IDAHO POWER®
An IDACORP Company

METHODS & MATERIALS

2024 OH

Overhead Manual

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Introduction-Joint Use & Special Circuits

Joint Use of Structures

Rule 222 of the 2017 edition of *the National Electrical Safety Code* (NESC) encourages joint use of structures along highways, roads, streets, and alleys. In harmony with the national standard, Idaho Power allows communication utilities to under build on lines where this can be done safely. This Joint Use and Special Circuits Section outlines the specific requirements for safe construction, operation and maintenance of joint use lines.

General Conditions for Attachment

- The Joint User must establish a Pole Attachment Agreement with Idaho Power prior to making attachments. After the Agreement has been established, the utility must contact Idaho Power prior to making attachments pursuant to the Agreement, see *Distribution Manual* 10.
- The Joint User must meet the requirements of the particular NESC edition that applies.
- Communication utilities must meet proper clearances and the protection requirements of NESC Rule 223. Methods of protection must be adequate to withstand possible voltages.

NOTE. The NESC code requires Grade B construction for communication cables over railroad tracks, limited access highways, and navigable waters requiring waterway crossing permits, see 2017 NESC, Table 242-1.

Vegetation Management

Per NESC 218A, *Vegetation management should be performed around supply and communication lines*.... To comply with this rule, all vegetation that is touching communication lines will be trimmed by the owner of that line. Lines should be inspected for touching vegetation on a periodic basis as experience has shown necessary.

Multiple companies or owners can be affected by vegetation touching lines. If one piece of vegetation touches multiple lines with different owners, all companies are in violation until the vegetation is trimmed. Companies that share a facility can agree to have one vegetation manager who trims for the entire space.

NOTE. Use only Vegetation Management Companies that are approved to work in proximity to overhead power lines.

General Joint Use Practices

Communication Cable Attachment

On Idaho Power (IP) poles, the communication cable attachment is located below all power conductors and will comply with NESC and Idaho Power clearance requirements as illustrated in Overhead Manual 04-03.

When installing wire/cable attachments, the Joint User and installation contractors will use the standards set forth in this manual.

For construction standards not specifically covered in this manual, the Joint User will follow the latest edition of the Telcordia Blue Book, IEEE 524 Standard, and best construction industry practice for stringing wires.

Wood Pole Attachments

Idaho Power requires that communication cables attach directly to wood poles, unless there are multiple communication attachments; see next page.

Communication cables are attached to the same side of the pole as the power neutral or secondary conductors as shown below.

Steel Pole Attachments

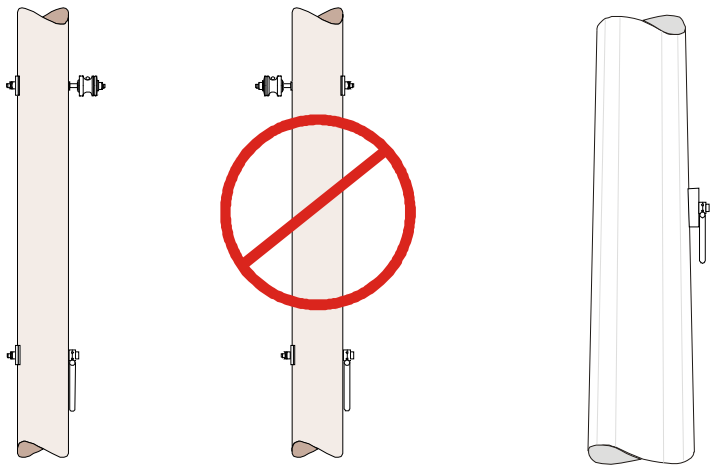
Contact Transmission & Distribution (T&D) Design Department for approval before attaching to steel poles. Brackets and crossarms are allowed on steel poles only with approval from T&D. Idaho Power does not allow steel bands, drilled holes, or welds other than the mounting provisions originally supplied by the manufacturer and those installed by an IP welder.

Drilled holes may be allowed on light duty steel poles, but not on foundation structures.

See Overhead 04-02-03 for information on grounding on steel poles.

Protruding Bolts

Protruding bolt ends are a safety hazard to workers on the structure. Therefore, bolt ends should not protrude more than two (2) inches from the pole surface and sharp edges must be filed off.



Attach communication cables on same side as primary neutral.

No bands or drilling on steel poles except as stated above

Attachment of Communication Cables to Poles

Multiple Attachments

Idaho Power may allow brackets and/or crossarms where multiple communication circuit attachments are needed.

Idaho Power approved two multiple attachment configurations, see illustration below.

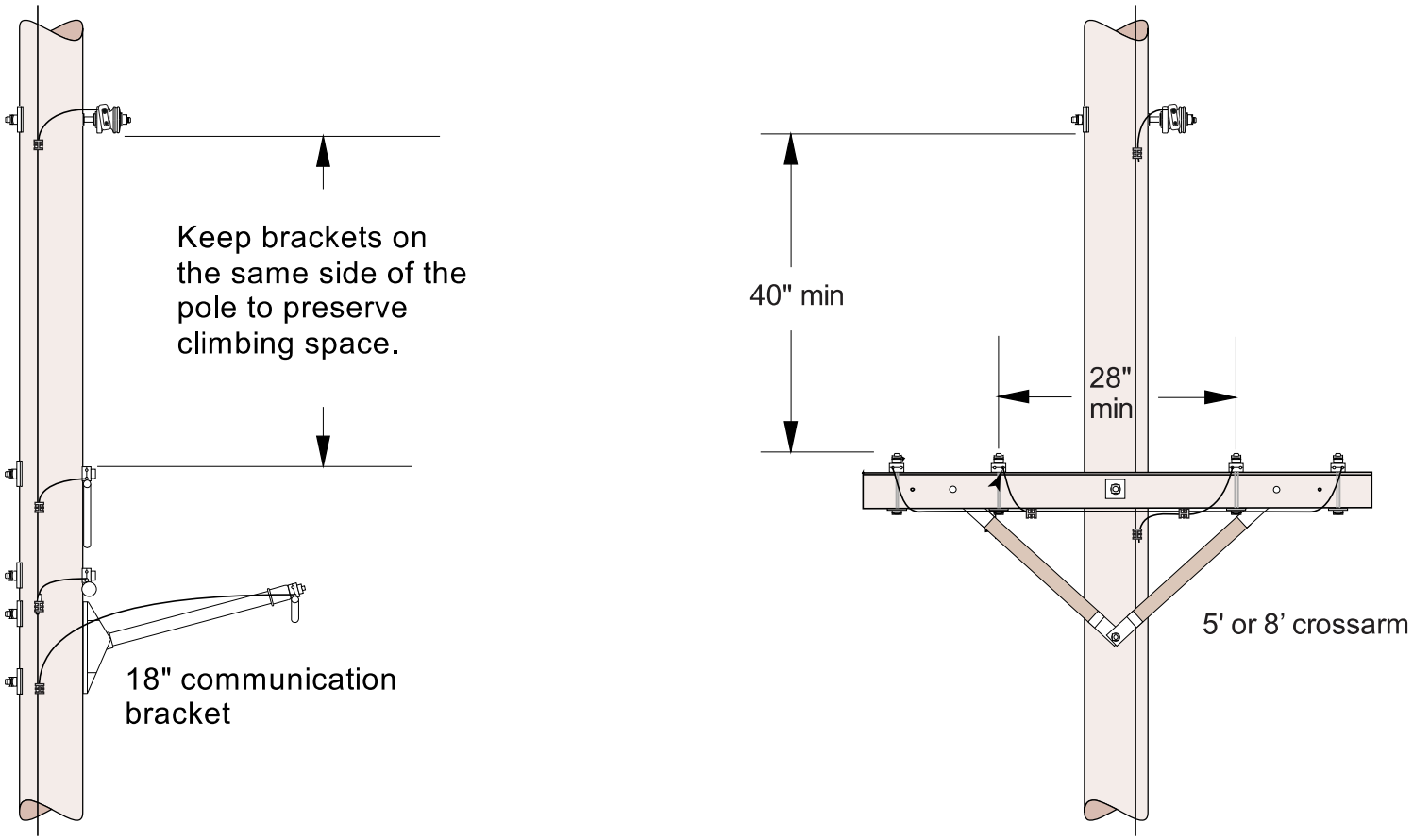
- 18 inch fiberglass extension bracket
- 5- or 8-foot wood crossarm

Only IP or approved contractors install this equipment. Any other arrangement must be submitted to the Joint Use Team for engineering approval.

NOTE–The use of brackets does not reduce the vertical clearance requirement to power conductors. Vertical and horizontal clearances must be met regardless of the method of attachment, see *Overhead Manual* 04-03-10.

Install heavier communication cables on the inner position on the crossarm or bracket.

