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This mandatory functional series document is available online at <http://engstandards.lanl.gov>. It derives from P342, Engineering Standards, which is issued as part of the Conduct of Engineering program implementation at the Laboratory.

The general requirements in ESM Chapter 1 Section Z10 also apply to this chapter’s subject.

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**RECORD OF REVISION**

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0	1/26/2011	Initial issue. Material formerly in Chapter 9 with minor revisions.	Leonard J. Valerio, <i>NIE-1</i>	Larry Goen, <i>CENG-OFF</i>
1	2/12/2015	Allowing EMT in some circumstances (4.G.5.a), labeling changed (4.J.1)	Adrian Trujillo <i>NIE-ESS</i>	Mel Burnett, <i>ES-DO</i>

**PLEASE CONTACT THE CURRENT ESM PTS PROGRAM OWNER**  
 for upkeep, interpretation, and variance issues

<b>Chapter 18</b>	<a href="#">Secure Communications POC/Committee</a> Use <a href="mailto:pts@lanl.gov">pts@lanl.gov</a> to reach primary and alternate POCs.
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## 1.0 PURPOSE

To establish the minimum requirements and guidance for protected transmission systems (PTSs), communication security (COMSEC), and TEMPEST<sup>1</sup>.

## 2.0 TEMPEST

1. Secure communications systems shall comply with DOE M 205.1-3<sup>2</sup>.
2. Data processing, amplifying, telecommunications, and other systems that emit electromagnetic emanations, and communications lines to remote interrogation points used to process classified data processing information, shall be protected against compromise of such data in accordance with DOE M 205.1-3.
3. Electric power distribution systems shall be filtered to reduce emanation of detectable electromagnetic signals to acceptable levels as directed by the cognizant DOE telecommunications and security personnel. Installations shall comply with DOE M 205.1-3. This may be used as a notice for electricians to be aware that there are other systems that require separation from their systems.
4. Sites selected for radio repeater stations shall comply with DOE M 205.1-3. Approval for a radio repeater station shall be obtained from DOE Headquarters, Office of Computer Services and Telecommunications Management.
5. Antennas or reflectors, transmission lines, and other equipment to be mounted on the antenna structures, and the location, number, height, arrangement, and orientation of antenna structures shall comply with DOE M 205.1-3.

## 3.0 COMSEC -- AUTOMATED INFORMATION SYSTEMS AND OTHER CLASSIFIED SYSTEMS

1. Systems that require protection include, but are not limited to:
  - a. Mainframe classified information systems, word processors, microprocessors, personal computers, programmable controllers, automated office support systems, memory typewriters, and other stand-alone or special systems that process, store, transfer, or provide access to classified information, including those classified information systems that also process store, transfer, or provide concurrent access to both classified and unclassified information.
  - b. Special purpose computers that perform classified functions and/or contain classified data, such as numerically controlled machines, smart switches, single-task preprogrammed controllers, programmable facsimile devices, automated testers, and digital-to-analog digital converters.
  - c. Networks and pathways wherein classified information is processed, stored, transferred, or accessed in one or more components of the network.

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<sup>1</sup> TEMPEST is a nationally mandated program that studies unintentional compromising emanations from information systems, communications, and electrical pathways. The LANL TEMPEST Program Coordinator recommends and implements countermeasures to mitigate and minimize the electromagnetic emanation phenomena referencing DOE directives and guidance from the DOE-Certified TEMPEST Technical Authority (CTTA) at DOE Headquarters (who also approves such recommendations).

<sup>2</sup> The use of this "For Official Use Only" document and the PTS Master Plan will be facilitated by the LANL PTS Site Coordinator.

