SECTION 27 1500.18

Classified Network Infrastructure Rough-In

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LANL MASTER SPECIFICATION SECTION

Word file at <https://engstandards.lanl.gov>

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| Rev. 3 Summary of Changes: Title was Protected Transmission System Rough-in. Clarified submittals, required standards revised, other minor changes throughout. |

This template 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. This section must also be edited to delete 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 section that are applicable, contact the Engineering Standards Manual (ESM) Secure Communications point of contact ([POC](http://engstandards.lanl.gov/POCs.shtml#secnetworks)). Please contact POC with suggestions for improvement as well.

Section developed for management level (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: Template does not include such verbiage. If appropriate to include it, copy in language in 27 1000, *Structured Cabling*.  
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1. GENERAL
   1. SECTION INCLUDES
      1. Classified Network Infrastructure (CNI) rough-in to serve the secure communications areas in the building as indicated on the drawings.
   2. LANL-FURNISHED EQUIPMENT FOR SUBCONTRACTOR INSTALLATION
      1. Fiber-optic cable required to connect CNI outlets
      2. CNI outlet boxes
      3. Fiber-optic backbone cables
   3. LANL-FURNISHED and installed equipment
      1. CNI outlet/connectors
      2. CNI patch panel racks
      3. Fiber-optic entrance cable
   4. LANL-PERFORMED WORK
      1. Perform a comprehensive visual inspection of all CNI raceways before they are covered. Coordinate inspection with the LANL CNI Site Coordinator.
      2. Terminate CNI cables.
      3. Test terminated CNI cables.
   5. QUALITY ASSURANCE
      1. Comply with the National Electrical Code (NEC) for components and installation.
      2. Provide products that are listed and labeled by a Nationally Recognized Testing Laboratory (NRTL) for the application and environment in which installed.
      3. Conform to the LANL CNI Master Plan.
      4. Qualifications of copper and fiber-optic cable installers:
         1. Category 6A horizontal cables: BICSI Registered Installer Level 2 or equivalent certification plus successful completion of Systimax Installer Training that includes installation and termination of Category 6A cable; experience installing and terminating Category 6A cables on at least two previous projects.
         2. Fiber optic horizontal cables, all backbone cables: BICSI Registered Installer Level 2 or equivalent certification; experience installing backbone and fiber optic cables on at least two previous projects.
         3. Copper and fiber installers shall have Fluke copper and fiber testing certification.
         4. Recognized manufacturers, distributors, and industry certifiers include Corning, Belden, Systimax, and BICSI.
         5. Security clearance requirements:
            1. With approval from LANL CNI Site Coordinator, UNCLEARED personnel may perform the following CNI system work in new buildings: mounting protective outlet boxes (POBs), placing conduit, and pulling fiber cable.
            2. Structure must be placed by NM-EE98J licensed electricians.
            3. UNCLEARED personnel must be accompanied by escorts if work is in a Security Area.
            4. CNI fiber termination and testing will be performed by LANL Q‑CLEARED personnel only.
            5. If the fiber cable is placed by UNCLEARED personnel, additional testing MUST be performed: The fiber must be Optical Time Domain Reflectometer (OTDR)-tested twice, once from each end of the fiber cable, and at each wavelength. Using UNCLEARED installation personnel will result in higher costs to the project for testing.
   6. ACTION Submittals
      1. Submit the following in accordance with project submittal procedures.
         1. Within 30 days after Notice to Proceed, certifications of the qualifications of the fiber-optic cable installers as described in Article 1.4 of this Section to the LANL Telecommunications Group for review and approval before work can commence.
   7. CLOSEOUT Submittals
      1. Provide Fluke LinkWare test results in electronic file format for each cable to the LANL Telecommunications Group for review and acceptance.