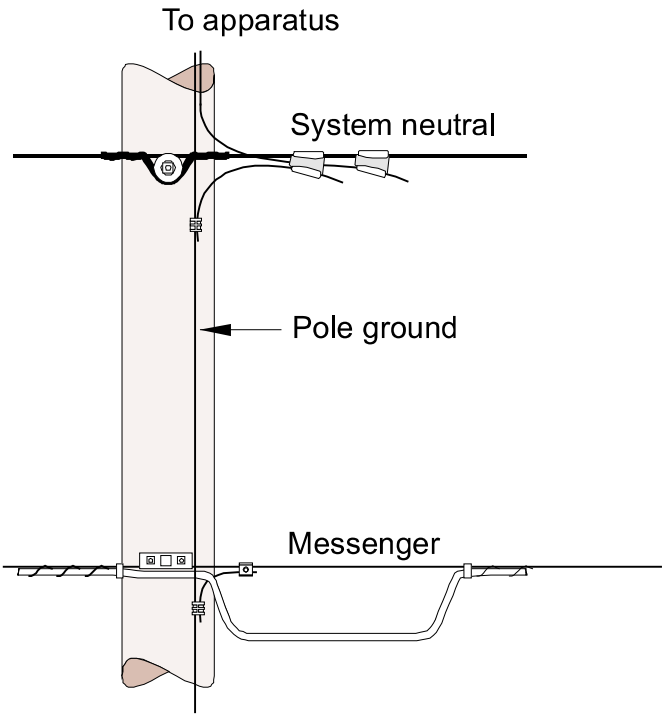
Mount brackets, communication cables, and the primary neutral on the same side of the pole to preserve climbing space as shown in the figure below, also see climbing space requirements in this section, 04-02-04.



Multiple Attachment of Communication Cables to Poles

Grounding and Bonding

Per NESC, bonding is required everywhere a pole ground exists. Therefore, communication utilities are to make bonding connections to every pole ground. On steel poles, the bonding connection must be made to a stainless steel nut, when available.If a nut is not available, the connection is not necessary.



Metallic cable sheaths and messengers must be electrically continuous for an effective grounding system.

The only exception is where IP installed a neutral isolator to separate our neutral from the customer's neutral for the purpose of reducing neutral-to-earth voltages on the customer's wiring, see Overhead Manual 04-05-02.

Communication Equipment

The communication utility will supply, install, and maintain its equipment, including risers and guys. The equipment must be installed according to the requirements of the NESC and IP and must not interfere with the climbing space on the pole.

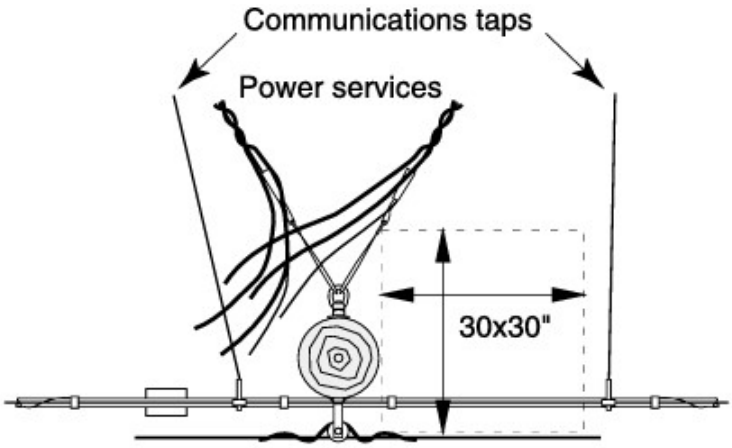
If electric service is required for communication equipment, the communication utility may install the service equipment. However, IP or an approved contractor must install the mast or any other equipment that extends into the supply space and connect the service drip loop; see Overhead Manual 04-05-03.

Idaho Power or an approved contractor must install or remove poles with power attached; even if the communications utility owns the pole.

Climbing Space

Position communication equipment on the pole with a clear climbing space that measures at least 30×30-inches. The climbing space must extend upward through the power conductors and on the same side or quadrant of the pole; see illustrations below.

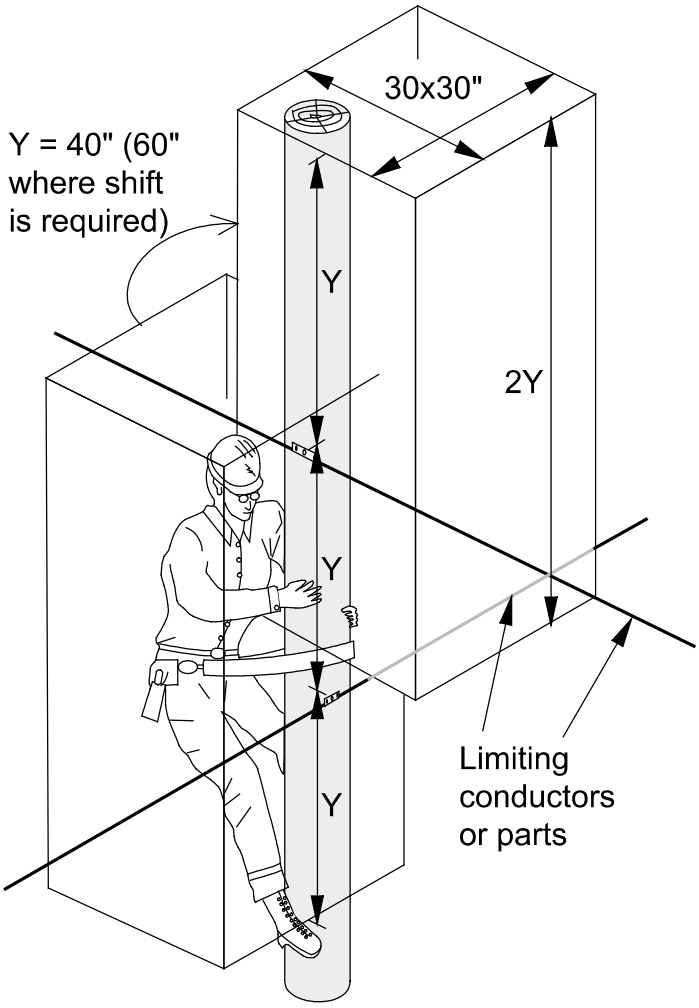
A 60 inch vertical clearance that is free of equipment must be provided to allow a worker to maneuver through the equipment when a shift to another side or quadrant is required.



Climbing Space Through Taps and Services

Multiple Attachments

Where multiple communication attachments are on crossarm, the climbing space may be reduced to 28×28-inches. The vertical clearance can be reduced to 40 inches where a shift to another quadrant is required; see illustration below.

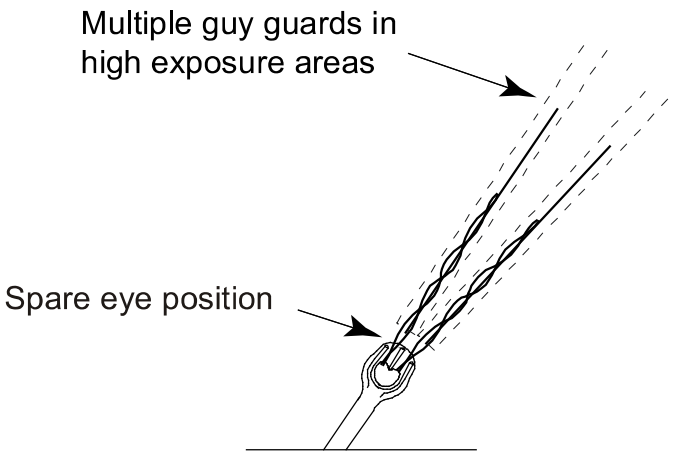


Climbing Space Where Shift is Required

Communication Anchors

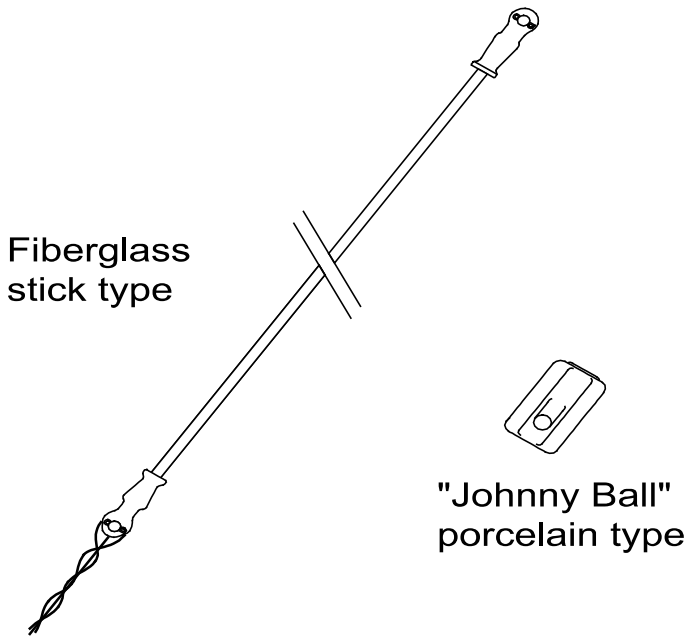
The communications utility will guy its equipment as necessary, and provide structural analysis if requested by IP. The guys may be connected to power anchors with approval of IP and if it meets the following conditions:

