

SPECIFICATION STANDARD

Communications Underground Duct And Raceways 27 05 43

PART 1: GENERAL

The Contractor is held responsible to be familiar with the provisions contained herein and with other Sections of this Specification as applicable to the completion of the installation. The approved Contractor, design team, or employee is held responsible to be familiar with the provisions contained herein and is assumed to possess the proper license(s), bonding, knowledge, manpower, and material needed for the completion of the design and installation.

1.01 WORK REQUIRED

- A. The work required under this Section consists of providing all primary, secondary, telecommunications/data underground ducts and raceways, including manholes and handholes for the project as shown on drawings and/or as specified herein.

1.02 WORK REQUIREMENTS BUT SPECIFIED ELSEWHERE

- A. Division 02 Section 02 00 00 Site Improvements (is existing conditions)
- B. Division 26 Section 26 00 00 Electrical Systems
- C. Division 27 Section 27 11 13 Communications Entrance Protection
- D. Division 31 Section 31 00 00 Earthwork (excavation, backfill, compaction, etc.)
- E. Division 32 Section 32 00 00 Exterior Improvements (concrete work, blacktop, etc.)
- F. Install to the National Safety Code requirements when installing in public streets or right of way.

1.03 RELATED SECTIONS

- A. Division 26 Electrical
- B. Division 27 Communication Systems.
- C. Division 28 Electronic Safety and Security
- D. Division 31 Earthwork
- E. Division 32 Exterior Improvements

PART 2: PRODUCTS

2.01 GENERAL

- A. The Exterior Telecommunications Pathways will provide a campus distribution system for all cabling that will be served by the building ERs (Entrance Rooms). Exterior pathways are required to connect new buildings or existing buildings with inadequate or obsolete entrance pathways to the campus telecommunications distribution systems. The pathways for a campus distribution system may include

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all or some of the following, maintenance holes, hand holes, inner ducts, and conduits.

1. The number, size, raceway duct material, and arrangement shall be as indicated on drawings and/or as specified herein.
2. Furnish and install a minimum (as approved) of four (4) each – 4” inch conduits building entrance conduits, encased in concrete from the building's main entrance or equipment room to the nearest telecommunications manhole or connection point, except for boring applications.
3. Backbone pathways shall be comprised of six (6) – 4” inch conduits typically (as approved).
4. All conduits shall minimally be 4” inches in diameter and can consist of schedule 40 construction if the concrete is encased.
5. All bends must be long, sweeping bends with ten times the internal diameter of conduits larger than (4” inches).
6. In underground raceways, angle couplings and bends alone or in combination with straight sections shall be used for direction changes; direction changes made by skewing straight sections of conduits will not be permitted. Any angle greater than 22° degrees shall be factory-made.
7. Orange locatable caution tape shall be installed in two rows 12” inches above all underground conduits.
8. Install a #14 stranded copper locatable wire with orange insulation in the trench or one open conduit. Mechanically secure the locate wire at all endpoints. When installing the locate route through more than one section, install the locate wire continuously through the route and terminate mechanically secure on each end.
9. Conduits may be non-metallic (PVC) or Rigid Galvanized Conduit heavy wall (RGC) conduit (as outlined in items B and C below) and indicated on Drawings and/or as specified herein.
10. Conduits shall be capped with manufactured caps (Duct Plugs) when installation is temporarily discontinued.
11. Conduits shall be cleaned by passing a wire brush mandrel and/or rubber duct swab (or approved alternative) of appropriate size back and forth until all foreign materials and water are removed.
12. Conduits shall be checked by pulling a round test mandrel, ¼ inch less than conduit size for each duct from both directions to remove obstructions.
13. Conduits shall be encased by a concrete envelope or as specified by UNM IT, with a minimum 3 inches cover on all sides or flowable backfill as specified on the drawings.
14. Conduits shall be installed using long radius sweeps unless otherwise noted on Drawings or in the Scope of work. No more than 180° degrees of total bends in any one section of conduit.
15. Conduit runs shall contain no continuous sections longer than 350 feet. If runs

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total more than 350 feet, pull points (Manholes or Handholes) shall be inserted at the midpoint or as specified by UNM IT.