      2. At the conclusion of physical work, provide detailed Project recorddocuments (PRDs) showing outlets, routing, and size of raceways, junction boxes, and pull boxes to the LANL Telecommunications subcontract technical representative (STR). The LANL Requesting Organization will then submit the PRDs (along with an Enclosure 2, Classified Network Infrastructure Security Plan) to the LANL CNI POC.
   8. COORDINATION
      1. Verify that the CNI security plan has been approved by the LANL CNI Site Coordinator before beginning work.
      2. Schedule inspections of the CNI raceway system with the LANL Telecommunications Group (NIE-TS) and LANL Building Inspector Vice OSH before covering with building finishes. Coordinate schedule with the LANL CNI Site Coordinator.
      3. Schedule completion of the secure telecommunications (server) rooms to allow no less than 5 working days for the LANL Telecommunications Group to install CNI patch panel racks before the scheduled start of cable installation. Coordinate schedule with the LANL Telecommunications Group.
      4. Request CNI outlet boxes and fiber-optic cable from the LANL Telecommunications Group based on actual count, measurement of conduit and wireway runs and required slack cable. Place order at least 10 working days prior to scheduled start of cable installation.
      5. Schedule installation of surface-mounted CNI outlet boxes and associated surface mounted conduit to start after the completion of application of finishes to walls.
      6. Schedule installation of CNI cabling to start after structural inspection and the completion of application of finishes to walls to minimize potential damage to cables. Cabling is to be installed per manufacturer’s instructions regarding minimum temperature requirements. The project is responsible to meet these requirements
   9. Receiving, Storing and Protecting
      1. Receive, transport, store, and protect, and handle products according to NECA 1 Standard Practices for Good Workmanship in Electrical Construction and NECA/FOA 301.
      2. Transport LANL-furnished material and equipment to the jobsite.
2. PRODUCTS
   1. PRODUCT OPTIONS AND SUBSTITUTIONS
      1. Alternate products may be accepted; follow Section 01 2500, *Substitution Procedures*.
   2. Conduit
      1. Use intermediate metal conduit (IMC) with threaded fittings in concealed areas that are not visually accessible. Use EMT or plastic wireway only where approved by LANL CNI Site Coordinator.
      2. Minimum conduit size: 1 inch
      3. Refer to Section 27 1000, *Structured Cabling*.
   3. WIREWAY
      1. Provide NRTL-listed lay-in wireway, complete with hinged covers, elbows, tees, hangers, and fittings required for a complete system.
      2. NRTL listing shall include use as equipment grounding conductor.
      3. Elbow, tee, and cross fittings shall be fabricated with 45° segments to accommodate bending radii for fiber optic cables.
      4. Supply wireway without knockouts, wing nuts, or clips. Fasten covers securely with screws.
      5. Supply wireway with inside and outside gray polyester powder finish over a phosphate surface preparation.
      6. Manufacturer: Square D “Square-Duct”.
      7. For CNI wireway that is not exposed (above the ceiling or underneath the floor), supply tamper-resistant fasteners for assembling the wireway and for securing covers.
         1. Use button-head “Torx” tamper-resistant cap screws with a solid post in the center.
         2. Use conical “Trident” tamper-resistant nuts, where located on the outside of the wireway.
   4. CNI CABLE
      1. Cable consists of multiple fibers; cable outside diameter is approximately 0.25 inches.
   5. CNI OUTLET BOXES (POBs/AOBs) (LANL-FURNISHED)
      1. CNI Site Coordinator will determine specifications of protective outlet boxes (POBs) and authenticated outlet boxes (AOB) to be used on a case-by-case basis.
      2. POBs and AOBs are metal, surface-mounted, 10 x 6.5 x 3.5 in. boxes with a lockable, welded-hinged cover.
   6. CROSS-CONNECT EQUIPMENT (LANL-FURNISHED)
      1. Cross-connect equipment for CNI fiber-optic cables will consist of patch panel racks.
      2. Fiber optic terminations will be made by LANL.
3. EXECUTION
   1. EXISTING WORK

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Delete this article when existing construction is not affected.