- An engineering analysis was performed to ensure that anchors are adequate for the load, including appropriate safety factors.
- An open position must be available on the anchor eye.
  - Auxillary anchor eyes are not allowed

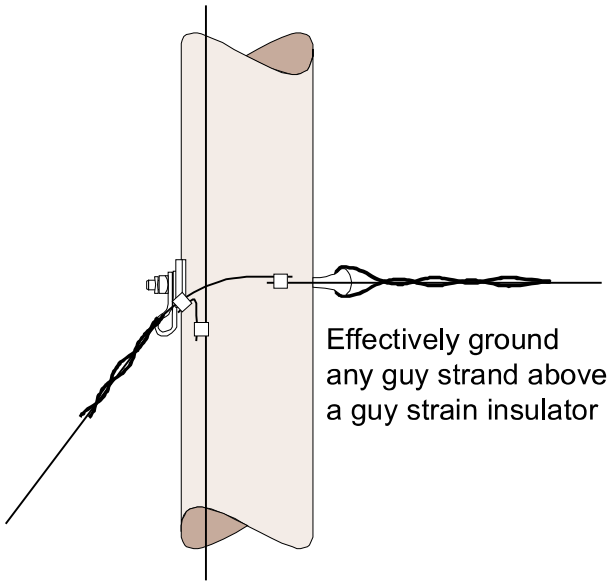


Anchor Attachments

- An IP approved guy marker must be installed on all down guys.
- An IP approved guy insulator must be installed.
- Guys and anchors must be in place before tension is applied.
- Any guy strand above the guy insulator must be bonded to the grounding conductor; see right.



Approved Guy Strain Insulator Types



Guy Strand Grounding Requirement

Communication Slack Spans

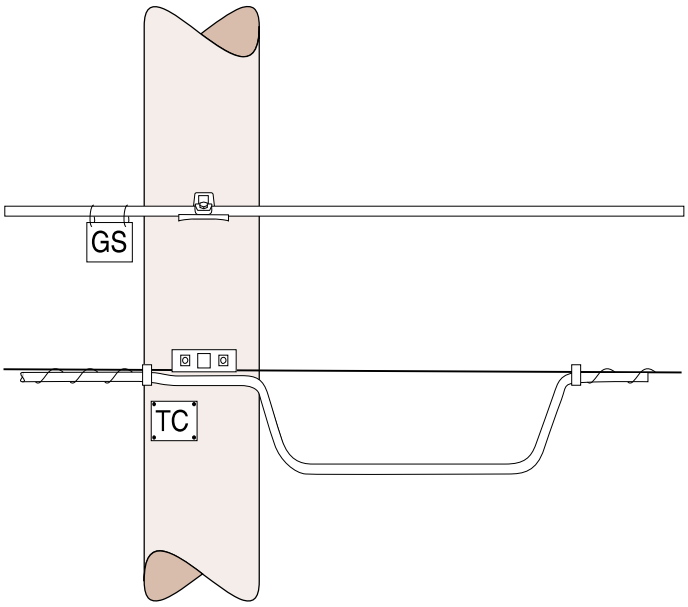
- Spans 100 feet or more must be guyed and anchored.
- Spans less than 100 feet are guyed and anchored at the discretion of Idaho Power.

Identification of Facilities

Joint Users must identify their facilities on all poles with identification tags that meet the following requirements:

- Made of weather and corrosion resistant material
- Print the approved Joint User 4-letter code in at least 1.25-inch font
- Attach securely on the cable near the pole, so the tags do not slide down the cable
- Position the tag so that it can be read from the ground

NOTE–Wrap-around sleeve tags are not compliant.



Communications Identification Tags

Coordination of Reconstruction Work

Coordinate with all affected Joint Users when work being planned will affect them.

Communication utilities must transfer their facilities to the new structures pursuant to their Pole Attachment Agreement.

Notify the requester that IP and Joint Users will charge for reconstruction work.

Communication Antennas & Equipment

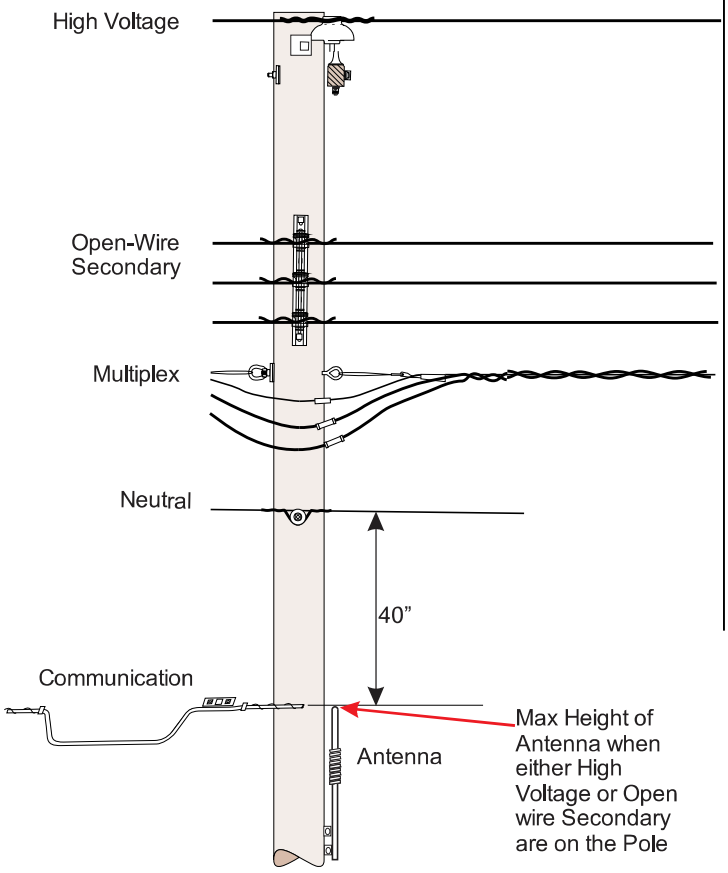
Purpose

This section provides standards for installation, operation, and maintenance of Joint Use antenna equipment and service connections to stand-alone antennas.

Location Selection

Use the following guidelines when choosing structures for antenna placement:

- **Secondary Poles and Light Poles (750 V or less)**
  These are the best options to place antennas. They can be placed above the secondary or service conductor, with the bottom of the antenna at least 12 inches above the secondary line. See this section 04-02-10 for AMR antenna illustration.



- **Primary Distribution Poles (750 V+)**
  Antennas are allowed only in the communication space* on these poles. However, it is not recommended to place antennas on these poles. In the event that new transformers are needed, then Idaho Power (IP) will require the Joint User to move the antenna to a new location.

*Communication space is area on the pole separated from the supply space by at least 40 inches vertical and 60 inches for 4-up flat-top construction; see *Overhead Manual* 11-20-10 and NESC 235C4.

- **Transformer Poles**–Antennas are not allowed on any pole with a transformer.
- **Pole Sizing**–Use at least a class-2 pole.

NOTE–If a lesser pole is used, the Joint User must provide engineering analysis for smaller class poles.

Incident Energy Levels

Maintain the Maximum Permissible Exposure (MPE) within the General Population/ Uncontrolled limit of eight (8) feet from the antenna.

NOTE–Radio frequency levels that exceed ten times the Occupational Exposure Limits are not allowed. Therefore, a *Warning* sign is not needed or allowed.

Metered Vs. Non-Metered

Most antenna equipment will qualify for a non-metered service connection. To do so, the following requirements must be met:

- **1800 Watts**–Single or multiple-unit loads totaling less than 1800-watts.
- **Fixed Load**–The load must be constant and fixed, so the actual usage can be accurately determined; no wired or plug-in outlets.
- **Service Drop Only**–Idaho Power's only investment will be an overhead service drop.

Grounding

- Bond the communication ground to the pole ground.
- Install antenna grounding electrode.
- Bond metal conduit to the pole ground.

For more details, see *Overhead Manual* this section on 04-02-03 and 04-04-01

Breaker/Disconnect Enclosure

Install the breaker or disconnect enclosure outside of the MPE radius and accessible to IP.