2. Secure communications systems shall comply with DOE requirements.
3. A classified AIS facility shall be located in a security area to provide adequate physical protection. It shall be secured to a level commensurate with the most highly classified material handled by the system. It shall be securely locked and alarmed when no authorized personnel are in attendance.
4. AIS, telecommunications, alarm, and AIS centers and radio repeater stations shall be housed in fire-resistant structures and located outside areas subject to explosion, fire, flood, chemical fumes, excessive dust, vibration, dampness, high noise levels, and high electrical interference. Protective measures shall be implemented in all instances where these facilities cannot be located outside such areas.
5. AIS centers and remote interrogation points used for classified information shall be established as limited areas or be located within larger limited areas such that access is controlled will be as required by DOE.
6. When contained within a larger limited area, AIS centers and remote interrogation points used to process classified information shall have separate access controls and barriers to restrict access to classified information to those persons who require it in the performance of official duties and with the need-to-know.
7. AIS centers shall be centralized and consolidated to maximize the range of electrical and communication systems coverage, reduce on-site distribution service cable and duct lengths, maximize the efficiency and effectiveness of physical protection systems and minimize operation and maintenance costs.
8. Essential equipment shall be connected to un-interruptible power supply or to emergency power. Design shall be coordinated with the equipment system specialists and DOE security personnel. Where continuity of service is required for critical cord-connected equipment, twist-lock-type connectors shall be used.
9. Only NSA-approved cryptographic devices or protected transmission systems shall be used to protect classified communication lines that pass outside the security area of an AIS system or facility. The specific security area of a facility will be defined in the AIS protection plan.
10. Each communications link that leaves an AIS facility shall be protected commensurate with the most highly classified material that it carries and in accordance with DOE. If all communications links are not protected at the highest level of material carried by any one of them, other security measures shall be installed to preclude transmission of classified material over unprotected links.
11. Data processing, amplifying, telecommunications, and other systems that emit electromagnetic emanations, and communications lines to remote interrogation points used to process classified data processing information, shall be protected against compromise of such data in accordance with DOE.
12. Measures shall be implemented on all new AIS equipment that processes classified material to prevent compromising emanations from such equipment and systems from being exploitable beyond the limits of effective physical control.
13. One or more of the following first two methods shall be used in conjunction with the fourth to prevent compromising emanations beyond the limits of the effective physical control zone:
  - a. Shielded enclosures. This may be a shielded room within which the equipment is contained or just an enclosure around the emanating equipment.
  - b. Equipment design. AIS equipment may be designed or modified to limit the strength of compromising signals to acceptable limits considering the control zone available. Radiation

- limit requirements shall be considered on a cost-effective basis for certain types of AIS equipment when being purchased or leased to process classified information.
- c. Installation Criteria. The installation of AIS equipment and cabling shall comply with DOE M 205.1-3.
  - d. Adequate maintenance service access to maintain all equipment. The minimum aisle space between cabinets or rack-mounted equipment and adjacent walls shall be 3 feet. Additional clearance shall be provided for high-voltage equipment and to allow for equipment change.
14. Consolidate related equipment and operations areas.
  15. Provide adequate fire-resistant wall separations between storage and maintenance areas and equipment and operations areas.
  16. Provide structural, architectural, environmental, mechanical, and electrical features and systems that will mitigate the degree of renovation necessary to accommodate future expansion needs for five years after facilities are occupied.
  17. Operations shall be located in the same or adjoining rooms. Supporting activities (storage, maintenance, power, and environmental control and scheduling, and administrative offices) shall be housed in separate rooms adjacent to the central operations area.
  18. Walls around secure AIS centers shall be constructed of concrete masonry units or other materials that are not easily penetrated.
  19. Centers that are electro-magnetically shielded shall be windowless and without skylights or roof windows; shall have column-free operating areas; and shall have clear ceiling heights of not less than 8 feet. Acoustic treatment shall be installed as required to maintain acceptable internal sound levels.
  20. Telephone circuits shall be used for other telecommunications and alarm services to the maximum extent practicable. If separate conductors are required, they shall be routed through the main telecommunications and signal raceway systems if raceway systems are present. Separate wire-ways and cabinets shall be used only when necessary to meet security, technical, or code requirements or to achieve significant economies.
  21. Cable trays that penetrate security barriers shall provide the same degree of penetration resistance as required by the site-specific security plan for the barrier through which they penetrate. This provision applies when the opening at the point the barrier is penetrated is more than 96 square inches in area and over 6 inches in smallest dimension and is located less than:
    - a. 18 feet above uncontrolled ground, roofs, or ledges.
    - b. 14 feet diagonally or directly opposite windows, fire escapes, roofs, or other openings in uncontrolled buildings.
    - c. 6 feet from uncontrolled openings in the same barrier.
  22. Telephones or public address systems in conference rooms or offices in which classified discussions at the Secret or Top Secret level occur shall comply with DOE O 6430.1A, Section 0110-99.10, *Secure Conference Rooms* and Section 0110-99.11, *Secure Offices* (or successor documents).

