EXHIBIT A
PROJECT SUMMARY ASSIGNED

Project Summary Assigned

Playbook

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UNDERGROUND

OVERVIEW

Minimum bend radius formula >= 20 x fiber cable O.D.

Aerial fiber 150' of slack approx. every 1500' of aerial route

*Slack loops will be stretched out to approx. 75' from loop to loop.

*Slack loops will be no closer than 8' to any pole.

Risers - 200' of slack - (riser with ENCLOSURE 125' slack)

Major crossings - 200' of slack- before and after.

OTE/MST- **Pass** Thru 100' coil, END OF LINE 50' tail

Underground/manhole slack - 50' of slack approx. every 500' of fiber pulled.

Underground/manhole enclosure - 50' coil or 25' tails

Underground MST/OTE - 20' coil for thru location, 10' tail for EOL

Underground OLT/AiO Cabinet - 50' of slack

Lock box/panel - 20' of slack

Building attachments - 50' of slack no closer than *8'* to structure

Fiber Minimum Bend Diameter

FIBER IS NOT TO EXCEED THE MINIMUM BEND DIAMETER OF THE FIBER AS LISTED IN TABLE BELOW.

MINIMUM FIBER BEND DIAMETER FORMULA

>= 20 X FIBER CABLE O.D. (OUTSIDE DIAMETER)

Material Category	Material Description	Cable Diameter	Minimum Bend Diameter in inches	Recommended Snow Shoe Size
Fiber	FBR 288CT RBBN SST ARMOR SNG JKT	0.85	17	17
Fiber	FBR 144CT RBBN AR GEL-FREE	0.71	14.2	17
Fiber	FBR 96CT ARMORED LT SM DRY	0.54	10.8	17
Fiber	FBR 72CT ARMORED LT SM DRY	0.48	9.6	17
Fiber	FBR 48CT ARMORED LT SM DRY	0.48	9.6	17
Fiber	FBR 24CT ARMORED LT SM DRY	0.48	9.6	17

UNDERGROUND PLANT SUPPORTING INFRASTRUCTURE – CONSTRUCTION

1. Contractor shall perform the following work:

    a. Machine trench to a minimum depth of six inches (6"), or as otherwise specified on the “APPROVED” permit.

    b. Bore under roads, driveways, and walkways to a minimum 36" depth unless otherwise specified in writing by the OSP construction manager or above.

    c. Cut asphalt and concrete as required (parallel trench lines) and trench to 36" depth unless otherwise specified in writing by the OSP construction manager or above.

    d. Install riser with guard.

2. Unless specified otherwise by the construction manager or above, Contractor shall determine and use the most economical underground construction method, but in all cases, shall comply with any and all local, state and federal construction practice requirements.

3. Contractor shall be responsible for locating all existing underground CATV plant, as well as the cost to repair or replace it if it becomes damaged.

4. Contractor shall be responsible for contacting all underground facility owners for locates, i.e., Power, Water, Telephone, Gas Companies, Locates company, etc.

5. Contractor shall restore all work areas to at least its original condition as soon as possible, including but not limited to sweeping of sidewalks, replacement of landscaping, sod, damaged plants, and any other item that may have been damaged in the normal course of construction.

6. When transitioning from underground to aerial plant, Contractor shall install cable riser(s), using metal or schedule 80 plastic U-guard as directed by construction manager. OSP shall supply all materials associated with riser installation. Contractor shall install riser conduit/guard to within 24 inches (24”) of CATV attachment grade. Contractor shall install riser clamps from ground level to top of conduit/guard every two feet (2’).

7. Contractor shall place and install approved vaults, conduit with pull tape, and/or cable in conduit (CIC) and/or fiber in conduit (FIC) as directed by construction manager.

8. Backfill and compaction consisting of suitable native earth may be used in dirt trench areas. Contractor shall be responsible for any costs associated with providing or disposing of backfill and/or spoil. Any spoil shall be properly disposed of by the close of business the same day as the excavation is performed.

9. Contractor shall ensure that all trenches are clean of debris (such as rocks, trash, material waste, etc.) prior to placement/installation of any and all CATV material.

10. All street trenches shall be backfilled in accordance with local or state requirements as applicable.

11. All backfilled trenches pending asphalt placement shall be delineated every 30' to keep pedestrian traffic from crossing the trench line.

12. Contractor shall be responsible for all surface restoration including replacement of any damaged sod, bushes, or any associated landscape material(s).

13. All sidewalks shall be bored whenever possible. Drop conduit shall extend from pedestal location to a drop pedestal when sidewalks exist.

14. All bore pits shall be dug in grass areas whenever possible.

15. All bore pits shall be properly compacted using the lift method of compaction and restored to its original condition or better. In the context of soil compaction, the "lift method" refers to the process of compacting soil in layers or lifts, ensuring each layer is properly compacted before adding the next. This is crucial for achieving the desired density and stability of the soil.

16. All asphalt trench lines shall be along the curb lip and gutter whenever possible.

17. Asphalt trenches shall be compacted prior to installation of any CATV materials. Following conduit installation, trenches shall be backfilled. An asphalt cap shall be applied in maximum of 2" lifts. The asphalt cap shall be 1" greater than existing asphalt. Where local municipalities or utility requirements are more stringent, the higher standard shall be followed.

18. Contractor shall provide all concrete and/or asphalt products and be responsible for the coordination and delivery of such.

19. Contractor shall apply a final asphalt cap to any trench by close of business each Friday subject only to circumstances preventing such capping that are beyond the Contractor's reasonable control. No trench shall be left open over a holiday or weekend.

20. Streets shall be cleaned as required daily by end of business day.

21. Bores will not be performed blind. All utilities must be exposed (potholed) prior to bore being performed.

22. All bores require conduit placement and shall accommodate conduit that initially does not exceed 50% fill capacity. Where the initial fill capacity would exceed this maximum limit, the next larger bore shall be made and the next larger size conduit placed. Bore size shall be identified by the total size of conduit being placed, not by the size of bore head or reamer being used.

23. Warning tape shall be placed twelve inches (12") above any trenched underground facility.

24. Contractor shall place appropriately sized pull tape in all newly placed conduit that does not already have pull tape in place and shall replace existing pull tape during cabling installations in existing conduits.

UNDERGROUND NEW BUILD AND REPLACEMENT, COAXIAL PLANT – CONSTRUCTION WORK

1. In joint trench opportunities, Contractor shall install approved vaults and conduit with pull tape and/or cable in conduit (CIC), as required and directed by the approved OSP representative.

2. Contractor shall pull cables in conduit according to the design maps.

3. Contractor shall place appropriately sized pull tape in all newly placed conduit that does not already have pull tape in place and shall replace existing pull tape during cabling installations in existing conduits.

4. Contractor shall place underground coaxial cable a manner to prevent cable tail crossing within the pedestal above the ground line.

5. Contractor shall ensure that underground plant is constructed in such a manner as to preclude below ground splices. Coaxial cable splices in

underground plant, other than in pedestals and vaults, is strictly prohibited.

6. Contractor shall install pedestals and vaults according to the system design maps.

    a. All pedestals / vaults shall be supplied by OSP.

    b. The pedestals shall be positioned so that the cabinet's factory-placed ground-line mark is flush with the surrounding ground level grade.

    c. All pedestals are to be plumb. Vaults shall be installed per manufacturers' specifications.

    d. Contractor shall provide and place a three to four inch (3”-4”) gravel base inside pedestals and/or vaults to allow for proper drainage; all conduit openings shall be plugged or sealed. All conduit ends must extend above the pea gravel base.

    e. Where necessary for stability or as may be directed by the construction manager, Contractor must provide a cement foundation at least three and one-half inches (3- 1/2”) thick as directed by the approved OSP representative.

UNDERGROUND REBUILD, COAXIAL PLANT – CONSTRUCTION WORK

1. Contractor shall remove existing cable and re-pull cables in existing conduit according to design maps.

2. Contractor shall pull cables into existing conduit according to the design maps.

3. Contractor shall replace existing pull tape during cabling installations in existing conduits.

4. Contractor shall place underground coaxial cable in a manner to prevent cable tail crossing within the pedestal above the ground line.

5. Contractor shall ensure that underground plant is constructed in such a manner as to preclude below ground splices. Coaxial cable splices in underground plant, other than in pedestals and vaults, is strictly prohibited.

6. Contractor shall pedestals and vaults according to the system design maps.

    a. All pedestals / vaults shall be supplied by OSP.

    b. The pedestals shall be positioned so that the cabinet's factory-placed

ground-line mark is flush with the surrounding ground level grade. All pedestals are to be plumb. Vaults shall be installed per manufacturers' specifications.

c. Contractor shall provide and place a three to four inch (3”-4”) gravel base inside pedestals and/or vaults to enable proper drainage; all conduit openings shall be plugged or sealed. All conduit ends must extend above the pea gravel base.

d. Contractor may be required to provide a cement foundation at least three and one- half inches (3-1/2”) thick as directed by the approved OSP representative.

UNDERGROUND UPGRADE/RETROFIT, COAXIAL PLANT – CONSTRUCTION WORK

1. Contractor shall use existing pedestals when those existing pedestals are of an adequate size to house the new equipment being installed in retrofit areas when possible. Any pedestal replacement must be approved in writing by the construction manager or above prior to work being performed. All damaged pedestals will be replaced if they are unrepairable.

   a. All pedestals/vaults shall be supplied by OSP.

   b. The pedestals shall be positioned so that the cabinet's factory-placed ground-line mark is flush with the surrounding ground level grade. All pedestals are to be plumb. Vaults shall be installed per manufacturers' specifications.

c. Contractor shall provide and place a three to four inch (3”-4”) gravel base inside pedestals and/or vaults to enable proper drainage; all conduit openings shall be plugged or sealed. All conduit ends must extend above the pea gravel base.

d. Contractor may be required to provide a cement foundation at least three and one- half inches (3-1/2”) thick as directed by the approved OSP representative.

2. Contractor shall protect existing equipment from electrical damage by deactivating each active leg of plant as it is being retrofitted.

3. New connectors shall be used for splicing all passives, directional taps, and actives, as well as weatherproofing of the connections, including the use of heat shrink.

4. Contractor shall submit end-of-line signal level readings to OSP upon completion.

5. Contractor shall be responsible for any damage to risersand/or cable plant. Contractor shall report any damage of cable plant, either inflicted by Contractor during the performance of Work, or any pre-existing damage discovered during the performance of Work. Such damage shall be reported to the Project Manager prior to continuing Work.

6. Contractor shall be required to tie-in the existing, non-retrofit plant into the newly constructed or retrofit plant, immediately preceding, or succeeding the aerial retrofit area once the final sweep is completed.

7. In Upgrade/Retrofit projects where it becomes necessary to place new equipment at locations that require exposing and splicing extension cable to underground plant, Contractor shall work in such a manner as to place a splice on only one side of the equipment to be placed. Such splice shall be protected to the maximum extent possible before being placed below ground level.

UNDERGROUND NEW BUILD/OVERLAY AND REPLACEMENT, FIBER PLANT – CONSTRUCTION WORK

1. In joint trench opportunities, Contractor shall install approved vaults, conduit with pull tape, and/or fiber in conduit (FIC), as required and directed by the approved OSP representative.

2. Contractor shall pull fiber cables in conduit according to the design maps.

3. Contractor shall place excess underground fiber optic cable, as indicated on the system design maps, in vaults in a coil not to exceed fiber bend radius to prevent cable kinking during future pulling operations.

4. Contractor shall place pedestals and vaults according to the system design maps.

    a. All pedestals / vaults shall be supplied by OSP.

    b. The pedestals shall be positioned so that the cabinet's factory-placed ground-line mark is flush with the surrounding ground level grade. All pedestals are to be plumb. Vaults shall be installed per manufacturers' specifications.

    c. Contractor shall provide and place a three to four inch (3”-4”) gravel base inside pedestals and/or vaults to enable proper drainage; all conduit openings shall be plugged or sealed. All conduit ends must extend above the pea gravel base.

    d. Contractor may be required to provide a cement foundation at least three and one- half inches (3-1/2”) thick as directed by the approved OSP representative.

5. Contractor shall mount splice enclosure(s) inside of an approved pedestal or vault.

6. Contractor shall insure that the splice enclosure is properly sealed and weatherproofed per manufacturer’s specifications.

7. Contractor shall insure approved enclosure underground mounting brackets are properly secured to enclosure and pedestal or vault.

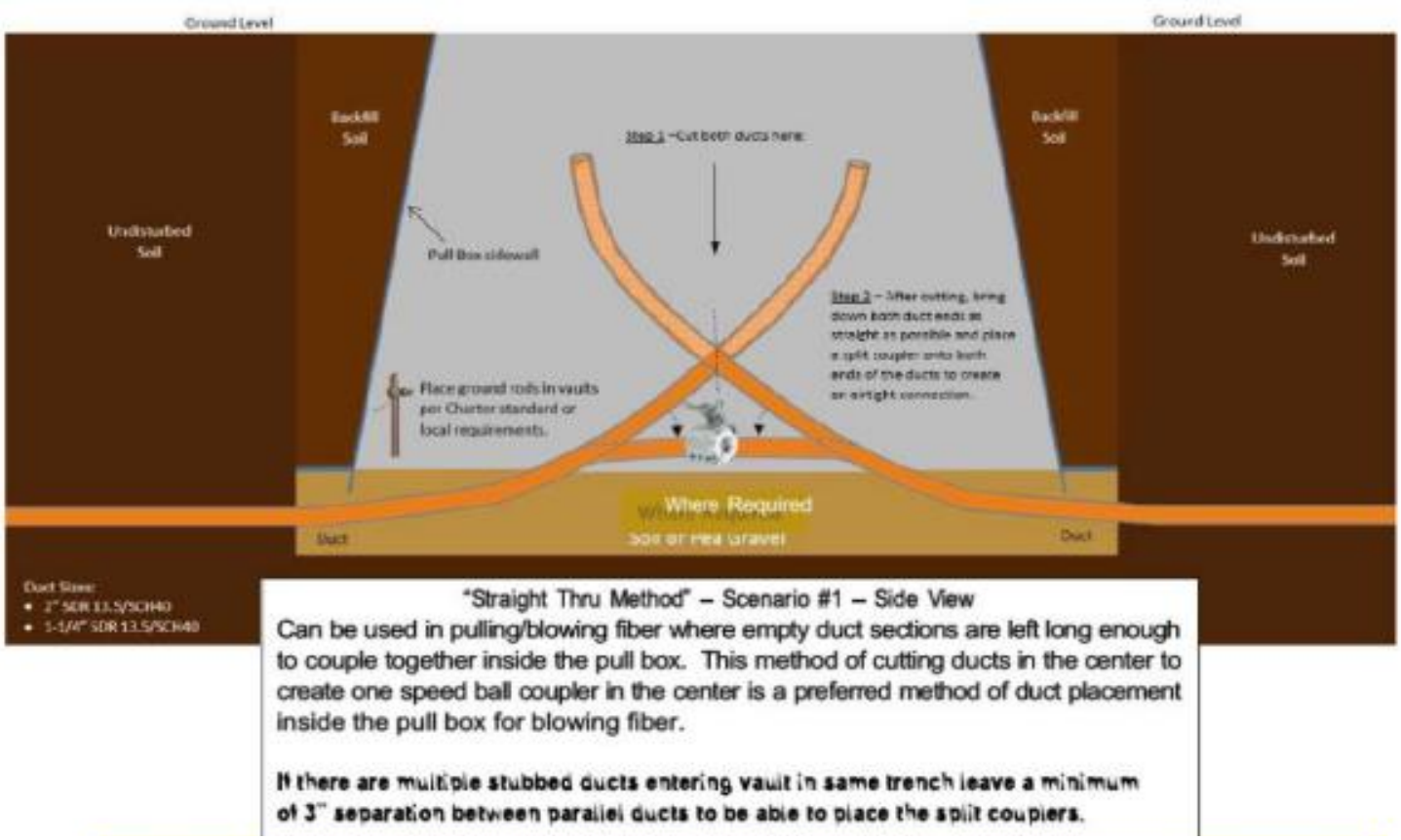
8. Contractor shall be experienced in the installation of current approved fiber optic splice case.

9. Contractor shall dress, tie-wrap all fibers, whether active or non-active.

- Method 1, preferred duct placement - "Straight Thru Method" Diagram

''' see Grounding note in diagram below

Duct Setup Method #1 for Pulling/Blowing in Fiber Optic Cable(s)
Side View



All final conduit trimming should leave a minimum of least 6"- 8" of conduit above ground level on both side walls of the pull box. The ducts should not come up into the middle of the box.

- Method 1, preferred duct placement – “Straight Thru Method” this is an actual Photo of the **page 1 drawing.**

- Method 1, preferred duct placement - "Straight Thru Method" actual Photo **2 of page 1 drawing.**

Top View

"Straight Thru Method" - Scenario #1 -Top View

Can be used in pulling/blowing fiber where empty duct sections are left long enough to couple together inside the pull box. This method of cutting ducts in the center to create one speed ball coupler in the center is a preferred method of duct placement inside the pull box for blowing fiber.

If there are multiple stubbed ducts entering vault In same trench leave a minimum of 3" separation between parallel ducts to be able to place the split couplers.

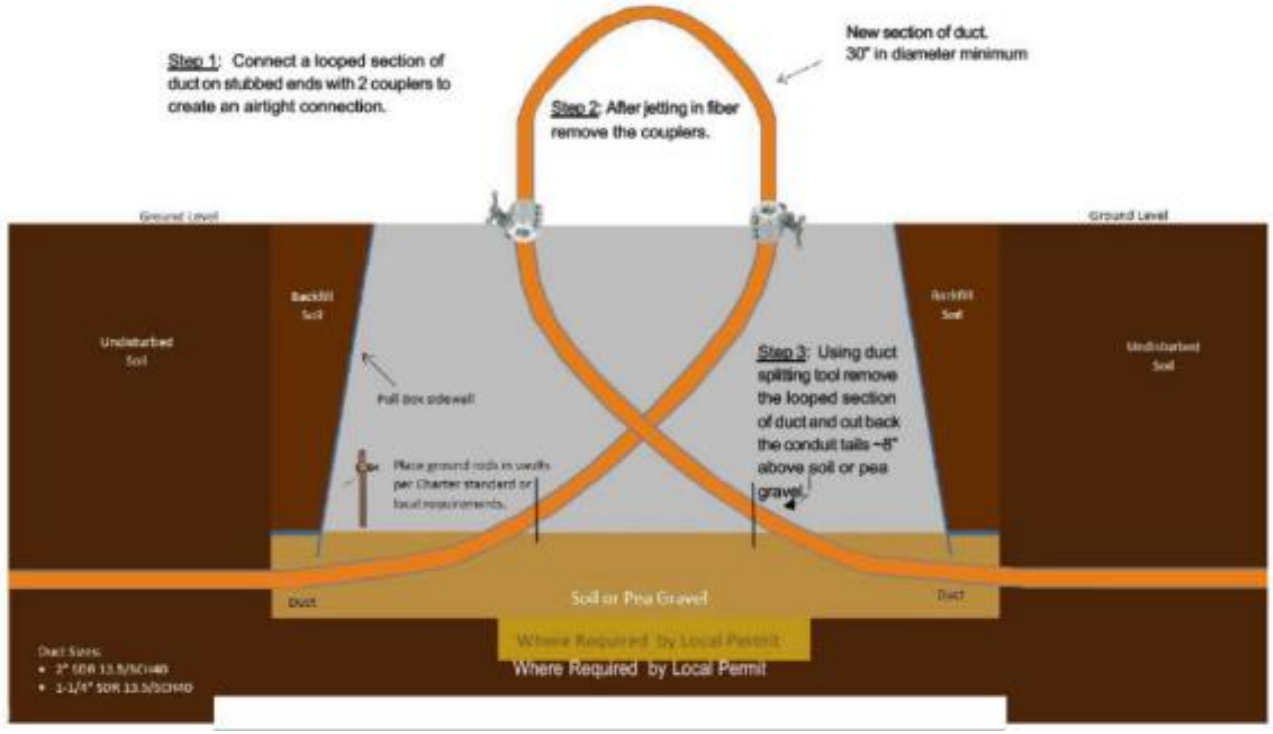
Do no cut duct short in the box, leave long enough to easily connect speed ball coupler(s).

- Method 2, secondary duct placement option Diagram

•• see Grounding note in diagram below

Duct Setup Method #2 for Blowing in Fiber Optic Cable(s)

Side View



"Looped Duct Method" - Scenario #2 - Side View

Can be used in blowing fiber where empty duct sections are left long enough inside the pull box using two speed ball couplers.

Minimum bend diameter for duct is 30"

If there are multiple stubbed ducts entering vault In same trench leave a minimum of 3" separation between parallel ducts to be able to place the split couplers.

- Method 2, secondary duct placement option actual Photo of **Page 5 drawing.**

Top View

"Looped Duct Method" - Scenario #2 - Side View

Can be used in blowing fiber where empty duct sections are left long enough inside the pull box using two speed ball couplers.

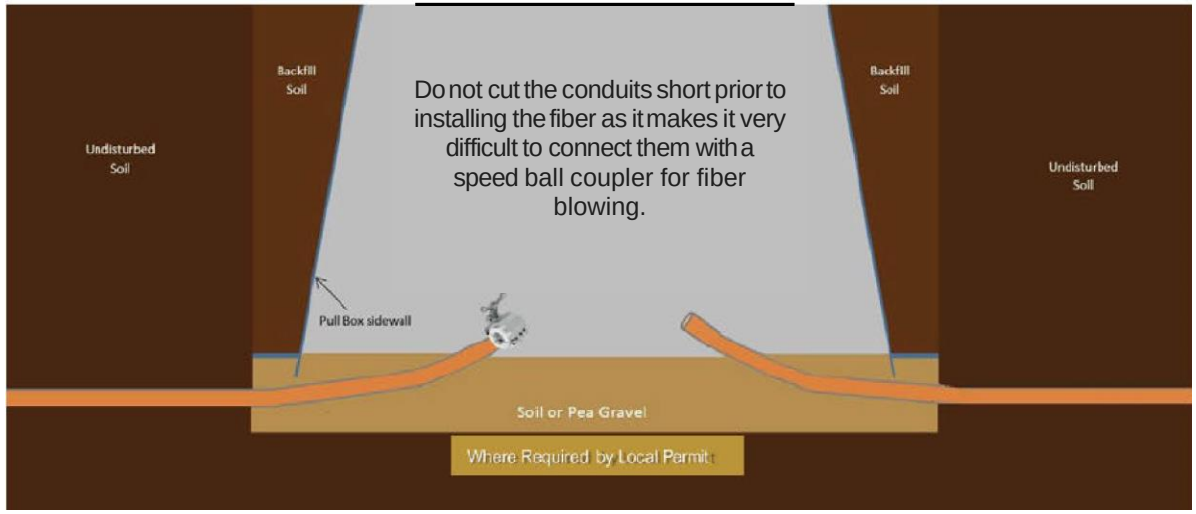
Minimum bend diameter for dud is 30".

If there are multiple stubbed ducts entering vault in same trench leave a minimum of 3" separation between parallel ducts to be able to place the split couplers.

Do not cut duct short in the box, leave long enough to easily connect speed ball couplers.

Do Not use or Install in this method. Short Ducts

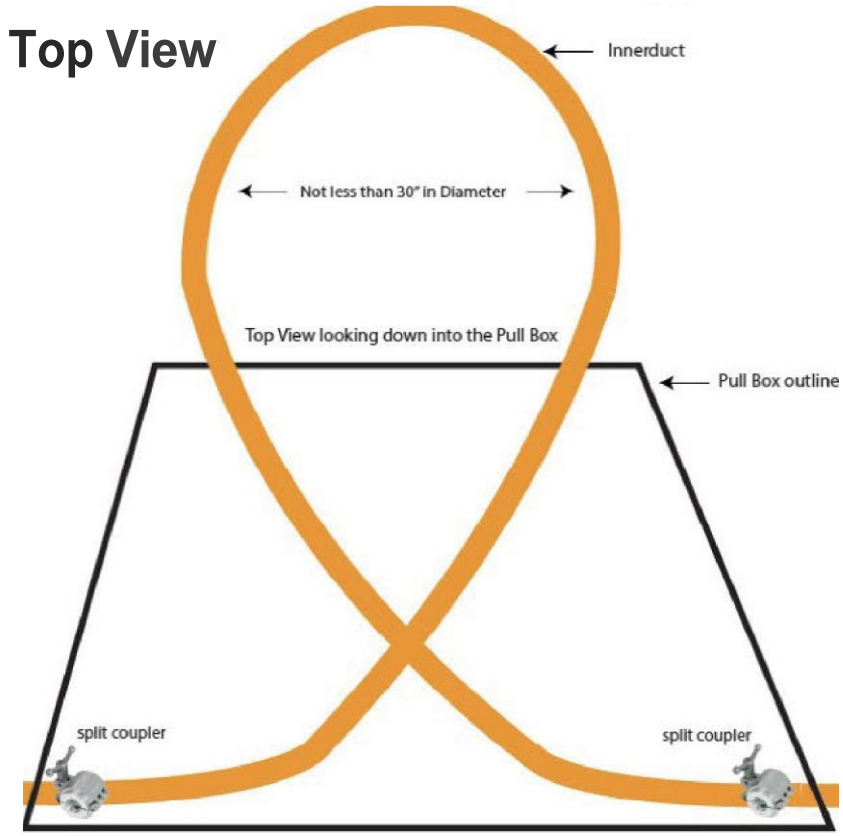
Side View



Do not cut the conduits short as it makes it very difficult to connect them with a speed ball coupler for fiber blowing.

- Not **preferred** as an **option - Short Stubbed** Duct setup to allow **blowing.**

Duct Setup #4 for <u>Blowing in Fiber</u> Optic Cable(s)



"Stubbed Duct" - Scenario #4 - Top View

** Can be used in jetting/blowing fiber where duct(s) are already cut short inside the pull box. This method of cutting ducts short is not a preferred method of duct placement. Inside the pull box.

Duct sizes·

2" SDR 13.5/SCH40

- 1-1/4" SDR13.5/SCH40

Minimum bend diameter for duct is a minimum of 30" in diameter.

- Do not use method, short ducts - Actual Photo **page**

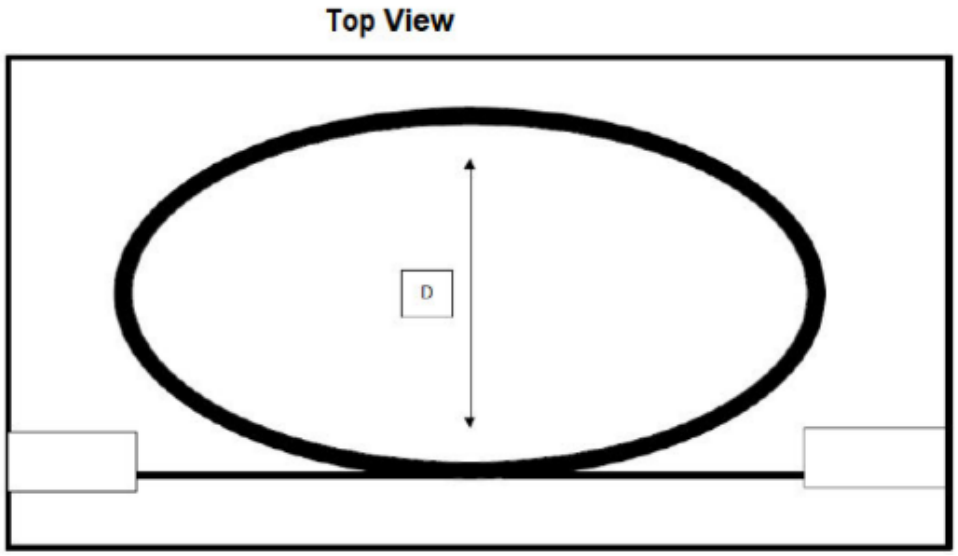
Top **View**

Note: * Short ducts cut during placement makes installing speedball couplers needed for pressurizing pipe for blowing very difficult to install/ Leave these empty ducts long as practical during duct placement to facilitate the installation of the fiber cable.

Fiber Optic Bend Diameter Principles - table 1

Material Category	MMID	Material Description	RDOF?	Diameter	Minimum Bend Diameter
Conduit	1064368	CONDUIT 1-1/4" SDR 13.5 OR 8000' RL	YES	1.660"	30"
Conduit	1041550	CONDUIT 1 1/4" SCH 40 WITH PULL TAPE	YES	1.660"	30"
Conduit	1063703	CONDUIT 2' SCH40 OR RIBBED W/ROPE	YES	2.375"	40"
Conduit	1033191	CONDUIT 2" SCH40 OR RIBBED W/ROPE	YES	2.375"	40"
Conduit	1064369	CONDUIT 2" SCH40 RIB W/ROPE OR 4000' RL	YES	2.375"	40"
Fiber	1028580	FBR 288CT RBBN SST ARMOR SNG JKT	YES	0..85"	26"
Fiber	1028575	FBR 144CT RBBN AR GEL-FREE	YES	0.71"	24"
Fiber	1028591	FBR 96 CT ARMORED LT SM DRY	YES	0.54"	20"
Fiber	1028590	FBR 72 CT ARMORED LT SM DRY	YES	0.48"	20"
Fiber	1028589	FBR 48 CT ARMORED LT SM DRY	YES	0.48"	15"
Fiber	1041554	FBR 24 CT ARMORED LT SM DRY	YES	0..48"	15"

Minimum bend diameter for slack storage: Diameter > or = 30 X Fiber Cable OD



Minimum inside dimension of vault must be large enough to allow slack coils to be stored without violating the minimum **recommended slack coil diameter.**

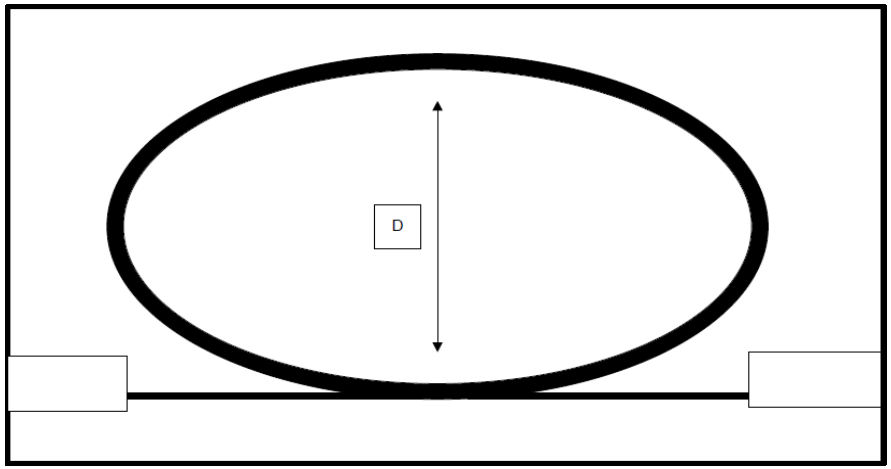
Minimum bend diameter for slack storage: Diameter > or = 30 X Fiber Cable OD

Fiber Coil Placement Methods

Loop of Fiber stored at Storage, Thru Pull Box Locations, Enclosures and MST Fiber Tap location.

- **Thru Pull Box = 75' of looped fiber**
- **Splice Enclosure Location = 100' of looped fiber**
- **MST Fiber Pedestal Location = 50' of looped fiber**
- **OLT Cabinet = 100' of looped fiber**
- **Thru Box (Butt End) Location = 75' tails**

Top View

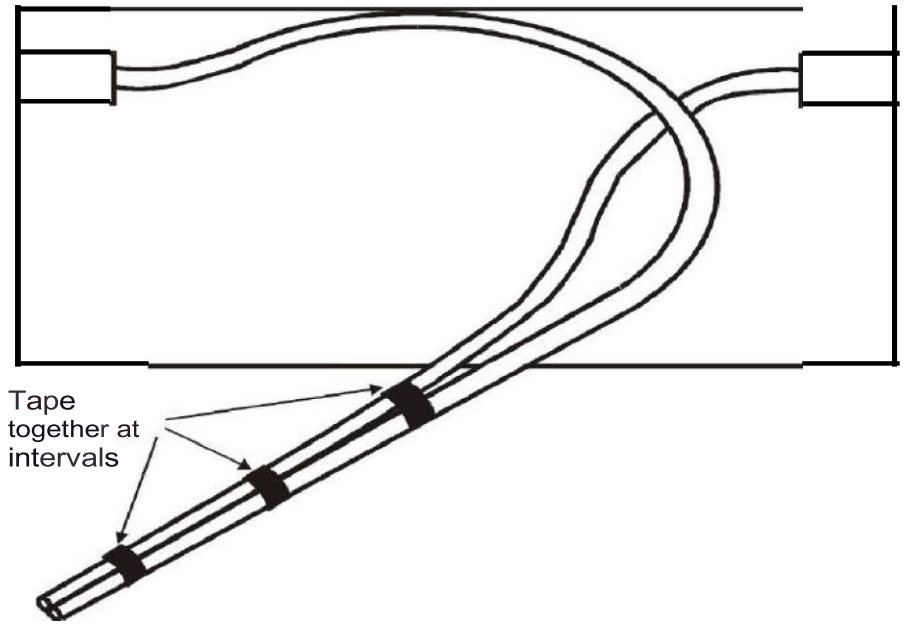


Coils Stored at Butt End Splice Point Locations

Prior to splicing, the two cable ends should be removed from the manhole and straightened as shown in the below diagram.

Be sure to maintain the minimum bend diameter of the cables when organizing them in the pull box. The cables should be secured together along their lengths using vinyl tape and the cable ends should be cut flush in preparation of splicing.