Labeling

- Install the information sign five (5) feet above the ground
- Include the following information on the sign:
  - Site name
  - Communications owner
  - Contact phone number
- Install appropriate *Caution* or *Notice* sign at least ten (10) feet from the antenna.
- Label the disconnect enclosure.

NOTE–*Warning* labels are not used, because radio frequency levels that exceed ten times the Occupational Exposure Limits are not allowed.

Amplifiers and Battery Backups

These are not allowed on the pole.

Pole Risers

Follow IP pole riser standards in *Overhead Manual* 04-04.

Aesthetics

Create a consistent appearace with other overhead electrical installations in the area by installing antenna equipment of similar color.

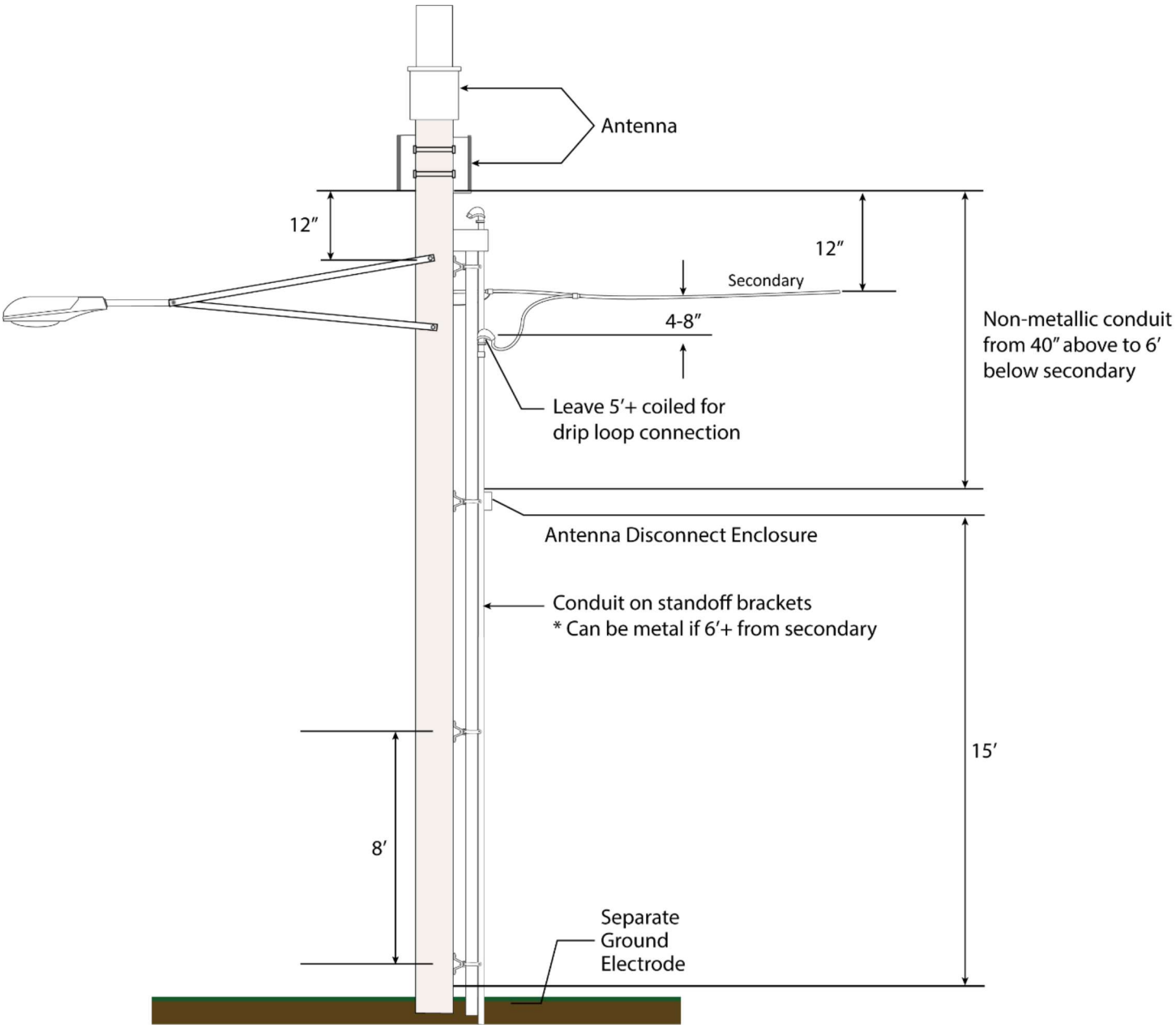
Small Cell Clearances

Small cells installed above the secondary or street light must meet the following vertical clearances, also shown in the illustration on the next page:

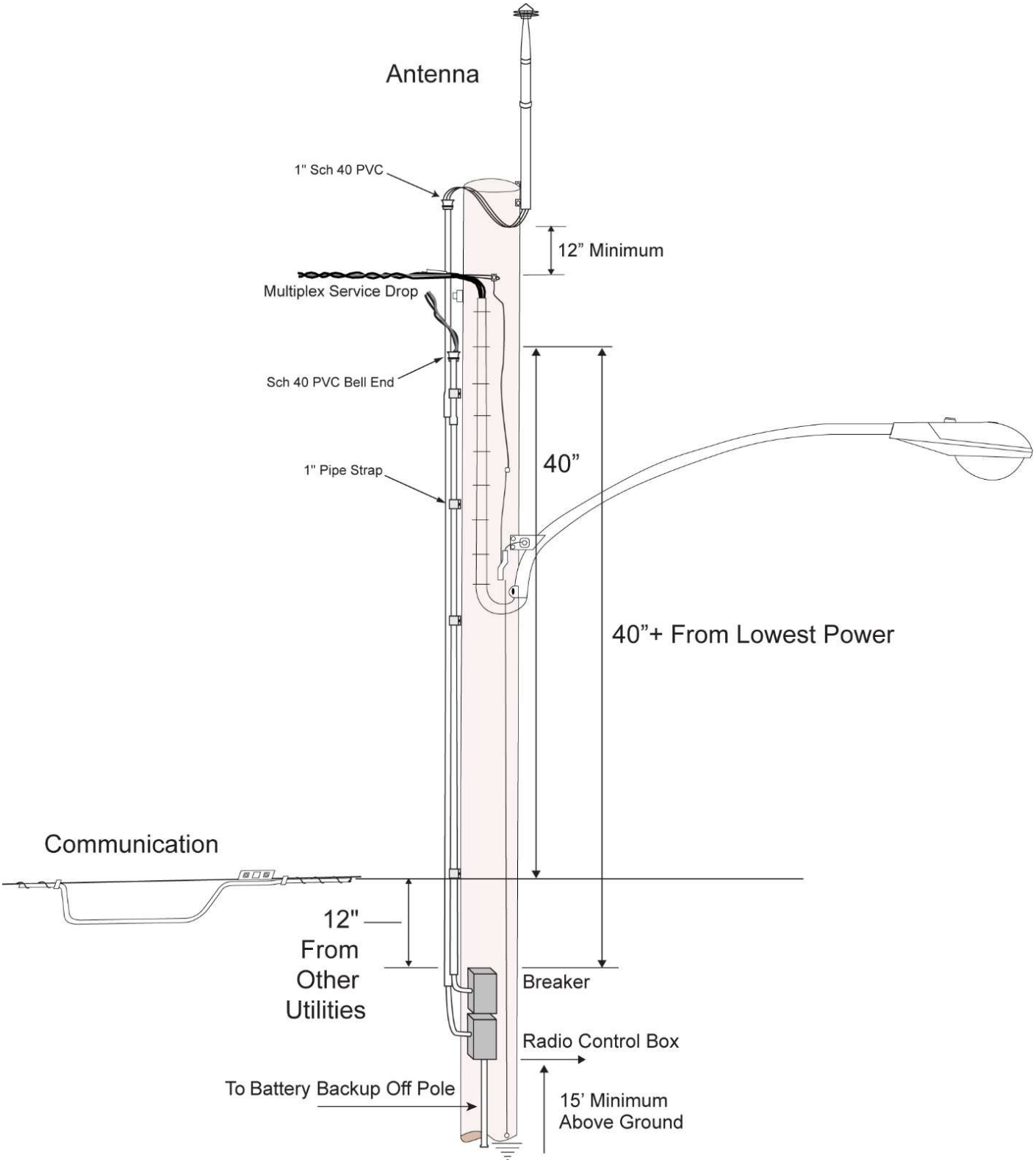
- Bottom of antenna to top of luminaire bracket—12 inches
- Bottom of antenna to overhead secondary cable—12 inches
- Overhead secondary cable to top of antenna service weather head—4- to 8-inches
- Overhead span guy wire to top of antenna service weather head—12 inches
- Bottom of the disconnect enclosure to the ground—15 feet
- Standoff brackets to meet the requirements on 04-04-01 and 04-04-02.