## 4.0 PROTECTED TRANSMISSION SYSTEMS

### A. DEFINITIONS<sup>3</sup>

1. CDIN: Classified distributive information network. Any cable, wire, or other approved transmission media used for the clear text transmission of classified information in certain DOE controlled access environments. Excluded is any system used solely for the clear text transmission and reception of intrusion/fire alarms or control signaling.
2. CDIN-1: A type of CDIN used in a Limited Area.
3. CDIN-2: A type of CDIN used in a Property Protection Area.
4. GFE: Government furnished equipment
5. NEC: National Electrical Code (NFPA 70), edition per ESM Ch 7 Section D5000.
6. RED: Designation applied to information systems and associated areas, circuits, components and equipment in which National Security Information (classified) is processed. [BLACK is the designation applied to information systems and associated areas, circuits, components and equipment in which National Security Information is not processed (i.e., unclassified). Encrypted signals are unclassified.]
7. Terminal Connection: A term used at LANL for the point where the user connects to the secure communications utility (personal computer interface). Terminal connections are commonly referred to as “drops.”

### B. GENERAL

1. When classified information processing in the proposed facility is planned/expected, the LANL TEMPEST Program Coordinator (normally same person as PTS Site Coordinator) must be included in all facility pre-construction planning/design activities. TEMPEST or transmission security requirements may exceed the specifications given in this standard.
2. Conform to the requirements of the latest editions of (and amendments to) the TIA wiring standards referenced for unclassified telecommunications systems<sup>4</sup> and any LANL amendments and additional requirements in ESM Chapter 19, the NEC, DOE M 205.1-3 - *Telecommunications Security Manual*, the LANL PTS Master Plan, and this document.
3. Coordinate PTS design requirements with the LANL PTS Site Coordinator and the LANL Telecommunications Group.
4. Before beginning PTS construction obtain approval of the design drawings and the “Protected Transmission Systems CDIN/PTS Security Plan Request for Access to a Secure Communications Utility” from the LANL PTS Site Coordinator.
  - a. The construction Subcontractor shall furnish and install the PTS pathway system.
  - b. LANL will perform a technical inspection of the contractor-installed PTS pathway system.
  - c. LANL will furnish the terminal connection boxes for construction contractor installation.
  - d. LANL will furnish and install the PTS patch panels and terminal connection devices.
  - e. LANL will install PTS cables and connectors then will terminate and test all PTS cables.

<sup>3</sup> Definitions generally from *Telecommunications Security Manual* as adopted for LANL use in the “Los Alamos National Laboratory Protected Transmission System (PTS) Master Plan” dated March 3, 2010.

<sup>4</sup> TIA wiring standards are used because PTS systems are fundamentally telecommunications systems.

5. After construction of the PTS, detailed “as-built” drawings showing outlets, routing of pathways, junction boxes and pull boxes must be submitted to the LANL PTS Site Coordinator prior to activation approval.
6. Include in the project budget sufficient funding for LANL-furnished PTS material, labor, and equipment. Include in the project schedule and budget sufficient time and funding for the inspection of PTS pathways, installation of PTS outlets and electronics, performance testing, and field quality assurance activities by LANL. Obtain a definitive cost estimate and schedule from the LANL Telecommunications Group and the LANL PTS Site Manager.
7. Refer to LANL Master Specification [Section 27](#), 1500.18, *Protected Transmission System Rough-In*, for PTS material and installation requirements.