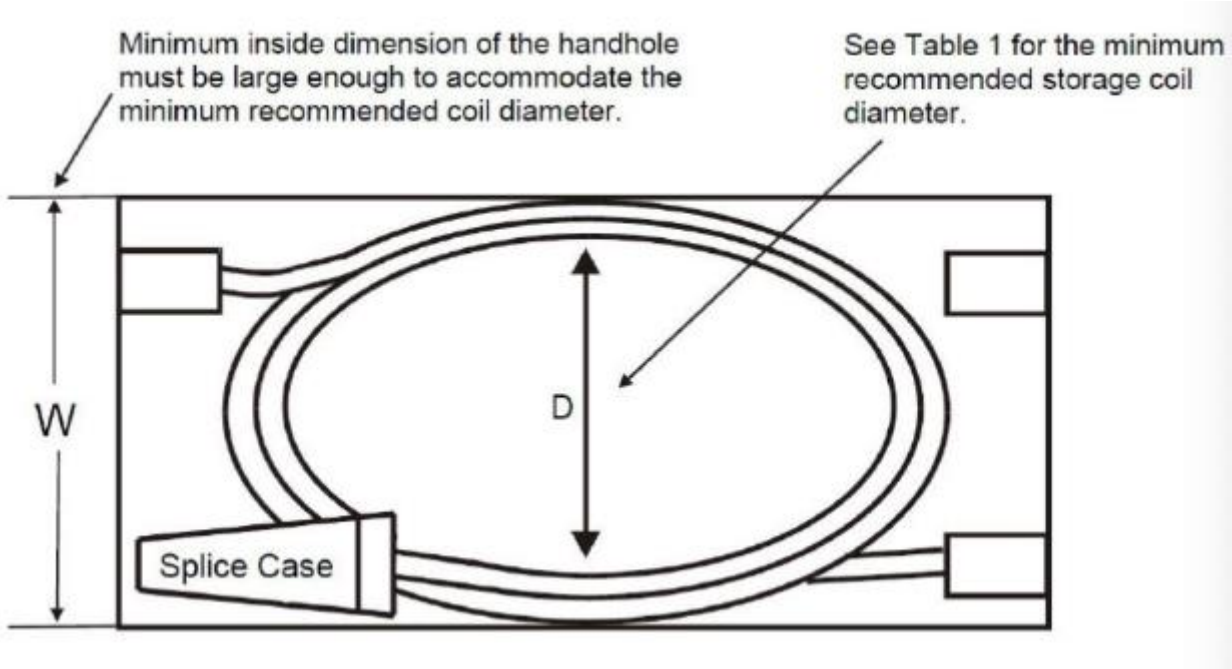
Top
View



Routing Cables at Splice Point

Tape tails together at 18" to 24" intervals

Coils Stored at Splitter Enclosure Locations



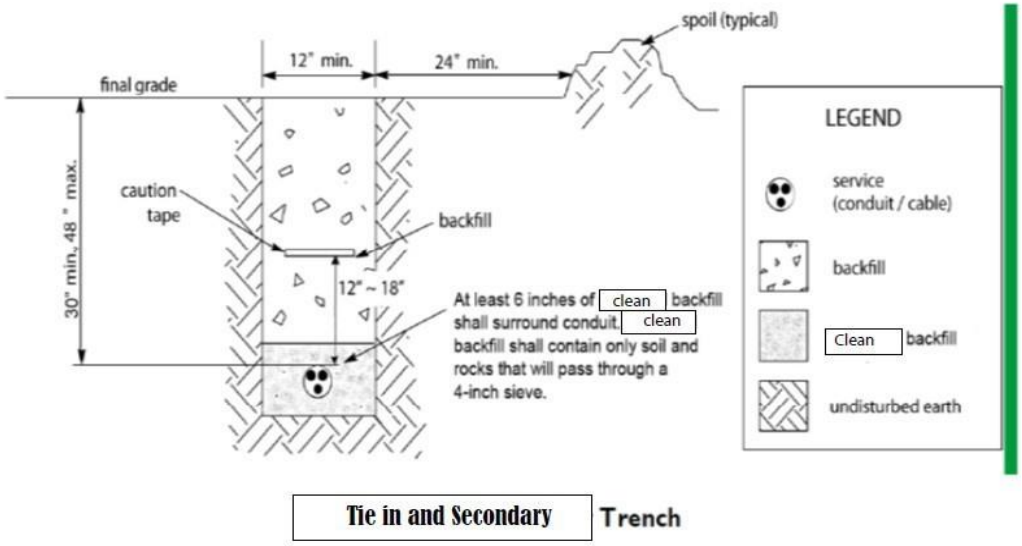
Storing slack cable and splice closure.

Minimum bend diameter for slack storage Diameter > or = 30 X Fiber Cable OD

Tape tails together at 18" to 24" intervals

Conduit and Innerduct - Trench for Tie In

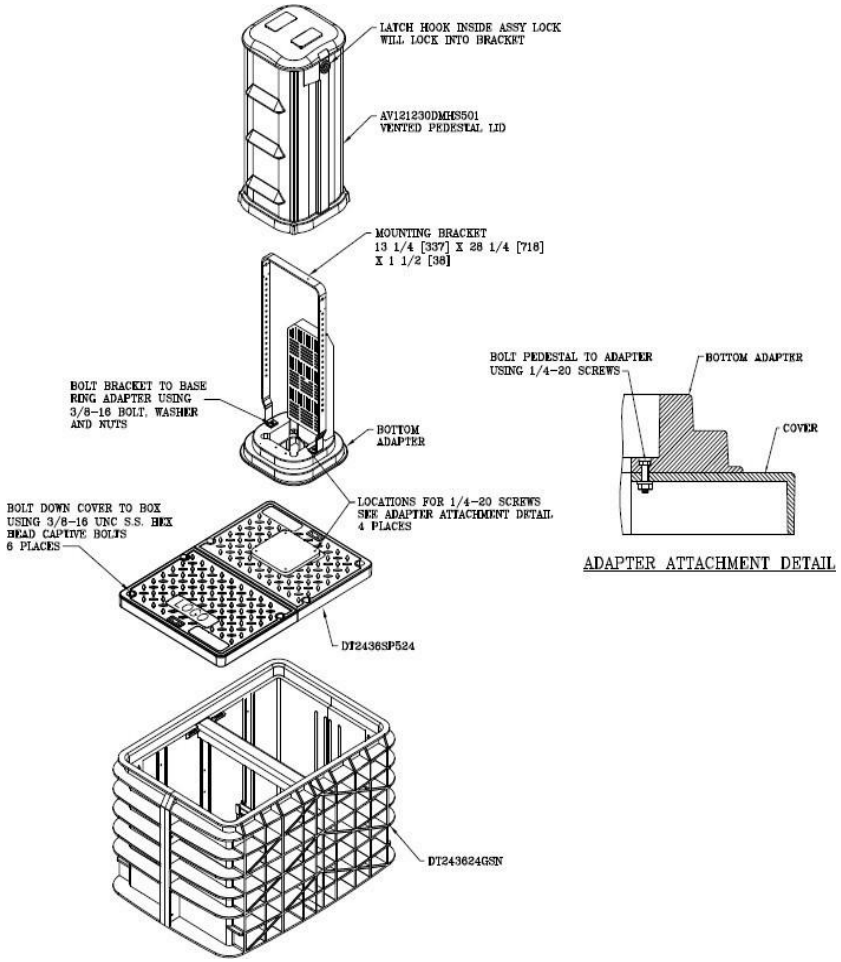
The Tie in and Secondary conduit/duct trench is normally in the Public Utility Easement (PUE) or an Established right-of-way (ROW). This trench may include both secondary and primary Cable to connect to bores and pull boxes. When digging Tie in trench, follow the dimensions shown



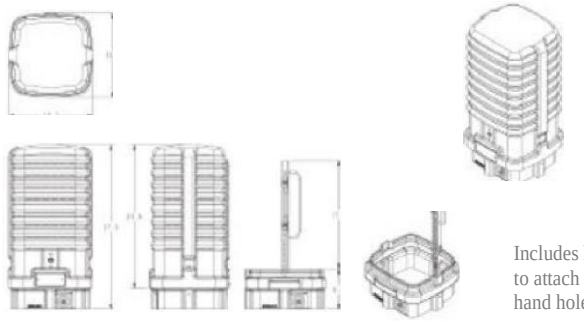
Tie in and Secondary Trench

Where possible, colored warning tapes identifying the cables as telecommunications cables shall be placed 12 inches above cables.

Pedestal Mounted Enclosure

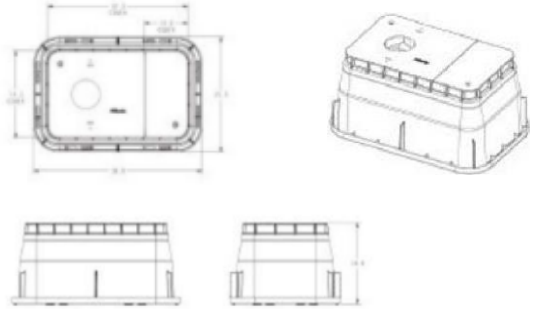


Color	Light Green - Option #2
Lock	HEX (option SS07) 
Cover Dimensions BO5 Series PI73018	 12” X 12” X 24"H 19” X 32"
Overall Dimensions 805 Series PI73018	 14” X 14" X 27"H 26” X 39” X 18"H



Includes hardware kit to attach to PI73018 hand hole.

P/N **805SS07V20B04BB**



P/N **P173018YBGTHXXX**

Solid Level Footing for Pull Box Enclosures is Essential

RECOMMENDED INSTALLATION PROCEDURES

Note: The following information is provided as reference only. The installing contractor, utility, developer or the person responsible for the placement of the enclosure is advised to follow the American Society for Testing Materials (ASTM) C-891,"Standard Practice for the Installation of Underground Precast Concrete Utility Structures", as last revised, current OSHA Regulation and /or the local agency requirements.

A. Excavation

A.1 The excavation should be prepared so that the overall dimension of the excavation is twelve- (12) inches longer and wider than those of the enclosure. The depth of the excavation should include the overall outside height of the enclosure plus the required thickness of the base material. Normally the requirement for the base material is four- (4) to six- (6) inch of crushed rock. However, the utility or municipality should provide the actual requirements.

B. Placement of the Enclosure

B.1 Positioning the enclosure into the excavation with the frame and cover in place. Check elevation of the frame and cover with the final grade and ma the necessary adjustments if required.

C. Backfill

C.1 The backfill material shall be granular and free from large stones, rocks, pavement etc.

C.2 The backfill material should be placed as soon as practical after the enclosure has been placed in the excavation.

C.3 Backfilling should be achieved by using lifts (layers) or flooding (Jetting) the excavation to achieve 95% compaction.

C.4 If vibrating tamping equipment is used to achieve the required compactio care should be taken not to damage the enclosure and internal bracing should be placed inside the enclosure to prevent excessive deflection. The bracing should be left in place until backfilling is completed.

Pull Box / Vault Placement Guidelines

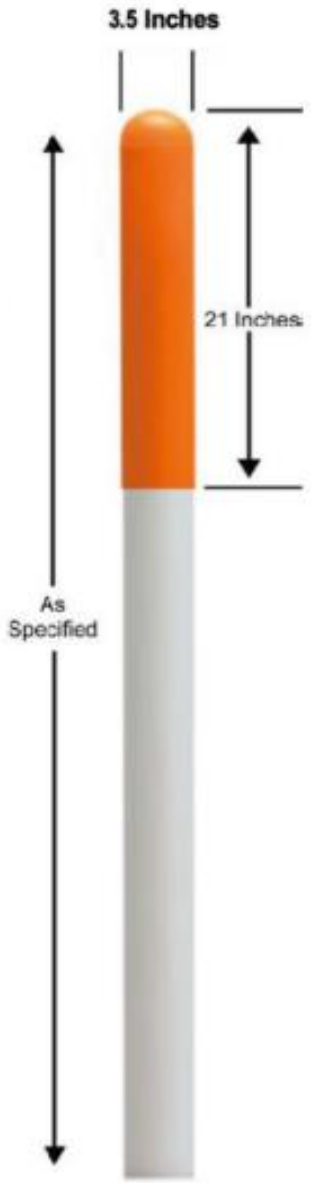
- Boxes should be place level and at grade, proper landscaping completed
- Do not place a pull box /vault directly in front of a wood utility pole
- Avoid placement of the box on the slope of a hill or ditch
- Avoid placing boxes in high farming traffic areas
- Place Ground rods per Customer Standards or Local requirements for future grounding of Armored Fiber
- Place fiber marker posts with the horizontal ground stake at each box location (see instructions on next page)

Fiber Optic Marker Post Installation

SPECIFICATIONS

Material: HDPE
Weight: 0.54 lbs per foot
Width: 3.5 inch
Wall Thickness: .135
*Standard Lengths: 72 & 96 inch
*Standard Dome Colors: White, Orange, Yellow, Blue, Green, Red, Purple, Black
*Standard Post Colors: White, Orange, Yellow, Blue, Green, Red, Purple, Black

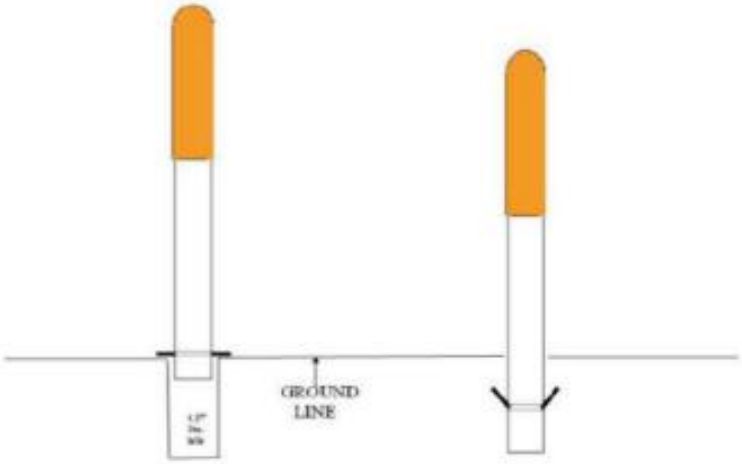
* Custom colors or lengths available upon request



INSTALLATION INSTRUCTIONS FOR DOME MARKER WITH ANCHOR BAR

1. Dig hole. (small auger or post hole digger)
2. Line the marker on top of the hole with plastic anchor in place as shown on first drawing.
3. Push the marker down to the bottom of the hole. Flexible anchor will create a fish hook effect and prevent the post from withdrawing.
4. Align marker straight in the hole then backfill and tamp earth as shown in the second drawing.

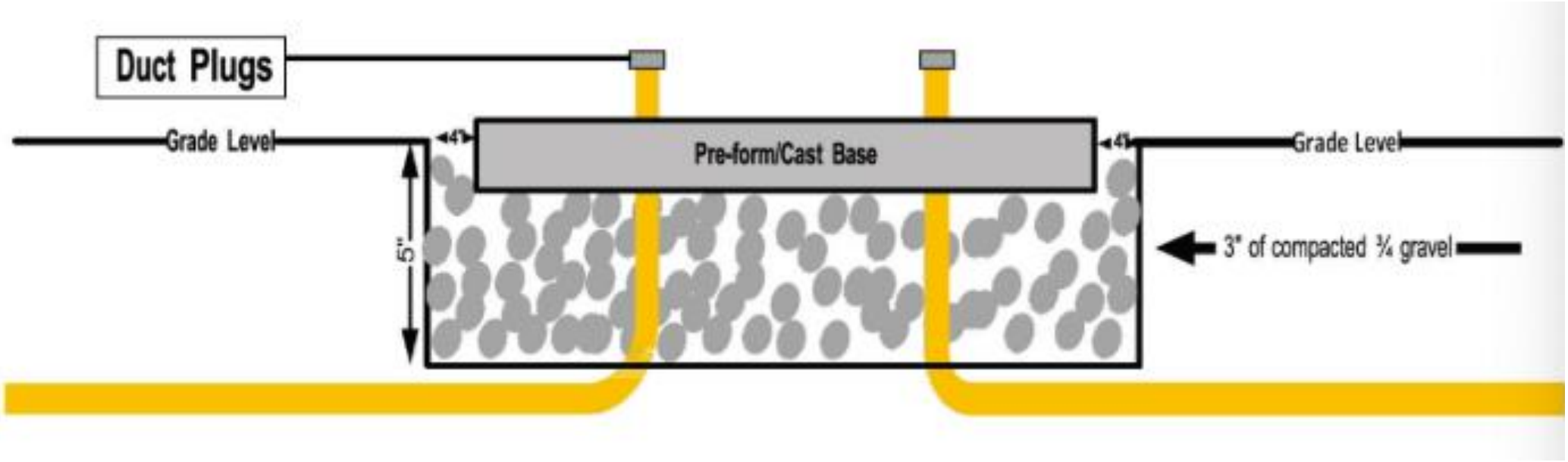
Post Diameter	Minimum Hole Diameter	Suggested Hole Depth
3.5"	4.5"	18" – 24"



Underground Equipment Mounting Uniformity

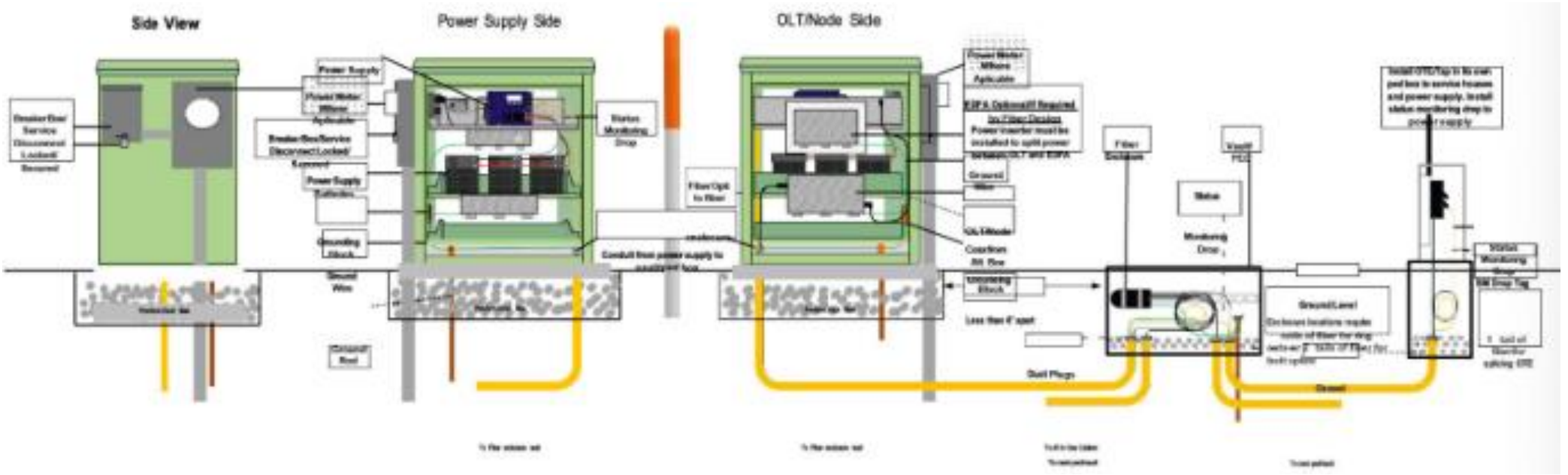
Cabinet Base Installation

- **Dig hole at a minimum of 5" deep and 4" larger than dimensions of base pad for drainage.**
- **Install a minimum of 3" layer of compacted ¾ gravel.**
- **Install Customer approved pre-form or cast base 1" above grade level.**
- **Install duct plugs on ends of all conduits.**



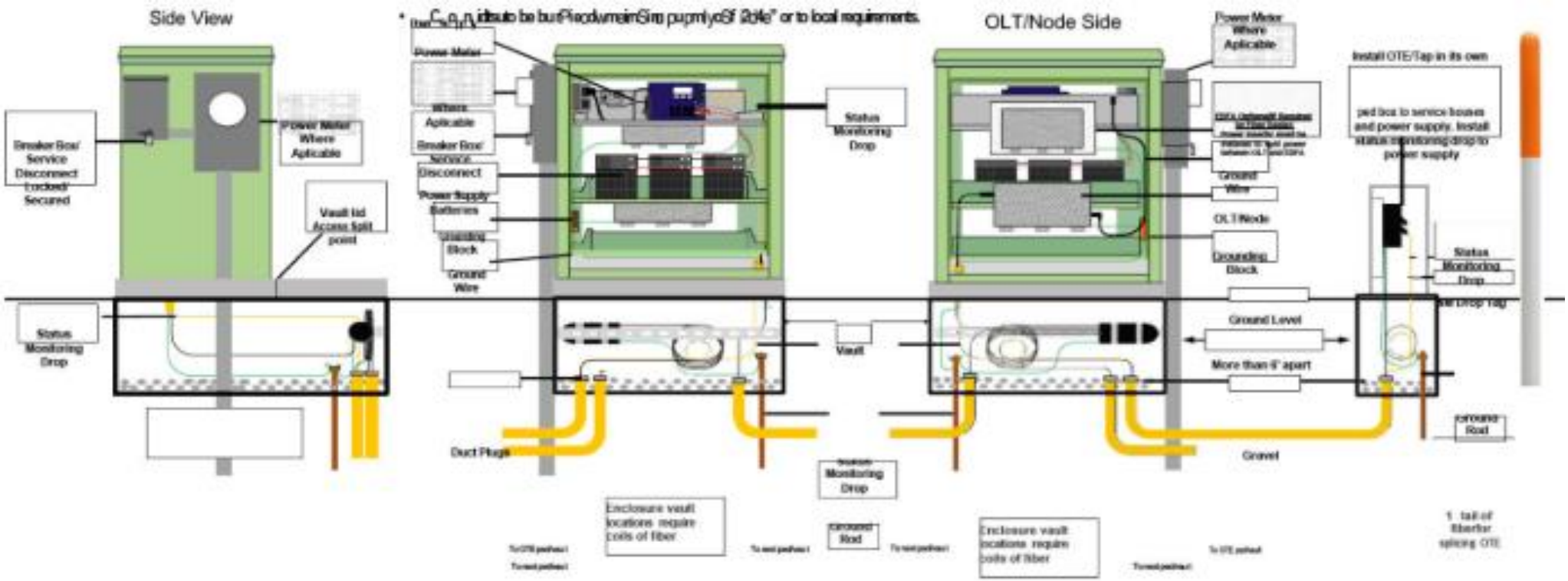
All in One Cabinet Pad Mounted

- Mounting pad to be installed as per Cabinet Base Installation method.
- Cabinets to be installed on mounting pads approved by Customer.
- Ground rods to be installed and all equipment to be grounded as per NESC and Customer specifications.
- If ground rods are 6' or less from each other, ground rods must be bonded together.
- Power supply is to be installed as per manufacturer specifications.
- OTE/Tap is to be installed in separate ped box for status monitoring drop and customer drops.
- Status monitoring drop to be installed from OTE/Tap ped to power supply.
- Install drop tag on status monitoring drop identifying as such
- Fiber to be coiled and placed in bottom of vault and ped as per Customer specifications. Install fiber marker post as per Customer specifications.
- Install duct plugs on ends of all conduits.
- Conduits to be buried minimum of 24" or to local requirements.



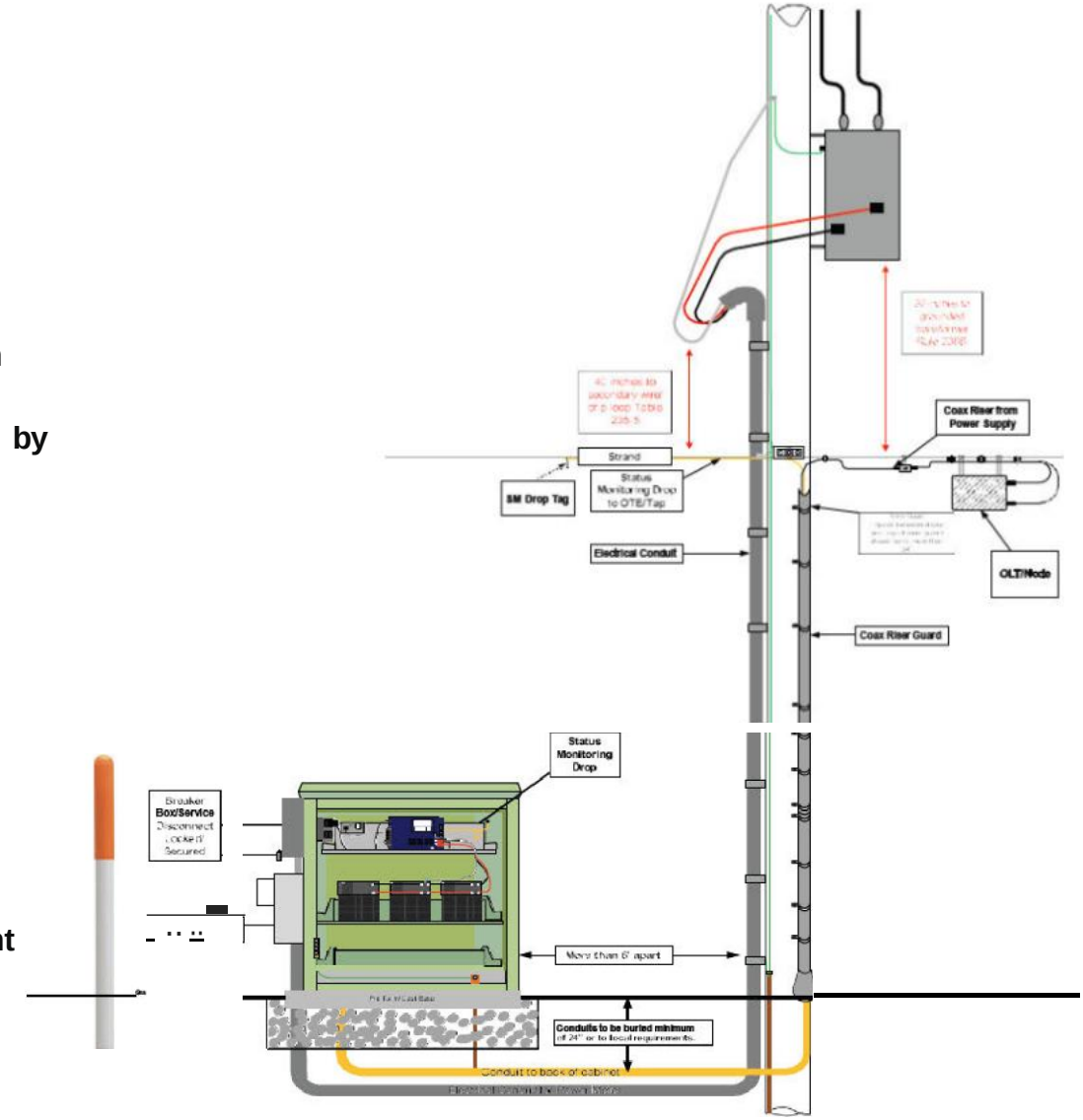
All in One Cabinet Vault Mounted

- Vault box to be installed as per Customer specifications.
- Cabinets are to be installed on vault mounting pads approved by Customer.
- Ground rods to be installed and all equipment to be grounded as per NESC and Customer specifications.
- If ground rods are 6' or less from each other, ground rods must be bonded together.
- Power supply is to be installed as per manufacturer specifications.
- OTE/Tap is to be installed in separate ped box for status monitoring drop and customer drops.
- Status monitoring drop to be installed from OTE/Tap ped to power supply.
- Install drop tag on status monitoring drop identifying as such
- Fiber to be coiled and placed in bottom of vault and ped as per Customer specifications.
- Install fiber marker post as per Customer specifications.
- Install duct plugs on ends of all conduits.



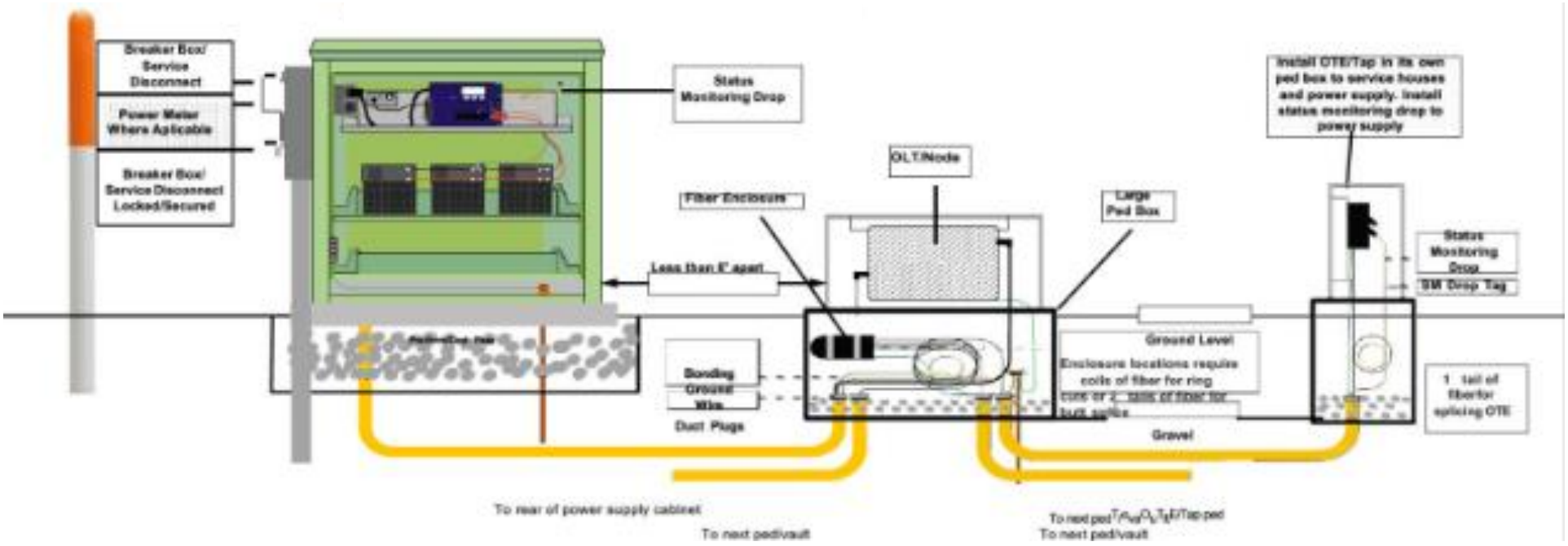
Ground Mounted Power Supply

- **Cabinets to be mounted no closer than 6ft to a utility pole (where possible and unless local code requires)**
- **If utility pole is within 6' of cabinet the two are to be bonded together as per NESC.**
- **Mounting pad is to be installed as per Cabinet installation** method.
- **Cabinets are to be installed on mounting pads approved by Customer**
- **Ground rods to be installed and all equipment to be grounded as per NESC and Customer specifications.**
- **Power supply is to be installed as per manufacturer specifications.**
- **Status monitoring drop to be installed from OTE/Tap tpower supply.**
- **Install drop tag on status monitoring drop identifying as such**
- **All risers on pole are to be installed with riser guard or** conduit.
- **Conduit stand offs are to be used if utility pole agreement** requires.
- **Install duct plugs on ends of all conduits.**
- **Conduits to be buried minimum of 24" or to local**



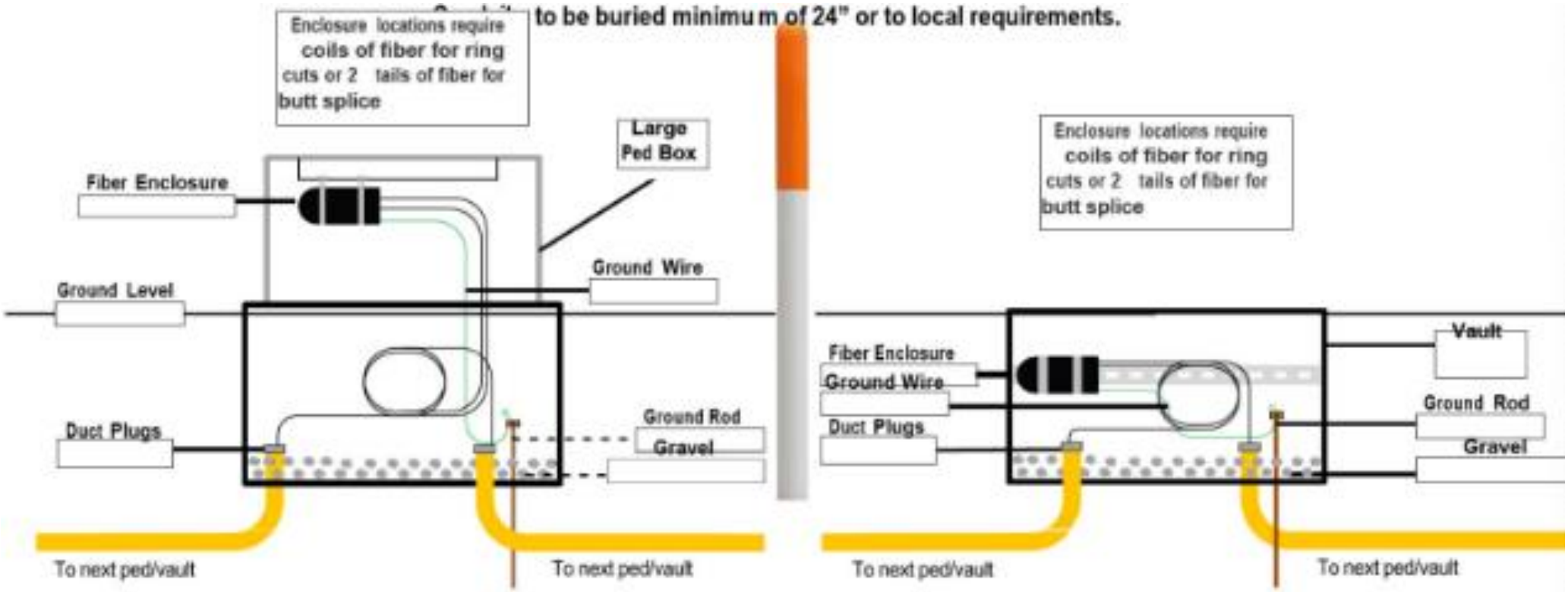
OLT/Node Pedestal

- Mounting pad is to be installed as per Cabinet Base Installation method.
- Cabinet to be installed on mounting pads approved by Customer.
- Ground rods to be installed and all equipment to be grounded as per NESC and Customer specifications.
- If ground rods are 6' or less from each other, ground rods must be bonded together.
- Power supply to be installed as per manufacturer specifications.
- OTE/Tap is to be installed in separate ped box for status monitoring drop and customer drops.
- Status monitoring drop to be installed from OTE/Tap ped to power supply.
- Install drop tag on status monitoring drop identifying as such
- Fiber to be coiled and placed In bottom of vaults and peds as per Customer specifications.
- OLT/Node ped box to be Installed as per Customer specifications.
- OLT/Node to be mounted In ped box using mounting clamps to mounting bracket supplied with ped
- box.
- Install fiber marker post as per Customer specifications.
- Install duct plugs on ends of all conduits.
- Conduits to be buried minimum of 24" or to local requirements.



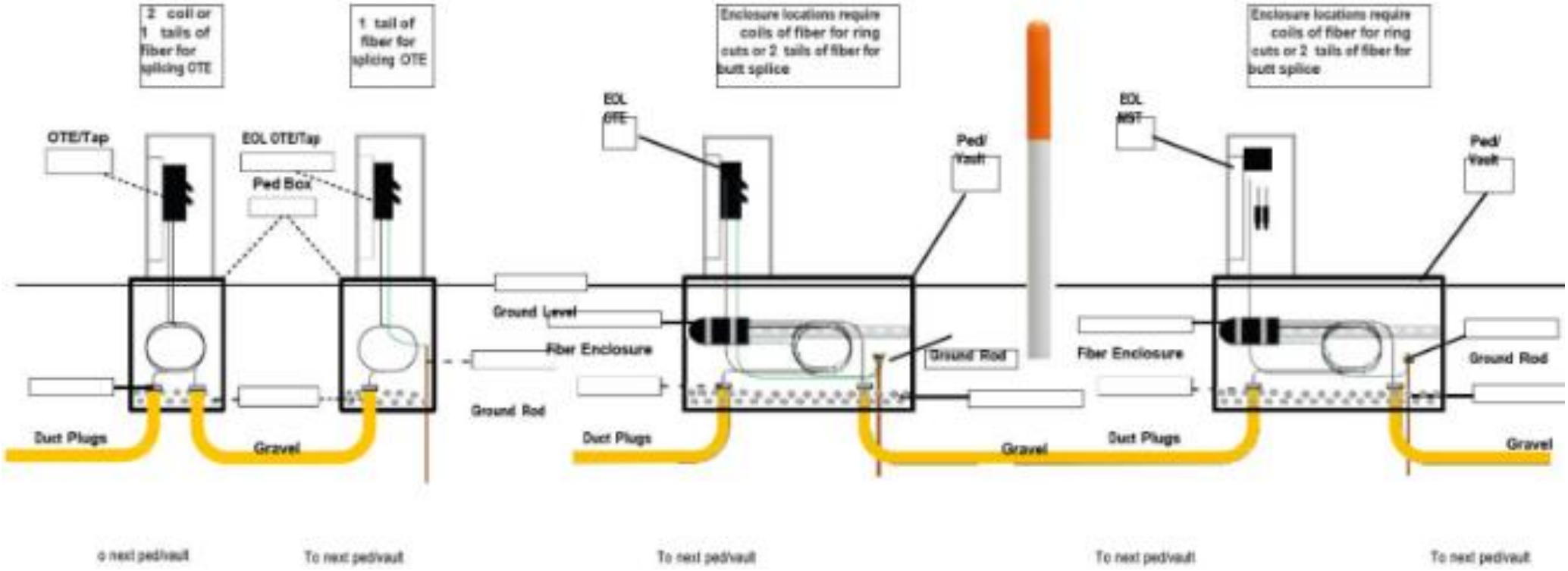
Fiber Enclosure Pedestal/Vault

- **Large ped or Vault box to be installed as per Customer specifications.**
- **Fiber to be coiled and placed in bottom of vault as per Customer specifications.**
- **Fiber enclosure to be mounted on support brackets in vault or ped box using hanger brackets.**
- **Ground rods to be installed and all equipment to be grounded as per NESC and Customer specifications**
- **Install fiber marker post as per Customer specifications.**
- **Install duct plugs on ends of all conduits.**



OTE-MST Pedestal

- OTE/MST only locations install ped box to Customer specifications.
- OTE/MST locations with fiber enclosures install ped vault box to Customer specifications.
- OTE/MSTs to be mounted on support bracket with mounting brackets supplied and fiber to be coil at bottom of ped box as per Customer specifications.
- Ground rods to be installed and all equipment to be grounded as per NESC and Customer specifications.
- Install fiber marker post as per Customer specifications.
- Install duct plugs on ends of all conduits.
- Conduits to be buried minimum of 24" or to local requirements.