Additional requirements include the following:

- Provide at least five (5) feet coiled wire for the service connection to ensure enough cable to form the drip loop.
- Install required non-metallic conduit from the antenna mount to the overhead secondary cable or 40 inches, whichever is smaller. Also, from from the overhead secondary cable to six (6) feet below, see illustration on the next page.

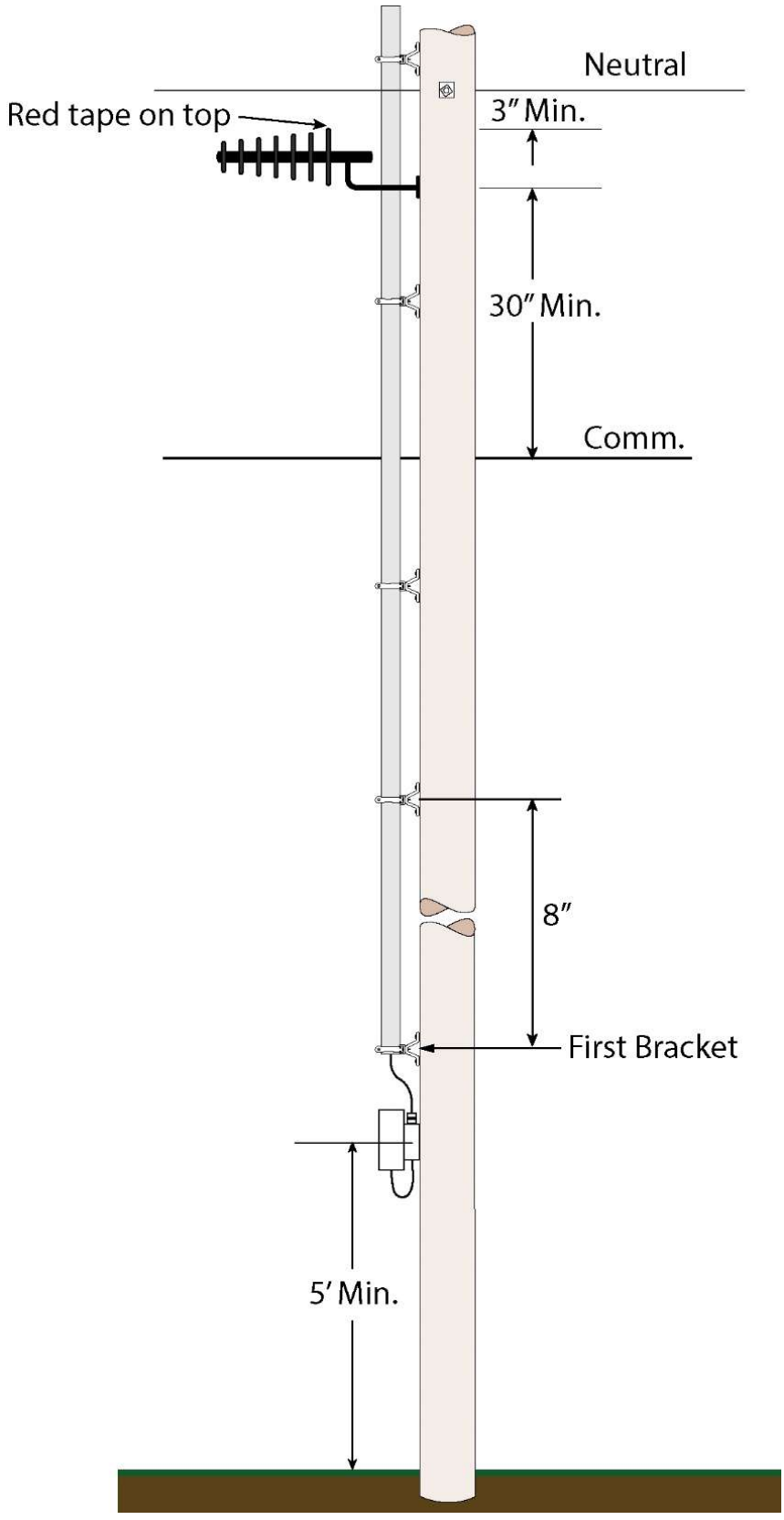

Antenna
12″
12″
Secondary
4-8″
Non-metallic conduit
from 40″ above to 6′
below secondary
Leave 5′+ coiled for
drip loop connection
Antenna Disconnect Enclosure
Conduit on standoff brackets
* Can be metal if 6′+ from secondary
15′
8′
Separate
Ground
Electrode

Automatic Meter Reading (AMR) Antenna



NOTE– Communications conductors and communications equipment must also maintain clearances to street light drip loops as outlined in OH 04-03-08

Idaho Power Owned Radio Frequency Antenna

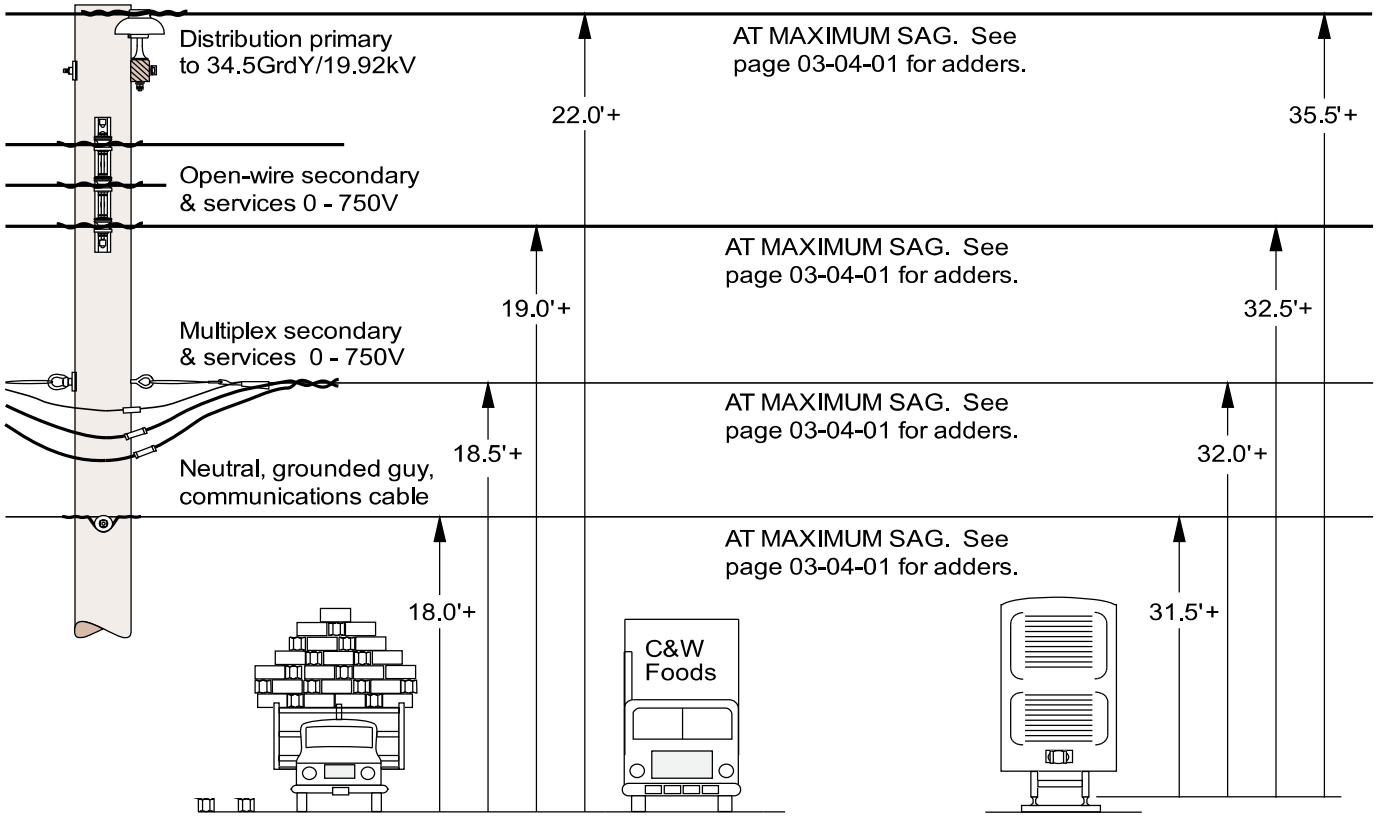


Joint Use Clearances

Follow NESC and Idaho Power clearance specifications for Joint Use, summarized here. Any deviation must be approved by the Joint Use Team. For more detail see *Overhead Manual* 03.