### C. TOPOLOGY

1. In large facilities (larger than 25,000-sq. ft.) design a system of dedicated secure (RED) telecommunications rooms for terminating PTS entrance pathways, PTS backbone pathways, and PTS horizontal pathways. Provide secure (RED) server rooms that are connected to the RED telecommunications rooms by PTS backbone pathways.
2. In a smaller facilities use the RED server room as the termination point for PTS entrance pathways and PTS horizontal pathways.

### D. RED TELECOMMUNICATIONS ROOMS

1. Design dedicated RED telecommunications room(s) that meet relevant requirements described for unclassified telecommunications rooms plus the following additional requirements:
  - a. Provide RED telecommunications room(s) in addition to the unclassified telecommunications room(s). If possible, locate the RED telecommunications room(s) adjacent to the unclassified telecommunications room(s).
  - b. Locate RED telecommunications room(s) in the secure part(s) of the building.
  - c. Increase the size of the RED telecommunication room(s) to accommodate one or more RED patch panel racks (each a minimum of 29" wide by 34" deep) and to provide not less than the required RED/BLACK separation from BLACK equipment, signal/data lines, power lines, and “fortuitous conductors.” RED/BLACK separation requirements depend upon the PTS transmission media. Obtain RED/BLACK separation requirements from the LANL PTS Site Manager.

### E. RED SERVER EQUIPMENT ROOM(S)

1. Design dedicated, RED server equipment room(s) as required to meet the Users’ programmatic needs. *RED server rooms are often designated as “vault-type rooms” having special security system requirements.*
2. Design RED server room(s) to meet requirements for unclassified telecommunications server rooms plus the following additional requirements:
  - a. Locate RED server room(s) within the secure part(s) of the building.
  - b. Locate RED server rooms adjacent to RED telecommunications rooms (if used).
  - c. Provide not less than the required RED/BLACK separation from BLACK equipment, signal/data lines, power lines, and “fortuitous conductors.” RED/BLACK separation

requirements depend upon the PTS transmission media. Obtain RED/BLACK separation requirements from the LANL PTS Site Manager.

#### F. TERMINAL CONNECTIONS

1. Each PTS terminal connection shall consist of a LANL-furnished surface-mounted box with LANL-furnished and installed fiber-optic cables and connectors.
2. Position each PTS terminal connection at a readily accessible location 42 inches above the floor. *PTS terminal connection should be located at least 30 inches from corner of room to prevent being blocked by furnishings. Visual access prevention must be considered when locating the PTS terminal connection.*

#### G. HORIZONTAL PATHWAYS

1. Design PTS horizontal pathway systems to meet applicable requirements in TIA-569, the NEC, DOE M 205.1-3, the LANL PTS Master Plan, and this Chapter.
2. In Limited Areas provide PTS horizontal pathways as follows:<sup>5</sup>
  - a. Exposed: CDIN-1.
  - b. Above easily accessible ceilings or below an easily accessible floor: CDIN-1. *Note that an unexposed CDIN must receive visual and technical inspections more frequently than an exposed CDIN. The User should evaluate this stream of future costs compared to the aesthetic benefits of concealing the CDIN. Approval for unexposed CDIN must be obtained on a case-by-case basis from the LANL PTS Site Coordinator.*
3. In Property Protection Areas design PTS horizontal pathways as follows: CDIN-2.
4. PTS pathways shall not be installed in the public domain (Uncontrolled Access Areas) at LANL.<sup>6</sup>
5. Physical requirements for CDIN-1 pathways are as follows:
  - a. Use conduits, wire-ways, and boxes made of ferrous material. Use intermediate metal conduit (IMC) with threaded fittings in concealed areas (not visually accessible); EMT or plastic wireway may be used for CDIN -1 where approved by the PTS Site Coordinator.
  - b. Secure covers for boxes with tamper-resistant fasteners. Secure wire-way covers with tamper resistant fasteners.<sup>7</sup> For PTS that is approved for unexposed installation secure covers with tamper resistant fasteners.
  - c. Position pathways with respect to mechanical equipment, ductwork, piping, and fixed architectural finishes so the pathways can be inspectable in perpetuity.
  - d. Maintain a 2-inch RED/BLACK separation throughout the CDIN pathways. Obtain RED/BLACK pathway separation requirements from the LANL PTS Site Coordinator.
6. CDIN-2 pathways must meet CDIN-1 requirements plus all joints, connections, cracks, seams, doors, etc. must be sealed with a properly administered tamper-indicating seal approved by DOE. *Welding or conductive epoxy may also be used at the discretion of the cognizant DOE office.*