VAULT AND PEDESTAL

PLACEMENT

Excavation

- The excavation should be prepared so that the overall dimension of the excavation is 8 inches longer and wider than those of a fiber enclosure/ pull box vault, and 8 inches longer and wider than those of a pedestal box vault.

- The depth of the excavation should include the overall outside height of the enclosure vault plus the required thickness of the base material, at least 5-8 inches deeper than enclosure depth. Normally the requirement for the base material is a minimum of 3 inches of crushed rock. The gravel should extend past the sidewalls of the enclosure, which will act as

Pull Box/ Fiber Enclosure

Placement of the Enclosure

- Positioning the enclosure into the excavation with the frame and cover in place. Check elevation of the frame and cover with the final grade and make the necessary adjustments if required.

Backfill

- The backfill material shall be granular and free from large stones, rocks, pavement etc. Large stones, rocks, pavement should be sifted from the backfill material.
- The backfill material should be placed as soon as practical after the enclosure has been placed in the excavation.
- Backfilling should be achieved by using lifts (tamping the layers) in the excavation to achieve 95% compaction.
- If vibrating tamping equipment is used to achieve the required compaction care should be taken not to damage the enclosure and internal bracing should be placed inside the enclosure to prevent excessive deflection. The bracing should be left in place until backfilling is completed.

Enclosure Placement Guidelines

- Boxes should be placed level and at grade, proper landscaping completed.
- Place fiber marker posts with the horizontal ground stake at each box location (Please refer to fiber marker post placement guidelines page 12).
- In rural application, it is recommended to place two fiber marker post where fiber enclosures are located to assist identifying these locations.

Fiber Enclosure Location 2 Markers

Enclosure Placement Guidelines

- Do not place a pull box /vault next to, or directly in front of a wood utility pole. Enclosures should be placed 6 feet or greater in all directions from poles, no closer.

Enclosure Placement Guidelines

- Avoid placement of the enclosure on the slope of a hill or ditch if available.

Fiber Enclosure Vault Placement Guidelines

- Place an 8 ft. vertical ground rod and a No.6 ground wire per OSP TECHNOLOGIES Standards or Local requirements for future grounding of Armored Fiber and HFC Plant.
- All Fiber enclosures (in HFC and ROOF applications) stored within vaults need to be grounded, also End of Line OTEs need to be grounded.
- In HFC applications four grounds per mile are required for Amp and Line Extenders. End of Line Taps need to be grounded as well.
- In ROOF applications four grounds per mile are required for Fiber Enclosures and, End of Line OTEs.
- All taps should be mounted on brackets, no tie wraps or tape.

Enclosure Placement Guidelines

- Avoid placing boxes in high farming traffic areas.
- Seek direction from your in-house construction contact in the event an enclosure is set to be placed in one of these areas

Enclosure Placement Guidelines

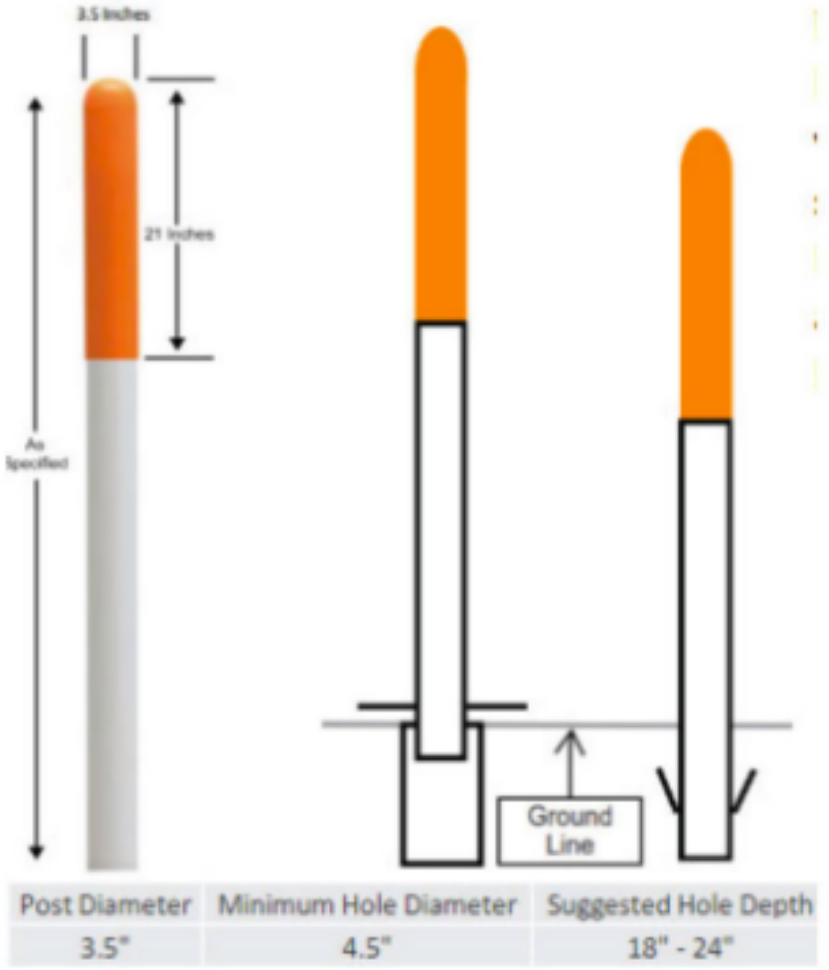
- Bolt down all enclosure and ped vault lids with correct hardware.

Enclosure Placement Guidelines

- Mount all equipment in ped vaults with correct brackets and hardware. No zip ties.

Fiber Marker Post Placement Guidelines

- Underground fiber marker post are required to be installed at regular intervals between fiber pedestals or vaults, with a maximum spacing of 500ft.
- Marker posts are required at all ped box and vault locations.



Post Diameter	Minimum Hole Diameter	Suggested Hole Depth
3.5"	4.5"	18" - 24"

BONDING AND GROUNDING SPECIFICATIONS OUTSIDE PLANT

BONDING AND GROUNDING – CONSTRUCTION WORK

1. Contractor shall perform system grounding in compliance with all local, state and federal electrical codes (NESC) including general orders from utilities and joint pole administration agencies. State, county, and local requirements supersede OSP requirements.

2. Contractor shall also install bond-supporting strand in compliance with the pole owner's specifications and requirements.

3. Contractor shall place eight-foot (8') vertical ground rods at all power supply locations and shall bond to the applicable power company's ground if power facilities are within 6 feet (6') of CATV plant. In any case where this specification is in conflict with respect to the pole owner's vertical grounding specifications and requirements, the pole owner's grounding specifications and requirements shall control and be followed.

4. Contractor shall place a bond at all pole mounted power supply cabinet locations and shall bond to the applicable power company's ground. In any case where this specification conflicts with respect to the pole owner's vertical grounding specifications and requirements, the pole owner's grounding specifications and requirements shall control and be followed.

5. Contractor shall place vertical grounds and bond with appropriate bonding materials and methods to existing power company verticals at all active devices and end of lines., (Any device that requires power to operate is considered an active device.)

6. Contractor shall place bonds and/or vertical grounds as required, with other utility neutrals on joint use poles at every first, tenth, and last pole, with a minimum of four grounds/bonds per mile.

7. Contractor shall complete all bonding and grounding of all fiber enclosures prior to performing final optical fiber testing. Contractor shall install a bond to strand for all aerial fiber enclosures, end of line OTEs and MSTs Contractor shall ground all enclosures, end of line OTEs and MSTs, and attach to a standard full vertical ground rod in underground locations.

8. OSP will provide all materials for bonding and grounding.

DEFINITIONS

BONDING: The electrical interconnecting of conductive parts, designed to maintain a common electrical potential

BONDING JUMPER: A reliable conductor to assure the required electrical conductivity between metal parts required to be electrically connected.

GROUNDING: A conducting connection, whether intentional or accidental, between an electrical circuit or equipment and the earth, or to some conducting body that serves in place of earth.

GROUNDED: Connected to or in contact with earth or a conductive body that extends the earth connection.

GROUNDED CONDUCTOR: A conductor that is used to connect the equipment or the wiring system with a grounding electrode or electrodes

GROUNDING ELECTRODE: A permanent and adequate system involving connection of the electrical system to existing electrodes such as metallic water piping systems, steel reinforcing bars in concrete foundations and footing, and/or made electrodes, such as driven ground rods, buried wires in a ground ring or buried copper plates.

GROUNDING ELECTRODE CONDUCTOR: The conductor used to connect the grounding electrode to the equipment grounding conductor and/or to the grounded conductor of the circuit at the service equipment or at the source of a separately derived system.

BONDING AND GROUNDING SPECIFICATIONS

- Customer requires a ground to be installed at all **power supplies, active equipment, splice enclosures, and end of line OTE/MSTs with a minimum four connections per 1-mile (1.6 km).**
- An 8ft vertical ground rod with a No.6 ground wire will be installed at all ground locations.
- State, municipality and local utility may require additional connections and will supersede Charters requirements. Coordinate with local Project Management for information.
- All existing bonds or grounds that do not meet current specifications will be properly repaired or replaced.
- Bonding between all above ground metallic supply and communications enclosures that are separated by 6 feet or less is required. For this rule pole grounds are not required to be bonded to the communication enclosure.

NESC REQUIREMENTS - UNDERGROUND

The minimum requirements for bonding and grounding of our outside plant are detailed in the National Electric Safety Code (NESC). Utilities and municipalities can demand requirements additional to those specified in the NESC but all requirements of the NESC must be met.

The National Electric Safety Code (2023 Edition) details the minimum requirements for bonding and grounding in the following rules listed.

354D. Supply and communication cables or conductors:

1g. Adequate bonding shall be provided between the effectively grounded supply conductor or conductors and the communication cable shield or sheath at intervals that should not exceed 1000 ft.

374. Grounding:

A. All exposed conducting surfaces of the termination device other than live parts and equipment to which it is attached shall be effectively grounded.

8. Conductive structures supporting cable terminations will be effectively grounded

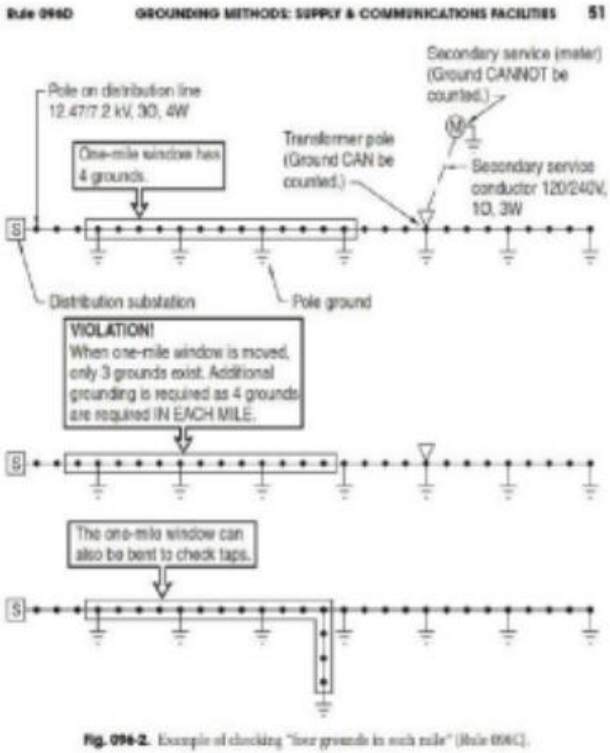


Fig. 096-2. Example of checking "four grounds in each mile" [Rule 096C].

Fiber Splice Enclosure Locations

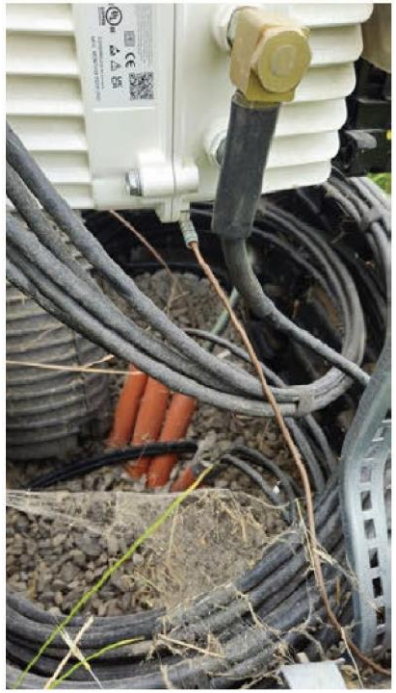
Underground fiber slice enclosure locations weather in a vault or a ped box are to have an 8ft vertical ground rod installed and a No.6 ground wire connected to fiber enclosure as per manufacturers specifications.

End of Line (EOL) OTE/MST Locations

Underground End of Line (EOL) OTE/MST locations are to have an 8ft vertical ground rod installed and a No.6 ground wire connected to OTE/MST as per manufacturers specifications.

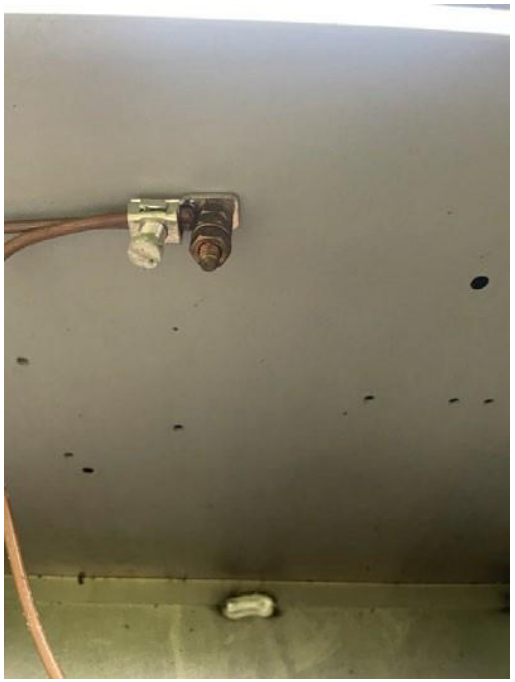
Ground Mounted OLT Locations

Ground mounted OLT locations weather in a cabinet or a ped box are to have an 8ft vertical ground rod installed and a No.6 ground wire connected from the ground rod to the OLT and/or cabinet as per manufacturers specifications.



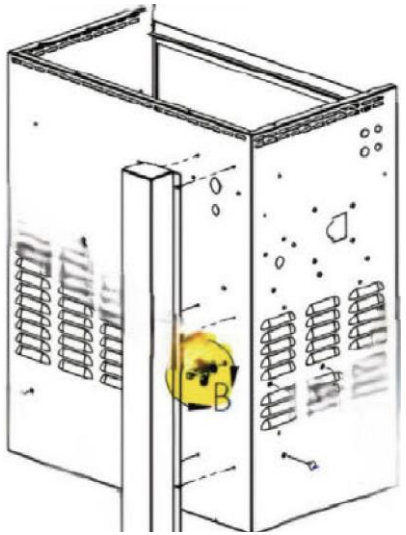
Ground Mounted Power Supply Locations

Ground mounted power supply cabinets must have an 8ft ground rod installed and the cabinet must be connected to the ground rod using the supplied ground lug or bus bar installed by the manufacturer.



Ground Mounted Power Supply Locations cont.

Ground Lug for this cabinet
is located behind the Coax



BONDING CABINETS

Bonding between all above ground supply and communications enclosures that are separated by 6' or less are required. For this rule cabinets installed next to utility poles need to bonded together.

Underground

Fiber Construction Slack (Storage) Loop

Method of Procedures

OVERVIEW

Minimum bend radius formula >= 20 x fiber cable O.D.

Aerial fiber 150' of slack approx. every 1500' of aerial route

*Slack loops will be stretched out to approx. 75' from loop to loop.

*Slack loops will be no closer than 8' to any pole.

Risers - 200' of slack - (riser with ENCLOSURE 125' slack)

Major crossings - 200' of slack- before and after.

OTE/MST- Pass Thru 100' coil, END OF LINE 50' tail

Underground/manhole slack - 50' of slack approx. every 500' of fiber pulled.

Underground/manhole enclosure - 50' coil or 25' tails

Underground MST/OTE - 20' coil for thru location, 10' tail for EOL

Underground OLT/AiO Cabinet - 50' of slack

Lock box/panel - 20' of slack

Building attachments - 50' of slack no closer than 8' to structure

Fiber Minimum Bend Diameter

FIBER IS NOT TO EXCEED THE MINIMUM BEND DIAMETER OF THE FIBER AS LISTED IN TABLE BELOW.

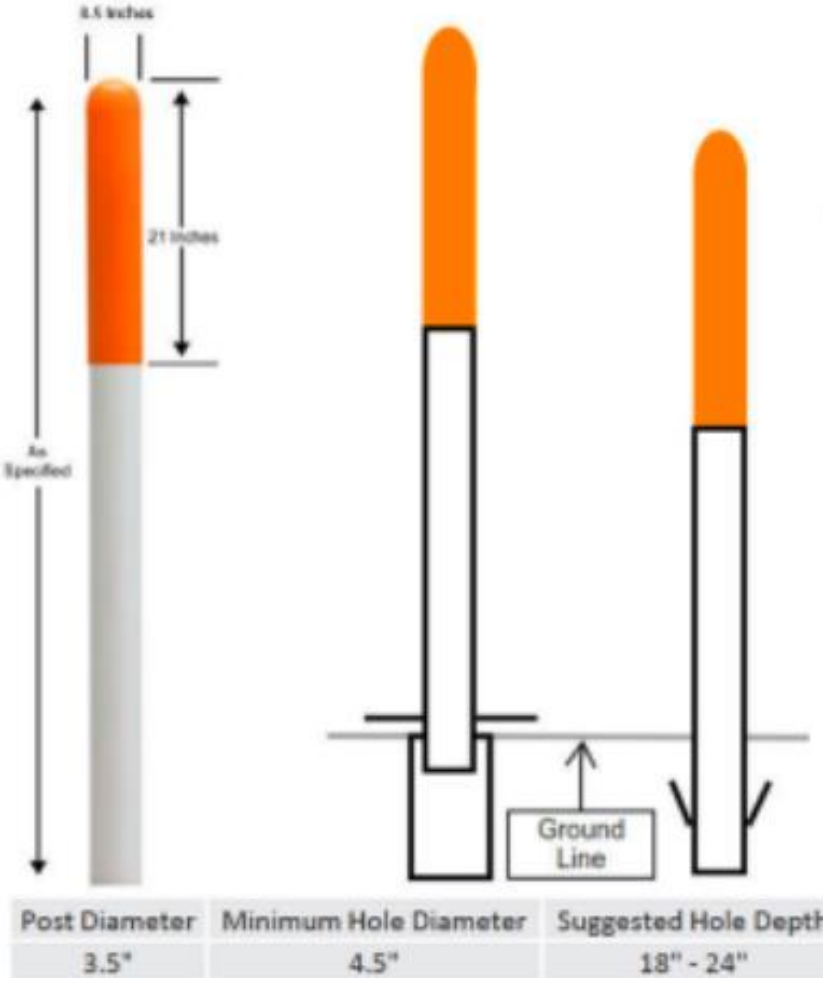
MINIMUM FIBER BEND DIAMETER FORMULA

>= 20 X FIBER CABLE O.D. (OUTSIDE DIAMETER)

Material Category	Material Description	Cable Diameter	Minimum Bend Diameter in inches	Recommended Snow Shoe Size
Fiber	FBR 288CT RBBN SST ARMOR SNG JKT	0.85	17	17
Fiber	FBR 144CT RBBN AR GEL-FREE	0.71	14.2	17
Fiber	FBR 96CT ARMORED LT SM DRY	0.54	10.8	17
Fiber	FBR 72CT ARMORED LT SM DRY	0.48	9.6	17
Fiber	FBR 48CT ARMORED LT SM DRY	0.48	9.6	17
Fiber	FBR 24CT ARMORED LT SM DRY	0.48	9.6	17

Underground Fiber Slack (Storage)

Underground Fiber Marker Posts



Post Diameter	Minimum Hole Diameter	Suggested Hole Depth
3.5"	4.5"	18" - 24"

Underground fiber marker post are required to be installed at regular intervals between fiber pedestals or vaults, with a maximum spacing of 500ft.
Marker posts are required at all ped box and vault locations.

Underground Fiber Slack (Storage) Location

UNDERGROUND FIBER SLACK LOOPS WILL REQUIRE SO' OF FIBER FOR APPROX. EVERY 500[1] OF FIBER PULLED. SLACK LOOPS WILL BE COILED TO FIT IN VAULT LOCATIONS NOT TO EXCEED MINIMUM BEND DIAMETER.

SLACK LOOP AND SPACING TO BE DENOTED BY TIC-FOOTAGE MARKS ON AS-BUILT DOCUMENTS:

MST/OTE Fiber Pedestal Location

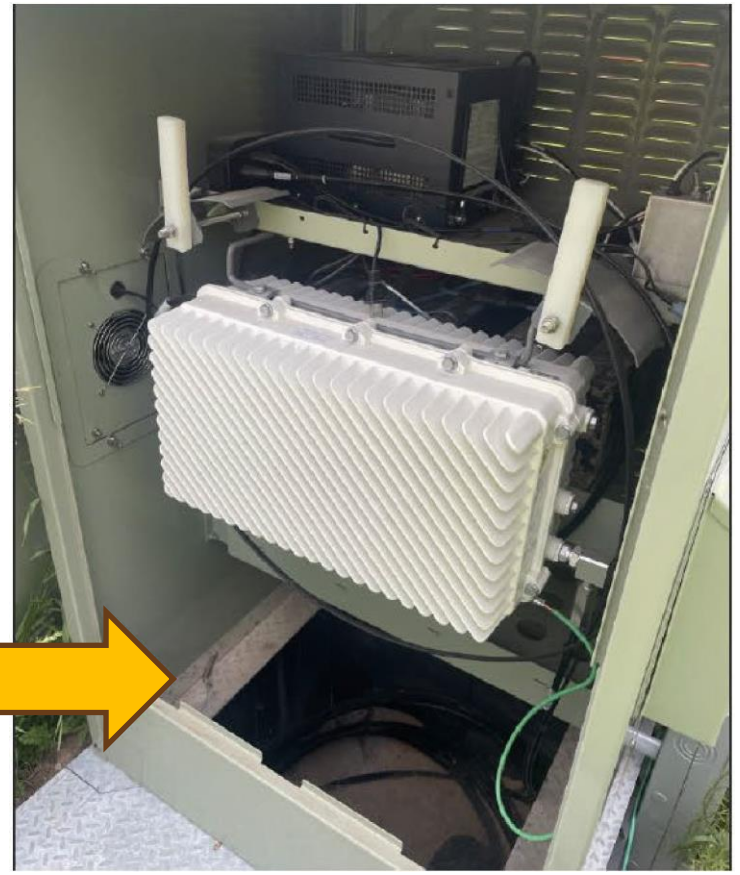
UNDERGROUND MST/OTE PEDESTAL SLACK LOOPS WILL REQUIRE 20' COIL OR 10' TAIL OF FIBER TOTAL FOR SPLICING A MST/OTE.

SLACK LOOPS WILL BE COILED TO FIT IN VAULT LOCATIONS NOT TO EXCEED MINIMUM BEND DIAMETER.

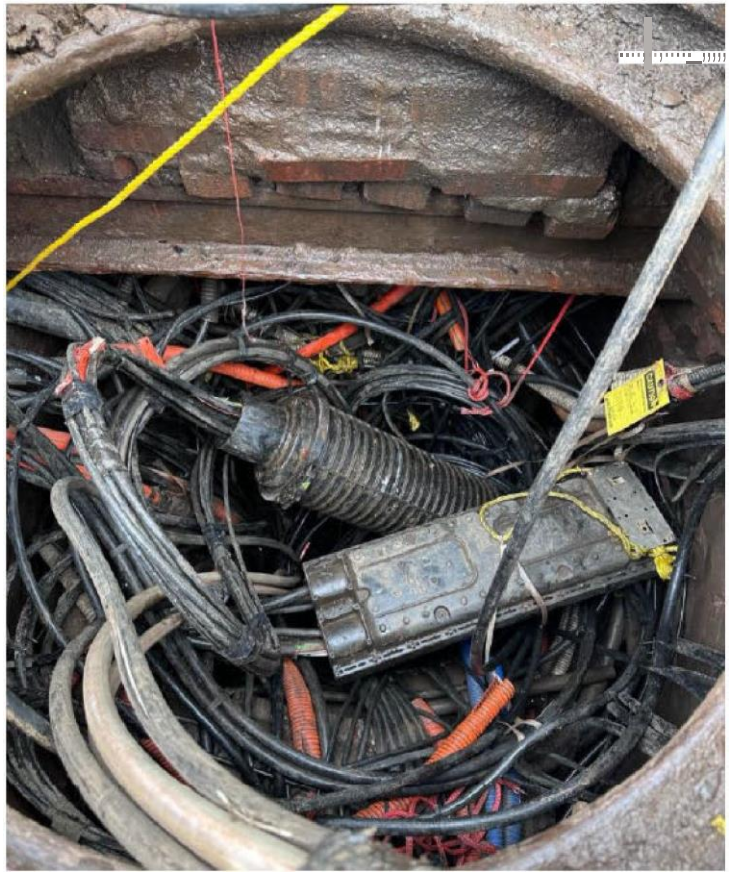
All in One (AiO) OLT Locations

UNDERGROUND OLT/AIO CABINET LOCATIONS WILL REQUIRE 50' OF FIBER SLACK. SLACK LOOPS WILL BE COILED TO FIT IN VAULT LOCATIONS NOT TO EXCEED MINIMUM BEND DIAMETER

FIBER COILS



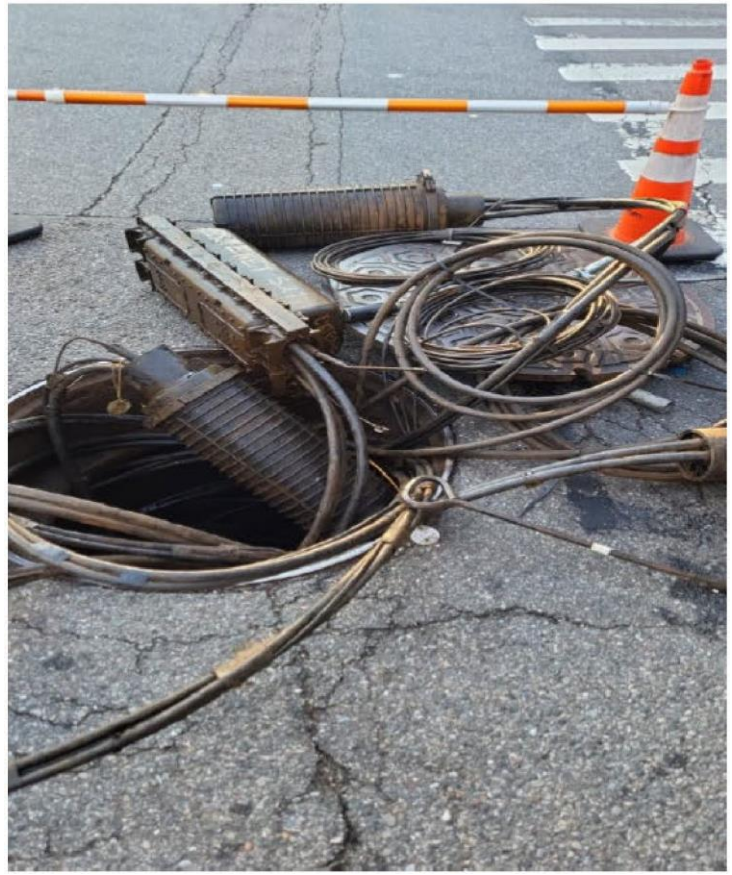
Manhole Locations



Manhole locations will require 5O' slack loops at each location. If manhole space is limited slack will be split between adjacent available locations.

Enclosure manhole locations require 5O' coil for ring cuts or 25' tails.

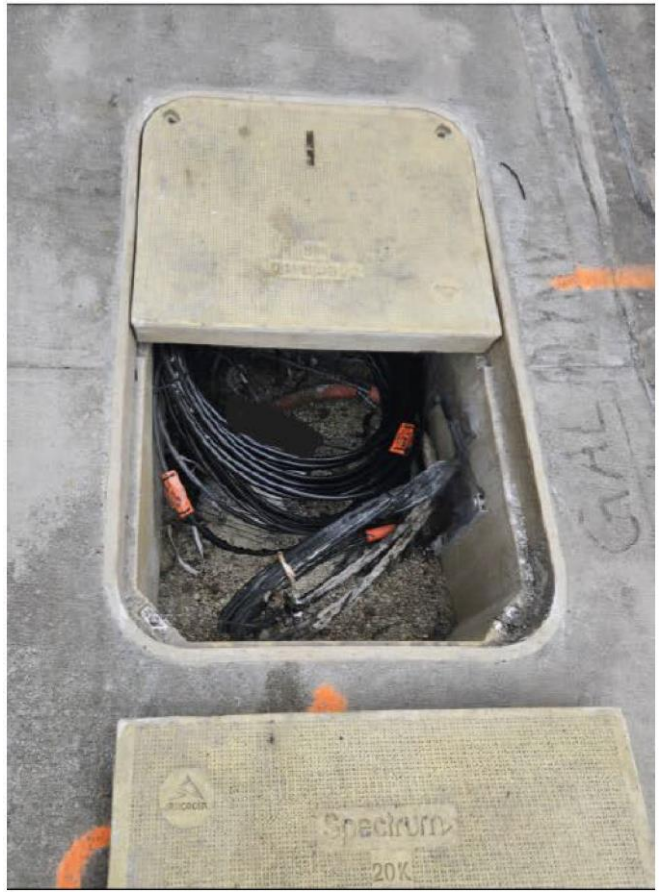
Slack loops will be coiled to fit in manhole location not to exceed minimum bend diameter.



Vault Locations

Vault locations require 25' slack loops at each location.

Enclosure vault locations require 50' coils for ring cuts or 25' tails



Lock Box/Panel/Building Attachments

LOCK BOX LOCATIONS: 20' FOR ACCESS/SERVICE

LOCK BOXES HOUSING SPLITTER TRAYS: 20[1] FOR ACCESS/SERVICE

IN-BUILDING LOCATIONS: 20' OF SLACK FOR EVERY OTE LOCATION (SINGLE AND COUPLED OTE'S; EX: TWO OTE'S WILL HAVE 20' EACH).

PANEL LOCATIONS: 20' FOR ACCESS/SERVICE

BUILDING ATTACHMENTS: 50[1] OF SLACK WILL BE LEFT PRIOR TO ENTRANCE TO BUILDING AND PLACED NO CLOSER THAN 8' TO STRUCTURE

AERIAL

AERIAL PLANT SUPPORTING INFRASTRUCTURE – CONSTRUCTION WORK

1. CATV MAKE-READY:

    a. OSP will provide a set of make ready instructions on the maps denoting attachment heights and locations where Contractor shall be required to place CATV plant. Contractor shall consult with the construction manager when plant violations are noted or will result if Work is performed; in such cases, Contractor shall defer to the construction manager's direction.

    b. Contractor shall exercise due caution in protecting CATV, power and/or telephone company plant as well as other service providers'/utilities' plant. Damage to any plant shall result in an immediate work stoppage until the construction manager has been fully informed of the damage. Contractor shall be responsible for any damages to CATV, power, and/or telephone plant facilities as well as any other service providers' plant or other party's property.

2. ANCHORS AND DOWNGUYS:

    a. Contractor shall not use auxiliary eyes unless prior written authorization has been received from the construction manager or above.

    b. Contractor shall install earth anchor(s) according to local requirements, unless otherwise directed by the construction manager or otherwise specified on the "APPROVED" make-ready work sheet.

    c. Contractor shall comply with local utility call requirements to ensure notification and location of all underground utilities prior to any excavation or placement of anchors.

    d. Contractor shall, when installing anchors, maintain a minimum of 12 inches (12") of clearance from existing power anchors. In any case where this specification is in conflict with respect to the pole owner's minimum requirements, the pole owner's specifications and requirements shall be followed.

    e. Contractor shall, when anchoring is complete, restore all ground, asphalt, or concrete to at least its original condition.

f. Contractor shall place all required CATV anchors by node, power supply area, or as specified by the construction manager, prior to construction taking place.

g. Contractor shall replace and pull all downguys prior to, or at the time of construction/Work.

h. Contractor shall install guy guards on all downguys.

i. All downguys shall be completed and attached to their respective anchors before departing the construction site for the day. Contractor shall not leave any downguy untensioned or unsecured.

3. POLE FRAMING:

a. Contractor shall use 100% new hardware for all contract work as directed by the construction manager or above. All approved materials will be provided by OSP unless otherwise directed and approved by construction manager or above.

b. Contractor shall frame all poles in accordance with the OSP Construction Manual specifications and any local mandated ordinances enforced by local PUC, state agency or pole administration body. Contractor shall secure permission, via approved make-ready process directive(s), from the appropriate utility company before framing poles.

c. Contractor shall not drill a new bolt hole within four inches (4”) of an existing bolt at any pole location.

d. Contractor shall not use extension arms unless specifically authorized in writing by the construction manager or above.

e. Contractor shall complete all anchoring and guying prior to strand placement.

f. Contractor shall construct all plant with EHS (Extra High Strength) strand.

g. Strand with Class A galvanizing designation A90 as per American Society for Test and Materials (ASTM) is recommended for use in areas where corrosive conditions are classified as normal Class C galvanizing (ASTM designation A363) should be used in areas classified by the telephone company as corrosive.

h. Only use galvanized thru bolts, eye bolts and other pole hardware 5/8” construction for ¼” EHS strand. The majority of

the systems will be built with ¼" EHS strand.