Ground Clearance for Communications

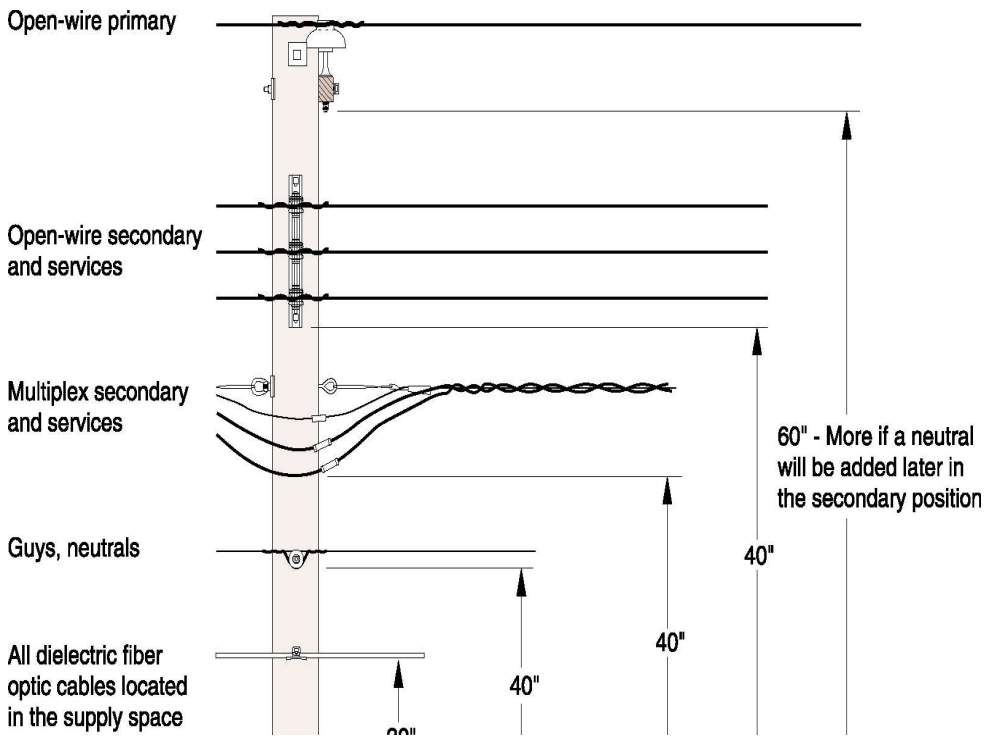
Jurisdictional clearance requirements may vary. Joint Use Users must secure their own crossing permits. For sailboating areas and river crossings contact Idaho Power.



Idaho Power Design Clearances for Communications

Crossing on the Same Structure

Where communication lines and power lines cross on the same structure, follow clearances shown below.

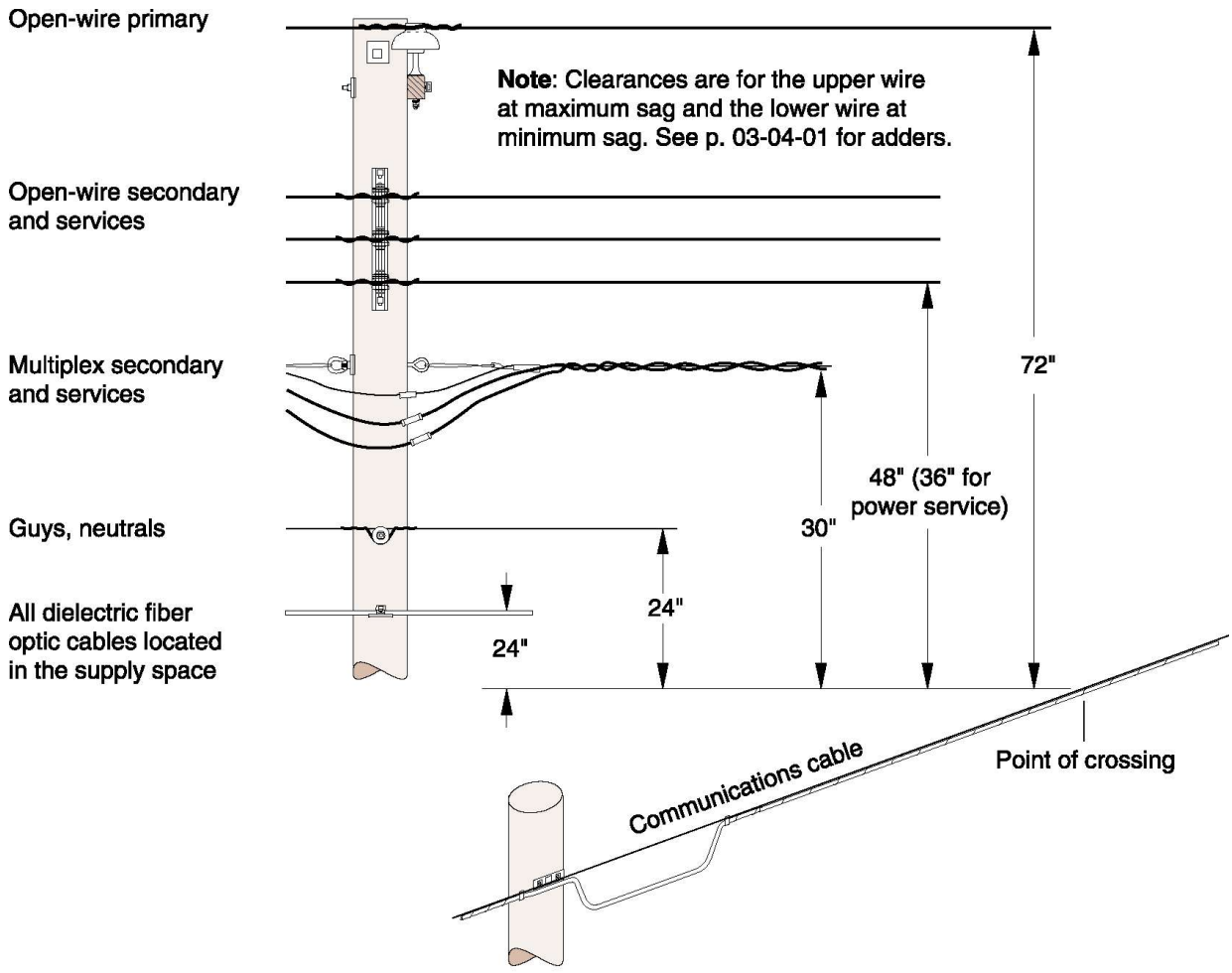


Clearance at a Crossing on the Same Structure

Crossing in the Span

Crossings should be made on the same supporting structure; see NESC Rule 233A. Where this is not practical, follow vertical clearances shown below.

If a communications line is within three (3) feet of a power pole it must be attached to the pole, see NESC Rule 234B(1)(a).



Clearance at a Crossing in the Span

Parallel Lines on Separate Structures

Separate power lines and communication line structures far enough away from each other so that if either structure falls they will not fall on each other, see NESC Rule 221.

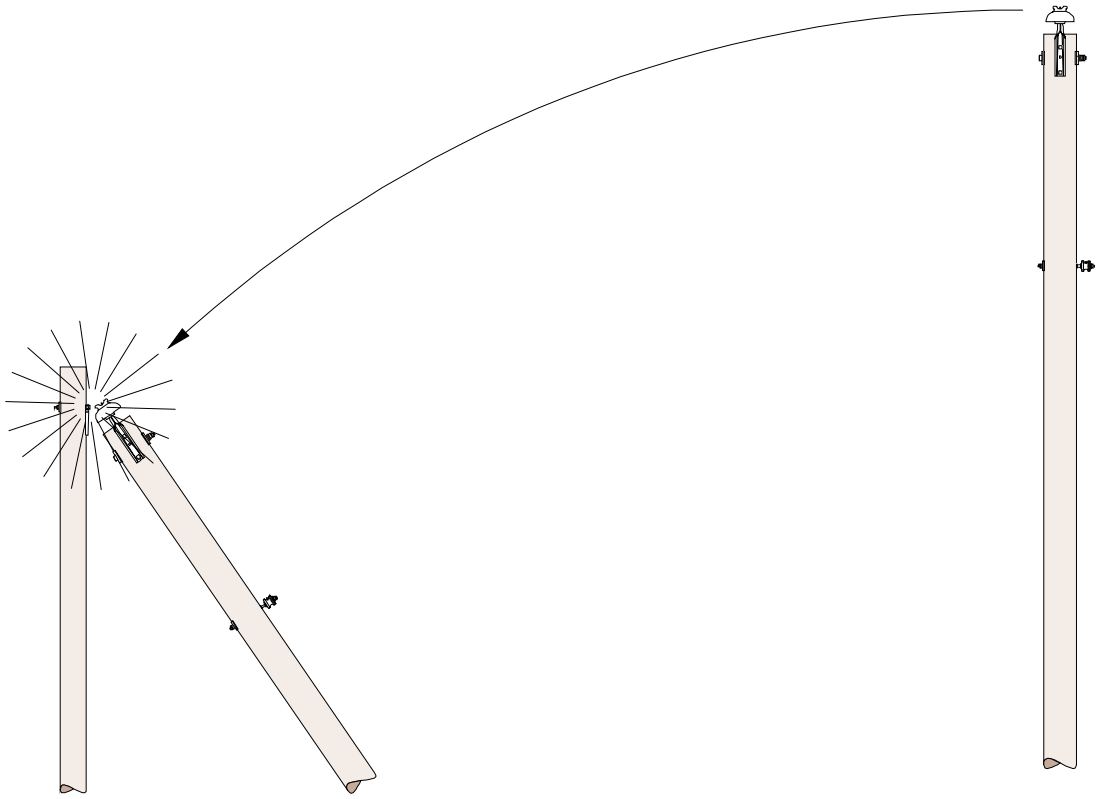
Where this is not practical, meet one of the following options:

- Separate the structures as far as practical and use Grade B construction for the Idaho Power line.