16. Conduits shall be installed with a minimum of 6" inches of fall per 100 feet run toward manholes and away from buildings.
 17. Conduits shall be provided with continuous 1250-pound tensile strength conduit measuring pull tape in each duct.
 18. Conduits shall be inspected and approved for correct formations before tying to prevent ducts from floating when concrete is poured.
 - A. Separate from power up to one KVA:
 - ☐ 12" inches of well-packed earth
 - ☐ 4" inches of masonry
 - ☐ 3" inches of Concrete
 - B. Separate from Gas, Oil, Water, etc.:
 - ☐ 12" inches when parallel
 - C. Separate 6" inches when crossing
 19. A minimum of 30" inches of buried depth (measured from the top of the concrete encasement to the finished grade) is required. Exceptions may be granted to avoid conflicts of approval between UNM IT and the AHJ.
- B. HDPE Directional Bored / Horizontal Drilling
1. Typically two (2) - 4" HDPE Conduits should be installed or as specified by UNM IT.
- C. Non-metallic Raceways
1. PVC Type Schedule 40 with concrete encasement.
 2. The plastic duct shall meet NEMA TC-6 standards.
 3. The plastic duct shall be provided with straight couplings and PVC cement.
 4. Couplings shall be staggered horizontally and vertically.
 5. Use Schedule 40 for all raceways except where rigid conduit is required.
 6. Complete with the threaded adapter when attached to rigid steel conduit.
 7. Protected from deformation during stockpiling.
 8. Conduits shall be perfectly circular in shape. Other configurations will not be permitted.
 9. Joints and fittings shall be provided as per the manufacturer's specifications and directions.
 10. Comply with manufacturers' requirements for bending and cutting.
 11. Joints shall be wrapped with Scotch #88 tape as a temporary concrete seal.
 12. Provide end bells flush with the inside wall of the manhole or vault.
- D. Rigid Galvanized Conduit Heavy Wall
1. As specified in Section 26 05 33 - Raceways and Fittings.

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2. All entrance conduits shall be rigid and also shall be used within the excavated portion of the building, including any areas where building excavation has or will be backfilled.
3. Extended conduits 10 feet minimum from building into undisturbed earth.
4. Use rigid conduits for all bells stubbed "in," or "out" or concrete bases for equipment housings.
5. Use rigid steel conduits in areas of extended backfill, requiring maximum strength against shear.
6. Use rigid steel conduits when crossing under tunnels.
7. Use rigid steel conduits when crossing under a roadway

E. Concrete Envelope

1. Size where shown on drawings, with raceways receiving not less than 3 inches of Concrete cover all around and 1-1/2" inches between raceways.
2. Provided support piers to undisturbed soil where necessary for permanent bearing.
3. Provide 3000 psi, class 2, concrete ready mix per ASTM-94.
4. Provide with fine sand cover for initial curing except where waived by UNM ITS in writing.
5. Rebar reinforcement is required where duct banks will cross roadways.

F. Backfill

1. As specified Division 31 00 00 Earthwork (excavation, backfill, compaction, etc.).

2.02 COMMUNICATIONS MANHOLES

A. Manholes shall be as follows;

1. Provided by Electrical or Telecommunications Contractor as described in the drawings and as specified herein.
2. All Manholes and Handholes requirements must be approved by UNM IT.
3. Conduits shall enter and exit the manhole in a straight-line method. The remaining parallel walls are to remain free of conduit entrances. These walls shall remain free to allow cable support and splicing operations.
4. Shall be reinforced pre-cast concrete, approved by UNM IT, 4500 psi, and designed for truck loading.
5. Minimum sizing shall be 10 feet long by 8 feet wide by 7 feet high inside dimensions, unless otherwise approved by UNM IT, specified on the Drawings and/or as specified herein.
6. Be provided with pulling irons opposite each duct bank, rated at 10,000 pounds of pulling tension.
7. Be complete with bonding jumper to reinforcing steel in each section.
8. Pre-cast manholes have reinforcing steel bonded together and do not require an

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additional ground rod. Install a bonding ribbon horizontally around the top of the manhole and attached it to all cable racks and hardware. Continue installation vertically between bonding clamps so both the top and bottom halves are bonded together on each side. The bonding ribbon will be used to bond and ground all splice cases and hardware placed within the manhole.

