

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 vendor, designated agent 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 applicable to the completion of the installation.

1.01 WORK REQUIRED:

- A. The work required under this Section consist 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, ect.)
- E. Division 32, Section 32 00 00 Exterior Improvements (concrete work, blacktop, ect.)

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 GERERAL:

- A. The Exterior Telecommunications Pathways will provide a campus distribution system for all system cabling that will be served by the building ERs. 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 all or some of the following, maintenance holes, hand holes, innerducts, 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 4 each – 4 inch conduits building entrance conduits, encased in concrete from the building main entrance or equipment room to the nearest telecommunications manhole or connection point, with the exception of boring applications.
3. Backbone pathways shall comprise of 6 - 4 inches conduits typically (as approved).
4. All conduits shall minimally be 4 inches in diameter and can consist of schedule 40 construction if concrete 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 deg. shall be factory made.
7. Orange locatable caution tape shall be installed in two rows 12 inches above all underground conduits.
8. 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.
9. Conduits shall be capped with manufactured caps (Duct Plugs) when installation is temporarily discontinued
10. 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.

11. Conduits shall be checked by pulling a round test mandrel, $\frac{1}{4}$ inch less than conduit size for each duct from both directions to remove obstructions.
12. Conduits shall be encased by a concrete envelope, minimum 3 inches cover on all sides or flowable backfill as specified on the drawings.
13. Conduits shall be installed using long radius sweeps, unless otherwise noted on Drawings or in Job Scope. No more than 180 degrees of total bends in any one section of conduit.
14. Conduit runs shall contain no continuous sections longer than 350 feet. If runs total more than 350 feet, pull points (Manholes or Handholes) need to be inserted.
15. Conduits shall be installed with minimum of 3 inches of fall per 100 feet run toward manholes and away from buildings.
16. Conduits shall be provided with continuous 1250 pound tensile strength conduit measuring pull tape in each duct.
17. Conduits shall be inspected and approved for correct formations before tying to prevent ducts from floating when concrete is poured.
 - a. Power up to one KVA:
 - 12 inches of well- packed earth
 - 4 inches of masonry
 - 3 inches of Concrete
 - b. Gas, Oil, Water, etc.:
 - 12 inches when parallel
 - c. 6 in. when crossing
18. A minimum of 30 inches bury depth (measured from top of concrete encasement to finished grade) is required. Exceptions may be granted to avoid interference's with approval of UNM IT

B. HDPE Directional Bored / Horizontal Drilling**a. Typically, 2- 4" HDPE Conduits**

C. Non-metallic Raceways:

1. PVC Type Schedule 40 with concrete encasement.
2. Plastic duct to meet NEMA TC-6 standards.
3. Plastic duct with straight couplings and appropriate cement. Couplings to be staggered horizontally and vertical
4. Used for all raceways except where rigid conduit is required.
5. Complete with threaded adapter when attached to rigid conduit.
6. Protected from deformation during stockpiling.
7. Perfectly circular in shape. Other configurations will not be permitted.
8. Have joints made with materials provided by, and installed per manufacturer's directions. Comply with manufacturers requirements for bending and cutting.
9. Have joints covered with Scotch #88 tape as temporary concrete seal.
10. Provide with end bells flush with inside wall of manhole or vault.

D. Rigid Galvanized Conduit Heavy Wall:

1. As specified in Section 26 05 33 - Raceways and Fittings.
2. All entrance conduits shall be rigid conduit and also shall be used within excavated portion of building, including any areas where building excavation has been backfilled.
3. Extended 10 feet minimum from building into undisturbed earth.
4. Used for all ells stubbed "in," or "out" or concrete bases for equipment housings.
5. Used in areas of extended backfill, requiring maximum strength against shear.

6. Used where crossing under tunnels.

7. Used when crossing under 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 with support piers to undisturbed soil where necessary for permanent bearing.
3. 3000 psi, class 2, concrete ready mix per ASTM-94.
4. Provided 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. Per 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. 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 are to remain free to allow cable support and splicing operations.
3. Be reinforced pre-cast concrete, 4500 psi and designed for truck loading.
4. Minimum shall be 10 feet long by 8 feet wide by 7 feet high inside dimensions, unless otherwise specified on the Drawings and/or as specified herein.