Or

- Bond either the communication messenger or ground conductor to Idaho Power's neutral or ground at least eight (8) times per mile.

With either option, the communication's protection system must be adequate for Idaho Power's system voltage.



Structure Conflict

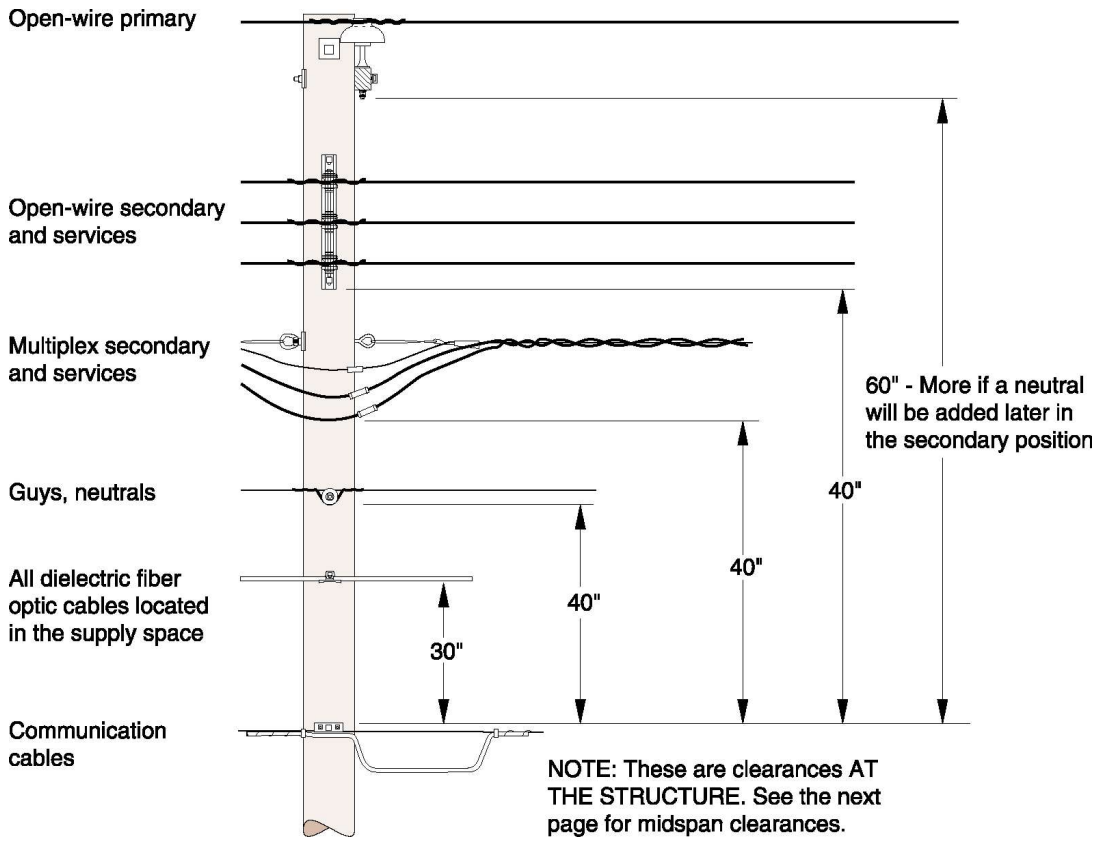
Parallel Lines on the Same Structure

For parallel lines on the same structure there are two requirements that must be met:

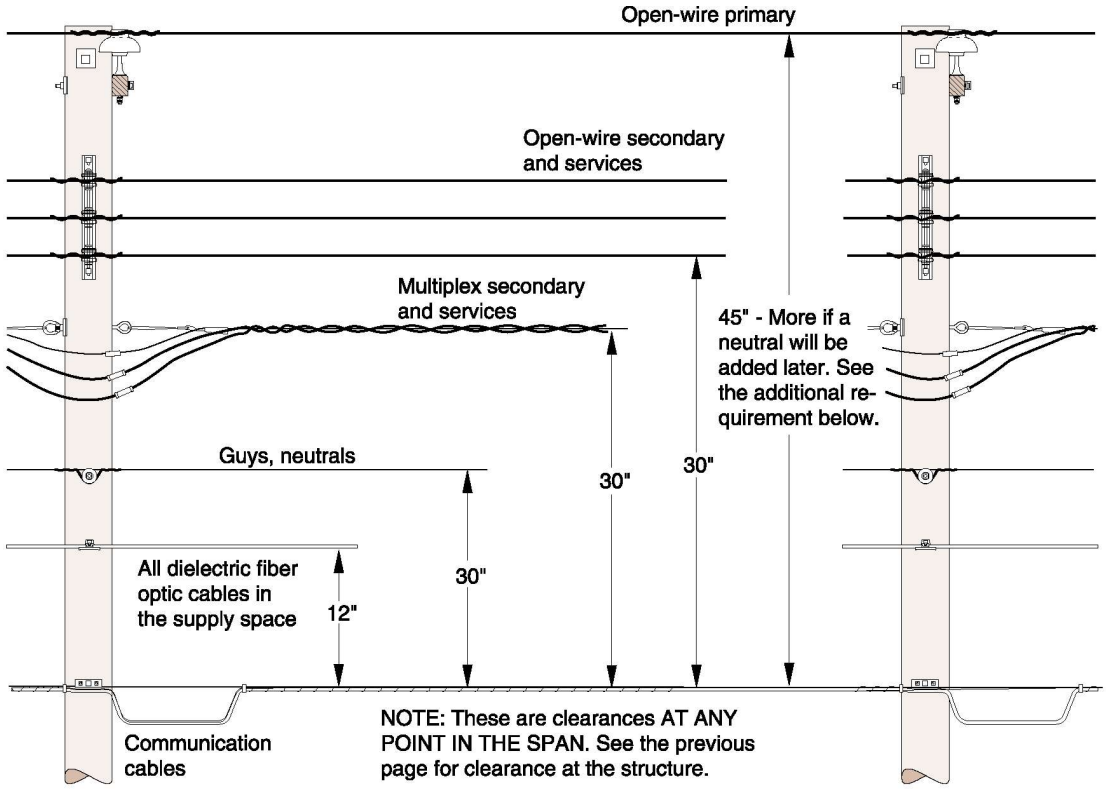
- Clearance at the structure, see below.
- Clearance at any point in the span, see the next page.

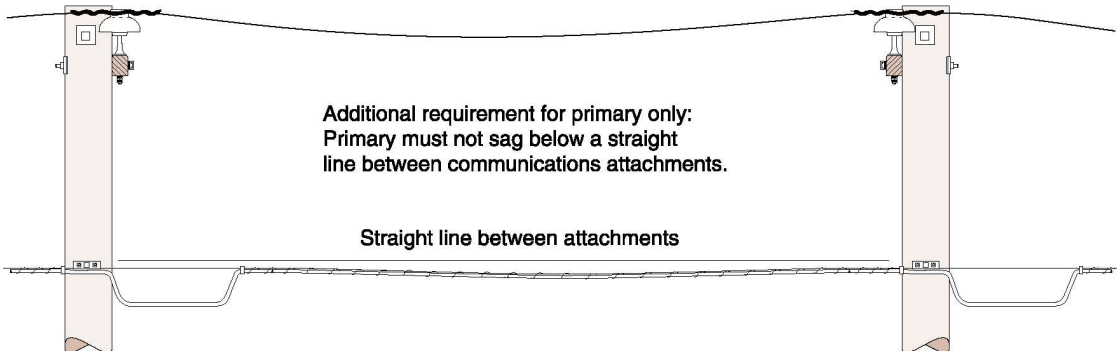
To meet clearance in the span, increase the clearance at the structure.