9. All manhole hardware shall have a rubberized or hot-dipped galvanized finish. Provide heavy-duty, cast-iron, frame with nominal 36" inches opening equal to NEENAH #R-1640-D with a NEENAH TYPE "C" lid with pick holes or approved equal. The lid shall be lettered "Communications" and number (as assigned by UNM IT). Install locking inter cover from McGard to UNM Spec.
10. Provide 6" inch and 12" inch grade ring riser castings as required to elevate the cover to approximately 1" above the finished grade. The internal diameter of grade rings shall be not less than the internal diameter of the manhole cover frame. Verify with the manufacturer on availability. Custom-grade rings are acceptable upon prior approval of UNM IT. Cast-iron adjusting rings, Neenah #R1979 series or equal may be used to trim final elevations.
11. Set on leveled undisturbed earth with a minimum of 3 inches of granular fill under the entire manhole before setting. If the earth is disturbed during excavation, properly compact soil and provide (3")
12. Manhole ladders are required for all manholes unless otherwise noted on Drawings and/or as specified herein.
13. Provide a 14" inches sump with gravel and grate cover.
14. Furnish and install manhole signage within the chimney including a manhole/handhole designator, the measured distance to the next hole or building, North designation, and direction to adjoining maintenance holes and building entry points. Signage shall be stamped metal attached to the chimney.

2.03 HAND HOLES

A. Hand holes shall provide the following:

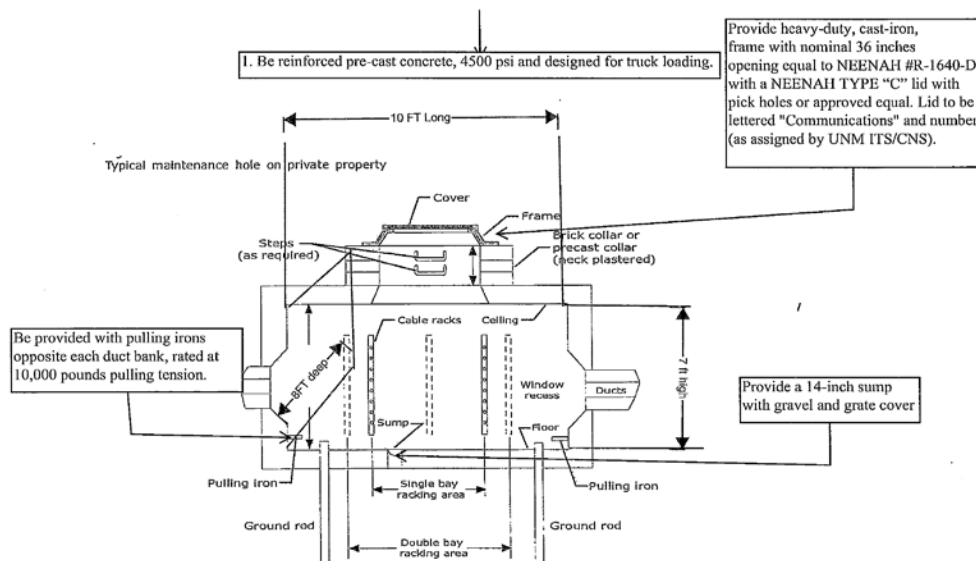
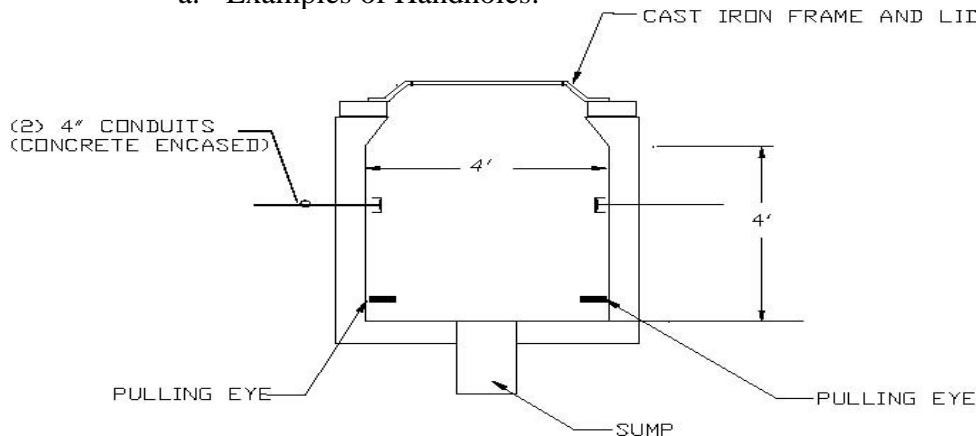
1. Shall be provided for in the Electrical or Communications drawings and/or as specified herein.
2. Be reinforced concrete, H-20, 4500 psi, and designed for truck loading.
3. Be 4 feet by 4 feet by 4 feet high inside dimensions.
4. Provided with pulling irons opposite each duct opening.
5. Be provided with pulling irons opposite each duct opening.
6. The handhole Cover shall be NEENAH #R-1640-D, with pick hole, lid lettered "COMMUNICATIONS" and number assigned by UNM IT.
7. Provide 6" inch and 12" inches grade ring riser castings as required to bring the lid up to proper grade, and NEENAH #R-1979 rings for final adjustments. The