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* + 1. When a requirement no longer exists for a CNI, the user will prepare and submit a Request to the LANL Telecommunications Group POC and the CNI Site Coordinator requesting termination of support.
    2. Identify, tag, and remove exposed abandoned CNI system components, including abandoned cable and raceways and markings above accessible ceiling finish back to source. Patch surfaces where removed cables pass through building finishes.
    3. Only U.S. Government final-cleared, technically competent personnel may install, modify, or maintain any portion of an active LANL CNI.
    4. Do not leave active CNI infrastructure open and unsupervised during modifications. DO NOT keep keys overnight; at the end of each day all keys must be returned and checked in.
       1. For existing CNI systems, or for new systems that have been locked, check out and sign for keys daily.
       2. For customer owned CNI systems, the CNI owner will supply keys.
       3. For LANL Telecommunications Group owned systems, keys will be supplied by the LANL Telecommunications Group CMC.
    5. Extend existing CNI using materials and methods as specified herein.
  1. EXAMINATION
     1. Verify interior of building has been protected from weather.
     2. Verify that work of other trades likely to damage CNI components has been completed.
     3. Examine building finishes that are to receive CNI components and cables for compliance with installation tolerances and other conditions. Do not proceed with installation until unsatisfactory conditions have been corrected.
     4. CNI device locations and raceway routings shown on Drawings are approximate unless dimensioned.
        1. CNI components as required to meet project conditions.
        2. Route raceways and cables as required to meet project conditions.
        3. Where raceway routing is not shown, and destination only is indicated, determine exact routing and lengths required to meet project conditions. Record actual routing on as-built drawings.
  2. CNI General Installation Requirements
     1. Verify that CNI security plan has been approved by the LANL CNI Site Coordinator before beginning any CNI system installation.
     2. Install CNI in accordance with the LANL CNI Master Plan. Installation requirement information in these Official Use Only documents is available from the LANL CNI Site Coordinator.
  3. CNI Outlet Installation
     1. Surface mount LANL-supplied CNI outlets with centers at the following heights:
        1. CNI outlets: center 44 inches above the finished floor.
        2. CNI outlets at lab benches and counters: center 44 inches maximum above the finished floor. Coordinate locations to be above or completely within, bench and counter backsplashes.
     2. Verify location of each CNI outlet by field measurements and coordination with other trades.
        1. Install each outlet at a location suitable to serve its intended purpose.
        2. Install CNI outlets so they will have 6 inches of separation from all other outlets.
  4. CONDUIT INSTALLATION
     1. Install CNI service entrance conduits.
        1. Refer to section 33 7119, *Electrical Underground Ducts and Manholes*, for description. Also refer to ESM Chapter 19, Section G50, Site Communications.
        2. Turn up the secure telecommunications conduits in the main secure telecommunications (server) room in a 24 x 24 x 12 in., hinged-cover box or as directed by LANL Telecommunications Group.
        3. Provide a woven polyester pull tape (1200 lb. test) with stamped footage markings into each service conduit and tied off at each end.
     2. Install an individual 1-inch conduit for CNI cable from each CNI outlet box to the CNI wireway. Currently up 11, 6-strand fibers are being placed in a 1-inch conduit.
        1. Install CNI conduits that will contain only fiber-optic cables so they will have 2 inches of separation from other utilities throughout the conduit route.
        2. Acoustical Ceilings: Conduits above accessible ceilings are only allowed with LANL Telecommunications Group permission and direction. When allowed, this is typically required to be 3 inches above the ceiling tiles and below suspended mechanical equipment, piping, ductwork, cable trays, and building structure so entire route is visible for inspection.
        3. Install CNI conduits passing through walls, floors, and ceilings shall have no hidden joints or fittings. Firestop material must not cover pipe threads; they must be visible.
        4. Surface mount CNI conduits and outlets in offices so they will be visually inspectable.
     3. Provide a woven polyester pull tape (1,200 lb test) with stamped footage markings in each empty CNI conduit. Do not leave any pull strings hanging out of the CNI anywhere.
     4. Use bends on conduits for horizontal cables with a minimum inner edge radius of 5 inches.
     5. Do not use conduit bodies for changes in direction or as pull boxes.
  5. Wireway Installation
     1. Install CNI wireway following the manufacturer’s installation instructions and NECA 1, Standard for Good Workmanship in Electrical Construction. Have the manufacturer’s installation instructions available at the work site.
     2. Use CNI wireway only in corridors, secure telecommunications rooms, secure server rooms, and vault-type rooms.
     3. If permitted by the CNI security plan, CNI wireway may be installed above corridor suspended accessible ceiling.
     4. Install CNI wireways with not less than 12 inches access above and 12 inches to one side of each wireway to permit access for installing and maintaining cables and for security inspections.
     5. Bond each section of the wireway to ensure electrical continuity. Bond the wireway to the secure telecommunications (server) room ground bar with 6 AWG copper conductor.