<sup>5</sup> Chapter 5 in DOE M 205.1-3

<sup>6</sup> "Los Alamos National Laboratory Protected Transmission System (PTS) Master Plan" dated March 3, 2010.

<sup>7</sup> Tamper-resistant fasteners required by the "Los Alamos National Laboratory Protected Transmission System (PTS) Master Plan" dated March 3, 2010.



7. PTS pathways must pass a comprehensive technical inspection by the LANL PTS Site Coordinator.
8. Use NRTL-listed metal wire-ways to distribute multiple PTS cables from RED patch panel racks to the vicinity of the PTS terminal connections. Wire-way systems shall meet the appropriate CDIN requirements and the following criteria:
  - a. Size raceway based on one cable per terminal connection.<sup>8</sup>
  - b. Cable outside diameter approximately 0.25”.
  - c. Provide for 20% future growth in the number of PTS cables.
  - d. Initial wire-way fill shall not exceed the following values:
    - 41.7% of the wire-way cross-sectional area if there are no current-carrying electrical conductors in the wire-way.<sup>9</sup>
    - 16.7% of the wire-way cross-sectional area if there is any current-carrying electrical conductor in the wire-way.<sup>10</sup>
  - e. Locate PTS wire-ways or conduits 3 inches above ceiling tiles with sufficient space to permit access for installing and maintaining cables and for security inspections. *Careful design and installation coordination with the building structure, HVAC ductwork, sprinkler piping, and luminaries is required to maintain the required access. Develop “plan and profile” type drawings for each PTS wire-way to assure meeting this requirement.*
  - f. Refer to [Section 27](#) 1500.18, *Protected Transmission System Rough-In*, for wire-way material and installation requirements.
9. Provide an individual 1-inch conduit from PTS wire-way to each PTS terminal connection. Design conduit systems to meet the appropriate CDIN requirements. Refer to [Section 27](#), 1500.18, *Protected Transmission System Rough-In*, for conduit material and installation requirements.

## H. BACKBONE AND ENTRANCE PATHWAYS

1. For large buildings provide the following secure backbone and entrance pathways:
  - a. Provide a minimum of two 4-inch CDIN conduits interconnecting secure patch panel racks in the vertically aligned secure telecommunications rooms in a building.<sup>11</sup>
  - b. Provide a minimum of one 4-inch CDIN conduit interconnecting secure equipment racks in multiple secure telecommunications rooms or secure server rooms on a floor.<sup>12</sup>
  - c. Provide an underground duct-bank with a minimum of two 4-inch ducts from the point of connection to the network (telephone manhole or telephone pedestal as directed by LANL

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<sup>8</sup> Typical configuration is called “KVM”; the user’s computer is in the RED server room and is connected via the PTS to a keyboard, video display, and mouse at the terminal connection in the workspace.

<sup>9</sup> NEC Section 800-110(B) removes raceway fill limitations if there are no current-carrying conductors; however, clause 4.5.3 in TIA-569-C sets an absolute maximum wire-way fill ratio of 50%. Limiting the initial fill ratio to 41.7% provides for 20% future growth.

<sup>10</sup> NEC Sections 770.12 and 376.22. Section 376.22 limits wire-way fill to 20%. Limiting the initial fill ratio to 16.7% provides for 20% future growth.