- After tensioning, there may be no more than two inches, or less than two full threads, of the thru bolt extending beyond the outside of the square nut.
- Use only three bolt, flat back suspension clamps.
- Use curved suspension clamps for tangent pulls and angles of ten through twenty degrees. For angles under ten degrees, use a straight suspension clamp. For angles over 20 degrees, always use dead-end construction techniques.
- Always place suspension clamps on the threaded ended of a thru bolt. Attach dead-end construction attachments to the unthreaded end of a thru bolt.
- OSP does not allow the use of strand vices (a.k.a. strand pickle).
- Follow all manufacturer's application and safety procedures for all installed equipment.

AERIAL NEW BUILD AND REPLACEMENT, STRAND – CONSTRUCTION

a. Contractor shall always attach the strand to the same side of the pole (field or street) as the telephone cable. If there is no telephone plant, attach the CATV strand to the same side of the pole as power (including neutral) of the pole. This is subject to local power company requirements.

b. Never "box" the pole with the strand route. Boxing refers to running strand in a previously open quadrant of the pole. This creates a closed-in pole with no free climbing space or route for pole replacement or removal for any reason by the owner.

c. Maintain all clearances across streets, alleys, driveways, etc. while installing the strand.

d. Temporary grounding of suspensions strand is required by OSP.

    i. This suspension strand shall be grounded to existing grounds when being placed on jointly used poles.

    ii. Where roller type bonds are used, they shall be restrained

so as to avoid stressing the electrical connections.

iii. Bonds between the suspension strand and the existing ground shall be at least No. 6AWG copper.

iv. Temporary bonds shall be left in place until the strand has been tensioned, dead ended, and permanently grounded.

AERIAL NEW BUILD AND REPLACEMENT, COAXIAL PLANT – CONSTRUCTION

1. Contractor shall place and "sag-in" all strand to the approximate power line "sag" unless this presents a problem with Telco midspan clearance. Contractor shall not leave strand hanging loose or unsecured within eighteen feet (18') of the ground, or per local specifications.

2. Contractor shall double-lash all cables.

3. Contractor shall allow sufficient slack at each pole location to include all necessary expansion loops and splice slack as prescribed by the construction manager.

4. Contractor shall provide a formed expansion loop at all poles and devices except terminating taps. Loops shall be formed using OSP approved equipment. Hand formed loops are prohibited.

5. Contractor shall be responsible for determining and complying with all local requirements for tree trimming, including securing permits if necessary. Contractor shall not trim any trees without the prior approval from the Project Manager.

6. Contractor shall place tap hanger brackets in locations having multiple cables.

7. Contractor shall place all directional taps in vertical alignment with the existing directional tap. For example, if the existing directional tap is on the output side of the old plant, the new directional tap shall also be placed on the output side of the pole.

8. Contractor shall place aerial innerduct at all rail crossings as well as all major street and highway crossings identified by the construction manager.

9. Contractor shall install coaxial cable riser(s), using metal or schedule 80

plastic U-guard as directed by construction manager. OSP shall supply all materials associated with riser installation. Contractor shall install riser conduit/guard to within 24 inches (24”) of CATV attachment grade. Inner duct shall encase and gradually extend through conduit or guard to attachment grade. In the event that coax in conduit (CIC) is employed, CIC shall extend through conduit or guard gradually to attachment grade. Contractor shall install riser clamps from ground level to top of conduit/guard every two feet (2’).

AERIAL REBUILD, COAXIAL PLANT – CONSTRUCTION

1. Contractor shall lower, raise or re-tension existing CATV plant as needed to allow for new plant to be attached in the permanent location. As required, contractor shall re-tension all spans during any overlash process, to maintain compliance with midspan clearance regulations.

2. Contractor shall secure old CATV plant temporarily in a safe manner using the utmost of caution with respect to active subscribers and existing utilities.

3. Contractor shall place and "sag-in" all strand to the approximate power line "sag" unless this presents a problem with Telco midspan clearance. Contractor shall not leave strand hanging loose or unsecured within eighteen feet (18’) of the ground, or per local specifications.

4. Contractor shall double-lash all cables.

5. Contractor shall be responsible for determining and complying with all local requirements for tree trimming, including securing permits if necessary. Contractor shall not trim any trees without the prior approval from the construction manager or above.

6. Contractor shall overlash cable as required.

7. Contractor shall place tap hanger brackets in locations having multiple cables.

8. Contractor shall place all directional taps in vertical alignment with the existing directional tap. For example, if the existing directional tap is on the output side of the old plant, the new directional tap shall also be placed on the output side of the pole.

9. Contractor shall allow sufficient slack at each pole location to include all necessary expansion loops and splice slack as prescribed by the construction manager.

10. For any new coaxial cable placed, contractor shall provide a formed expansion loop at all devices except terminating taps. Loops shall be formed using OSP specified equipment. Hand formed loops are prohibited.

11. Contractor shall place aerial innerduct at all rail crossings as well as all major street and highway crossings identified by the construction manager.

12. Contractor shall install coaxial cable riser(s), using metal or schedule 80 plastic U- guard as directed by construction manager. OSP shall supply all materials associated with riser installation. Contractor shall install riser conduit/guard to within 24 inches (24”) of CATV attachment grade. Inner duct shall encase and gradually extend through conduit or guard to attachment grade. In the event that coax in conduit (CIC) is employed, CIC shall extend through conduit or guard gradually to attachment grade. Contractor shall install riser clamps from ground level to top of conduit/guard every two feet (2’).

AERIAL UPGRADE/RETROFIT, COAXIAL PLANT – CONSTRUCTION

1. Contractor shall use existing pole-line and attachment hardware in retrofit areas when possible. Exceptions to this would be when new hardware is required to improve substandard conditions, (i.e., broken lashing wire, straps, and spacers, grounding, and bonding, etc.).

2. Contractor shall protect existing equipment from electrical damage by deactivating each active leg of plant as it is being retrofitted.

3. New connectors shall be used for splicing all passives, directional taps, and actives, as well as weatherproofing of the connections, including the use of heat shrink.

4. For any new coaxial cable placed, contractor shall provide a formed expansion loop at all devices except terminating taps. Loops shall be formed using OSP specified equipment. Hand formed loops are prohibited.

5. Contractor shall submit end-of-line signal level readings to OSP at the end of the workday.

6. Contractor shall be responsible for any damage to risers and/or cable plant. Contractor shall report any damage of cable plant, either inflicted by

Contractor during the performance of contract work, or any pre-existing damage discovered during the performance of contract work. Such damage shall be reported to the construction manager prior to continuing contract work.

7. Contractor shall be required to tie-in the existing, non-retrofit plant into the newly constructed or retrofit plant, immediately preceding, or succeeding the aerial retrofit area once the final sweep is completed.

8. Contractor shall install coaxial cable riser(s), using metal or schedule 80 plastic U-guard as directed by construction manager. OSP shall supply all materials associated with riser installation. Contractor shall install riser conduit/guard to within 24 inches (24”) of CATV attachment grade. Inner duct shall encase and gradually extend through conduit or guard to attachment grade. In the event that coax in conduit (CIC) is employed, CIC shall extend through conduit or guard gradually to attachment grade. Contractor shall install riser clamps from ground level to top of conduit/guard every two feet (2’).

AERIAL NEW BUILD/OVERLAY AND REPLACEMENT, FIBER PLANT – CONSTRUCTION

1. Contractor shall place and tension all strand to the approximate power line "sag" unless this presents a problem with Telco midspan clearance. Contractors shall achieve all required clearances above ground as per NESC, and/or California GO95 specifications.
2. Contractor shall place and double-lash fiber optic cable. On spans consisting of both coaxial and fiber optic cables, the fiber optic cable(s) shall be the outermost cable(s).

3. Contractor shall install tree guard continuous through tree span interference. Tree guard shall extend eight inches (8”) each side beyond area of exposure.

4. Contractor shall install fiber marker tags at each pole where fiber optic cable passes the pole. Only one fiber marker tag is required on the outermost fiber cable.

5. Fiber optic cable shall only be cut at the designated optical splice points depicted on the design prints. No additional cuts in the fiber optic cable shall occur without prior authorization given by the construction manager

or above.

6. Contractor shall dual lash all aerial fiber optic cable, whether new construction or over- lash in nature. Cable roller/dolly spacing shall not exceed 30 feet. A 90-degree roller block will be used at all pole locations that have take-off angles that exceed 30 degrees. Contractor shall be required to supply sufficient manpower during cable installation, an assist person at cable reel, even-numbered 90 degree pole(s), "figure 8" locations and all riser locations to ensure that no damage is done to the fiber cable and shall utilize the appropriate break-away swivel at all times to ensure that the maximum allowable pulling tension is not exceeded. Contractor shall not use the "drive-off" method of cable installation, unless approved, in advance by the construction manager or above. Contractor is responsible for all fiber placement from installation start to post installation and OSP acceptance.

7. Contractor shall place 50 feet of excess tail on each side of each optical splice point location. Tails shall be coiled on input and output side of pole. Contractor shall tie-wrap fiber cable in a temporary manner, to strand if possible, or within the communications space, prior to fiber splicing completion. Upon fiber splicing completion, Contractor shall dress and secure fiber cable excess and install associated hardware per the OSP Construction Manual.

8. For aerial fiber optic cable plant, contractor shall attach splice enclosure(s) to strand using the appropriate hardware and brackets at eight feet (8') from middle of three-bolt pole suspension clamp. Contractor shall ensure that splice enclosure is properly sealed and weatherproofed per manufacturer's specifications and ensure mounting brackets are properly secured to enclosure and strand. Contractor shall be experienced in the installation of OSP approved fiber optic splice enclosures.

9. Contractor shall install excess "loop back" cable locations as depicted on fiber optic network prints. Designated cable "loop backs" shall extend back one (1) span (previous pole), from denoted "loop back" location(s).

10. Contractor shall install fiber cable riser(s), using metal or schedule 80 plastic U-guard as directed by construction manager. OSP shall supply all materials associated with riser installation. Contractor shall install riser conduit/guard to within 24 (24") inches of CATV attachment grade. Inner duct shall encase and gradually extend through conduit or guard to attachment grade. In the event that fiber in conduit (FIC) is employed, FIC shall extend

through conduit or guard gradually to attachment grade. Contractor shall install riser clamps from ground level to top of conduit/guard every two feet (2').

11. Contractor shall protect exposed fiber cable during the installation process, at all figure eight, riser, splice and vault locations, to include, if necessary, security guard(s). Under no circumstances shall Contractor leave fiber cable exposed or unprotected overnight.

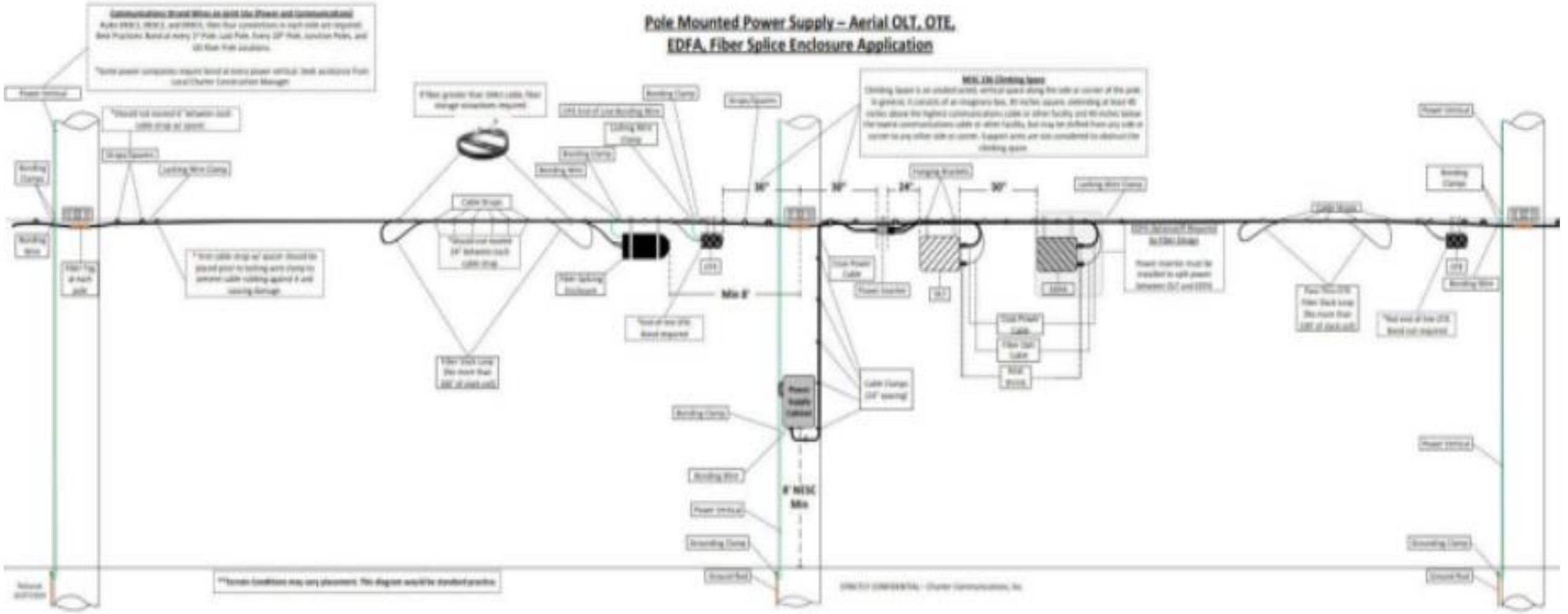
12. All fiber cable is to be properly installed, prior to any fiber splicing, unless authorized by the construction manager.

13. Contractor shall be responsible for determining and complying with all local requirements for tree trimming, including securing permits if necessary. Contractor shall not trim any trees without the prior approval from the construction manager or above.

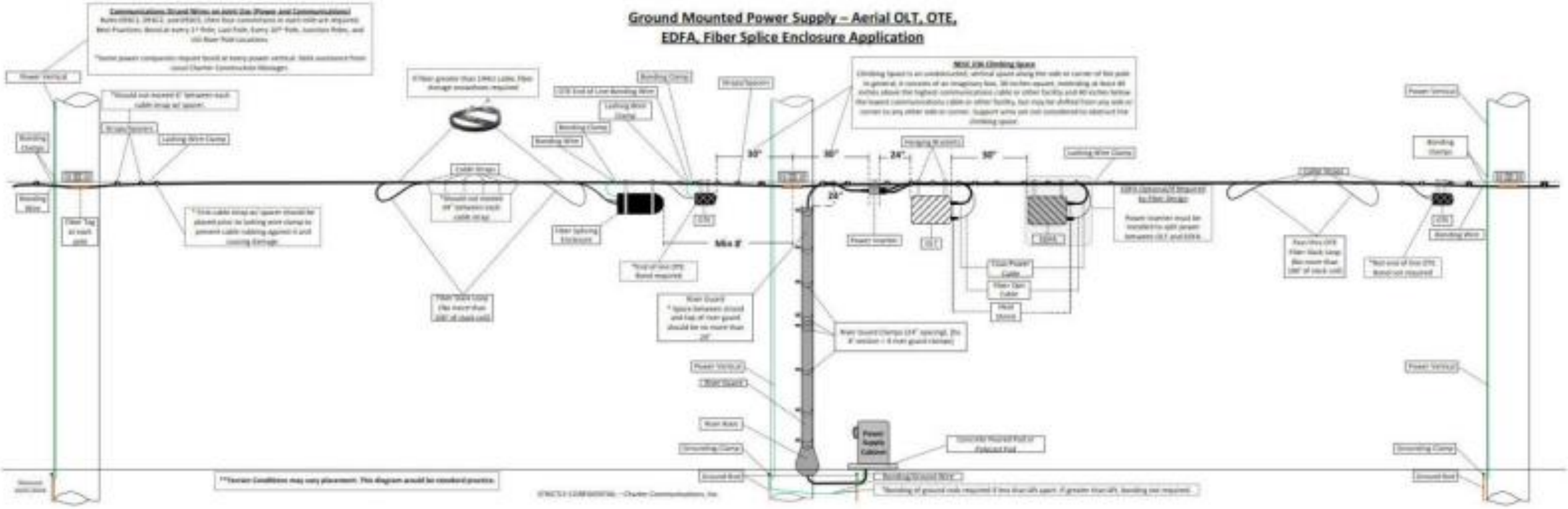
14. Contractor shall place aerial innerduct at all rail crossings as well as all major street and highway crossings identified by the construction manager.

Aerial Equipment Mounting Uniformity

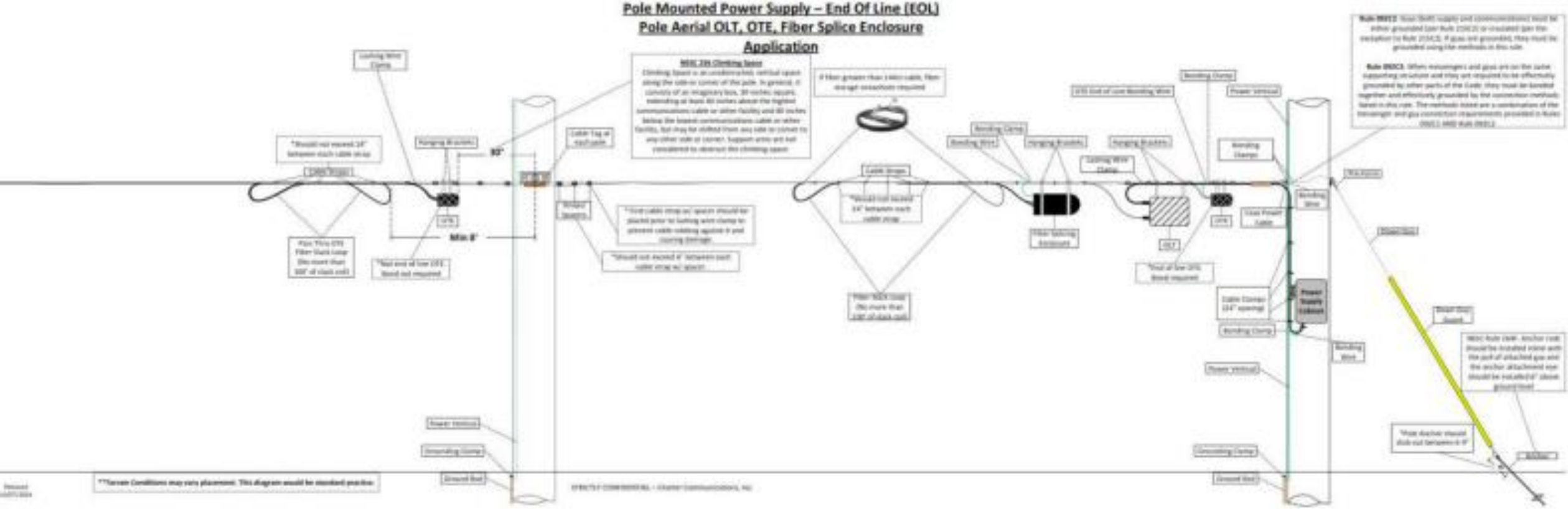
Pole Mounted Power Supply – Aerial OLT, OTE, EDFA, Fiber Splice Enclosure Application



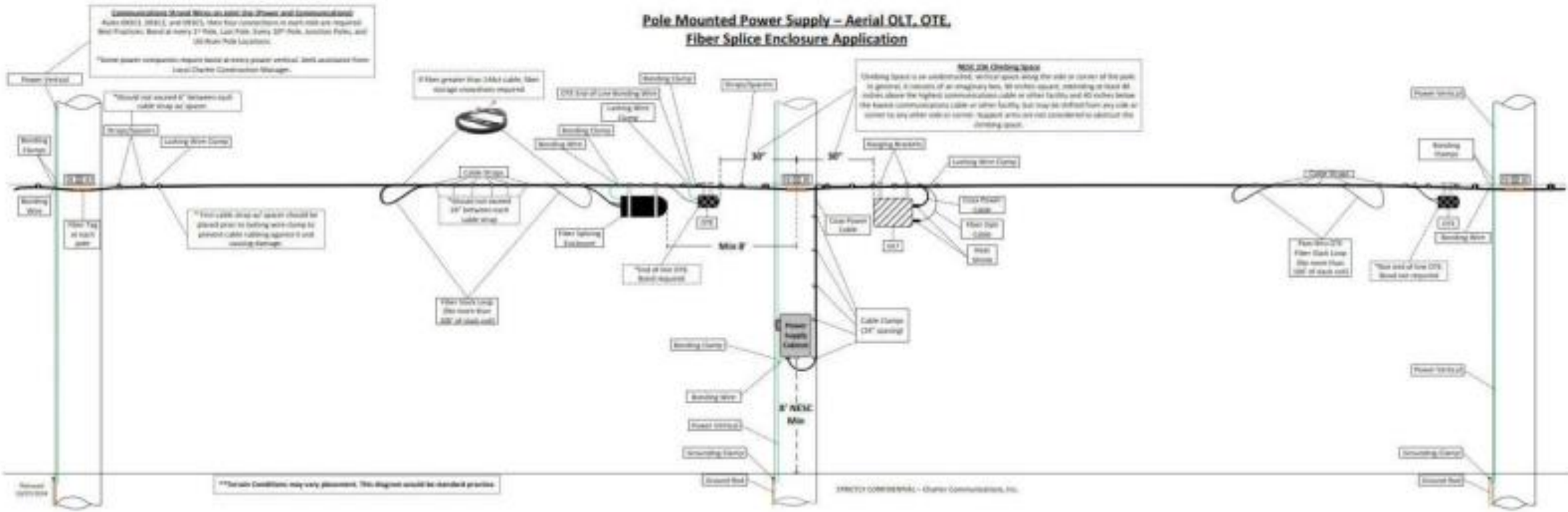
Ground Mounted Power Supply – Aerial OLT, OTE, EDFA, Fiber Splice Enclosure Application



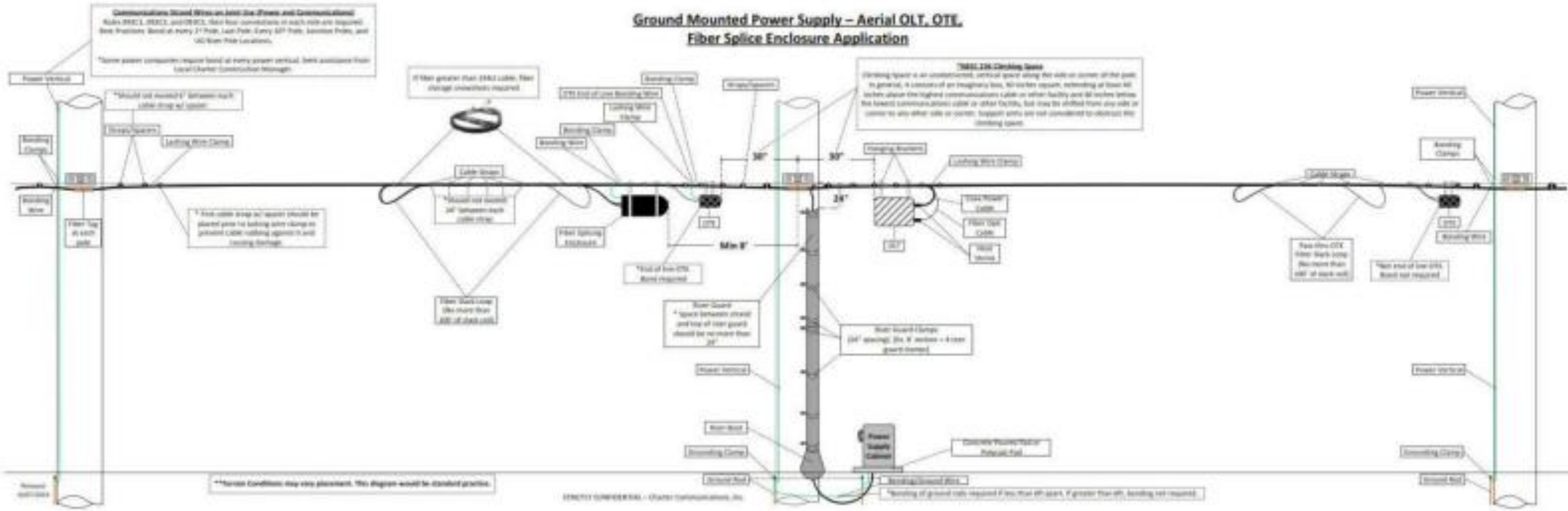
Pole Mounted Power Supply – End Of Line (EOL)
Pole Aerial OLT, OTE, Fiber Splice Enclosure
Application



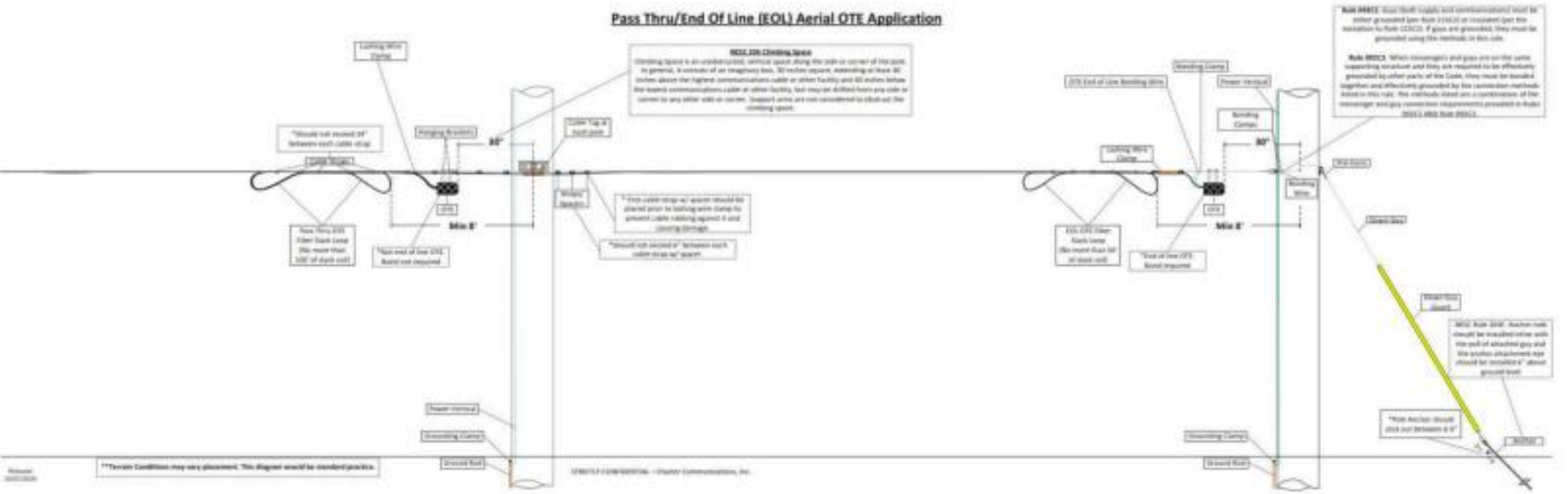
Pole Mounted Power Supply – Aerial OLT, OTE, Fiber Splice Enclosure Application



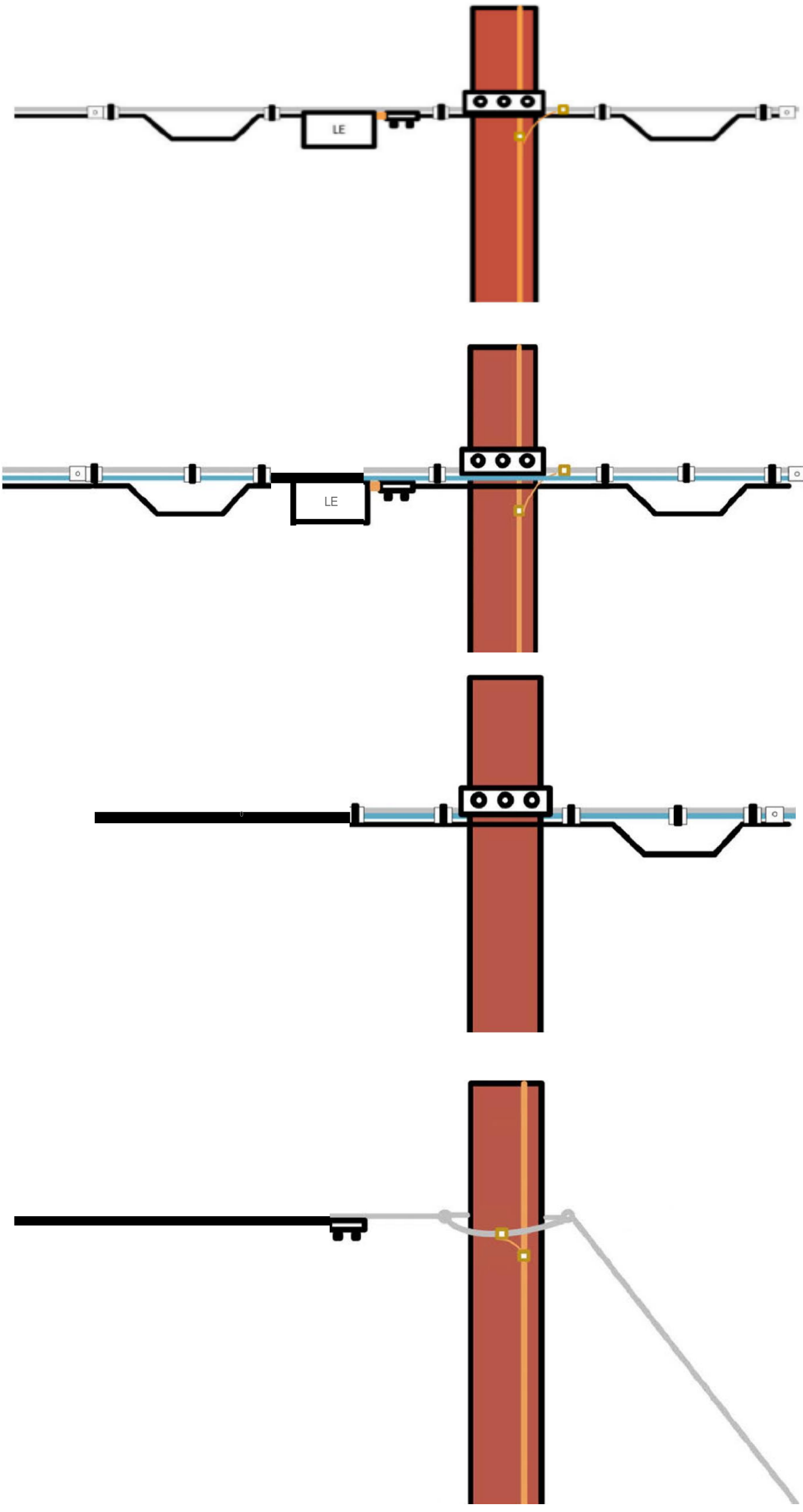
Ground Mounted Power Supply – Aerial OLT, OTE, Fiber Splice Enclosure Application



Pass Thru/End Of Line (EOL) Aerial OTE Application



OSP Technologies - Pole Illustrations



BONDING AND GROUNDING SPECIFICATIONS OUTSIDE PLANT

BONDING AND GROUNDING – CONSTRUCTION WORK

1. Contractor shall perform system grounding in compliance with all local, state and federal electrical codes (NESC) including general orders from utilities and joint pole administration agencies. State, county, and local requirements supersede OSP requirements.

2. Contractor shall also install bond-supporting strand in compliance with the pole owner's specifications and requirements.

3. Contractor shall place eight-foot (8') vertical ground rods at all power supply locations and shall bond to the applicable power company's ground if power facilities are within 6 feet (6') of CATV plant. In any case where this specification is in conflict with respect to the pole owner's vertical grounding specifications and requirements, the pole owner's grounding specifications and requirements shall control and be followed.

4. Contractor shall place a bond at all pole mounted power supply cabinet locations and shall bond to the applicable power company's ground. In any case where this specification conflicts with respect to the pole owner's vertical grounding specifications and requirements, the pole owner's grounding specifications and requirements shall control and be followed.

5. Contractor shall place vertical grounds and bond with appropriate bonding materials and methods to existing power company verticals at all active devices and end of lines., (Any device that requires power to operate is considered an active device.)

6. Contractor shall place bonds and/or vertical grounds as required, with other utility neutrals on joint use poles at every first, tenth, and last pole, with a minimum of four grounds/bonds per mile.

7. Contractor shall complete all bonding and grounding of all fiber enclosures prior to performing final optical fiber testing. Contractor shall install a bond to strand for all aerial fiber enclosures, end of line OTEs and MSTs Contractor shall ground all enclosures, end of line OTEs and MSTs, and attach to a standard full vertical ground rod in underground locations.

8. OSP will provide all materials for bonding and grounding.

NESC R,EQUIREMENTS -AERIAL

The minimum requirements for bonding and grounding of our outside plant are detailed in the National Electric Safety Code (NESC). Utilities and municipalities can demand requirements additional to those specified in the NESC but all requirements of the NESC must be met.

The National Electric Safety Code (2023 Edition) details the minimum requirements for bonding and grounding in the following rules listed.

097. Separation of grounding conductors:

G) Where both electric supply systems and communication systems are grounded on a joint-use structure and a single grounding conductor is present, the grounding conductor shall be connected to both systems. Where separate supply and communication grounding conductors are used, they shall be bonded together.

354D. Supply and communication cables or conductors:

1g) Adequate bonding shall be provided between the effectively grounded supply conductor or conductors and the communication cable shield or sheath at intervals that should not exceed 1000 ft.

374. Grounding:

A) All exposed conducting surfaces of the termination device other than live parts and equipment to which it is attached shall be effectively grounded.

B) Conductive structures supporting cable terminations will be effectively grounded

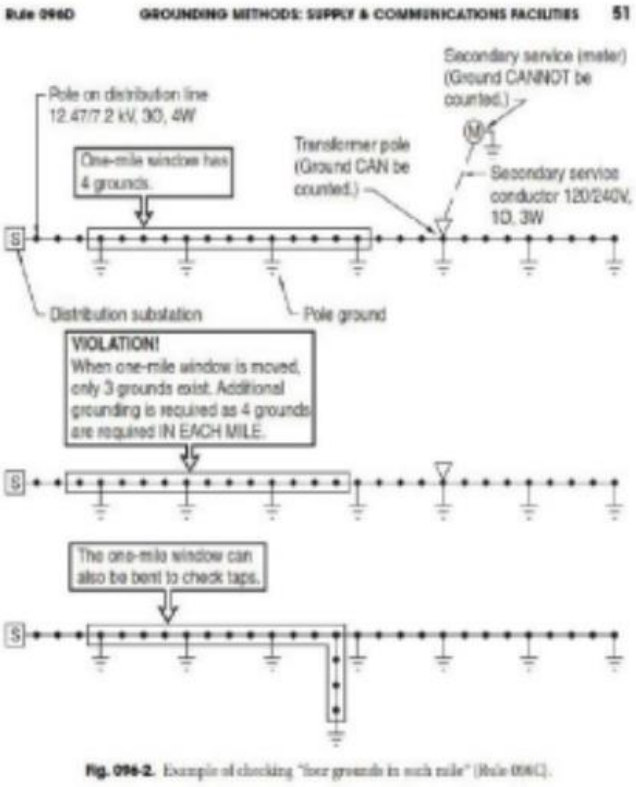
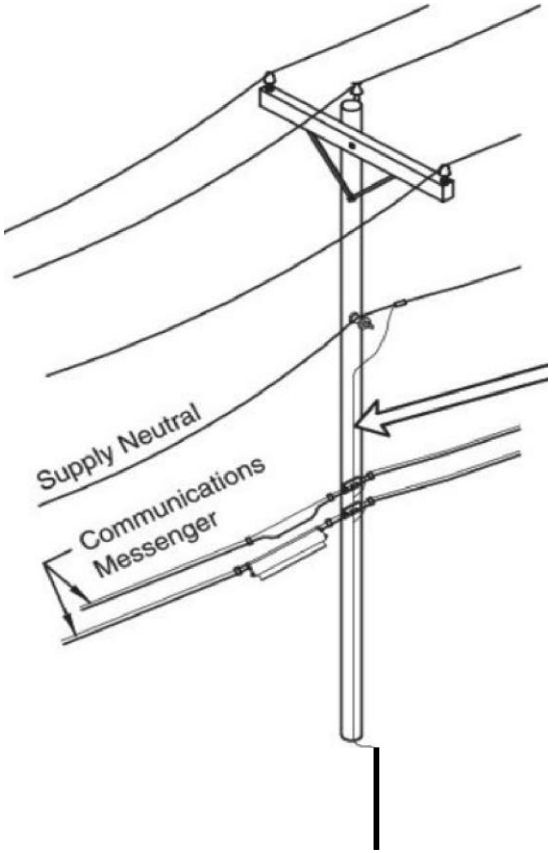


Fig. 096-2. Example of checking "four grounds in each mile" [Rule 096C].