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Edit the following article to match project requirements.

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* + 1. Extend CNI wireways to patch panel racks in the [secure server room(s)] [secure telecommunications room(s)] [vault-type room(s)]. Coordinate attachments to racks with LANL Telecommunications Group.
    2. Support and brace wireway in accordance with Section 26 0529, *Hangers and Supports for Electrical Systems*.
  1. CNI Cable Installation
     1. Install LANL-supplied CNI cables according to ESM Chapter 19, Section D60, Optical Fiber Cabling Components and addenda, the NEC (including Article 800), and requirements in this section.
     2. Handle and install cable according to cable manufacturers’ instructions. Have the manufacturer’s installation instructions available at the work site.
     3. Completely and thoroughly swab raceways before installing cable.
     4. Clean foreign matter from interior of boxes before installing cables.
     5. Store cable for 24 hours in the installation area ambient temperature before installing.
     6. Do not “through-pull” cables at boxes, fittings, or cabinets where a change of raceway alignment occurs.
     7. Install [quantity as per performance specification] LANL-furnished fiber-optic cable(s) from each CNI outlet to the CNI patch panel racks in the secure telecommunications (server) room. Leave 15 feet of slack at the patch panel end and 18 inches of slack at the outlet end.
     8. Fiber optic cables may not be terminated until lock cores are installed in CNI outlet boxes.
  2. Identification
     1. Band CNI raceways, wireways and conduit with 3/4-inch wide, red plastic tape on 5-foot centers, beginning with the first band within 2 inches of the POB, on both sides of wall, ceiling, and floor penetrations, at every change of direction and within 2 inches of wireway penetration. Apply tape after painting is completed.
     2. Positively identify and label each cable using an approved light source and at both ends using a numbering scheme that complies with Section 27 1000, *Structured Cabling* and instructions from the LANL Telecommunications Group.
  3. ACCEPTANCE TESTING
     1. Perform testing with a Fluke Model OTDR (Optical Time Domain Reflectometer). Subcontractor must allow the LANL Telecommunications Group to download and then erase LinkWare test results from the test equipment. Under no circumstances may Subcontractor save secure test results to a database other than a LANL-owned database, nor remove test results from LANL site.
     2. Submit test reports in a Fluke Linkware format for each installed and terminated fiber and Category 5E or 6A horizontal cable. Physically deliver test results to the LANL Telecommunications Group to download into their database.
     3. LANL Telecommunications Group will review the electronic test results on all Category 5E or 6A UTP and fiber cables for conformance. Cables must meet all testing requirements before cable is accepted
  4. Field Quality Control
     1. CNI raceway system will receive a comprehensive visual inspection by LANL CNI Site Coordinator and LANL Telecommunications Group Inspector before being covered.
     2. Correct deficiencies identified by this inspection and arrange for re-inspection.

END OF SECTION

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Do not delete the following reference information:

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THE FOLLOWING STATEMENT IS FOR LANL USE ONLY

This project specification section is based on LANL Master Specification Section 27 1500.18, Rev. 3, dated June 23, 2022.