raceway size is 3/4-inch.

      iii. Follow other raceway requirements as shown in Section 26 0533 Raceways and Boxes for Electrical Systems.

   b. Bonding and Grounding:

      i. Security system components are to be bonded to the building grounding system by:

         1. Equipment grounding conductor used in Class I systems.

         2. Raceway bonding bushings properly bonded to wire ways, cable trays, and pull boxes.

         3. See Class III power supply installation instructions for proper power supply grounding.

   c. Lightning Protection:

      i. Every underground and overhead security conductor which enter each facility from the outdoors requires lighting arrestors or optical isolation to protect the system from stray voltages and surges caused by the build up or contact with static discharge.

   d. Utility Power Outage Protection:

      i. Security device power supplies, monitoring equipment, recording equipment, and other components critical to the physical security and safety of each facility shall be supported by an uninterruptable power supply.

      ii. Uninterruptable power supplies are to utilize batteries and are to be powered from the building’s essential power system where available.

      iii. Battery support duration will be determined by the NU Physical Security Dept.
iv. Door security device power supplies are to have internal back-up batteries. Refer to Section 28 1000 Access Control for power supply requirements.

END OF SECTION
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SECTION 28 1000 – ACCESS CONTROL

1. General: This section outlines general requirements for security systems. Specific requirements are to be reviewed with the Northwestern Project Manager during the design phases of the project.

2. Design Considerations:
   a. Access control entry hardware, monitoring and control shall be selected by the NU Physical Security Department.
   b. The access control system will:
      i. Unlock electrified door locks upon authentication of submitted credential to local card readers.
      ii. Monitor door alarms and remotely unlock.
      iii. Lock doors on an automated schedule from central system.
      iv. Unlock doors as required by code via fire alarm relays.
      v. Annunciate intrusion alarms from remote sensors.
      vi. Unlock individual doors manually via operator interface.
      vii. Manual unlocking shall be logged in system audit trail.
   c. Electrified mortise locks are the preferred locking mechanisms. Door hardware is to be coordinated with Project Architect and NU Physical Security Director.

3. Equipment
   a. System Controller:
      i. RS2 Technologies model CP-2500 or University approved equal.
   b. Serial Multiplexer:
      i. RS2 Technologies model MUX-8 or University approved equal.
   c. Door Controller:
      i. RS2 Technologies model MR-52 or University approved equal.
      ii. Controller shall accommodate a minimum of two card readers and associated inputs/outputs.
d. Proximity Card Readers:
   i. Evanston Campus:
      1. HID RP40 model 6125BKN0410 (black) or 6125BGN0410 (grey) for wall mount applications, 42”AFF.
      2. HID RP15 model 6145AKN0410 (black) or 6145AGN0410 (grey) for mullion mount applications, 42” AFF.
   ii. Chicago Campus:
      1. HID RP40 model 6125BKD0410 (black) or 6125BDG0410 (grey) for wall mount applications, 42”AFF.
      2. HID RP15 model 6145AKD0410 (black) or 6145AGD0410 (grey) for mullion mount applications, 42” AFF.
   iii. Frequency: 13.56MHz
   iv. Green and red LED indicator to signal acceptance or rejection of card.
   v. Outdoor readers shall be of weatherproof construction.

e. Door Contacts:
   i. Door contact switches shall be concealed in the door or frame.
   ii. Gap: 3/8”.
   iii. Configuration: Normally Closed.
   iv. Manufacturers: GE, Honeywell or University approved equal.

f. Request to Exit Motion Sensors:
   i. Detection Technology: Infrared.
   ii. Detection Pattern: 35 degree narrow cone.
   iii. Power requirements: 12-24VDC.
   iv. Mounting: Ceiling.

g. Power Supplies:
   i. General:
      1. Provide Battery backup for all power supplies. Coordinate run-time with University requirements for the facility.
2. Provide alarm terminals for:
   a. Loss of power.
   b. Tamper.
3. Input voltage: 120-240VAC with input fusing.
4. Output voltage: see below. Provide output fusing for each individual circuit.
5. New facilities are to be 24VDC.
6. Power supply shall be mounted in a locking metal cabinet.