- Where both electric supply systems and communication systems are grounded on a joint-use structure, and a single grounding conductor (pole ground) is used, it must be connected to both the supply neutral and the communications strand.

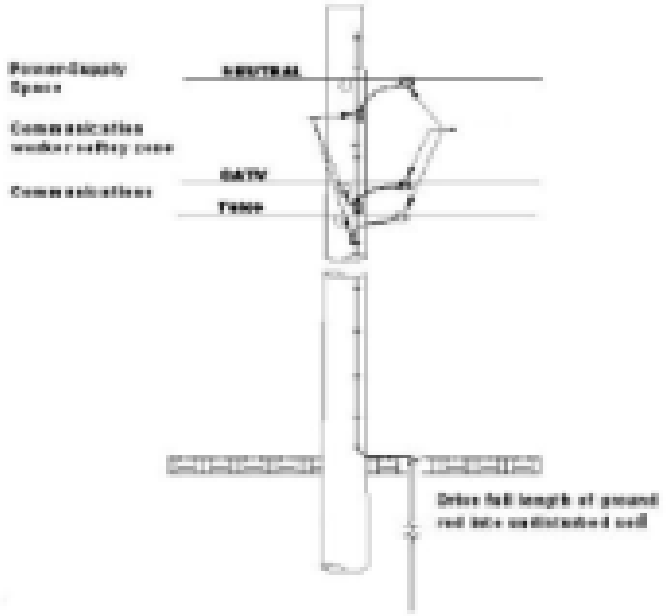
- If separate grounding conductors (pole grounds) are run to the supply neutral and the communications strand, they must be bonded together.

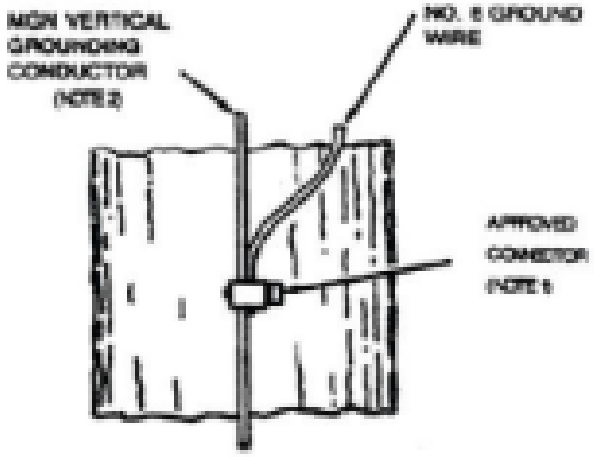
- Exceptions apply when separate grounding conductors are required by other rules (e.g., delta primary systems).

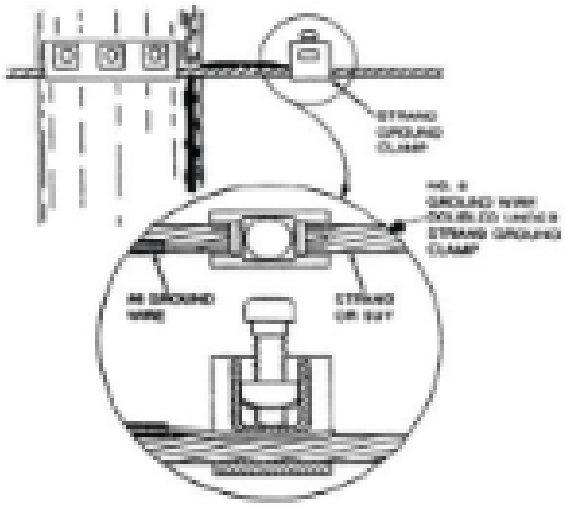
- If isolation is being maintained between primary and secondary neutrals (e.g., for stray voltage), the communications strand must be connected only to the primary grounding conductor.

STRAND BONDING

- All bonding and grounding connectors and clamps must be rated for outside use and properly sized to accept the wire and strand size involved. A No. 6 AWG copper wire shall be used for all connections.



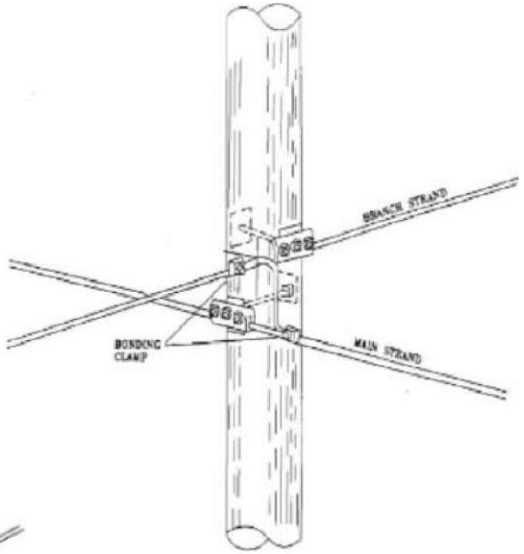




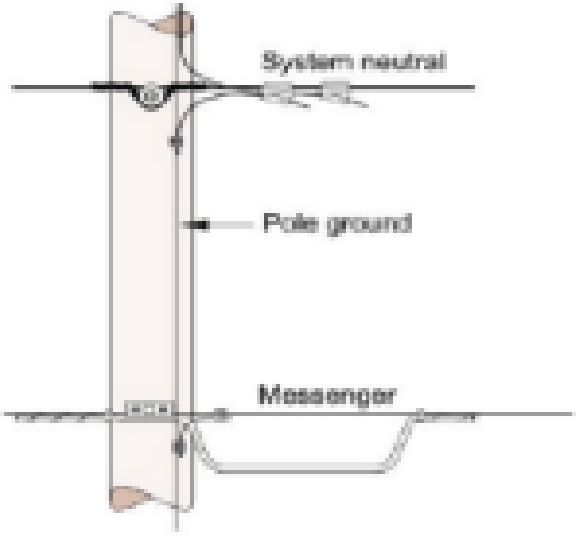
NESC 92C3a. Where strands and guys on the same supporting structure are required to be effectively grounded, they shall be bonded together.

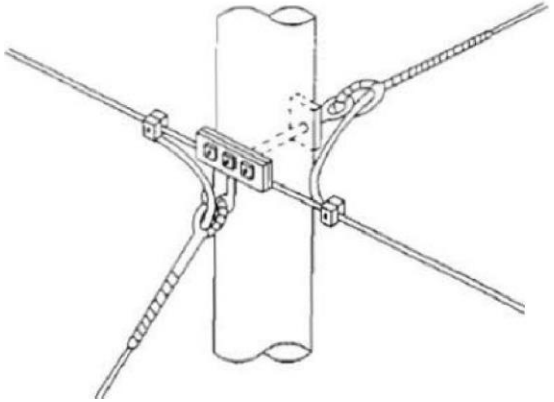
Bonding Installation Considerations:

Aerial cables that include joint use construction will require common bonding. The cables must be bonded together to reduce the electrical power differences



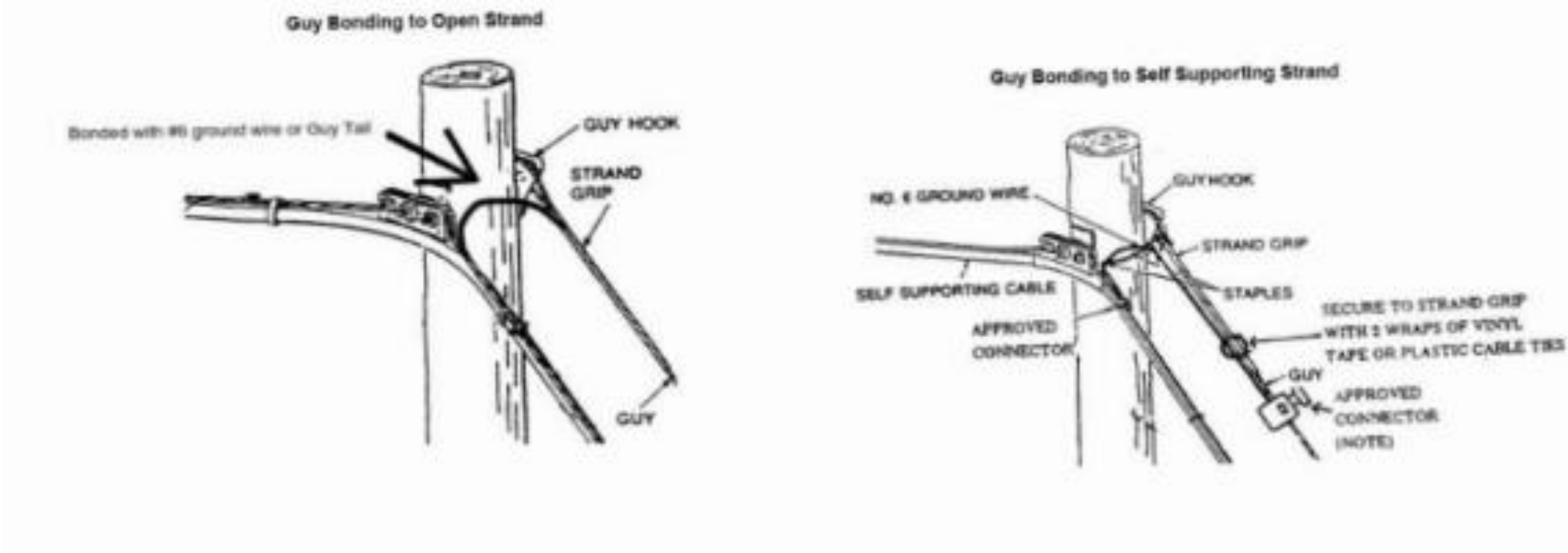
Bonding Cross Strand to Main Strand



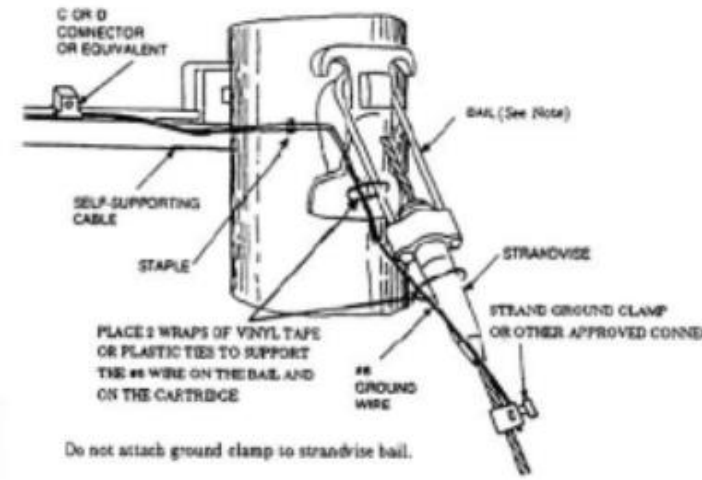


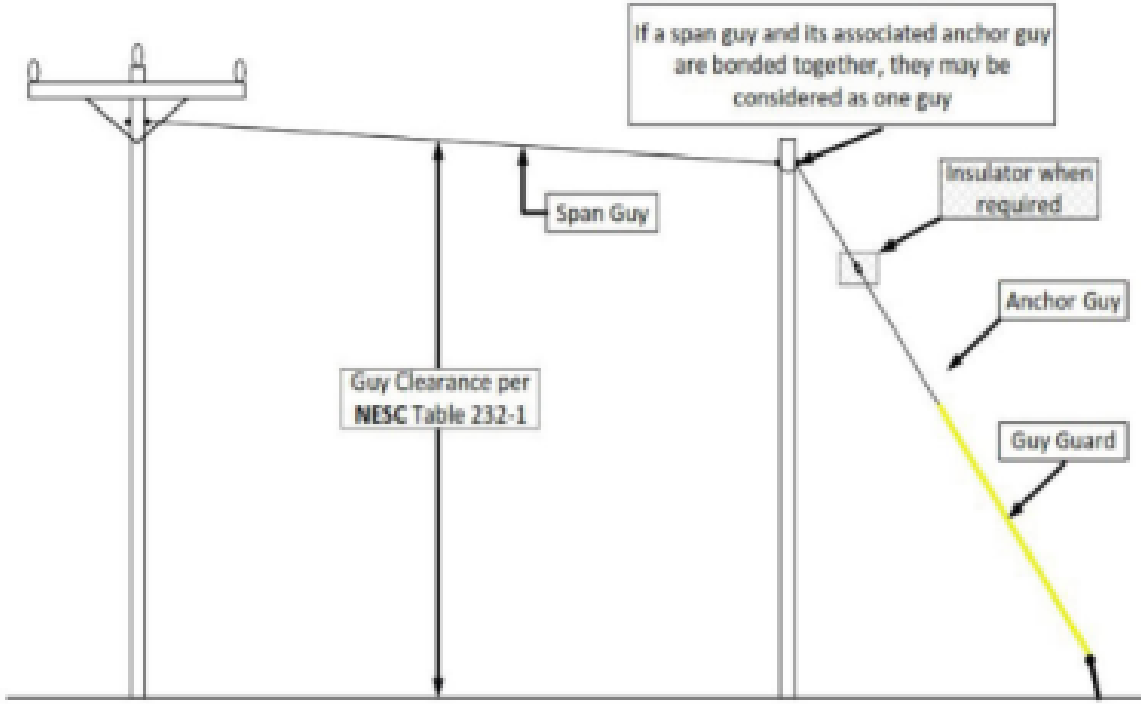
GUY WIRE BONDING

All Customer guy wires must be bonded to Customer strand using either No. 6 ground wire or guy tail using a Customer approved ground clamp .

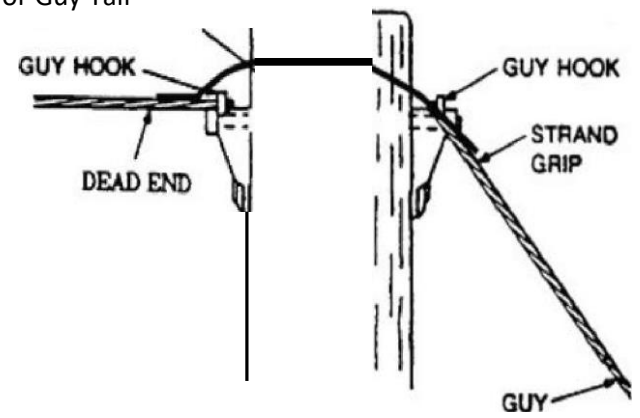


When using a stand vice to attach a guy wire to a pole bonding clamp is to be connected to guy wire below strand vice.





Bonded with #6 ground wire or Guy Tail



FIBER ENCLOSURE BONDING

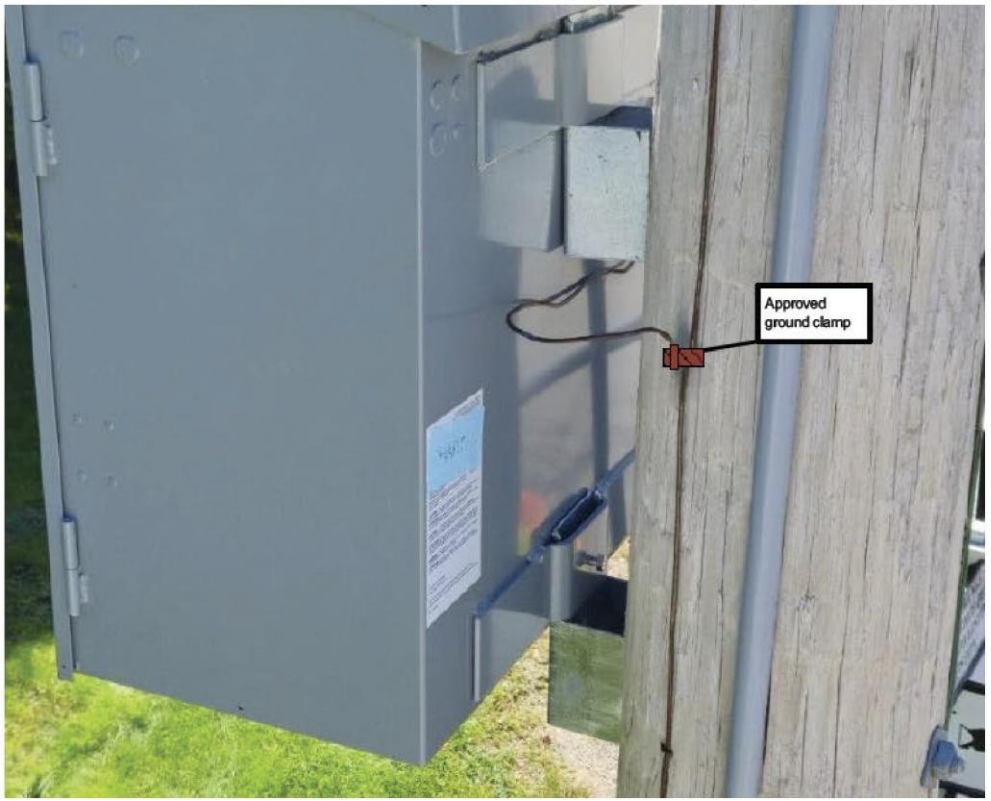
All Customer aerial fiber enclosures must be bonded to the strand. Bonding will be done using No. 6 ground wire from the fiber enclosure to the strand and bonded using a Customer approved bond clamp. (See fiber enclosure manufacturer specs on connecting bond wire to fiber enclosure)

END of LINE MST/OTE BONDING

All End of Line MST/OTEs must be bonded to the strand. Bonding will be done using No. 6 ground wire from the MST/OTE to the strand and bonded using a Customer approved bond clamp. (See MST/ OTE manufacturer specs on connecting bond wire to fiber enclosure)

POLE MOUNTED POWER SUPPLY

Aerial power supplies must be bonded to power vertical. Verify with local utility and electric code to verify if additional requirements must be followed.



ELECTRICAL POWER METER

Pole mounted electrical meters must be connected to a power vertical. Verify with local utility and NEC electric code to verify if additional requirements must be followed.

NESC GROUND ROD INSTALLATION RULES

093A. In all cases, the grounding conductor shall be made of copper or other materials or combinations of materials that will not corrode excessively during the expected service life under the existing conditions and shall be without joint or splice.

09301. Guarding is required of grounding conductors.

09303. Guarding will extend no less than 8' above the ground.

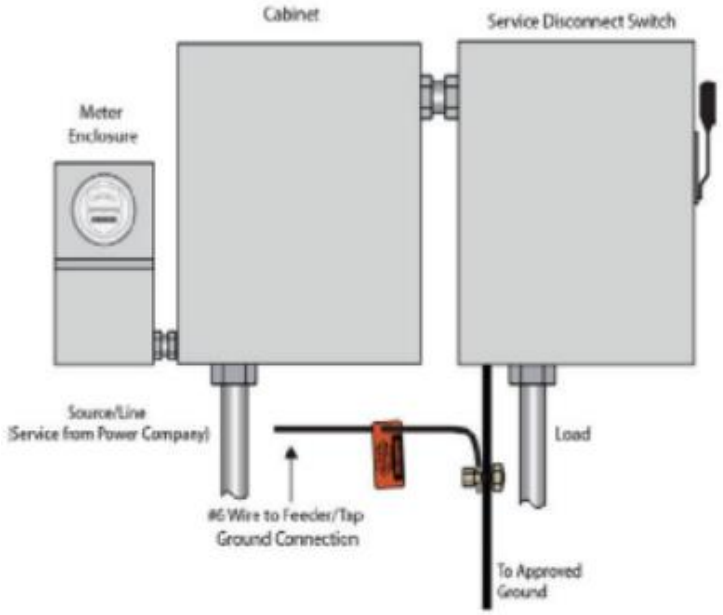
09305. Guards used for grounding conductors shall be made of nonmetallic materials if the guard completely encloses the grounding conductor.

094C2a1. Driven rods shall not be less than 8ft long and no less than 0.5" in diameter.

084c2a3. Driven depth shall be not less than 8'. The upper end shall be flush with or below the ground level unless suitable protected.

BONDING AND GROUNDING SPECIFICATIONS

- State, municipality and local utility may require different connections and will supersede the customer. Coordinate with local Project Management for information.
- The bonding shall be as close as practicable to the point of entrance.
- Place the ground/bonding connector as close as possible to the power company ground rod.
- Connect the practical copper ground between the ground/bonding connector and the building's grounding electrode as straight as possible.
- The maximum customer ground wire length is not to exceed 15ft in length.
- Ground the fiber optic cable at first splice location closest to point of entry.
- Make sure all bonding and grounding connections are clean and tight.

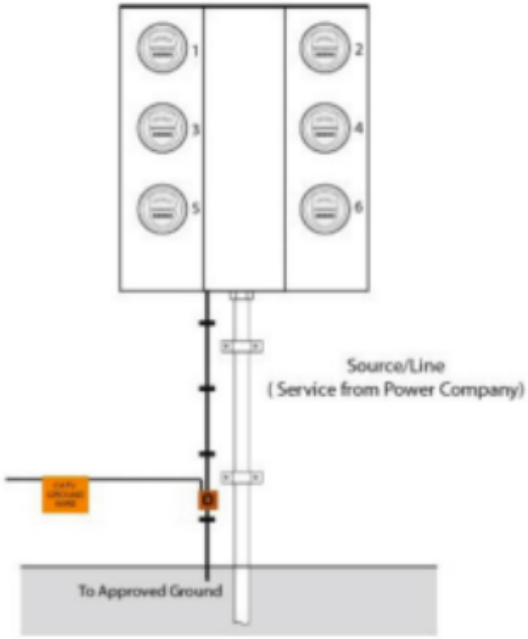


NEC Requirements

The 2008 edition of the NEC requires the installation of an intersystem bonding termination at the electrical source for all new construction.

NEC code 770.100
Where required, the non-current-carrying metallic members of optical fiber cables entering buildings shall be bonded or grounded as specified in 770.100(A) through (D).

Building Grounding System
The MDU/Commercial grounding and bonding system is commonly referred to as the building grounding system. This is the point in which the "common ground is established. All services entering the building must be bonded to the common building grounding electrode system to ensure that they maintain the same ground/voltage potential



Reason for Bonding and Grounding

The grounding of a CATV shield at the customer's building/home is performed to limit voltages that may be present by contact with energized equipment on poles or underground plant and to quickly dissipate voltages produced by lightning strikes, power surges or downed poles.

Safety Issue

A fire could result from improper grounding or insulation failure on cables and electrical wiring. The resulting fire can cause property damage and/or injury.

A large potential voltage difference could occur between the electrical service in a customer's building/home and the cable television equipment or cables. The existence of the large potential voltage difference could cause serious injury to anyone completing the circuit.

Bonding/grounding the cable system to the existing electrical system, or common ground in the building/home helps protects the structure and its residents.

Bonding/Grounding Connector

- Only one ground wire should be attached to one ground/bonding connector.
- An existing bonding connection is never disconnected to attach a Customer bond.
- Customer approved bonding/grounding connectors are to be used. The connectors must be rated for the correct wire size and type (copper, aluminum, etc.) being used.
- The proper connector must be used for the specific grounding attachment being made. A screw or bolt being used for another purpose is unacceptable for use.
- The surface that the clamp is applied to must be clear of any paint, insulation, or any other obstruction to make a good electrical connection.
- The area can be cleaned by wire brushing or scraping the selected connection area. The technician should be careful to ensure that the connector is properly fitted and seated, and all connections are wrench-tight.

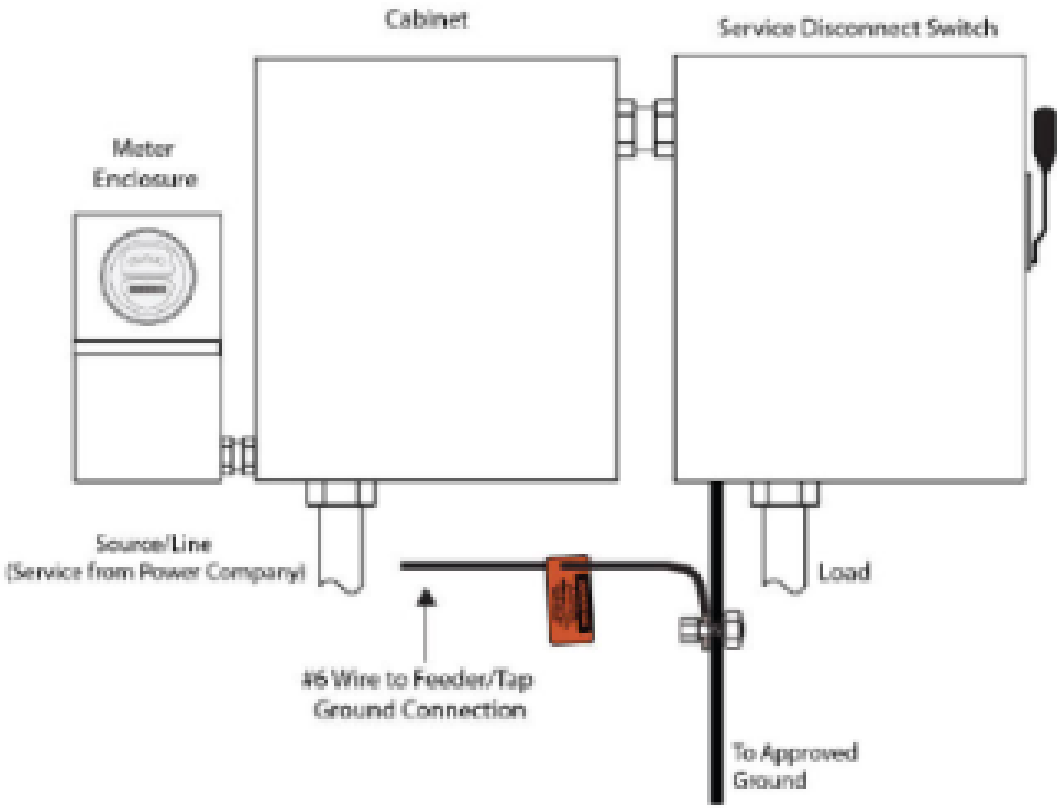
Ground Wire

- Attach ground wire with the proper bonding/grounding connector/clamp.
- Ensure that the ground wire is insulated with rubber or other suitable insulation.
- Ensure that the ground wire is made of copper or other corrosion-resistant conductive material.
- Ensure that no damage is done to the ground wire insulation during installation.
- Ensure that the ground wire is as short and straight as practical between the bonding/grounding connection and the building's grounding electrode.
- Ensure that the connections are tight. Metal must touch metal for a good connection.
- The grounding conductors should be free of any paint, rust or dirt.

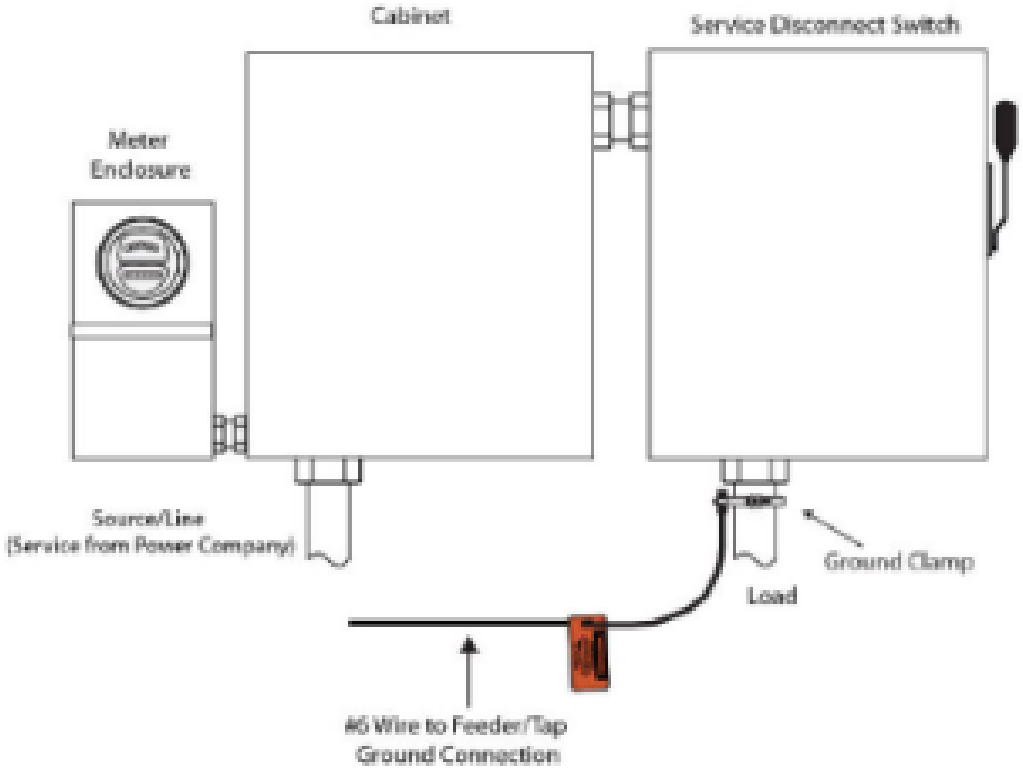
Ground Tag

- A ground tag must be connected to the ground wire connection advising to not remove the tag.
- Slide the ground tag on the ground wire before connecting to the bonding/ground connector.

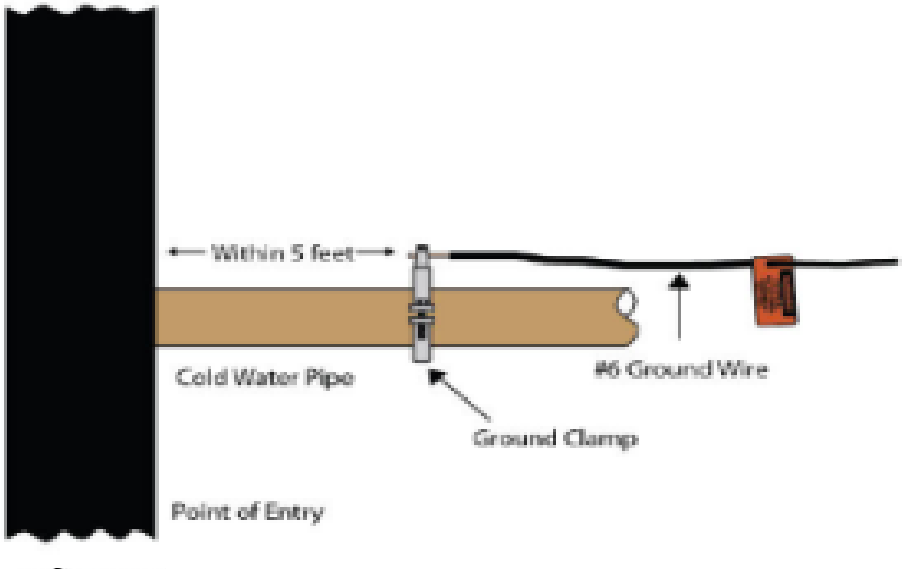
Priority 1: Bonding to Power Utility's Grou1nd Wire



Priority 2: Bonding to the Power Service Load Conduit

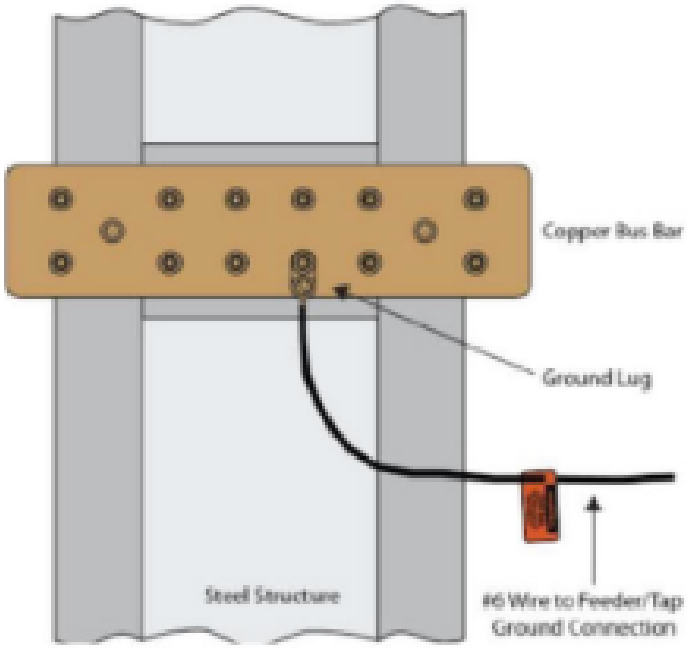


Priority 3: Bonding to a Main Cold-Water Pipe



- Grounding of CATV must be connected to the metallic cold-water within 5 feet of the service main's entrance into the structure.
- Verification must be made to ensure that the cold-water is a viable grounding electrode.
- The pipe must be metal all the way to the ground. The metal underground water pipe must be in contact with the earth for greater than or equal to 10 feet and is electrically continuous

Priority 4: Structural Steel/Intersystem Bonding Termination



Grounding of CATV service must be connected to the electrical bus bar with an approved ground lug connector.

The maximum CATV ground wire length cannot exceed 15 feet.

This type of Intersystem Bonding Termination (IBTB) can commonly be found on new Residential, MDU and Small Commercial Facilities/buildings. This IBTB allows an integral mounting base to connect to the grounding electrode conductor and does not rely on meter base enclosure bonding connection.

SOURCE:

The following sources have been referenced for information on these specifications:

- 2023 National Electric Safety Code (NESC)
- Bellcore Blue Book- Manual of Construction Procedures #SR-1421 Issue 4 dated December 2007.
- Recommendations and requirements by Corporate Engineering and the Corporate Construction Compliance team.

ANCHORING AND GUYING

Anchoring and Guying

Guys

A guy is a brace or cable fastened to the pole to strengthen it and keep in position. Guys are used wherever the wires tend to pull the pole from its normal position and to sustain the line during abnormal loads caused by sleet, wind, and cold. Guys counteract the unbalanced forces imposed on the poles. The guy should be considered as counteracting the horizontal component of the forces with the pole or supporting structure as resisting the vertical component of the forces.