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internal diameter of grade rings shall be not less than the internal diameter of the manhole cover frame.

8. Set on leveled undisturbed earth with a minimum of eight (8) inches of (pea gravel) granular fill under the entire manhole before setting. If the earth is disturbed during excavation, properly compact soil and provide 8 inches concrete leveling pad under the entire manhole before setting.

a. Examples of Handholes:



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2.04 MICRO-DUCT

- A. Outdoor micro-duct – All micro-duct shall be composed of all dielectric materials (except for armored version or locate wire where applicable). The micro-duct shall be suitable for underground conduit, direct buried, or aerial applications as appropriate. During installation, micro-duct cable ends and individual micro-ducts are to be completely sealed to prevent the ingress of contaminants, including water. Upon completion of micro-duct installation, all micro-ducts shall pass the standard pressure test and proof test per the manufacturer's recommended procedures. All unoccupied micro-ducts shall be capped on both ends with airtight/watertight end caps. Install micro duct to meet the manufacturer's specifications and instructions.

2.05 INNERDUCT

- A. Innerduct shall be installed where required and as specified and approved by UNM IT. Each inner duct shall have a one-half inch pre-lubricated, woven, 1250 pound tensile minimum polyester tape made from low friction, high abrasion resistant yarns placed within the inner duct and secured at each end. Tape shall be printed with sequential footage markings for accurate measurements. Install a single conductor locating wire in the inner duct conduit with a 14-gauge solid orange insulated wire for all non-metallic optical fiber cables. Install a single conductor locating wire in the inner duct conduit with a 14-gauge solid orange insulated wire for empty inner ducts. Where interlock armored fiber is the approved optical fiber cabling choice inner duct is not required or approved for empty conduit installations.

2.06 DUCT PLUGS

- A. UNM IT requires Dura-line S-60 Wide Temp Foam Conduit Sealant Kit for all conduits either occupied or unoccupied.
- B. Innerduct sealing plugs shall be used to seal all inner ducts and conduits used or unused per manufacturers' recommendations.

2.07: HANDHOLES - Special Purpose

- A. Verify exact size and load requirements with UNM IT for approval before specification and installation of any

PART 3: EXECUTION

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3.01 CABLE SUPPORT

- A. The cable supports described on the drawings or herein are intended to assist the Contractor in obtaining a satisfactory job and shall be altered to fit job conditions.
- B. In general, all cables in manholes shall be supported on 4 feet maximum centers for straight runs, on each side of splices, and within 2 feet of cable entering or exiting a duct or termination.

3.02 EXCAVATION:

- 1. Coordinated with other trades.
 - A. Verify all elevations and utilities. Notify NM One Call (dial 811)
 - B. If soil conditions are such that because of the depth or any other reasons the trench/excavation cannot conform to the size of the duct bank, provide forms and bracing as required.
 - C. The contractor shall open the entire length of the trench and establish proper grades before beginning installation of any portion of connecting duct runs.
 - D. Per Division 310000 - Earthwork and Division 020000 - Excavation, Backfill, Concrete, Asphalt Repairs, and Related Work.
 - E. The depth of excavation shall be such that the required bury depths (top of concrete encasement) are met. UNM IT shall approve any deviation from the required depths before installation.