ii. 13.8VDC Applications:
   1. Manufacturer: Millennium Group.
   3. Output Amperes: 5A.
   4. Battery Backup: (2) 8AH, 6VDC.

iii. 12VDC and 24VDC Applications:
   1. Manufacturer: Alarm-SAF.
   3. Output Amperes: 10A.
   4. Battery Backup: (2) 17AH, 12VDC.

h. Conductors:
   i. All conductors shall be shielded.
   ii. Minimum conductor size for field assembled cables is 20 AWG.
   iii. Serial cables are to be RS-485 compliant.
   iv. All conductors shall be routed in metallic raceways when installed indoors.
   v. Verify outdoor requirements with NU Physical Security Dept.

i. Rough-In Diagrams: The following diagrams are for information and reference only. Specific requirements shall be reviewed with the Northwestern Project Manager.
Typical Access Control Rough-In Diagram

- The maximum cabling distance from the SCU to the last DCD is 5000 feet.
- Power supplies are to be separated by floor with a maximum of 45 DCD's per power supply.
- All wire to be protected in minimum ¾" conduit – blue in color to identify low voltage.

12VDC and 13VDC Systems Diagram
24VDC System Diagram

- Power supplies are to be separated by floor and wing with a maximum of 8 doors per supply
- All wire to be protected in minimum ¾” conduit – blue in color to identify low voltage

END OF SECTION
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DIVISION 28 – SECURITY

SECTION 28 3113 – FIRE DETECTION AND ALARM SYSTEMS

1. General:
   a. This section outlines general requirements for fire detection and alarm systems.
   b. Specific requirements are to be reviewed with the Northwestern Project Manager during the design phases of the project.
   c. Review the Life safety Systems Checklist in the Appendix. Copies are available from the Northwestern Project Manager.

2. Design Considerations:
   a. General:
      i. Fire alarm systems shall provide full and complete coverage per NFPA and include mass notification with a connection to the NUPD system.
      ii. Total (complete) coverage shall be provided per NFPA 72 for R2 occupancies with more than eleven units or more than 3 stories. Provide infrastructure for connecting the mass notification system to the NUPD system.
   b. City of Chicago Guidance:
      i. Most fire alarm requirements are contained within two separate sections of Group 9, Chapter 15-16 of the City of Chicago Building Code. In addition, careful research in other chapters pertaining to occupancy is required to identify special fire alarm needs.
         1. For example, dormitory smoke detectors are covered in Group 3, Chapter 13-64.
      ii. On a general basis, two distinct types of fire alarm system requirements exist: Class I and Class II and equipment must be City of Chicago approved for use in the alarm system class being installed. Review and approval of fire alarm plans usually includes both the Fire Prevention Bureau and Electrical Inspection Bureau.
      iii. In the Building Code, references to NFPA fire alarm and detection standards covers a range of years from 1984 to 1993 requiring careful coordination in the specifications. (Note: the example specification needs considerable revision for use on a City of Chicago project.)
      iv. A number of common wiring and device connection means permitted by NFPA standards are not allowed in Chicago.
1. For example, “T-tapping” of intelligent (addressable) fire alarm initiating circuits is not permitted.

   v. And there are special fire resistance requirements for initiating and signaling circuit risers.

   vi. There are other unique requirements that may not be specifically contained in the Building Code but are encountered in the review process.

   vii. A preliminary meeting is strongly recommended with the Fire Prevention Bureau on projects.

   c. Sections 26 0000, 26 1000, 26 0519, 26 0533 and 26 0553 of these standards also contain related design requirements which shall be incorporated or referenced in the design and specifications for the fire detection and alarm system.

3. Contractor Requirements: The following requirements shall be reviewed with the Northwestern Project Manager during the design phases of the project and incorporated into the Construction Documents.

   a. The fire detection and alarm system (including the conduit) shall be a separate bid item and not part of the general electrical contract for typical FMO projects.

   b. The contractor responsible for installing the conduit, wiring and devices shall have completed at least five similar fire alarm projects.

   c. Training for University technicians must consist of more than a description of the equipment and its operation. Tuition for two attendees at manufacturer sponsored and taught service schools shall be included in the contract.

   d. Installer system warranty is to include complete maintenance and testing for 2 year after completion of project.

   e. Provide a system recertification if there is an emergency system repair during the 2 year warranty.

   f. Provide free software upgrade if it is available within 6 months of the acceptance test.