Anchors

An anchor and down guy consists of a wire running from the attachment near the top of the pole to a rod and anchor installed in the ground. This type of anchor/guy is preferable if field conditions permit its installation since it transfers the unbalanced force on a pole or structure to the earth without intermediate supports.

Anchoring and Guying (Lead Over Height & Size of Guy Wire)

The purpose of guying and anchoring is to maintain the stability of a pole or pole-line despite the loads placed on them by the attachment of our facilities. It is important to note that the size of guy strands and anchors is determined by the potential tension that could be exhibited based upon the following:

- The size of the support strand being guyed.
- The angle or measurement (in feet) of the support strand comer, referred to as "pull".
- The lead-to-height ratio, which is the ratio indicating the distance from the bottom of the pole to the anchor vs. the vertical distance from the attachment point to the ground at the base of the pole.

Because we generally use the same sized guy strand as support strand (6.6M 1/4" EHS galvanized strand w/ maximum breaking strength of 6600 lbs. & usable tension load, NESC heavy district of 3960 lbs.), the down guy must have a minimum lead to-height ratio of 1:2. A 1:2 lead-to-height ratio could be a 10' lead and a 20' attachment height.

Never use guy strand that is smaller than the support stands it is supporting.

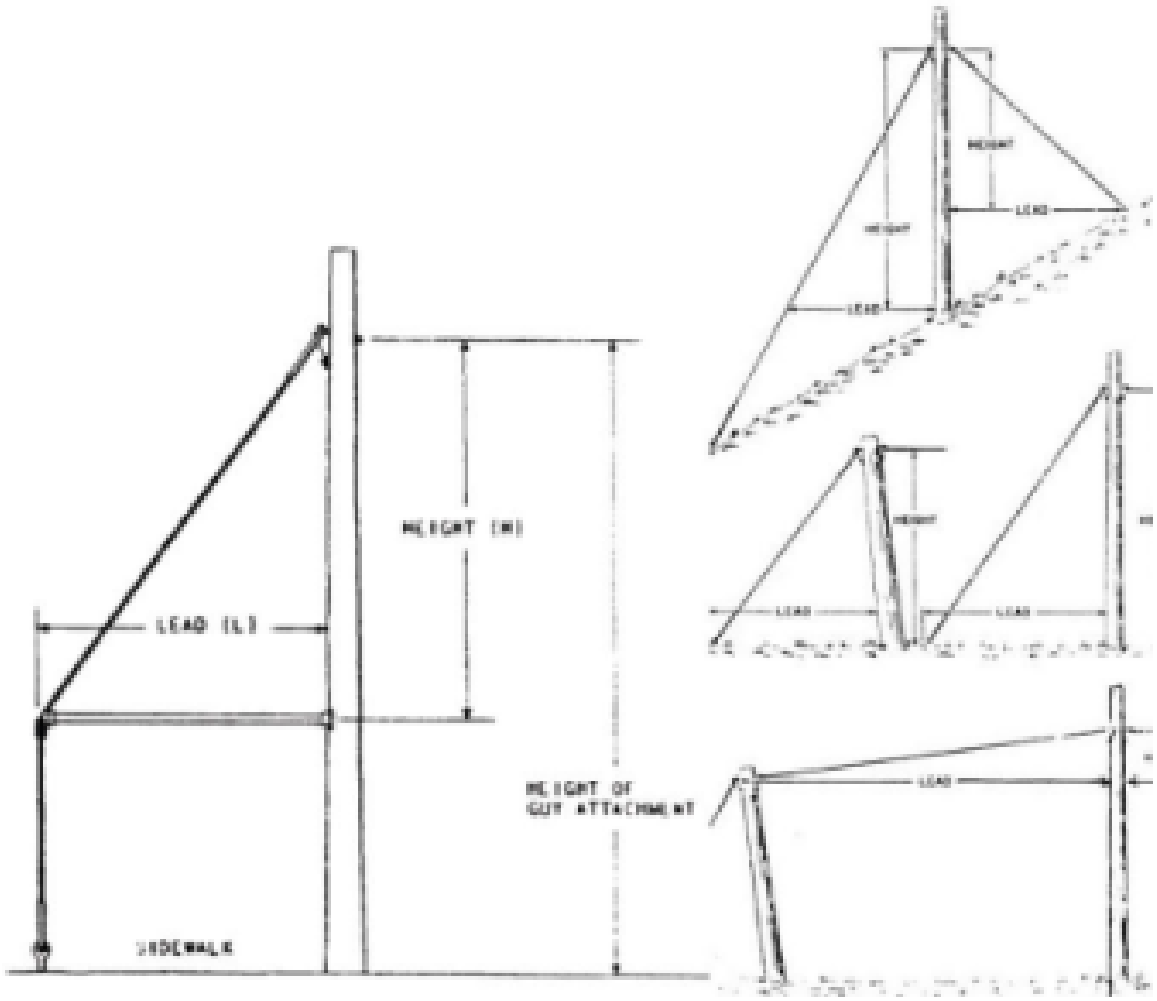
Pole-line construction, including guying and anchoring, shall be in accordance with our lease agreements with the pole owner, as well as municipal, and state regulations. All guy wires shall maintain proper clearances to ensure safe passage by persons or vehicles during and after construction.

Anchors and guys must be installed and tensioned prior to strand placement.

Coordinate the installation of anchors with all other utility companies to ensure no damage will be done to their underground facilities. Call and get permission (811 Call before you dig hotline) locating services prior to the commencement of any underground work.

Determining Lead and Height

The lead and height of a guy is defined as distances in feet (meters) and expressed as a fraction to give the lead-over-height ratio. For example, a lead of 15 feet and a height of 30 feet are expressed as 15/30 feet, or a lead-over-height ratio of 1/2.



Anchoring and Guying cont.

Place all anchors making certain that the anchor rod is in line with the proposed guy wire.

Attaching auxiliary eye or open eye attachments to existing anchor rods will be allowed only when the pole owner has granted written permission.

Yellow Guy guards must be installed on every down guy.

The eye on an installed anchor rod shall not be less than 4" (inches) nor greater than 12" out of the ground.

The contractor is responsible for any damage that their crews cause to utility poles or peripheral equipment

Use sidewalk guys in situations where the minimum headroom of 8' is not available over sidewalks or when the correct lead-to-height ratio is unobtainable, and a pole-to-pole guy is not used.

Always remove an anchor when a guy is removed.

Make all anchor attachments using a preformed dead-end, with the strand not to exceed beyond the eye of the dead-end.

There cannot be any splices in the guy strand that is attached to the anchor. The upper guy wire end must always be bonded to the support strand at the pole its end must be flush with the continuity clamp. The loop where the strand comes around the pole to make the bond should be no more than 4 in. from the pole.

How we Determine where to place a Down Guy

Determining Pull

We guy at all termination poles, where the strand makes an angle, and side pull is produced on the pole. A side guy should be installed to balance that side pull.

Pull at a corner pole may be determined by measuring the distance in feet from the pole to a point away from the pole as shown in (Fig. 1). The preferred and alternative methods are shown in the (Fig 3).

The pull at a comer pole can more conveniently be ascertained by using a pull finder. As shown in the next slide.

Note:

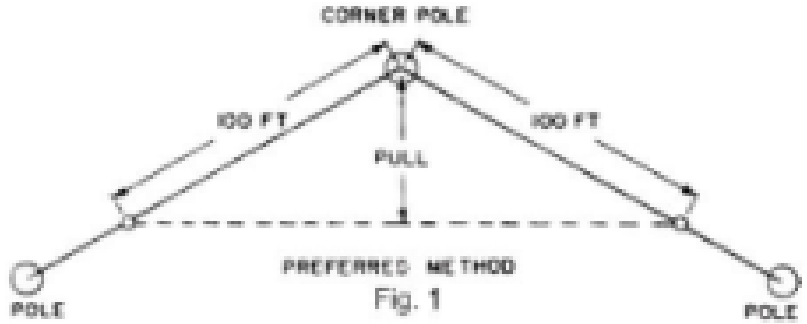
Different Strand Clamps are used based on the amount of pull..

- Straight Clamps are used when there's less than 10 feet of pull.

  Curve Clamps are used when the pull is within 10 - 50 feet.

  Dead End attachments are used with the pull is greater than 50 feet.

The Corner Suspension Clamp supports¼ EHS strand at corners where pull is 10 - 50 feet. At any comer where pull is greater than feet, the strand must be dead ended and guyed each way.



PREFERRED METHOD
Fig. 1

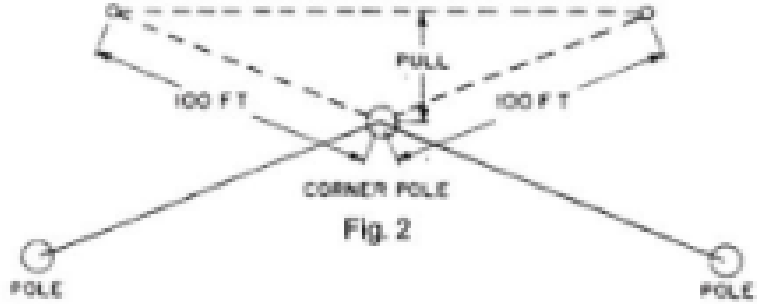
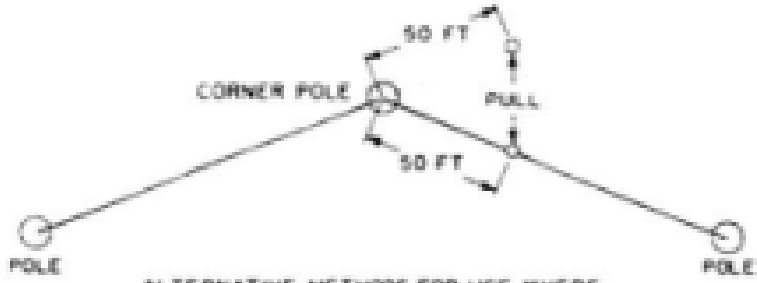


Fig. 2



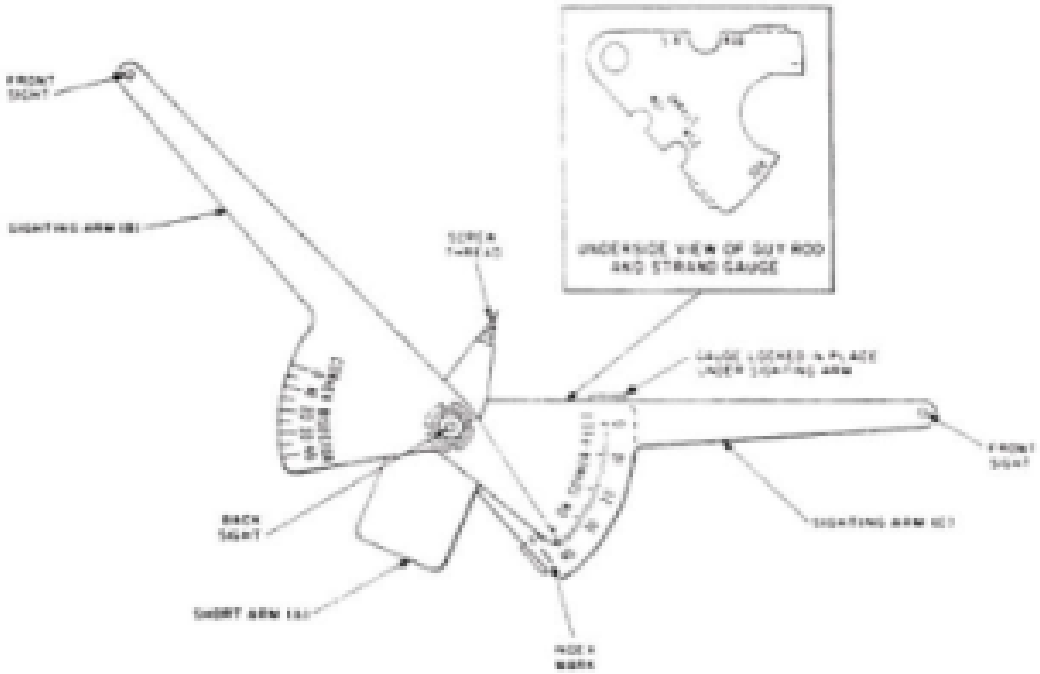
ALTERNATIVE METHODS FOR USE WHERE OBSTRUCTIONS BLOCK THE LINE OF SIGHT
Fig. 3

How we Determine where to place a Down Guy

Determining Pull with a Pull Finder

A pull finder, as shown, consists of two pivoting sighting arms and a short arm that supports the sighting arms. The short arm has a threaded point that screws into a pole and supports the tools. The pull finder illustrated has an integral guy rod and strand gauge, but other models may not.

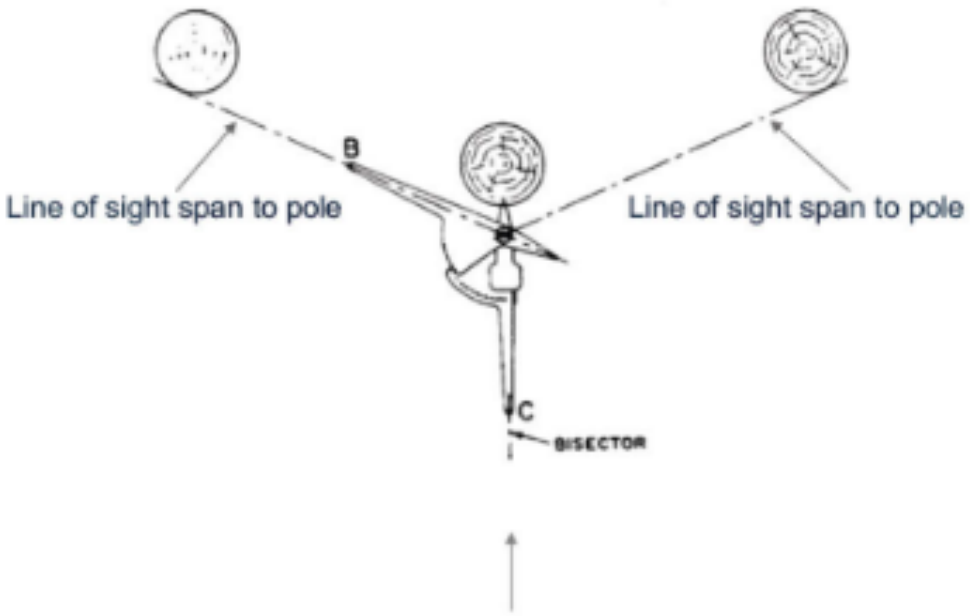
The pointer on arm B indicates the pull in feet on the scale inscribed on arm C. The other scale inscribed on arm B, when used with the index mark of arm C, enables arm C to be swung around and pointed along the correct bisecting line of the corner angle. Front sight pins, located at the end of each sighting arm, are used for alignment with a pin or back sight on top of the pivot bolt assembly.



Determining Pull with a Pull Finder Cont.

Measuring Pull

To determine the pull at a corner pole using the pull finder, screw the short arm (A) into the corner pole as shown in image. Adjust arm C so the line of sight, when sighting over the back sight and the front sight on arm C, is tangent to the surface of the pole adjacent to the corner pole. Similarly, line up arm B by sighting on the other pole adjacent to the corner pole. Check arm C to make certain it has not moved. The pointer on arm B now indicates on the scale on arm C, the pull in feet at the corner.

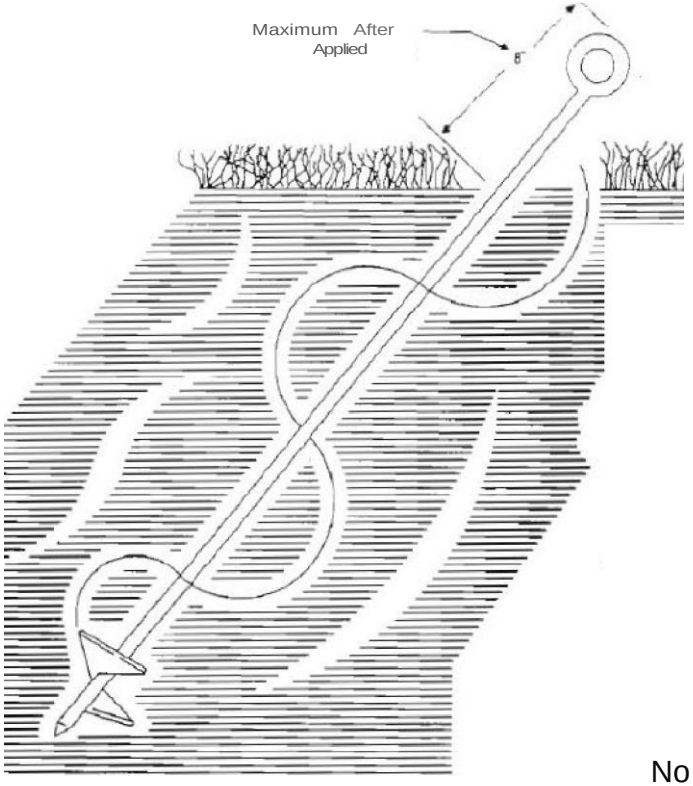


Types of Anchors

No Wrench Screw Anchor

No-Wrench Screw Anchors may be installed by hand or machine. The THIMBLEYE® eye or TRIPLEYE® eye on the rod has a large opening to admit a turning bar for screwing the anchor down. The eye will also fit into an adapter available from most hole-boring machine manufacturers so the anchor may be power-installed. The No-Wrench Screw Anchor consists of a drop-forged steel THIMBLEYE® eye or TRIPLEYE® eye rod welded to a steel helix. The entire anchor is hot-dip galvanized for long resistance to rust.

No-Wrench Screw Anchors can be installed to a greater depth to reach a firmer soil by using an extension rod. Maximum installing torque is 2300 ft.-lbs. for 1-¼" diameter rod.

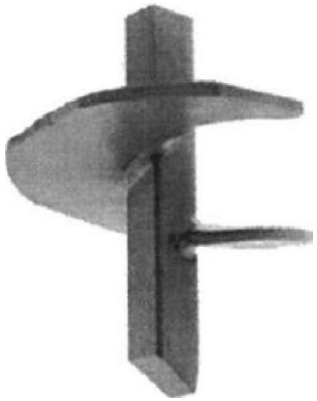


No Wrench Screw Anchor

Anchors

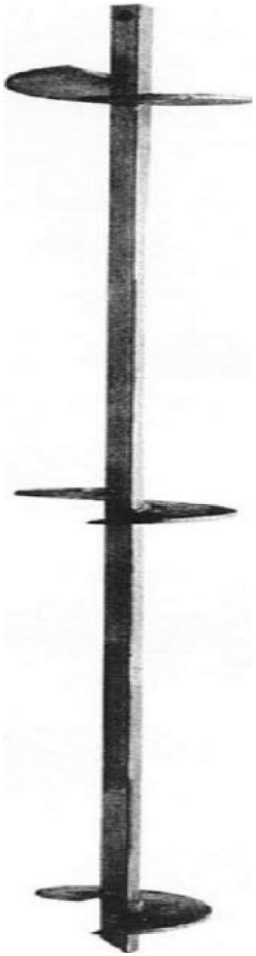
Helix Anchors

The helix anchor shown in has a torque rating of 8,000 ft pounds and is acceptable for use in soft and medium hard soils. The anchor's sloped lead point improves penetration and helps soil flow from below the hub to flow above the anchor. Helixes are stacked on the steel shaft. Each combination of either the 8-inch or 10-inch helix acts essentially as a separate anchor for increased holding power.



Single Helix Anchor

Double Helix Anchor



Multiple Helix Anchor

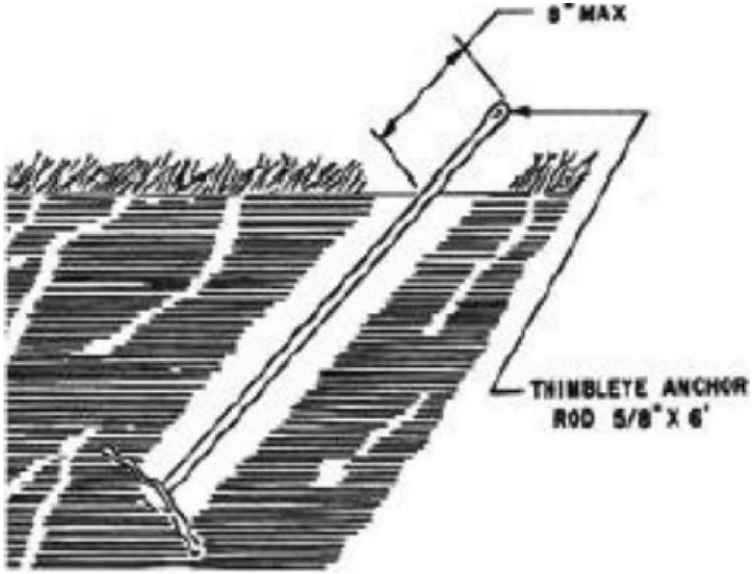
Anchors

Expansion Anchor

These anchors come in various sizes and require excavation of a hole. An earth auger should be used to bore the hole. Because this type of anchor develops most of its holding power by engaging the blades into undisturbed earth, it is important that the hole be no larger than necessary to admit the un-expanded anchor.

The anchor is inserted in the hole in the closed position. Then the top of the anchor is struck several blows with a ram to cause the leaves to expand into solid undisturbed earth at the bottom of the hole.

This anchor should be installed in relatively dry and solid soils. The effectiveness of the anchor is dependent upon the thoroughness of backfill tamping.



Closed Position

Expanded Position

Anchors

Manta Ray Anchor

Manta Rays are driven into the ground not augured or torque, nor is a hole dug or drilled.

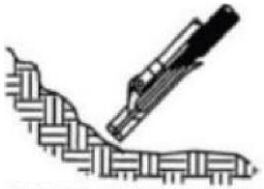
There is no disturbance or displacement of soil. Unlike other anchoring systems Manta Ray's compact the soil around itself.

After installing the Manta Ray to the proper depth, an upward pull rotates the anchor into the anchor lock position in undisturbed soil, like a toggle bolt in earth.

There are six Manta Ray anchors with light to super heavy-duty holding capacities. All are made of galvanized ductile iron, can be driven with the drive steel set (except the MR-88), and can be tested to the desired holding capacity with the anchor locker.

1. THREAD ANCHOR ROD INTO MANTA RAY

2. INSERT DRIVE STEEL INTO ANCHOR



POSITION ANCHOR AT PROP LOCATION AND ANGLE

4. DRIVE ANCHOR TO PROPER DEPTH

REMOVE DRIVE STEEL

6. USE LOAD LOCKER TO PROOF ANCHOR INTO LOAD LOCK POSITION

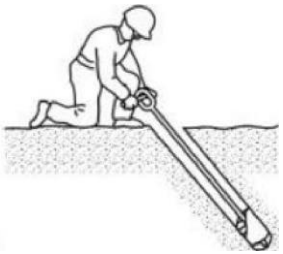
Anchors

Rock Anchor

Rock anchors are used in situations where there is solid bedrock, and it is impossible to use either a screw or expanding anchor. Drilling a 2 1/16" diameter hole in the rock formation using an air compressor and rock drill, install a rock anchor. Grouting should be done if protection of the rock against weathering is a concern.

DRILL HOLE
ENSURECORRECT DIAMETER AND DEPTH

PUSH ANCHOR INTO HOLE
ENSURE IT GOES FULLY HOME



TURN ROD TO EXPAND
USING 1220mm
STRAIGHT BAR

Closed

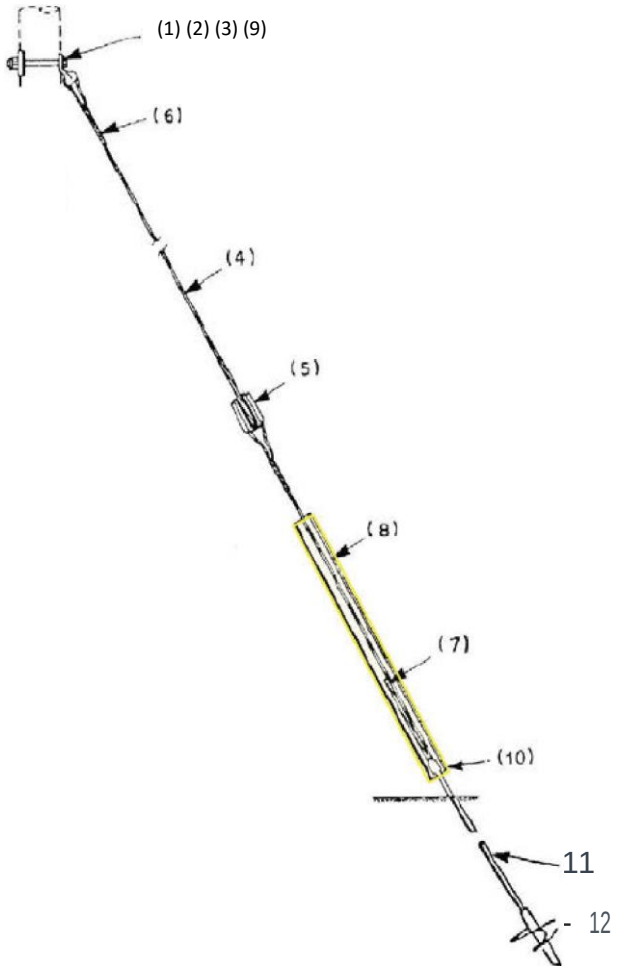
Open

Guying Poles - Components

A Guy

A guy is a brace or cable fastened to the pole to strengthen it and keep it in position. Guys are used wherever the wires tend to pull the pole out of its normal position and to sustain the line during abnormal loads caused by sleet, wind, and cold. Guys counteract the unbalanced forces imposed on the poles. The guy should be considered as counteracting the horizontal component of the forces with the pole or supporting structure as a strut resisting the vertical component of the forces.

A Down Guy consists of a wire running from tile attachment near the top of the pole to a rod and anchor installed in the ground. This type of guy is preferable if field conditions permit its installation since it transfers the unbalanced force on a pole or structure to the earth without intermediate supports.



(1) Galvanized machine bolt **with** nut

(2) Locknut

(3) square curved galvanized washer

(4) Galvanized steel guy wire

(5) Porcelain guy strain insulator (Where required)

(6) Prefabricated guy dead-end grip

(7) Prefabricated guy dead-end grip

(8) Plastic guy guard;

(9) Angle thimble eye

(10) Eyenut

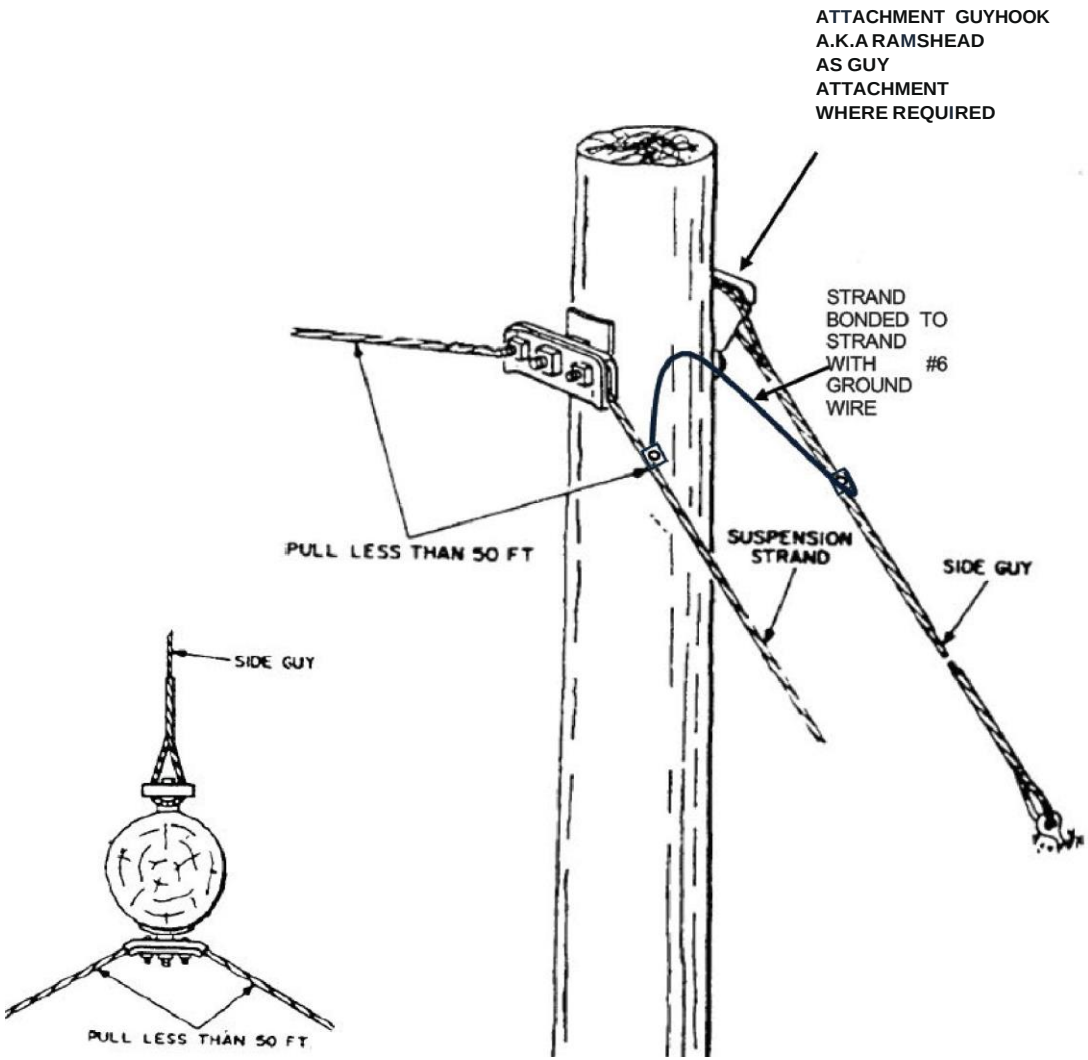
(11) Steel anchor rod

(12) Power-installed screw anchor.

Types Of Guys

Side Guys

Where the line makes an angle, a side pull is produced on the pole. A side guy should be installed to balance the side pull.

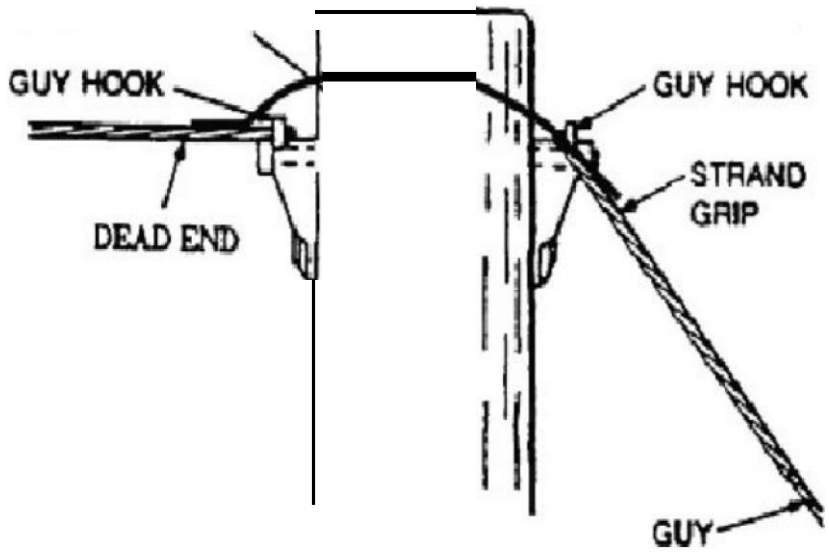


Types Of Guys

Dead End Guy/ Terminating Guys

A Dead-End Guy also known as a Terminal Guy or Head Guy Is used at the end of a pole line to counterbalance the pull of the support strand cables.

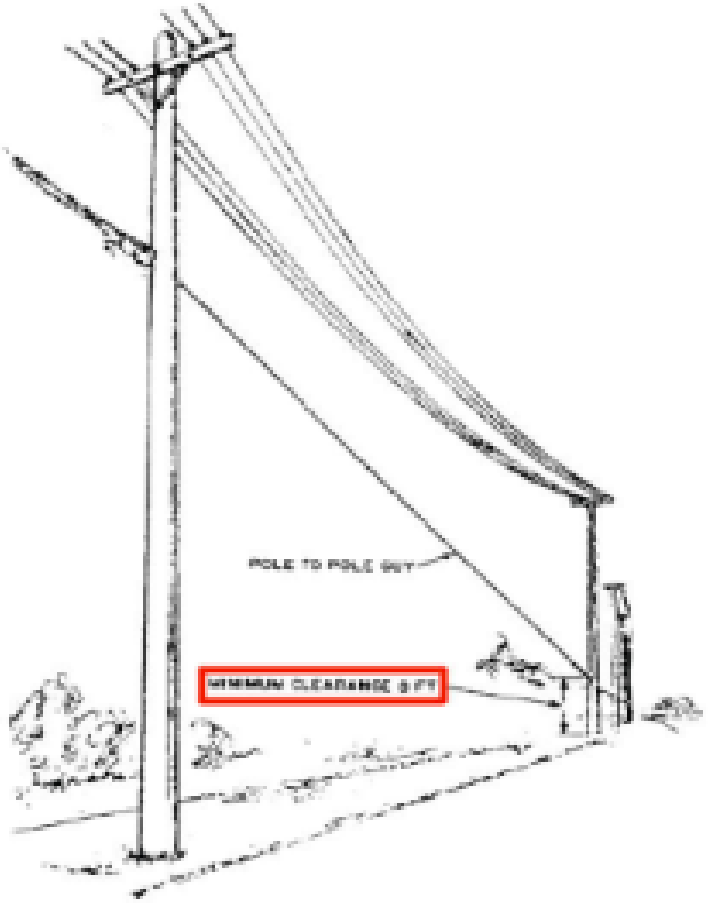
Bonded with #6 ground wire or Guy Tail



Types of Guys

Pole to Pole Guy

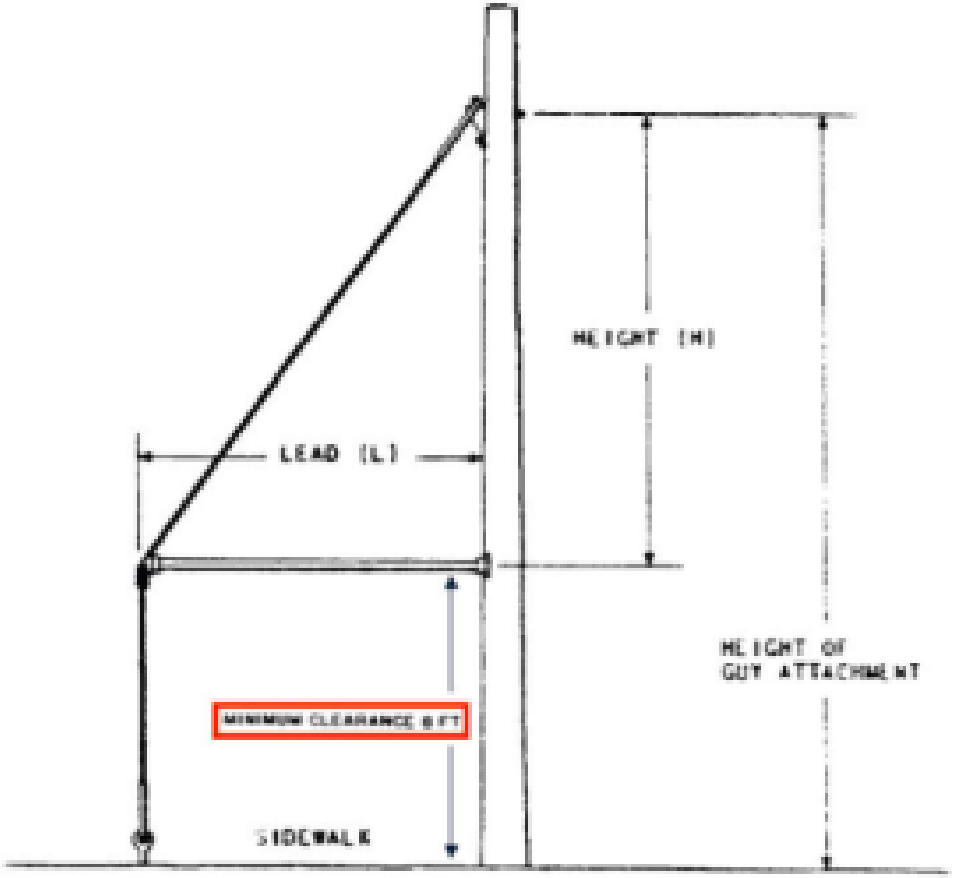
A Pole -to-pole guy is strand running from the attachment point of one pole to a point below the attachment point of the adjacent pole but at least eight feet above the ground.