3.03 CONCRETE ENVELOPE

- A. Protected against freezing, etc., as required in General Construction Specifications.
- B. Installed so no honeycombing occurs and be properly vibrated with a small vibrator. Do not vibrate between ducts.
- C. Size where shown on drawings, with raceways receiving not less than 3 inches of concrete cover all around and 1-1/2" between raceways.
- D. Concrete for the duct bank shall be placed in such a way that the duct bank will not be

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- disturbed and that the sides of the trench do not crumble, using splash boards, proper placement, etc. The vertical drop of concrete from the chute shall not exceed 30 inches.
- E. Concrete shall be poured continuously from manhole to manhole. No pours shall originate between manholes.
 - F. The interval between the base or intermediate spacers shall not exceed 8 feet with a minimum of two supports per length of duct.
 - G. Make provisions, such as nylon ties, to prevent the ducts from floating when concrete is poured.
 - H. The color of the top layer of concrete encasement shall be “ORANGE” (for telecommunications) chalk dust while still wet, or dye the concrete.

3.04 REINFORCING

- A. Shall be installed:
 - 1. Where noted on drawings and /or as specified herein.
 - 2. Where crossing trenches for other work.
 - 3. Where connected to buildings and manhole walls, anchored thereto with projecting re-bars shall be installed.
 - 4. At conduit joints.
 - 5. If the continuous pour is impractical, provide (4) #4 reinforcing bars extending 6 feet into the first and second pour.
 - 6. Where trenches cross roadways.
 - 7. Reinforcing shall be supported from the bottom of the trench at least one inch and is not required if conduits are supported by saddles.

3.05 BACKFILL

- A. Not be installed until after concrete has reached the initial set.
- B. Per Division Earthwork (excavation, backfill, compaction, etc.).
- C. The Contractor shall restore the landscape to its original condition.

3.06 AS-BUILDS

- A. Contractors shall provide as-built information to UNM IT before final payment for this work.
- B. As-built information shall be in electronic (Auto Cad) drawings. Indicate the location

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of all underground routes.

- C. If construction drawings are not utilized, the Contractor shall provide all telecommunications location information on an accurate scaled (Auto Cad) site plan.

3.07 DIRECTIONAL BORING

- A. Boring Depths** - Coil able duct shall be directionally bored at standard burial depths of 36" of cover for ducts housing primary cables and 24"-36" of cover for ducts housing secondary cables. UNM IT shall approve any exceptions in writing to the specified burial depths, up to a maximum 60" of cover from the final grade.

- B. Coil-able Duct Specification** - In areas where surface obstructions make standard open trenching undesirable or cost-prohibitive, directionally boring a coil-able duct provides a viable option to the University. The coil-able duct shall be high-density polyethylene (HDPE) orange in color, with sizes of 3", 4", or 5" nominal inside diameter, as specified on the Drawings. UNM IT specifies the following for coil-able ducts:

3" SDR-13.5 (0.259" min. wall) per ASTM D-1248
4" SDR-13.5 (0.333" min. wall) per ASTM D-1248
5" SDR-13.5 (0.413" min. wall) per ASTM D-1248

- C. Duct Joining** - Sections of the duct shall be joined using fusion couplings. Where the coil-able duct is to be joined with PVC conduit, the Contractor is to fuse a 24" straight piece of matching-size PVC conduit to the coil-able duct. Before fusing, the Contractor shall make circumferential scores around the outside of the PVC conduit at the end that is to be installed into the fusion coupling. This will allow the fusion coupling to adhere to the dissimilar PVC conduit. A special epoxy is also available that joins the coil-able duct with standard PVC couplings. The Contractor shall confer with UNM IT about epoxy.

- D. Vertical and Horizontal Bends** - All vertical bends shall be made using Schedule 40 PVC bends with belled or coupled ends as specified. Under no circumstances shall a vertical bend be fabricated by "sweeping" it up to grade using the guided boring machine.

- E. Connections into Vaults and Manholes** - Bored coil able duct Outdoor micro-duct – All micro-duct shall be composed of all dielectric materials (except for armored version or locate wire where applicable). The micro-duct shall be suitable for underground conduit, direct buried, or aerial applications as appropriate. During installation, micro-duct cable ends and individual micro-ducts are to be completely

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sealed to prevent the ingress of contaminants, including water. Upon completion of micro-duct installation, all micro-ducts shall pass the standard pressure test and proof test per the manufacturer's recommended procedures. All unoccupied micro-ducts shall be capped on both ends with airtight/water-tight end caps. Outdoor micro-duct specifications are as follows (HDPE) shall end 4'-5' feet from a new vault or manhole. This coil-able duct shall then be transitioned to a workable size PVC before connecting to the structure. The transition to PVC shall be made using the techniques described in Duct Joining.

End of Section