4. Spare Capacity:

   a. The fire alarm control panel, and its back box enclosure, shall accommodate a minimum of 25 percent additional zones for hardwire and 25 percent additional initiating points for addressable systems.

   b. Initiating circuits and signaling circuits to be designed with 25 percent spare capacity. Any signaling circuits using speakers and/or voice alert shall be designed with 25 percent spare capacity.
c. For voice alert/speaker systems, speakers shall be designed with a tap setting not to exceed 2 watts at any single speaker. In calculating spare circuit capacity, all speakers shall be assumed being at their highest available power setting except that 4 watts shall be the maximum required at any speaker in this calculation.

5. Equipment:

a. Northwestern University has standardized on Siemens (Pyrotronics), Notifier, and Symplex equipment throughout the campuses. Moderate sized and larger projects shall use intelligent technology. Small projects may use System 3 technology with review and approval by the NU Project Manager. Systems shall be addressable with voice notification.

b. Devices shall be provided with alarm reconfirmation features. Devices shall be combination heat and smoke detectors. Devices with voice notification shall say “alert”.

c. Fire alarm control panels shall be located in a secure location having a minimum 1 hour fire resistance rated enclosure for any building. A 2 hour fire resistance rated enclosure is required for major facilities having command centers or voice alert. Rooms shall have clean conditioned air with a temperature range of 50 to 80 degrees F and without wide fluctuations in humidity. Floor space and wall space shall provide room to install and maintain all systems and equipment located within. At least three feet of clear space shall be provided in front of all cabinets.

d. Fire alarm raceway riser shall be routed in a 2 hour rated shaft.

e. Fire alarm control panels and remote control modules shall not exceed 6 feet above finished floor to the top of the cabinet. Annunciators shall not exceed 5.5 feet above finished floor to the top of the cabinet. This is to assure that messages and controls can be readily accessed.

f. Voice alerting systems shall have a digitally synthesized recording (no tape drives) and messages shall use female voices. The system shall use the University’s standard message and it must be reviewed and approved by the University before recording. Finished voice messages shall be installed and tested prior to building occupancy and final acceptance testing of the system.

g. System printers shall be full 80 column impact printers provided with a stand and paper catch tray. After final acceptance testing of the system, the printer shall be provided with a new ribbon and at least 1,000 sheets of continuous feed paper.

h. Duct type smoke detector should be limited to the return air side of fans and on supply fans downstream of all filtering and conditioning equipment. These detectors shall not cause a building wide fire alarm signal but will cause a trouble supervisory signal on the fire alarm system. Means shall be provided for bypassing these signals when the fan system is being operated in the smoke control mode.
i. Provide a covered weatherproof box above the fire department Siamese connection for future audible device next to strobe. The strobe shall be red and continue to flash until the system is reset.

j. The fire alarm control panel will be connected by the University to the campus wide central supervisory system. Requirements for this connection can be obtained from Facilities Management Operations (FMO).

k. Door frame mounted combination smoke detectors and door holders are not permitted in University buildings. Door frame mounted holders require special University approval prior to their use.

l. Provide a minimum of two sets of keys to equipment locks and two sets of special tools to access flow switches and tamper switches. These shall be turned over to the Supervising Electrician during final acceptance testing.

m. Status lights shall be provided on fire alarm control panels to identify the smoke control zone operation and the elevator recall. Other special functions shall also have status lights.

n. Where voice alerting is used, provide a minimum of one back-up amplifier that can be switched to take the place of any three primary amplifiers without rewiring. Additional back-up amplifiers shall be provided on the ratio of one for each three primary amplifiers.

o. Provide fault separation modules in large and complex systems to limit the number of devices affected.