Types Of Guys

Sidewalk Guy

This type of guy is used when the anchor must be set within 5 ft of the pole. The horizontal strut shown consists of a 2-inch diameter galvanized iron pipe and should have a length equal to the distance between the anchor and the pole. The horizontal strut is installed at a height of 8 feet or greater from ground level. This guy is called a sidewalk guy because the pole is set on one side of the sidewalk, and the anchor is set on the opposite side.

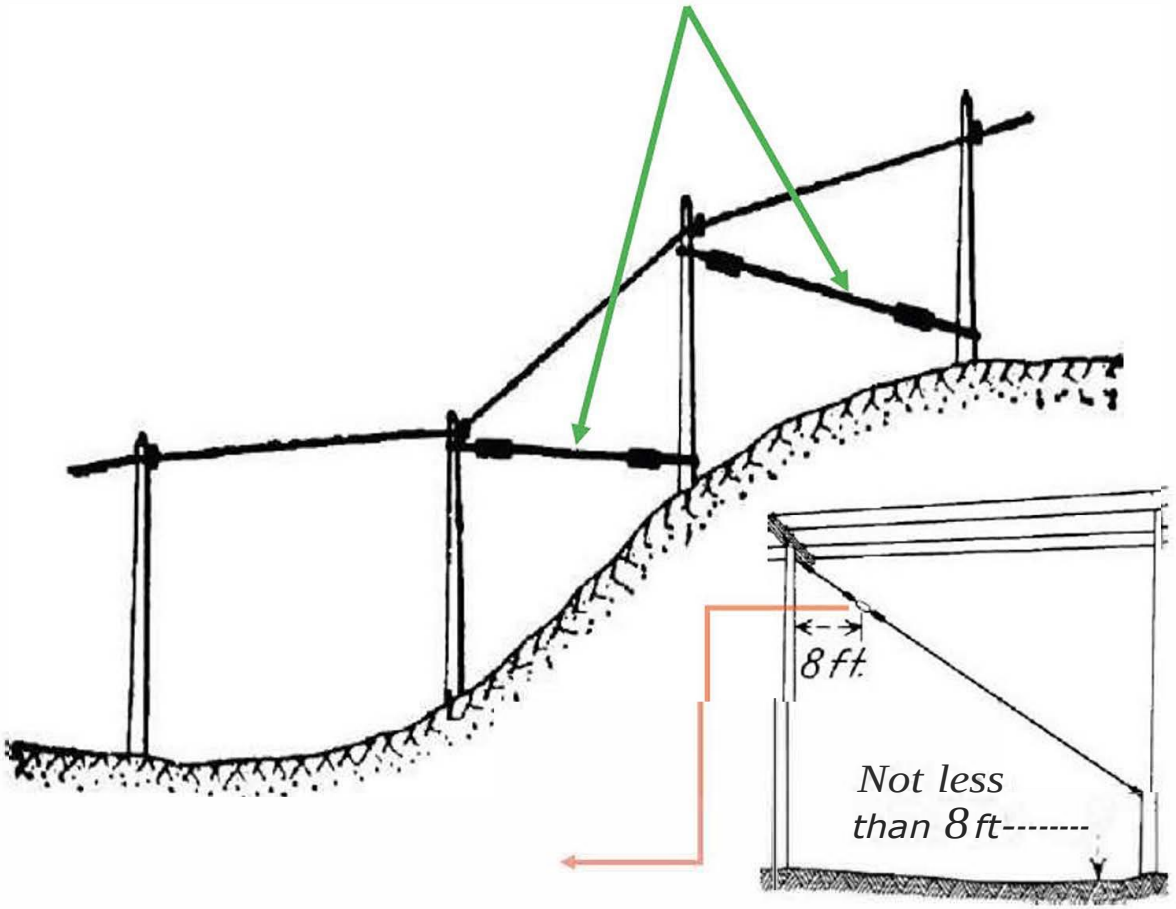


Types Of Guys

Head Guy

A guy wire running from the top of a pole to a point below the top of the adjacent pole is called a head guy. Lines on steep hills are normally constructed with head guys to counteract the downhill strain of the line.

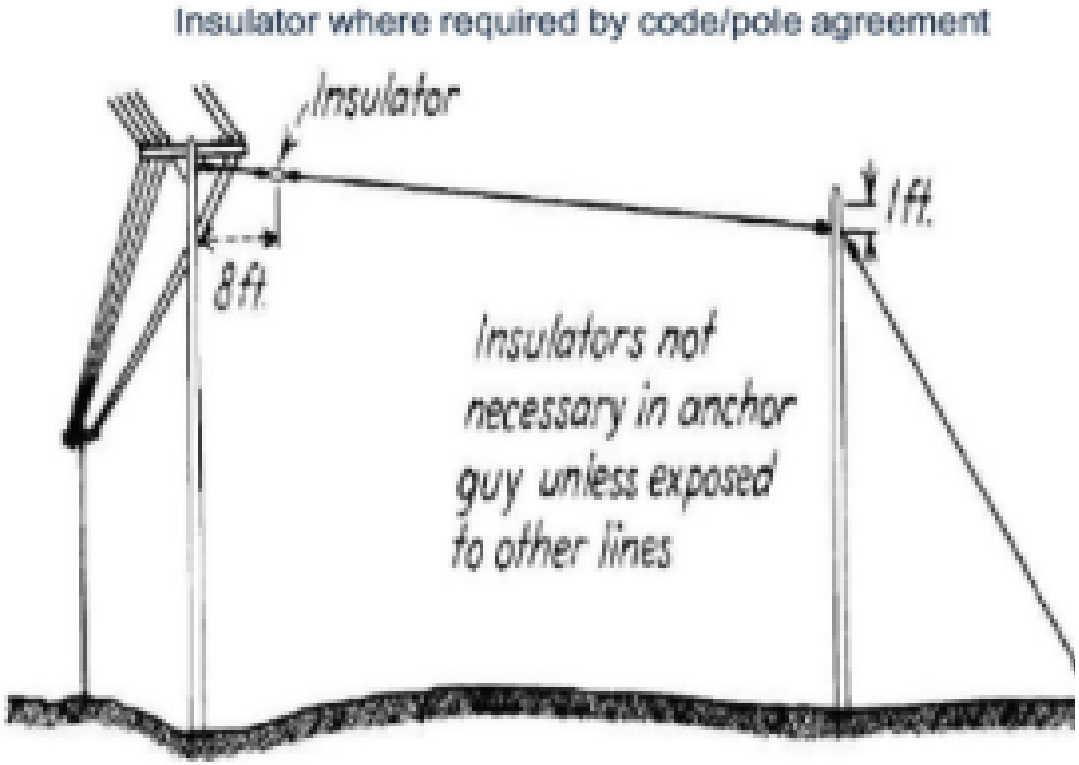
Head Guys Installed on steep grade



Types Of Guys

Stub Guys

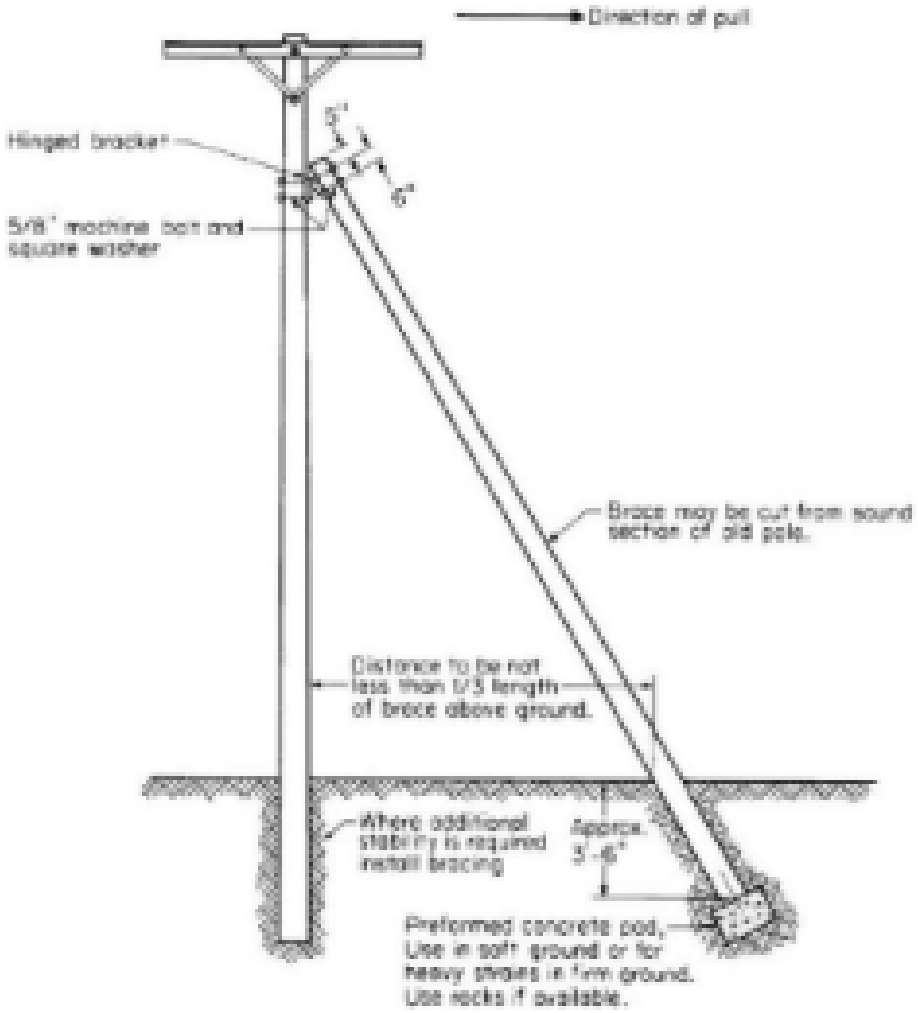
A guy wire installed between a line pole and a stub pole on which there is no energized equipment is called a stub. An anchor or down guy is used to secure the stub pole. This type of guy is often installed to obtain adequate clearance for guy wires extending across streets or highways. When transmission or distribution lines parallel to streets or roads must be guyed toward the street or road, the necessary clearance can be obtained using a pole stub on the opposite side.



Types Of Guys

Push Guys

A pole used as a brace to a line pole is often referred to as a push guy. A push brace or guy is used where it is impossible to use an anchor or down guys. When it is impossible to obtain sufficient right-of-way for a race can usually be installed.



NESC Clearances to Communication Cables

Application Guide for 2023 NESC Table 232-1 - *see NESC for details and exceptions*

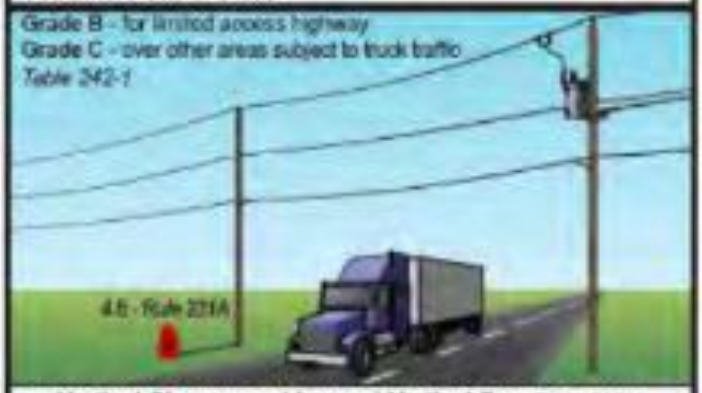
Railroads*

Vertical Clearance at Largest Vertical Sag *Table 232-1*

Neutral or Comm.	Span Guy	TPX	7.2/12.5 kV	14.4/25 kV	19.9/35 kV
23.5 ft		24.0 ft	26.5 ft		

**Railroad company may require greater clearance*

Trucks Over 8 Feet*



Vertical Clearance at Largest Vertical Sag *Table 232-1*

Neutral or Comm.	Span Guy	TPX	7.2/12.5 kV	14.4/25 kV	19.9/35 kV
15.5 ft		16.0 ft	18.5 ft		

**DOT may require greater clearance*

Water - No Sailboats

Vertical Clearance at Largest Vertical Sag *Table 232-1*

Neutral or Comm.	Span Guy	TPX	7.2/12.5 kV	14.4/25 kV	19.9/35 kV
14.0 ft		14.5 ft	17.0 ft		

**see NESC for sailboat clearances*

Over fields, orchards, forest, etc.

Vertical Clearance at Largest Vertical Sag *Table 232-1*

Neutral or Comm.	Span Guy	TPX	7.2/12.5 kV	14.4/25 kV	19.9/35 kV
15.5 ft		16.0 ft	18.5 ft		

**used by vehicles over 8 feet tall or riders on horses*

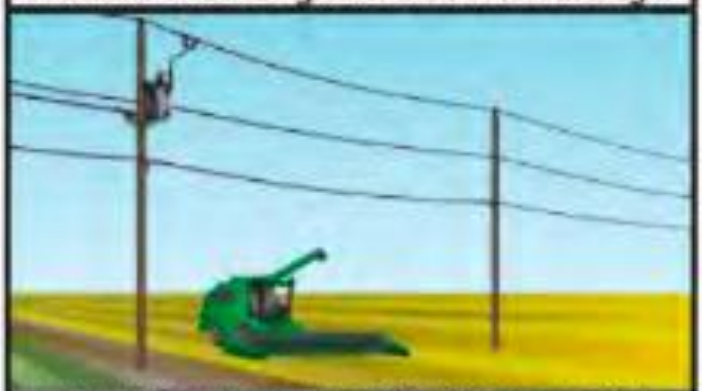
Pedestrians Only*

Vertical Clearance at Largest Vertical Sag *Table 232-1*

Neutral or Comm.	Span Guy	TPX	7.2/12.5 kV	14.4/25 kV	19.9/35 kV
9.5 ft		12.0 ft	14.5 ft		

**Not normally used by trucks or riders on horses (very steep hills, swamps, etc.)*

Oversized Vehicles - greater than 14 feet in height



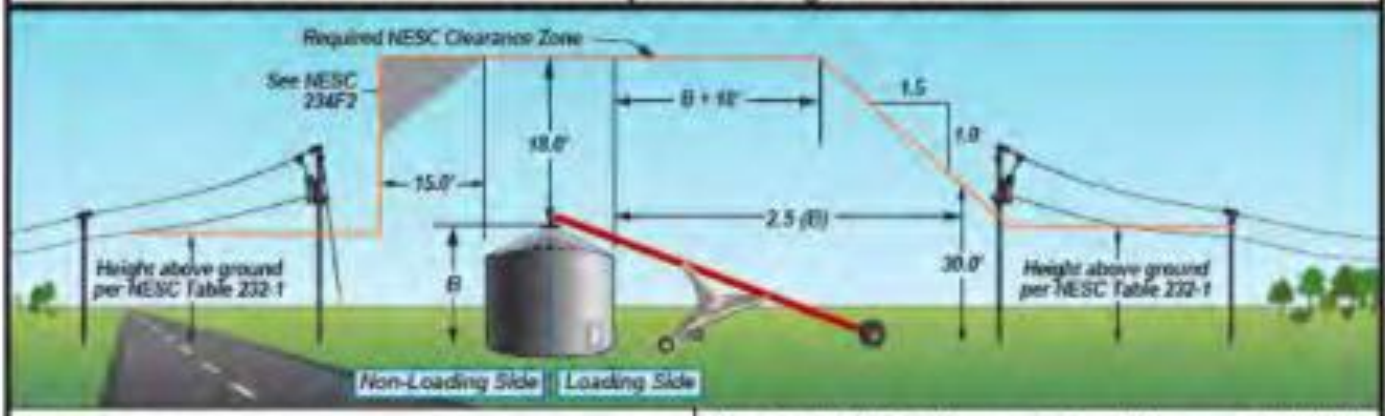
Vertical Clearance at Largest Vertical Sag *Table 232-1*

Neutral or Comm.	Span Guy	TPX	7.2/12.5 kV	14.4/25 kV	19.9/35 kV
X + 1.5 ft		X + 2 ft	X + 4.5 ft		

X = Known Height of oversized vehicle

Application Guide for 2023 NESC - *see NESC for details and exceptions*

Clearance Over* or Near Grain Bins Loaded by Portable Auger NESC 234F2



B = Vertical height to highest filling or probing port

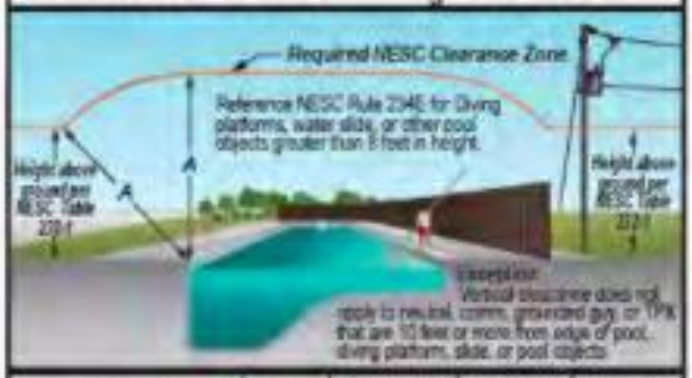
Note: If B > 12 feet, vertical height of conductors is 30 feet at a distance equal to 2.5 times B

*Largest vertical sag

Non-Loading Side is when use of portable auger is limited by:

1. Permanent building/structure
2. Physical obstruction
3. Public road or other right of way
4. Designation or agreement

Clearance Over* or Near Swimming Pools NESC 234E1

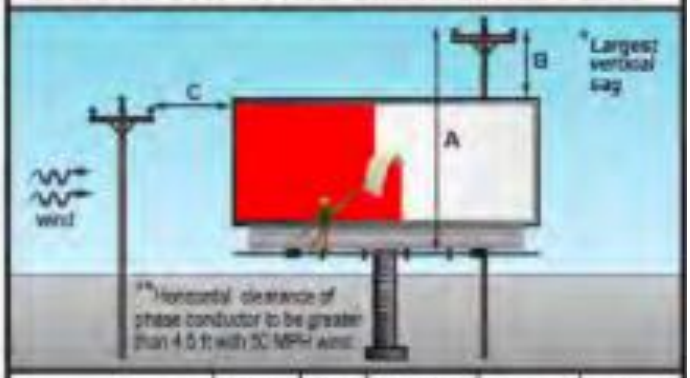


Neutral	TPX	7.2/12.5 kV	14.4/25 kV	19.9/35 kV
22.0 ft	22.5 ft	25.0 ft		

*Largest vertical sag

Aboveground pool with deck or ladder, clearance is from highest point upon which people can stand.

Clearance Over* or Near Billboards NESC 234C



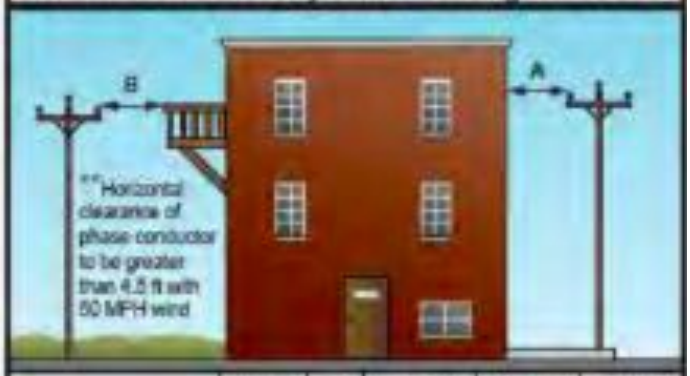
	Neutral	TPX	7.2/12.5kV	14.4/25kV	19.9/35kV
A-Where personnel walk	9.5 ft	10.0 ft	14.5 ft		
B - Other Surface	3.0 ft	3.5 ft	8.0 ft		
C - Horizontal**	4.5 ft	5.0 ft	7.5 ft		

Vertical Clearance Over* Buildings NESC 234C

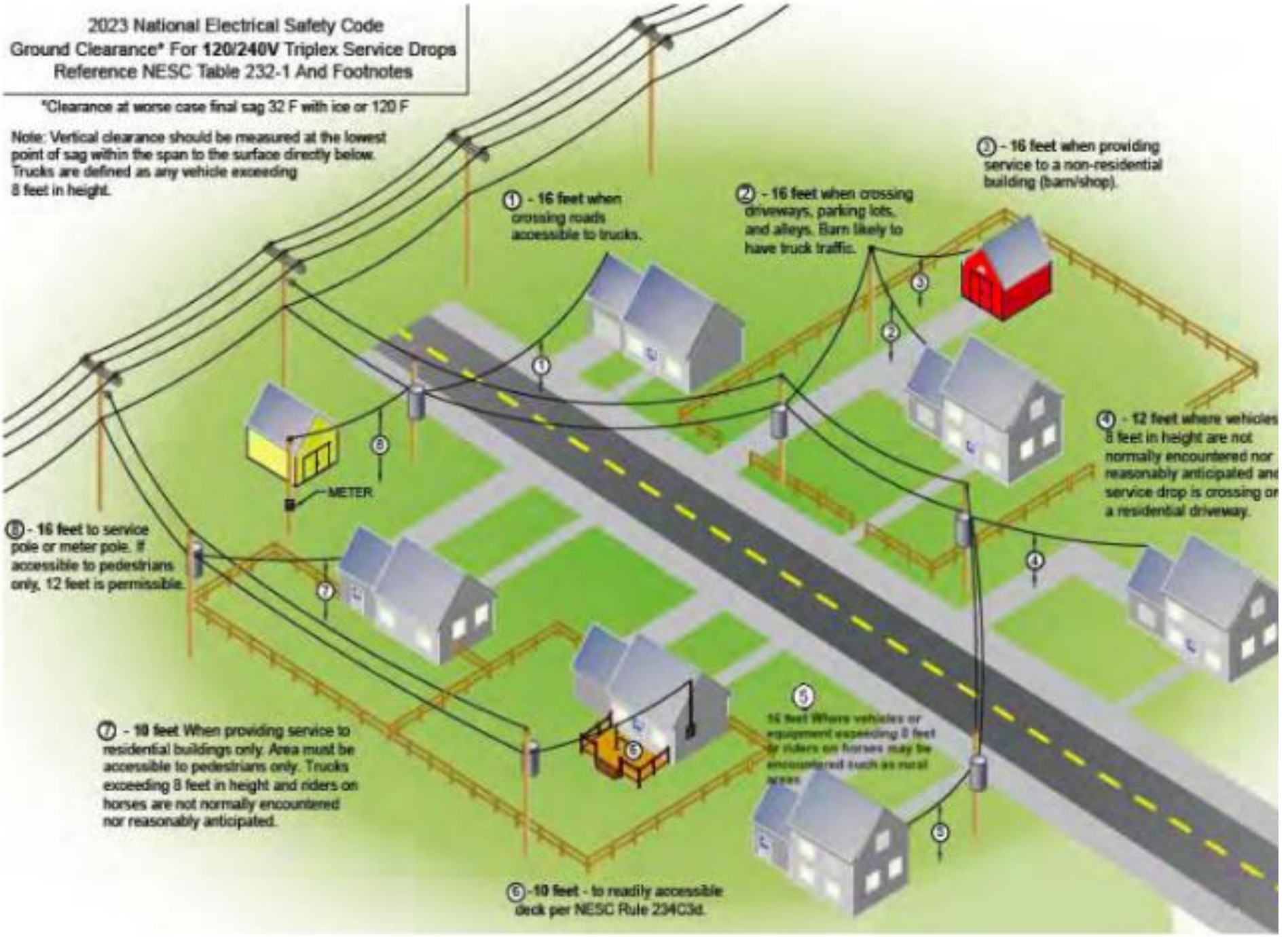
Roof	Neutral	TPX	7.2/12.5kV	14.4/25kV	19.9/35kV
Accessible**	9.5 ft	10.0 ft	14.5 ft		
Non-Accessible	3.0 ft	3.5 ft	12.5 ft		

*Largest vertical sag

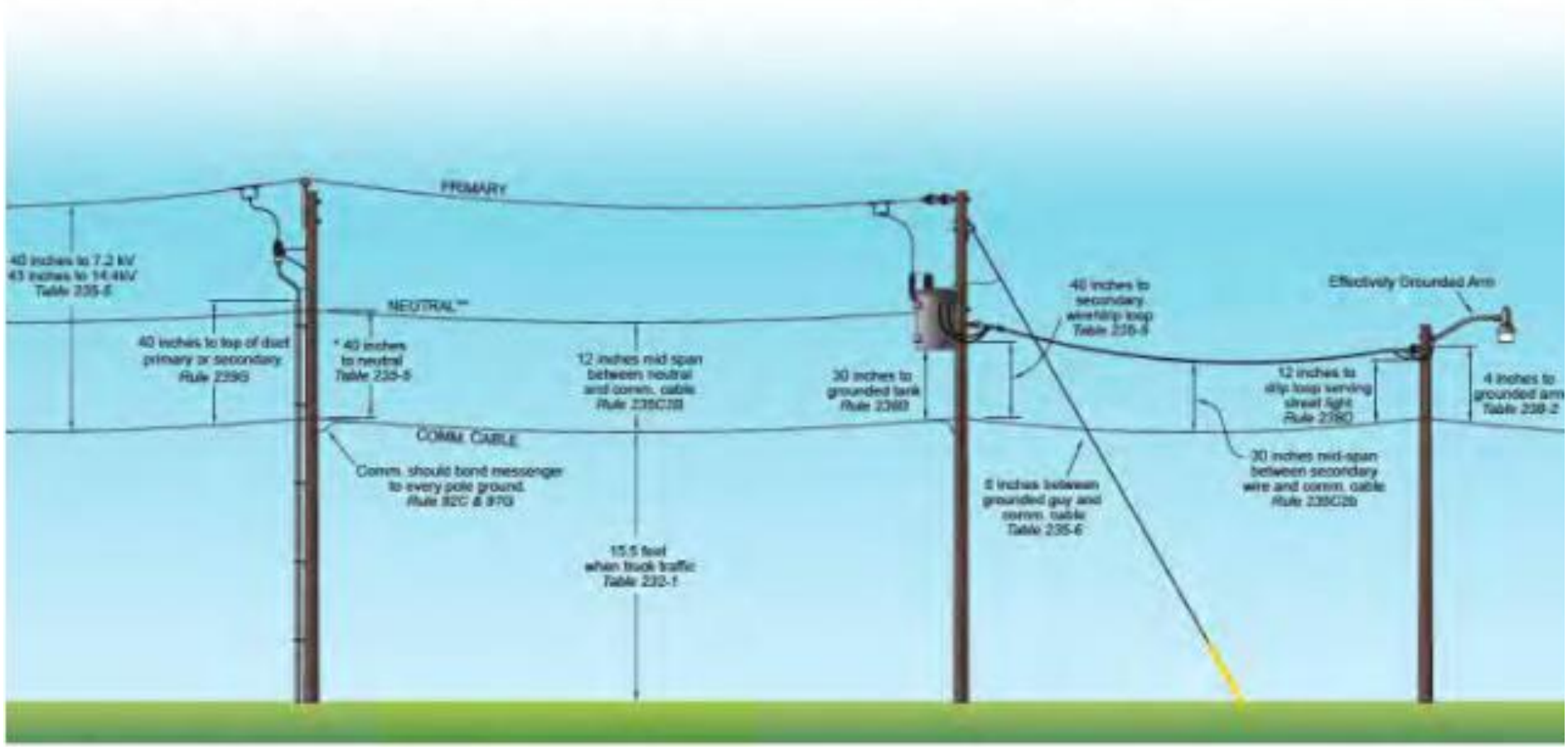
Horizontal Clearance Adjacent to Buildings NESC 234C



	Neutral	TPX	7.2/12.5kV	14.4/25kV	19.9/35kV
A-To Walls**	4.5 ft	5.0 ft	7.5 ft		
B - Accessible Areas**	4.5 ft	5.0 ft	7.5 ft		


2023 National Electrical Safety Code
Ground Clearance* For 120/240V Triplex Service Drops
Reference NESC Table 232-1 And Footnotes
*Clearance at worse case final sag 32 F with ice or 120 F
Note: Vertical clearance should be measured at the lowest point of sag within the span to the surface directly below. Trucks are defined as any vehicle exceeding 8 feet in height.
① - 16 feet when crossing roads accessible to trucks.
② - 16 feet when crossing driveways, parking lots, and alleys. Barn likely to have truck traffic.
③ - 16 feet when providing service to a non-residential building (barn/shop).
④ - 12 feet where vehicles 8 feet in height are not normally encountered nor reasonably anticipated and service drop is crossing or a residential driveway.
⑤ 16 feet Where vehicles or equipment exceeding 8 feet or riders on horses may be encountered such as rural areas
⑥ -10 feet - to readily accessible deck per NESC Rule 234C3d.
⑦ - 10 feet When providing service to residential buildings only. Area must be accessible to pedestrians only. Trucks exceeding 8 feet in height and riders on horses are not normally encountered nor reasonably anticipated.
⑧ - 16 feet to service pole or meter pole. If accessible to pedestrians only, 12 feet is permissible.
METER

Summary of 2023 NESC Clearances to Communication Cables - *see NESC for details and exceptions*



* 30 inches is allowed if the communication messenger is bonded to the neutral throughout the service area. *Table 235-5*

** Fiber Optic Cables in the supply space (*Rule 224A*) will have the same required clearance to communication cables in the communication space as a multi-grounded neutral (*Rule 235C*)

A **communication worker safety zone** is vertical space between lines/facilities in the supply space and lines/facilities in the communication space *Rule 235C4 & 238E*

Aerial

Fiber Construction Slack (Storage) Loop Method of Procedures

OVERVIEW

Minimum bend radius formula >= 20 x fiber cable O.D.

Aerial fiber 150' of slack approx. every 1500' of aerial route

***Slack loops will be stretched out to approx. 75' from loop to loop.**

***Slack loops will be no closer than 8' to any pole.**

Risers - 200' of slack - (riser with ENCLOSURE 125' slack)

Major crossings - 200' of slack- before and after.

OTE/MST- Pass Thru 100' coil, END OF LINE 50' tail

Underground/manhole slack - 50' of slack approx. every 500' of fiber pulled.

Underground/manhole enclosure - 50' coil or 25' tails

Underground MST/OTE - 20' coil for thru location, 10' tail for EOL

Underground OLT/AiO Cabinet - 50' of slack

Lock box/panel - 20' of slack

Building attachments - 50' of slack no closer than *8'* to structure

Fiber Minimum Bend Diameter

FIBER IS NOT TO EXCEED THE MINIMUM BEND DIAMETER OF THE FIBER AS LISTED IN TABLE BELOW.