**Communications Underground Duct,
Raceway and Structures 27 05-43**

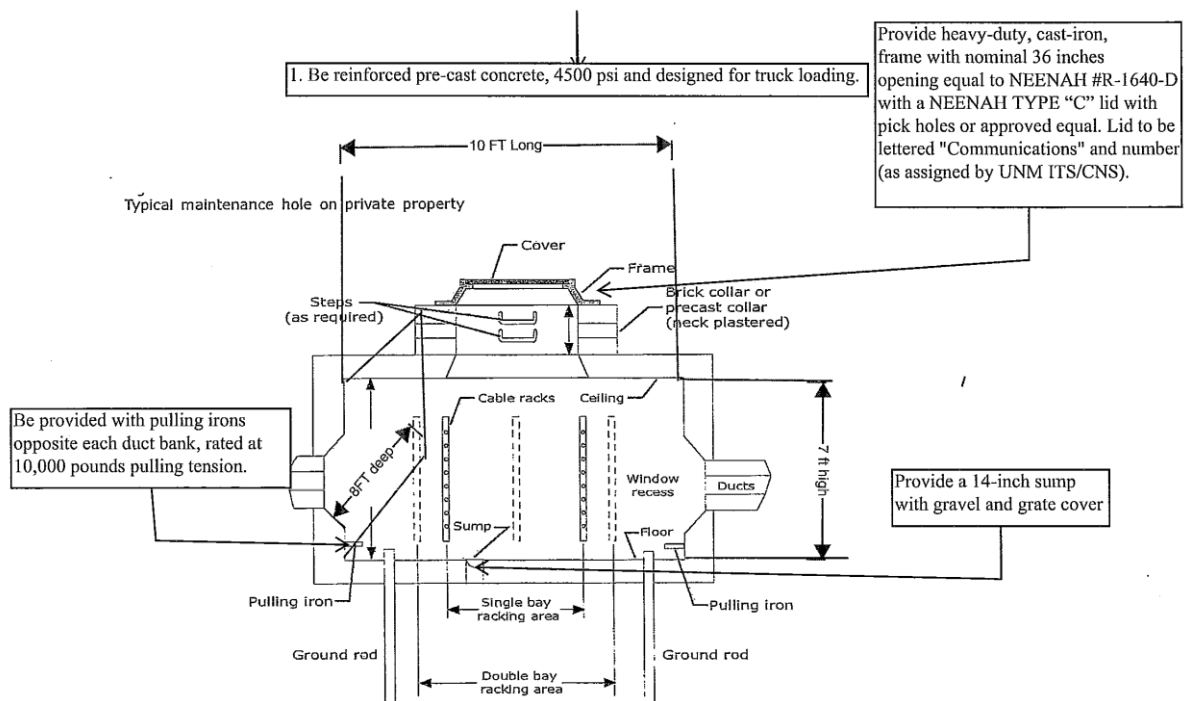
5. Be provided with pulling irons opposite each duct bank, rated at 10,000 pounds pulling tension.
6. Be complete with bonding jumper to reinforcing steel in each section.
 - a. Pre-cast manholes have reinforcing steel bonded together and do not require an additional ground rod. Install a bonding ribbon horizontally around the top of the manhole and attached to all cable racks and hardware. Continue installation vertically between bonding clamps so both 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.
7. Be complete with cable racks, arms, and insulators, for proper cable support.
8. All manhole hardware shall have rubberized or hot dipped galvanized finish.
9. 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. Lid to be lettered "Communications" and number (as assigned by UNM ITS). Install locking inter cover from McGard to UNM Spec.
10. Provide 6 inch and 12 inch grade ring riser castings as required to elevate cover to approximately 1" above finished grade. Internal diameter of grade rings to be not less than internal diameter of manhole cover frame. Verify with 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 minimum 3 inches granular fill under entire manhole before setting. If earth is disturbed during excavation, properly compact soil and provide 3 inches concrete leveling pad under entire manhole before setting.
12. Manhole ladders are required for these manholes, unless otherwise noted on Drawings and/or as specified herein.
13. Provide a 14-inch sump with gravel and grate cover.

14. Furnish and install manhole signage within chimney: to include manhole/handhole designator, measured distance to the next hole or building, North designation and direction to adjoining maintenance holes and building entrance points. Signage shall be stamped metal attached to the chimney.