<sup>11</sup> TIA-569 (Rev. A §5.2.2.2)

<sup>12</sup> TIA-569 (Rev. A §7.2.2.2)



- Telecommunications Group) into the entrance secure telecommunications closet.<sup>13</sup>  
Terminate PTS entrance conduits in a 24" x 24" x 12" hinged-cover box.
- d. For small buildings install an underground duct-bank with a minimum of two 4-inch ducts from the point of connection to the network (telephone manhole or telephone pedestal as directed by LANL Telecommunications Group) into secure server equipment room.<sup>14</sup>  
Terminate the conduits in the secure equipment rack.
  - e. Maintain not less than 6 inches separation between PTS entrance conduits and any other utility. Encase conduits for SRD systems in concrete providing not less than 3 inches coverage on all sides. Encase conduits for TSRD systems in concrete providing not less than 8 inches coverage on all sides. Place the top of the duct-bank not less than 3 feet below finished grade.<sup>15</sup> Identify the PTS entrance conduits with red spray paint neatly placed 3-5 ft on centers. Hold point: PTS conduits must be inspected and approved by the PTS Site Coordinator prior to encasing system in concrete. Failure to obtaining PTS Site Coordinator approval of the installation may cause the system from being accredited.
  - f. Use materials and installation methods described in LANL Master Specification Section [26 0533](#), *Raceway and Boxes for Electrical Systems* and Section [33 7119](#), *Electrical Underground Ducts and Manholes*.
  - g. PTS duct-banks must pass a comprehensive visual inspection by the PTS Site Coordinator before being encased in concrete and covered.
  - h. Coordinate requirements with the LANL Telecommunications Group and the PTS Site Coordinator.

## I. CABLES

1. LANL will install one GFE horizontal PTS cable for each terminal connection.
  - a. GFE PTS horizontal cable typically consists of multiple tight-buffered multi-mode fibers; cable outside diameter is approximately 0.25 inches.
  - b. *LANL will complete the connections, terminate, and test the PTS horizontal cables at both ends.*
2. LANL will install GFE backbone PTS cables to interconnect the secure telecommunications rooms.
  - a. CDIN fiber optic backbone cable will be UL listed as type OFNR, tight-buffered fiber-optic cable with a mixture of single-mode and multi-mode fibers. A quality assurance light test must be performed on all CDIN fiber.
  - b. *LANL will make final connections, terminate, and test the PTS backbone cables at both ends.*
3. Cable installers must have BICSI Registered Installer Level 2 or equivalent certification.

## J. IDENTIFICATION

1. Label PTS terminal connection boxes, patch panels, and cabling in accordance with ESM Chapter 19.

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<sup>13</sup> TIA-569C (Rev. A. §9.4.2.2)

<sup>14</sup> Ibid.

<sup>15</sup> Protected Distribution Systems requirements in Ch. 5 of DOE M 205.1-3 are extended to the entrance conduits.

2. Band CDIN raceways with 3/4-inch-wide red plastic tape. Apply banding 2 inches from each wall and floor penetration, termination (e.g., cap or protected outlet box), and at each joint/branch of a change-in-direction (both sides of an elbow, thrice on a tee, etc.). In addition, band runs on 5-ft centers.
3. Identify each PTS pathway and cable in accordance with TIA-606; generate records acceptable to the LANL Telecommunications Group. Use materials and installation methods described in LANL Master Specification [Section 26, 0553, \*Identification for Electrical Systems\*](#).
4. Install GFE clearance labels on 10-foot centers on all PTS conduits, wire-ways, junction boxes and protected outlet boxes. Obtain labels from the LANL PTS Site Coordinator.

## 5.0 REFERENCES

### A. LANL

1. Los Alamos National Laboratory Protected Transmission System (PTS) Master Plan dated March 3, 2010

### B. [DEPARTMENT OF ENERGY](#)

- DOE O 205.1A, Department of Energy Cyber Security Management
- DOE M 205.1-3, Telecommunications Security Manual

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### C. NATIONAL STANDARDS

1. TIA wiring standards 568, 569, and 606