6. Design Considerations:


b. Fire Command Center:
   
   i. Evanston Campus: An Evanston area phone shall be provided in each fire command center.

   ii. Chicago Campus: Specific requirements are to be reviewed with the NU Manager during the design phases of the project.

c. Zone smoke door closure by smoke control zones and/or by floor. Stairway door closure and unlocking shall take place throughout the entire building upon fire alarm signal.

d. Each laboratory suite/room over 500 square feet shall be provided with at least one audio/visual alerting device and manual pull station. A visual alerting device shall be installed in all public washrooms.

e. Electric powered magnetic door holders shall be 24 volt dc supplied from the fire alarm system.
f. Wire nuts are not acceptable for joining wires. Either crimp connections or wire terminal strips shall be used to join wires. Wire terminal strips shall be permanently mounted inside junction boxes with wires neatly bundled and arranged. Junction box cover is to be labeled “splice”.

g. Fire Alarm Devices:

   i. Ceiling mounted speakers and strobes are preferred.

   ii. Smoke detectors shall be installed at the top of each stairway and elevator shaft.

   iii. Smoke detector(s) shall be installed in the room housing the main and auxiliary fire alarm control panels, elevator machine room, telephone rooms, main electrical switch gear room and computer rooms over 500 square feet in area.

   iv. Smoke detectors installed for elevator recall and control will also activate the building and/or zone alarm signals.

   v. Fixed temperature heat detectors will be installed in sheltered outside electrical vaults and emergency generator rooms. Major electrical closets will be provided with rate-of-rise heat detectors.

   vi. Only double action type manual pull stations shall be specified.

   vii. Residential Buildings

      1. Provide hard-wired single station smoke detectors in the rooms.

      2. System connected photoelectric type smoke detectors are preferred in the corridors.

      3. Carbon monoxide (CO) detectors are required within 15 feet of each sleeping room or as required by the authority having jurisdiction.

   viii. Each laboratory suite/room over 500 square feet shall be provided with a manual pull station inside the suite/room at the entrance/exit door. This is to assist in notification of emergencies.

   ix. In non-sprinkled buildings, combination fixed temperature/rate-of-rise heat detectors shall be provided in Janitor’s closets.

h. Color Coding:

   i. Wiring shall be color coded as to function. Color codes shall be continuous from the fire alarm control panel to and through the last device. Initiating loops on addressable systems are an exception to the following requirements.
### Fire Detection and Alarm System

<table>
<thead>
<tr>
<th>Initiating Loop</th>
<th>Positive</th>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoke detectors and duct detectors</td>
<td>Yellow</td>
<td>Brown</td>
</tr>
<tr>
<td>Pull Stations</td>
<td>Yellow</td>
<td>Brown</td>
</tr>
<tr>
<td>Heat Detectors</td>
<td>Yellow</td>
<td>Brown</td>
</tr>
<tr>
<td>Flow Switches</td>
<td>Yellow w/white stripe</td>
<td>Brown w/white stripe</td>
</tr>
<tr>
<td>Tamper Switches and Pressure Indicators</td>
<td>Slate</td>
<td>Violet</td>
</tr>
<tr>
<td>Signaling Loops</td>
<td>Positive</td>
<td>Negative</td>
</tr>
<tr>
<td>24 volt dc Power</td>
<td>Red</td>
<td>Black</td>
</tr>
<tr>
<td>A/V Horns/Strobes</td>
<td>Yellow</td>
<td>Blue</td>
</tr>
<tr>
<td>Door Holders</td>
<td>Orange</td>
<td>Brown</td>
</tr>
</tbody>
</table>

**NOTES:**

- Minimum 16 AWG size; digital communication loops use minimum 18 AWG twisted and shielded low capacitance cable.

- The lighter color shall always be used to indicate the positive wire. Earth ground wires shall always be identified by a green wire with a yellow stripe. These grounds are to be supplied and wire per manufacturer's specifications. (Applies to both tables)

- Tags on wiring shall be of a permanent means and shall be subject to University approval. Stick-on wire tags are not acceptable as a means of permanent marking.

- The address of each initiating device shall be recorded in the fixed, non-removable base as a minimum.

- The audio amplifiers shall be labeled as to each speaker zone and channel being supplied.