MINIMUM FIBER BEND DIAMETER FORMULA

>= 20 X FIBER CABLE O.D. (OUTSIDE DIAMETER)

Material Category	Material Description	Cable Diameter	Minimum Bend Diameter in inches	Recommended Snow Shoe Size
Fiber	FBR 288CT RBBN SST ARMOR SNG JKT	0.85	17	17
Fiber	FBR 144CT RBBN AR GEL-FREE	0.71	14.2	17
Fiber	FBR 96CT ARMORED LT SM DRY	0.54	10.8	17
Fiber	FBR 72CT ARMORED LT SM DRY	0.48	9.6	17
Fiber	FBR 48CT ARMORED LT SM DRY	0.48	9.6	17
Fiber	FBR 24CT ARMORED LT SM DRY	0.48	9.6	17

Aerial Fiber Slack (Storage) Loops

SNOWSHOES ARE REQUIRED AT ALL SLACK (STORAGE) LOCATIONS

*SNOWSHOES ARE NOT REQUIRED AT FIBER SPLICE OR OTE LOCATIONS WITH FIBER LESS THAN 144 COUNT

ALUMINUM SNOWSHOE 17 FBR
SNOWSHOE W/BRKTS

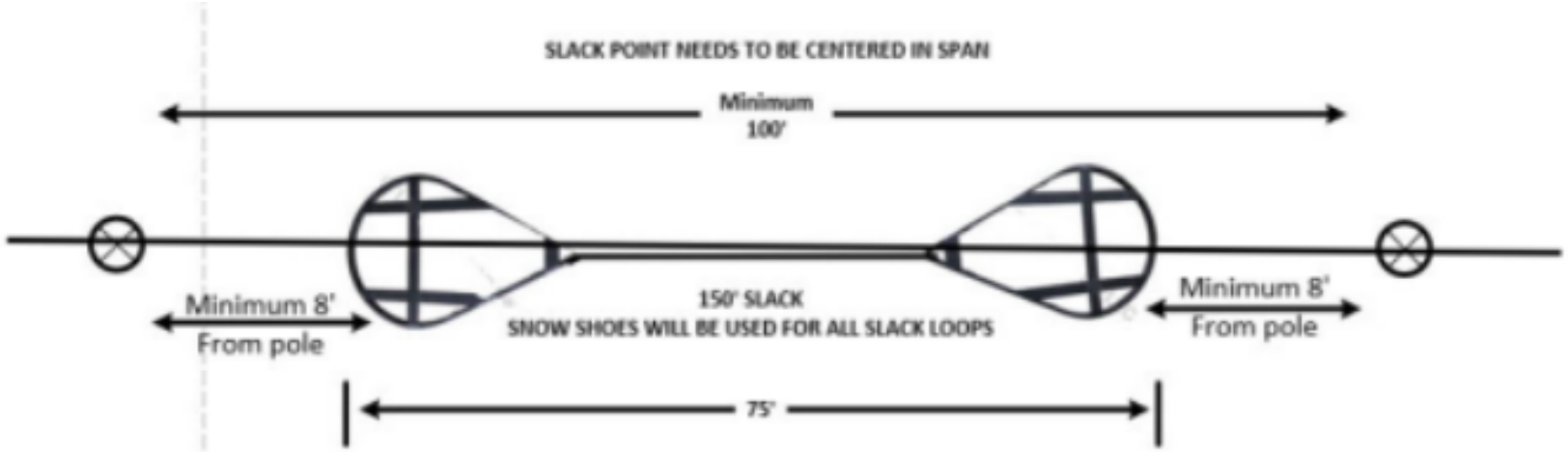
PLASTIC SNOWSHOE 24IN
W/STRAND MOUNTING KIT
TO BE USED ON 288CT
FIBER AND GREATER

Aerial Fiber Slack (Storage) Loop Footages

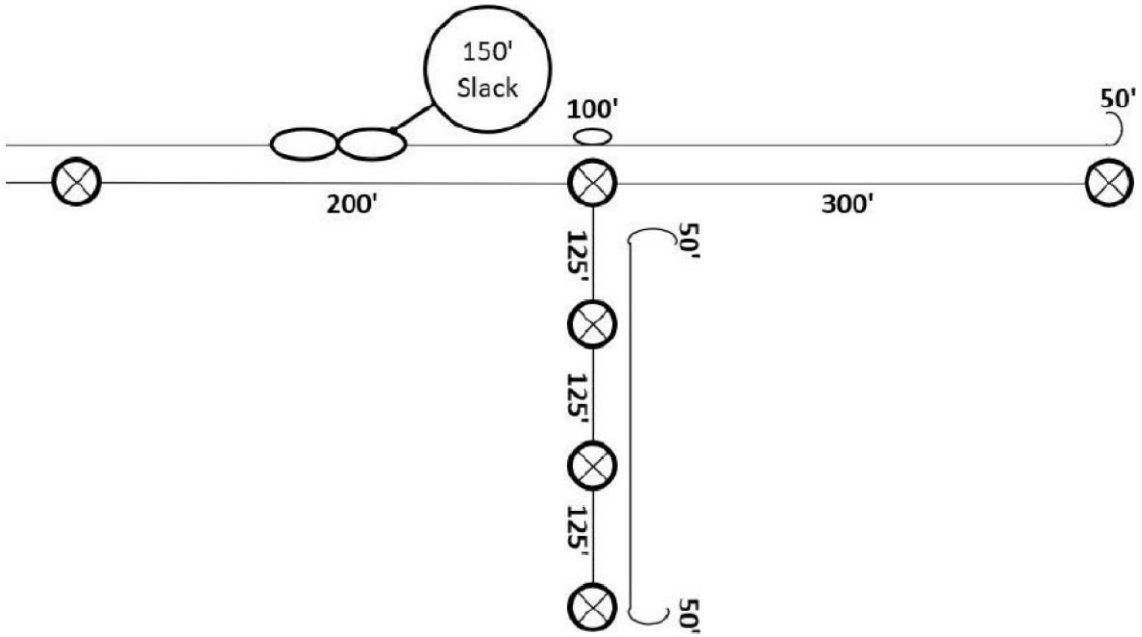
AERIAL FIBER SLACK (STORAGE) LOOP IS TO BE MINIMUM OF 8' FROM UTILITY POLE

150' SLACK - APPROX. EVERY 1500' OF AERIAL ROUTE
200' SLACK - AT EACH RISER (RISER WITH ENCLOSURE WILL HAVE 125')
200' SLACK - BEFORE AND AFTER MAJOR CROSSINGS. EXAMPLES OF MAJOR CROSSINGS:

- **STATE ROADS**
- **COUNTY ROADS**
- **HIGHWAYS**
- **ROADS/STREETS OF 5 LANES OR MORE, NOT NECESSARILY MEETING THE OTHER CRITERIA (2 LANES IN EACH DIRECTION + ISLAND OR TURNING LANE)**
- **RAILROAD CROSSINGS**
- **WATERWAYS**

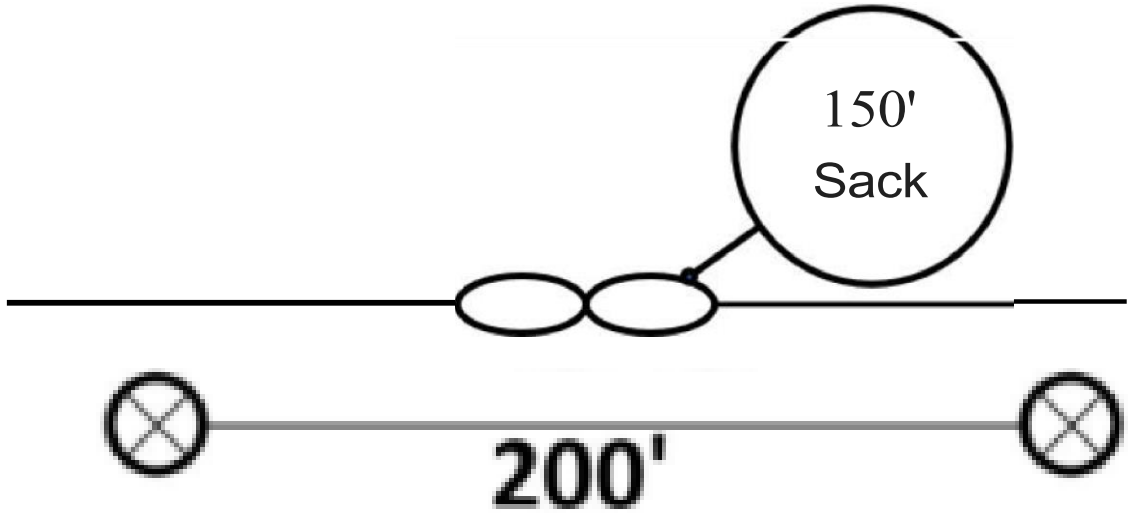


Aerial Fiber Slack (Storage) Loops on As-Builts

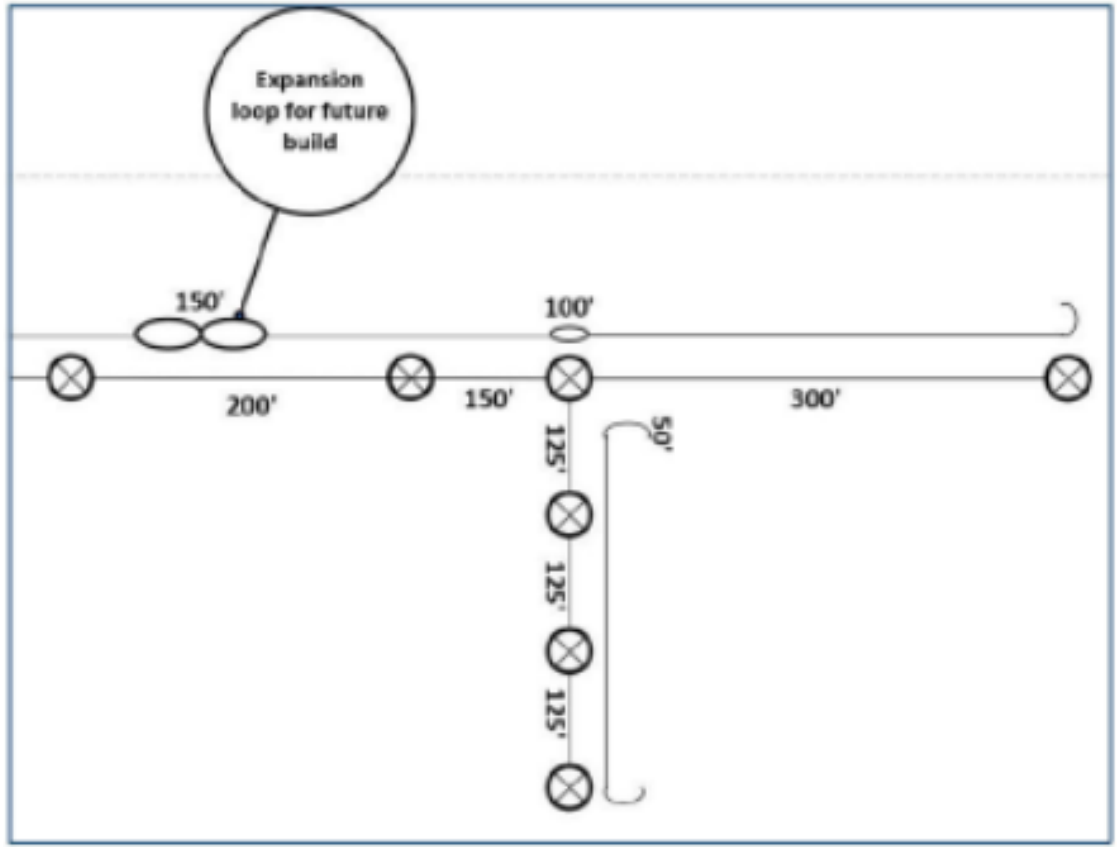


100' COILS AT POLE FOIR PASS THRU OTEs
100' COILS AT POLE FOR FIBER ENCLOSURES
50' CTAILS AT POLE FOR END OF LINE OTEs
50' TAILSS AT POLS FOR FIBER ENCLOSSURES

SLACK LOOP AND SPACING TO BE DENOTED BY TIC-FOOTAGE MARKS ON AS-BUILT DOCUMENTS:



Aerial Fiber Expansion Loop for Future Build on As-Builts



AERIAL FIBER EXPANSION LOOP FOR FUTURE BUILD IS TO BE DENOTED BY TIC-FOOTAGE MARKS ON AS-BUILT DOCUMENTS:

- Expansion loops can be added at locations where future growth may exist however, is not yet planned for build. These loops will serve as locations where splice cases can be added any time after construction complete.
- Future expansion loops should be added and called out on design for easy identification of future growth slack vs restoration slack.
- Restoration Slack cannot be used for future growth.
- Expansion loops should be adequate to reach fiber Splice location.
- Splice enclosures can only be used when a new connection is required in that enclosure. This includes butt splices from fiber to fiber and to service the customer locations in the Prism ID. No splice cases should be placed or spliced through for future growth opportunities.

Aerial MST/OTE Location

AERIAL MST/OTE WILL REQUIRE

100' FIBER COIL FOR SPLICING A THRU MST/OTE

50' FIBER TAIL FOR END OF LINE MST/OTE.

Aerial Fiber Enclosure Slack (Storage) Loop Footages

- AERIAL ENCLOSURE LOCATIONS WILL REQUIRE 50' FIBER TAILS OR 100' FIBER COIL FOR RING CUT LOCATIONS. AERIAL ENCLOSURES WILL BE LOCATED NO CLOSER THAN 8' TO UTILITY POLE. AERIAL SLACK LOOPS WILL NOT CROSS FACE OF UTILITY POLE

AS-BUILT | WALKOUT

AS-BUILT WALKOUT WORK

1. General

   a. Contractor shall gather all required information by walking out the applicable areas using appropriate tools such as wheeled distance measuring devices, laser distance devices, and ground cable locating equipment. Contractor should make use of the most accurate method possible depending on the terrain and environmental conditions.

   b. As applicable, OSP shall provide Contractor an initial set of copies of the network's existing key map, amplifier and fiber schematic(s) and source maps from which Contractor will make additional working sets as needed. Contractor will indicate on these working copies all conflicting or new information discovered during the field walkout. Contractor shall place this information on the working maps following the symbols and line types outlined in OSP's most current Design and Drafting Procedures Manual. Contractor shall use colored pens to indicate the information gathered during the walkout as follows:

      - Blue – Feeder Cable and Components
      - Green – Express Cable and Components
      - Red – Strand/Trench and Components
      - Blue – Water
      - Black – Fiber Cable
      - Brown – Wreck Out
      - Gray – Base and all other information not listed above

   c. Contractor shall create detailed hand drawings of any new information discovered during the walkout that is not shown on the source map. Detailed drawings must indicate the source map number and the system tie point.

   d. Contractor shall record outside plant deficiencies (aka make-ready violations) on the walkout source maps using the following chart and codes (next to the violation):

e. Contractor shall compile all available information which must contain the totals on a per map basis for each of the following:

- Strand footage
- Trench footage
- Conduit footage
- Footage for all underground coaxial cable
- Footage for all aerial coaxial cable
- Footage for each coaxial cable by type and size
- Footage for all underground fiber cable
- Footage for all aerial fiber cable
- Footage for each fiber cable by fiber count
- Number, type (standard or stand-by) manufacturer/model number (60 or 90 Volt), application (pole mounted or cabinet) of power supplies and verify/note status monitoring transponder vendor/model if deployed.
- Number and type of all actives including, nodes, express amplifiers, splice enclosures, storage loops and line extenders.

Note: These totals shall also be documented in the title block of all existing/new source maps upon completion of the as-built drafting. **Contractor shall not place their company logo on any OSP map or document.**

f. Contractor shall quality check their walkout and provide a weekly progress report to the OSP construction manager/Design Office. This report shall include a key map with highlighted areas indicating the status of the walkout along with the areas that have been QC'd with a goal of 100% accuracy.

g. Contractor shall guarantee the underground, aerial and multi-tenant building phases of the walkout will be accurate, per phase, for at least one year after the completed walkout has been approved by OSP's construction manager/Design Office. The Contractor shall re-walk any failed QC area that has been determined by the construction manager/Design Office not to be within 95% accuracy. The Contractor shall have no more than 5 working days to start the re-walk and 1 day for every 5 miles, or portion thereof, to complete the identified area re-walk.

h. Contractor shall, upon completion of the walkout, provide OSP's construction manager/Design Office all deliverables including:

- Network Walkout Summary
    - Template to be provided by OSP
    - Data to include by map number, aerial strand mileage, underground trench mileage, coax aerial mileage, coax underground mileage, fiber aerial counts/mileage, and fiber underground counts/mileage. Coax cable to be broken down by size/type and amount.
    - City or franchise identification, number and type of power supplies, number of fiber nodes, number, and type of actives, number, and type of make ready issues, and aerial and underground fed homes passed.
- All marked up copies of the source maps
- All MDU detailed drawings

- All new maps created by Contractor.

2. Land Base

a. Street names must conform to the U.S. Postal Service's Street Name List. Refer to USPS publication 28 Postal Addressing Standards. http://www.usps.com.

b. Contractor shall record the location of all city, county, state, federal and park boundaries within the network footprint.

c. Contractor shall verify and report the correct location of all natural and man-made barriers such as rivers, lakes, swamps, bridges, railroads, pedestrian tunnel and bridge walkways, federal, state and city parks.

d. Contractor shall verify the municipal name (and where applicable the state and/or federal name), route and location for all right of ways, which include all highways, primary roads, secondary roads, alleys, and private roads per source maps provided by OSP.

e. Contractor shall not be required to verify and document all lot lines. Footprint documentation is required to be included on all commercial, MDUs, schools, libraries, fire stations, churches, museums, hospitals, and government buildings.

Charter Outside Plant Deficiencies (Make Ready)			
Description	Code	Description	Code
Clearance Violation	MR-1	Temporary Coax/Fiber Cable	MR-7
Pole Transfer Required	MR-2	Damaged Electronics	MR-8
Downguy/Anchor Deficiency	MR-3	Place/Repair Ground/Bond	MR-9
Broken Lashing Wire	MR-4	Drop Splitter/Insufficient Tap Ports	MR-10
Damaged/Kinked Coax/Fiber	MR-5	Pedestal/Vault/Lockbox Damaged	MR-11
Drop Transfer Required	MR-6	Riser Guard Missing or Damaged	MR-12
Fiber Rolled up at Pole	MR-13	Splice not Attached Properly	MR-14
Damaged or Missing Snowshoe	MR-15	Tree Trim	MR-16

f. Contractor shall verify and document all addresses and building IDs including but not limited to commercial, residential, MDUs, schools, libraries, fire stations, churches, museums, hospitals, and all government buildings.

g. Contractor shall record all existing undocumented street information onto the source maps. If the source map does not contain the space to record as-built information, then a detailed drawings shall be created with the reference detailed map number denoted on the source map. This applies to commercial, municipal and college multi-story building with existing OSP facilities. See MDU section for MDU detail maps.

3. Strand/Underground Routing

a. Contractor shall verify and record the correct location and distances between all poles, pedestals, lockboxes, vaults, manholes, handholes, drop poles and all fiber strand-bearing poles.

b. Contractor shall verify that each pole is correctly indicated on the source maps with respect to usage:

- Power pole
- Joint use pole
- Transformer pole
- Joint use transformer pole
- Phone pole
- Push pole
- Drop pole
- CATV pole
- Any other pole owned or controlled by a company or the government that is carrying OSP amenities

c. Contractor shall verify and record all pole numbers and nearest address at fiber event locations (i.e., node, splice enclosure, storage loop, etc.)

d. Contractor shall verify and record all anchors, guys, grounds, bonds, and risers along fiber route only.

e. Contractor shall verify and record all house counts that each pole, pedestal, or lockbox is serving. Any multi-dwelling less than 5 units shall be considered a residential house count and no MDU symbol will be used. Individual addressees are required. Poles and pedestals that are not serving a house should indicate a zero house count.

f. Contractor shall verify and record all commercial and institutional counts by adding the total numbers of units/suites per floor and per building that are being served from each pole, pedestal, lockbox, or utility closet/cabinet.

g. Contractor shall record on the source maps each house address and length of any and all “long drops” whose lengths exceed 250 feet.

h. Contractor shall record all existing fiber fed facility information directly on the system source maps with the appropriate colored pen. For strand or trench footage this shall include the correct distances between poles, pedestals, lockboxes, vaults, manholes, hand holes, drop poles, correct pole type and ownership of pole, type and number of anchors, guys, grounds and bonds, correct number of houses, commercial units and institutional units.

i. Contractor shall record all new information in the field that was not previously shown on the source maps. All new strand information that will not fit onto the source maps shall be drafted onto a detailed map.

j. Contractor shall verify and record any physical plant damage including broken lashing wire and required pole transfers and locations along fiber route.

4. Multi-Dwelling Unit (MDU)/Multi-Tenant Unit (MTU) Routing

a. If as-building of the existing MDU facilities within the footprint of the source map is not practical, then the Contractor shall create, to scale, a one inch equals fifty feet (1"=50') detailed drawing for each MDU complex. Each drawing shall show the layout of the complex as well as each building footprint, number of units per building, lockbox/pedestal locations, building address by location and unit numbers by lockbox, pedestal, or utility closet location. Locations of the cable and telephone connection lockbox/equipment areas per building.

b. Contractor shall indicate on the multi-dwelling building drawing all cable types, actives, passives, fiber, fiber splice enclosures, nodes, lockboxes, and telephone punch down blocks that are located within each building.

c. Contractor shall indicate the route of only the fiber and/or coaxial cables, from the building cable entrance location within the multi-tenant building to the tap. Distances shall be displayed between every active and passive within the building. Do not show the drop cables.

5. Actives

a. Contractor shall verify and denote the location of all nodes, express amplifiers, and line extenders.

b. Contractor shall document all terminating and active port outputs on the nodes and amplifiers.

c. Contractor shall report all conflicting information directly on the source map with the appropriate colored pen. For actives, this will include the location address and/or pole number and type/manufacturer/model of all nodes and amplifiers.

6. Passives

a. Contractor shall verify and record all coaxial cables including:

- Location/Route
- Type and size
- Aerial or underground

b. Contractor shall record the location of all coaxial cable splices.

c. Contractor shall verify and record all tap values, ports, and locations.

d. Contractor shall verify and record all two and three way splitters, all directional couplers with the tap leg loss (DC-8, DC-12, DC-16, etc.) and the signal flow direction of the tap port and the thru port.

e. Contractor shall verify and record the location of all in-line equalizers, reverse conditioners, and local channel insertion equipment.

7. Power Supplies

a. Contractor shall verify and record the location of all power supplies, power inserters and express power cables.

b. Contractor shall verify and record the type and length of all power express cable.

c. If required by OSP, Contractor shall verify and record the manufacturer/type/model number of power supply (stand-by or standard, 60 or 90 Volt) as well as number of battery trays and batteries. OSP will supply cabinet keys.

d. Contractor shall verify and record the location of each power inserter including manufacturer and model number.

8. Fiber Optic Outside Plant Facilities – As-built Verification

a. Contractor shall verify and record the route and location of all aerial and underground fiber optic cables including fiber sheath count.

b. Contractor shall verify and record all fiber splice enclosures. Splice enclosure audits will be in two phases. Backbone enclosures will be as-built in the maintenance window. All other enclosures will be as-built within daytime work hours. The maintenance window versus daytime enclosure audit final determination by the local KMA technical staff.

c. Contractor is required to submit a street sheet of enclosures that will be audited in both daytime and maintenance window hours. The local Technical Operations department will generate a Remedy ticket for splice location audits. Enclosure audit will not commence until Remedy ticket issuance.

d. Contractor shall verify and record the estimated length of fiber storage between fiber splice points and nodes.

e. Contractor shall verify and record the locations of excess fiber storage and the estimated lengths of cable stored at each location.

f. Contractor shall field verify and record the location of all fiber nodes and the location and routes of all fiber rings.

9. Fiber network field survey/as-built walkout of Outside Plant (OSP) strand/underground route Full As-built walkout of strand/trench route including:

a. Full As-built walkout of strand/trench route including:

- Poles (with pole numbers at all fiber events), pedestals (no house counts required). Nearest address to be provided at all fiber events.

- DMI/Lasers to be used in back easements only as necessary.

b. Physical fiber events such as storage loops splice enclosures, risers, nodes, vaults, etc.

c. Document sheath footage markers at storage loops, riser locations, splice enclosures, etc. (may require the use of a bucket truck).

d. Document fiber counts at all footage marker locations.

MDU & COMMERCIAL BUILDINGS

PROJECT DESCRIPTION – MDU WORK

1. Construction of aerial miles and underground miles of cable television plant as lateral extensions from existing cable plant located in right of ways to privately owned multi-occupant buildings,

2. The correction of MDU facility discrepancies in multi-tenant buildings housing residential and/or commercial units,

3. Sweep and Certification of HFC cable television plant within multi- tenant buildings representing residential and commercial units, and

4. Proof of Performance of cable television plant within multi- tenant buildings representing and/or commercial units.

MATERIALS – MDU WORK

1. OSP will supply to Contractor all materials listed on the design BOM.

2. For coaxial plant, Contractor shall place bonds and/or vertical grounds, at poles with existing vertical grounds, with other utility neutrals on joint use poles.

3. All metal enclosures and metallic cable shields must be bonded to the building or power utility ground. A jacketed number 6 wire shall be used to bond to a common electrode system or to the power utility ground. Acceptable connection points to the power utility ground include the power utility ground rod, a ground rod connecting wire or a grounded metallic service entrance riser (ensure that the metallic service riser is itself grounded).

POWER SUPPLIES – MDU WORK

1. For outdoor power supply placement, contractor shall install conduit (as specified in the permit) to Power Company's secondary and to CATV power inserter tie-in location, i.e., riser pole or pedestal. Contractor shall turn over power supplies to the applicable power company for activation on a timely basis to eliminate delays to the respective Work project.

2. For indoor power supplies, Contractor shall locate the power supply as directed by the construction manager and attach the power supply cabinet securely to the floor and within six feet (6') of an unswitched 110 VAC outlet.

LATERAL CONSTRUCTION, AERIAL PLANT – MDU WORK

1. Contractor shall place all required CATV anchors prior to construction taking place.

BUILDING POINT OF ENTRY – MDU WORK

1. Primary building point of entry shall include placement of an entry distribution enclosure size appropriately to facilitate distribution coaxial cables, drop cables, bonding lugs and wires, line passives, drop passives and RF actives in accordance with the system design.

    a. The primary building entry enclosure and intermediate entry enclosures shall be mounted in utility rooms or utility closets whenever possible as assigned by the building owner. Outside and inside wall-mount enclosures or above ground pedestals are acceptable alternative locations where they are accessible for maintenance and not objectionable to the property owner.

    b. For roof distribution applications where a vertical wall exists above the roof (such as an air conditioning and/or elevator room), the entry enclosure can be mounted on the wall. **Cables must enter the building through a wall, and in all cases, roof penetrations are strictly prohibited**.

BUILDING DISTRIBUTION – MDU WORK

1. PRE-WIRE CONSTRUCTION: This installation is ideal and is performed while construction of the building is in progress. This opportunity provides for optimal in-suite outlet locations, protection of the cabling and an unobtrusive appearance. Coordination with the developer and on-site supervisor is essential. The installation shall follow the detailed design based on the information collected during the preliminary planning stages of the Work project. In all cases, all applicable building codes shall be followed; this may or may not include the placement and/or use of a conduit system.

    a. Homerun Suite Distribution: For multi-tenant buildings which plan for no more than two outlets per unit, cabling shall be homerun from the lock box to each in- suite service wall outlet. Each drop shall be tagged and signal quality measurements made at each outlet and documented as directed by the construction manager.

b. Express Suite Distribution: For multi-tenant buildings which plan for three or more outlets per unit, two cables (one primary and one spare) shall be installed between the lock box and an in-suite distribution center. The in-suite distribution center shall be installed in accordance with the design map that shall be in a location readily accessible for maintenance and not objectionable to the building/unit owner; preferred locations include a laundry room, utility closet or other such area. The in-suite distribution center shall be of sufficient size to accommodate RF coax splitters, house amplifier, cabling, and a utility power outlet. In-suite drop cabling shall be installed between the in-suite distribution center and each in-suite wall outlet. Each drop cable shall be tagged and signal quality measurements made at each outlet and documented as directed by the construction manager.

c. POST-WIRE CONSTRUCTION: This installation is the most prevalent. Post- wire construction shall follow the design based on the information collected during the preliminary planning process. The design will allow for the feeder cable entering or attaching to the building the building in proximity to the telephone and/or electric power entrance/attachment.

d. Interior post-wire construction shall generally use an owner approved/designated location or locations from which to distribute the individual unit drops, either by using the existing drop cabling or replacing it with new drop cables. A MDU enclosure shall be installed at each distribution point in accordance with the manufacturer's specifications and recommendations. In some applications, as directed by the construction manager, core drilling between floors and the installation of conduit may be required.

e. Other interior post-wire construction requires the installation of the drop wiring in hallways due to limited or no access to the interior of the building's wall and floor structures. In these cases, Contractor shall conceal the wiring by placing molding that blends with the interior color scheme.

f. Exterior post-wire construction shall be coordinated with the building owner and shall include the installation of lock boxes, the distribution network, new drop cabling to at least one outlet in each unit, and at the direction of the construction manager exterior molding to conceal all outside wiring.

2. ROOF DISTRIBUTION: A common apartment or condominium structure found in metropolitan areas has a flat roof, no basement and is generally four to twelve stories high. These buildings typically have an access hatch to the roof which is usually accessed in the stairwell exit. If the building has an air conditioning and/or elevator room with a vertical wall, the MDU enclosure can be mounted on the wall; and the cables can enter the building through the wall for inside distribution. **Note that roof penetrations are strictly prohibited.** When placing cables across a flat roof, special precautions must be taken. Workers must not step on any tar bubbles that can generate water leaks. Cables must be routed in conduit usually of PVC. Fasteners may not be used to secure cables or conduits directly to the roof. If cabling cannot be brought inside the build, exterior post-wire construction shall be used.

SURVEILLANCE SYSTEM – MDU WORK

1. For those multi-tenant buildings requiring installation of a surveillance system, Contractor shall ensure the system is installed in accordance with the design map and in accordance with the manufacturers' recommendations.

CORE DRILLING – MDU WORK

1. When drilling from floor-to-floor, Contractor shall know if there is reinforced steel preventing the use of regular hammer or roto-hammer drills. When drilling, care must be exercised to prevent "blowouts." Holes must be properly patched. Placement of conduit and fire-retardant sealant shall meet all applicable codes.
    a. Contractor shall coordinate all core drilling including locations, core sizes, drilling dates and times with the building owner in order to minimize disruption and inconvenience to the building occupants.

MOLDING – MDU WORK

1. As directed by the construction manager, MDU construction may include the installation of molding to conceal the distribution network and/or drop cabling. Molding may be either metal or plastic as directed by the construction manager.

2. Molding color selection shall be supplied by OSP and coordinated with the building owner prior to commencing construction.

3. Attachment of molding to brick or concrete surfaces can be accomplished with drive pins, ram set devices, drilling screws and anchors. When fastening-

molding consideration must be given to weather changes that cause expansions and contractions. Buckling, popping of faceplates, and cracking will result from improperly mounted molding.

4. For horizontal installation, molding should usually be mounted with fasteners spaced 18 inches apart. On vertical installations, molding fasteners should generally be spaced every 24 inches.

5. Molding should also be installed:

   a. Straight and level,

   b. Washers placed in pre-cut slots,

   c. Miter or butt cuts are acceptable but radial molding is preferred,

   d. Molding brackets must be sealed with approved sealant, and

   e. End caps must be installed on all molding ends.

6. There shall be **NO** underground splices permitted in completed plant.

UNIT ACCESS PROBLEMS – MDU WORK

1. Contractor shall coordinate with the building owner and/or manager to schedule access to each unit. In metropolitan areas, 100% access agreed to by the building management may not be obtained; many tenants change their locks or install new deadbolts denying even the building managers and maintenance personnel access. Where this occurs, contractor shall complete the maximum amount of work possible up to those units and door hang a request for completion notice to the tenant as well as communicating such to the building owner/manager. Contractor shall provide the construction manager a complete list of units not completed due to access denial.

MDU FACILITIES CORRECTIONS – MDU WORK

1. As directed by the construction manager, Contractor shall correct those identified deficiencies of existing MDU facilities not related to other work identified in the foregoing sections of this Scope of Work. These deficiencies are specifically related to mechanical integrity, security, and safety issues.

   a. Contractor shall invoice OSP for MDU facilities corrections Work on

component level basis.

b. Contractor shall provide construction manager a complete set of as- built maps of each MDU facility correction completed prior to invoice submission to OSP.

c. For assigned MDU deficiencies that cannot be properly and safely corrected, Contractor shall provide details regarding same on an as- built map and provide to the construction manager. Contractor shall not invoice OSP for MDU facilities correction Work that could not be properly completed.

SPLICE & ACTIVATION

SPLICING AND ACTIVATION – CONSTRUCTION WORK

1. Contractor shall perform splicing and activation by project service area as specified by the construction manager.

2. Contractor shall perform all spicing in accordance with the OSP Construction Manuals, the manufacturers' specifications, and OSP specifications.

3. Contractor shall have on site at least one set of the OSP Construction Manuals for ready field reference.

4. Coaxial Plant

    a. Contractor shall trim the cable's aluminum sheath and dielectric in accordance with the OSP Construction Manuals and the manufacturers' specifications, removing residual dielectric from the center conductor and deburring end of center conductors.

    b. Contractor shall core the cable in accordance with the OSP Construction Manuals and the manufacturers' specifications.

    c. Contractor shall use the appropriate cable jacket removal tool to remove and trim the cable jacket in accordance with the OSP Construction Manuals and the manufacturers' specifications.

    d. Contractor shall install all connectors in accordance with the manufacturers' specifications using industry recommended tools and tightened in accordance with manufacturers' specifications. The use of **any type** of pliers to tighten any connector is strictly forbidden.

    e. Contractor shall work in a manner that prohibits and prevents underground splices in completed plant.

    f. For Upgrade/Rebuild efforts, Contractor will place where necessary or as directed by the construction manager "temporary" power supplies, making necessary voltage adjustments, or making "temporary feed connections" to support upgrade/rebuild splicing. Depending on the existing plant architecture, complete cutovers to new nodes and powering may not be possible during a one-day Work period, and Contractor must be prepared to perform such Work according to such instances requiring multiple-day Work periods.

5. Fiber Optic Plant

    a. Contractor shall fusion splice all fiber optic cable. Automated splice loss estimation shall not exceed .05 dB per splice; "END-TO-END" attenuation shall not exceed .30 dB/km, measured from either end, over the total link taking into consideration link length, number of splices and number of connectors, measured from either end. Individual splices shall not exceed [.10 dB]. These measurements shall be conducted at the [1550] nm window. All splices shall

have heat shrink protectors; no exposed glass shall be permitted. Splicing of OVD to IVD fiber may alter the estimated loss and shall be discussed on an individual basis when applicable. Contractor shall prepare all fiber optic cable and place it inside of the receiver housing in advance of fiber proofing.

b. Contractor shall test all fiber optic cables upon completion of splicing using an approved OTDR and associated data recording equipment and a 1,000 foot fiber lead. Contractor shall perform OTDR testing from headend/hub end and provide OSP with a hard copy as well as a diskette (in a format to be determined by both parties), containing the fiber optic signature data, showing optical losses at 1550 nm. Said documentation shall be provided to OSP for approval.

c. Contractor shall provide OSP with a hard copy as well as an Excel copy (in a format to be determined by both parties), showing the as-built splicing diagram and/or chart. All active and non-active optical fibers enclosed within each fiber cable shall be depicted in detail on said diagram and/or chart, as to splice enclosure GPS location, cable type, cable size, cable manufactured year, buffer tube color, fiber color with utilization detail.

6. Contractor shall perform activation and balance of all cable system plant affected or installed during the performance of Work in accordance with OSP specifications.

7. Upon completion of splicing and activation of each project service area, Contractor shall provide a map or as-built print of that area to the construction manager. Said map(s) shall contain:

   a. End-of-line readings at each distribution termination point, denoting lowest, middle, and highest RF channel outputs.

   b. Input and output RF readings of each amplifier and line extender.

   c. Input optical (light) levels and output RF levels of each node; and

   d. Value(s) of all pads, equalizers, and AC/DC voltages for each active device by location.

8. Contractor shall indicate on all as-builts (at each end-of-line) that the cable plant related to that specific section (leg) of plant has been constructed in accordance with FCC signal leakage requirements, and that there is no signal leakage greater than 10 microvolts per meter in accordance with FCC regulations. Contractor shall correct, during the same day cable plant is activated, any signal leaks found in excess of the FCC defined 10 microvolts per meter standard.

POWER SUPPLIES – CONSTRUCTION WORK

1. Power supplies shall be metered where required by local utility company and shall be installed on poles, concrete or prefabricated pads, on vaults, in accordance with the applicable electrical codes, design maps or as otherwise directed by the construction manager.

2. All power supply cabinets must be installed according to the National Electric Safety Code (NESC), **National Electrical Code (NEC),** and local electrical code requirements, and must be effectively grounded.

3. Installation and activation of power supply, coordination with power company to complete the installation and obtaining all necessary permits. Installation and activation of the status monitoring equipment as directed by the OSP construction manager.

4. Any permit fees or additional electrical materials will be charged to OSP using NS004+ and/or NS005+. A receipt detailing all permit and material costs must be submitted with final invoicing before payment will be approved. Includes installing cabinet, meter base, cutoff switch, electrical wiring, batteries (up to six) and modules.

5. For underground poured concrete pad power supply locations, Contractor shall provide and build a brushed finish, supporting concrete foundation at least four (4) inches thick for all power supplies using rectangular forms. Concrete pad will be placed on top of a three (3) inch thick base of ¾ inch compacted gravel (as per provided OSP drawing). A base of ¾ inch compacted gravel three inches (3”) deep and four inches (4”) larger than the forms will be placed below concrete pad. The outer edge of the top surface of said foundation shall be positioned at ground level grade. Conduits shall be plugged. State, County, and Local requirements supersede OSP requirements.

6. Contractor shall install conduit (as specified in the permit) to the power company’s secondary wires and for the CATV power inserter tie-in location, i.e., riser pole or pedestal.

7. Each power supply installed or upgraded by the end of the project must have the necessary components installed and be operational for upstream and downstream communications. Components must be tested and certified with associated software. The MAC physical address must be documented for each location.

8. Contractor shall be responsible for all required electrical materials not provided by OSP, permits, electrical inspections, including scheduling of such.

9. Contractor shall turn over power supplies to the power company for activation on a timely basis to eliminate delays to the project.

10. Contractor shall be responsible to comply with all of OSP's QC/QA criteria for all power supply work aerial, underground, and buildings.