2.03 HAND HOLES

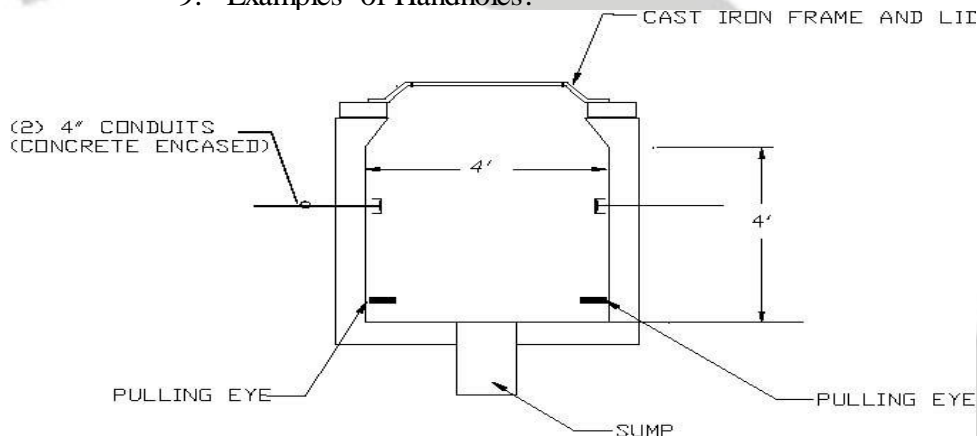
A. Hand holes shall be as follows:

1. Provide by Electrical or Communications as described on the 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. Handhole Cover shall be NEENAH #R-1640-D, with pick hole, lid lettered "COMMUNICATIONS" and number assigned by UNM UNM IT.



7. Provide 6 inch and 12 inch grade ring riser castings as required to bring lid up to proper grade, and NEENAH #R-1979 rings for final adjustments. Internal diameter of grade rings to be not less than internal diameter of manhole cover frame.
8. Set on leveled undisturbed earth with minimum 8 inches of (pea gravel) granular fill under entire manhole before setting. If earth is disturbed during excavation, properly compact soil and provide 8 inches concrete leveling pad under entire manhole before setting.

9. Examples of Handholes:



2.04: Multi 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 sealed to prevent 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

2.05: INNTERDUCT

- A. Innerduct shall be installed where required and as specified and approved by UNM IT. Each innerduct 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 innerduct 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 innerducts
- B. Where interlock armored fiber is the approved optical fiber cabling choice innerduct is not required or approved for empty conduit installations.

2.06: DUCT PLUGS

- A. Conduit and Innerduct sealing plugs to be used to seal all innerducts 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

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 existing a duct or termination.

3.02 EXCAVATION:

1. Coordinated with other trades.
 - A. Have elevations and arrangements verified on job.
 - 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. Contractor shall open entire length of 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. Depth of excavation shall be such that the required bury depths (top of concrete encasement) are met. UNM IT prior to installation shall approve any deviation from required depths.

3.03 CONCRETE ENVELOPE:

- A. Protected against freezing, etc., as required in General Construction Specification.
- B. Installed so no honeycombing occurs and be properly vibrated with 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 disturbed and that the sides of the trench do not crumble, using splash boards, proper placement, etc. The vertical drop of concrete from chute shall not exceed 30 inches.
- E. Concrete shall be poured continuous from manhole to manhole. No pours shall originate between manholes.

- F. Interval between 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. Color top layer of concrete encasement by using “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 continuous pour is impractical, provide (4) #4 reinforcing bars extending 6 feet into first and second pour.
 - 6. Where trenches cross roadways.
 - 7. Reinforcing shall be supported from bottom of 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 initial set.
- B. Per Division Earthwork (excavation, backfill, compaction, etc.).

- C. The Contractor shall restore landscape to original condition.

3.06 AS-BUILDS

- A. Contractors shall provide as-built information to UNM IT prior to final payment for this work.
- B. As-built information shall be in electronic (Auto Cad) drawings. Indicate location of all underground routes.
- C. If construction drawings are not utilized, 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 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, sizes of 3", 4" or 5" nominal inside diameter, as specified on the Drawings. UNM IT specifies the following for coil able duct:

- 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 coil able 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. Prior to 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 the UNM IT with regard to 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 sealed to prevent 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’ from a new vault or manhole. This coil able duct shall then be transitioned to the same size PVC before connecting into the structure. The transition to PVC shall be made using the techniques described in Duct Joining.

End of Section