- Wiring:

  | 24 DC Auxiliary Power | #14 Stranded |
  | Annunciator          | #18 TSP FPLR |

### Fire Detection and Alarm Systems

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<table>
<thead>
<tr>
<th>System</th>
<th>Wire Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>City Circuit</td>
<td>#14 Stranded</td>
</tr>
<tr>
<td>Door Control</td>
<td>#12 Stranded</td>
</tr>
<tr>
<td>Network RS232</td>
<td>#18 TSP FPLR</td>
</tr>
<tr>
<td>Communication RUI</td>
<td>#18 TSP</td>
</tr>
<tr>
<td>Fire Phone</td>
<td>#18 TSP FPLR</td>
</tr>
<tr>
<td>Audio Riser</td>
<td>#18 TSP FPLR</td>
</tr>
<tr>
<td>Audible</td>
<td>#12 THHN Stranded</td>
</tr>
<tr>
<td>Phone Riser</td>
<td>#18 TSP FPLR</td>
</tr>
<tr>
<td>Remote Test</td>
<td>#14 THHN Stranded</td>
</tr>
<tr>
<td>Remote LED</td>
<td>#14 Stranded</td>
</tr>
<tr>
<td>Addressable Alarm SLC</td>
<td>#18 TSP FPLR</td>
</tr>
<tr>
<td>Relay</td>
<td>#14 Stranded</td>
</tr>
<tr>
<td>Speaker</td>
<td>#18 TSP FPLR</td>
</tr>
<tr>
<td>Visual</td>
<td>#12 THHN Stranded</td>
</tr>
<tr>
<td>Initiating (Non-Addressable)</td>
<td>#14 THHN Stranded</td>
</tr>
</tbody>
</table>
7. Spare Parts:

a. The following spare parts list and quantities shall be used in the specification.

<table>
<thead>
<tr>
<th>Part Description</th>
<th>Required Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Printer Ribbons</td>
<td>4</td>
</tr>
<tr>
<td>Spot Type Smoke Detectors (for each type used)</td>
<td>3% of total units, minimum of 5</td>
</tr>
<tr>
<td>Audio and Visual Devices (for each type used)</td>
<td>3% of total units, minimum of 5</td>
</tr>
<tr>
<td>Spot Type Heat Detectors (for each type and temperature used)</td>
<td>3% of total units, minimum of 5</td>
</tr>
<tr>
<td>Address Modules</td>
<td>3% of total units, minimum of 3</td>
</tr>
<tr>
<td>Magnetic Door Holders</td>
<td>40% of total units, maximum of 5</td>
</tr>
</tbody>
</table>

b. The spare parts shall be turned over to Northwestern Supervising Electrician and receipt acknowledging this shall be required before final payment to contractor.

8. Acceptance Testing and Documentation:

a. NFPA Standard No. 72 provides guidance for conducting acceptance testing and documentation of the results. It is critical that each device be fully tested on a functional basis including the annunciation and operational interface with other building functions. Where the project is phased or partial occupancy and acceptance is made, full testing of the system must still be conducted prior to final acceptance. In this case, a written work plan shall be developed by the installing contractor and the design engineer and accepted by the University to assure complete acceptance testing.

b. Acceptance test records shall include all of the information requested by NFPA Standard No. 72, Figure 7-5.2.2. The contractor shall submit test record forms prior to acceptance testing for review and comment by the University. Deficient or lacking information shall be attached to the contractor's forms. Preliminary test record submission shall be made for systems installed or tested in phases. Final records shall be provided at the completion of testing.

c. As-built drawings shall be provided before acceptance of the work and final payment. A reproducible set and four (4) copies are required. Submit a CD ROM copy of all CAD files in addition to the drawings. File format shall be suitable for use with AutoCad. Confirm the revision requirements with the Northwestern University Project Manager.
d. Addition of devices or changes in layout need to be updated on SCADA in EV and FACP software Chicago. An internal review shall be complete by NU before submitting to the City of Evanston.

e. A parts cabinet with a minimum of 10 percent attic stock is required to be kept on-site in the FACP room.

f. The FACP room shall have the following document containers provided by the fire alarm system vendor:

   i. Fire alarm as-built prints and pertinent information.

   ii. Generator as-built prints and pertinent information.

   iii. Normal power as-built prints and pertinent information.

   iv. Inspection certificates, service work tickets, etc. This box shall have a recordable device for updates and program changes.

END OF SECTION
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