Note–Structure clearances must be measured between the closest equipment and not between bolt holes, as shown below.



Clearance at the Structure for Parallel Lines





Clearance at Any Point in the Span for Parallel Lines

Clearance at Service Drops

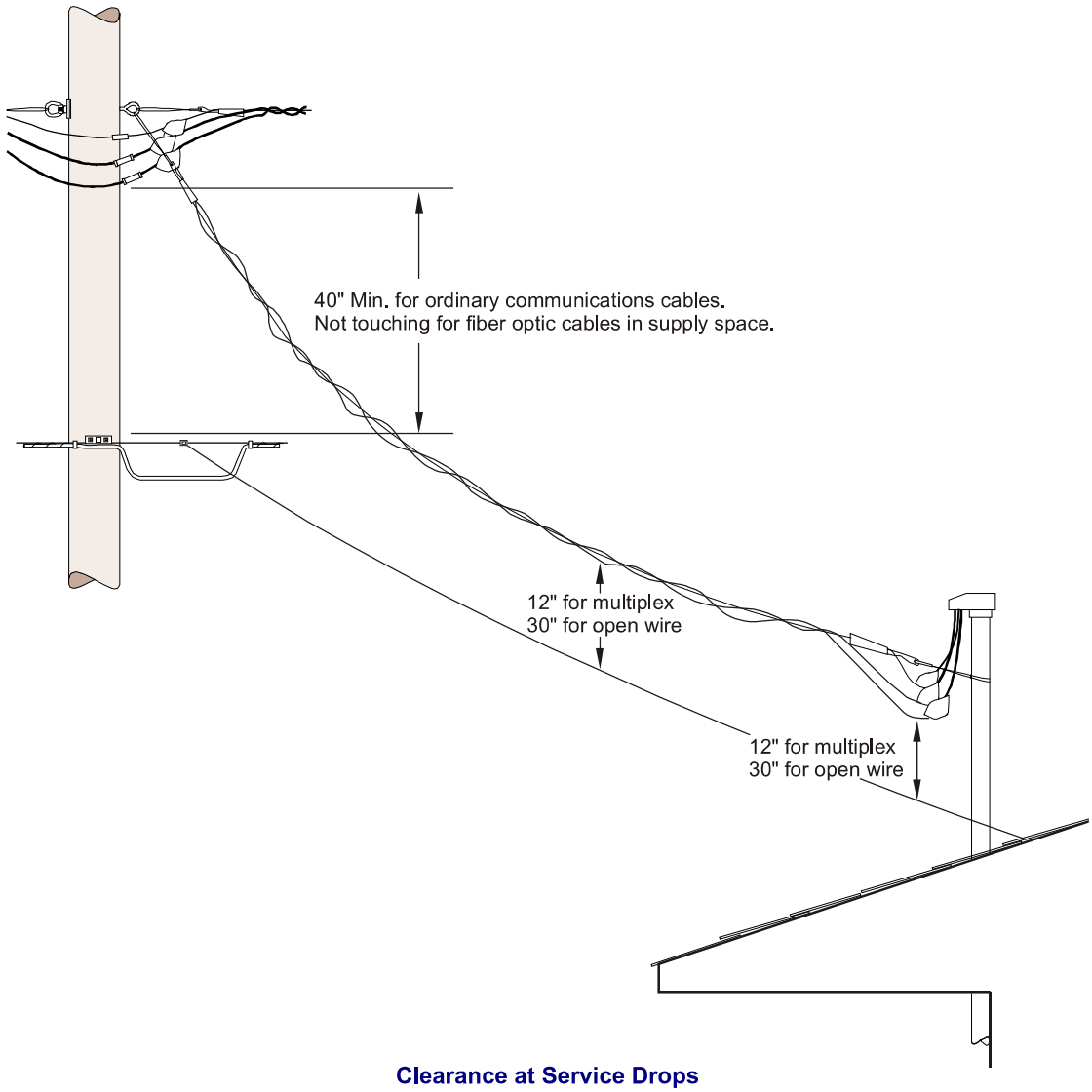
Clearance between supply service drop and the communication service drop must meet the following requirements at any point in the span including the point of service:

- Multiplex supply cable—12 inches
- Open wire supply cables—30 inches

The structure clearance must be maintained as shown on page 04-03-05.

Ground Clearance for Communications

- Driveways, Parking Lots, and Alleys—18 feet
- Pedestrian only areas—12 feet

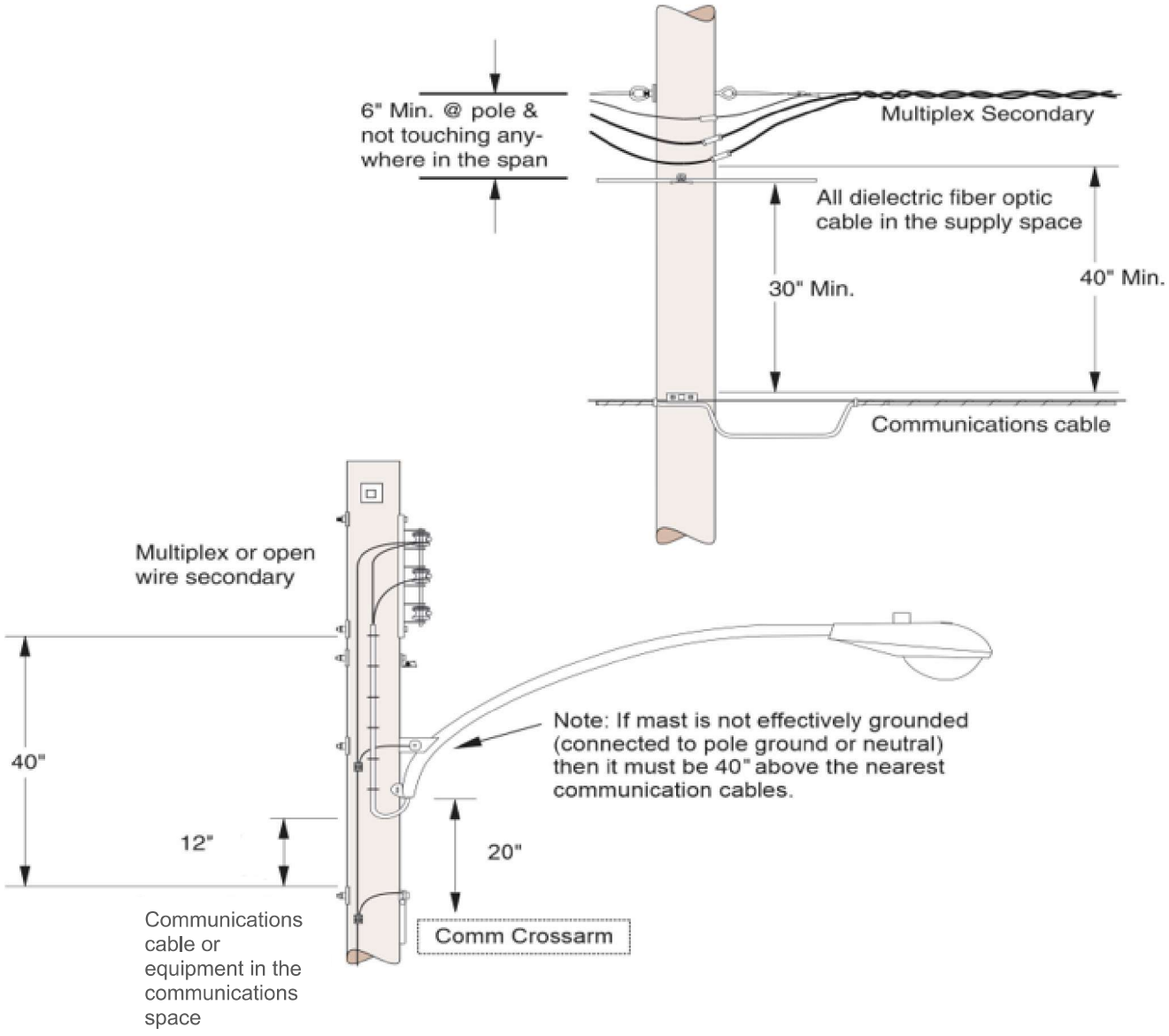


Clearance at Service Drops

Clearance at Street Light Drip Loops

The clearance requirements between communication cables or equipment and the supply drip loop is 40 inches. The only exceptions are:

- Drip-loops to street lights are 12 inches, as shown below.
- Grounded mast requires at least 20 inches clearance from communication cross-arms.
- If mast is not grounded, then it must be 40 inches above the nearest communication cable.

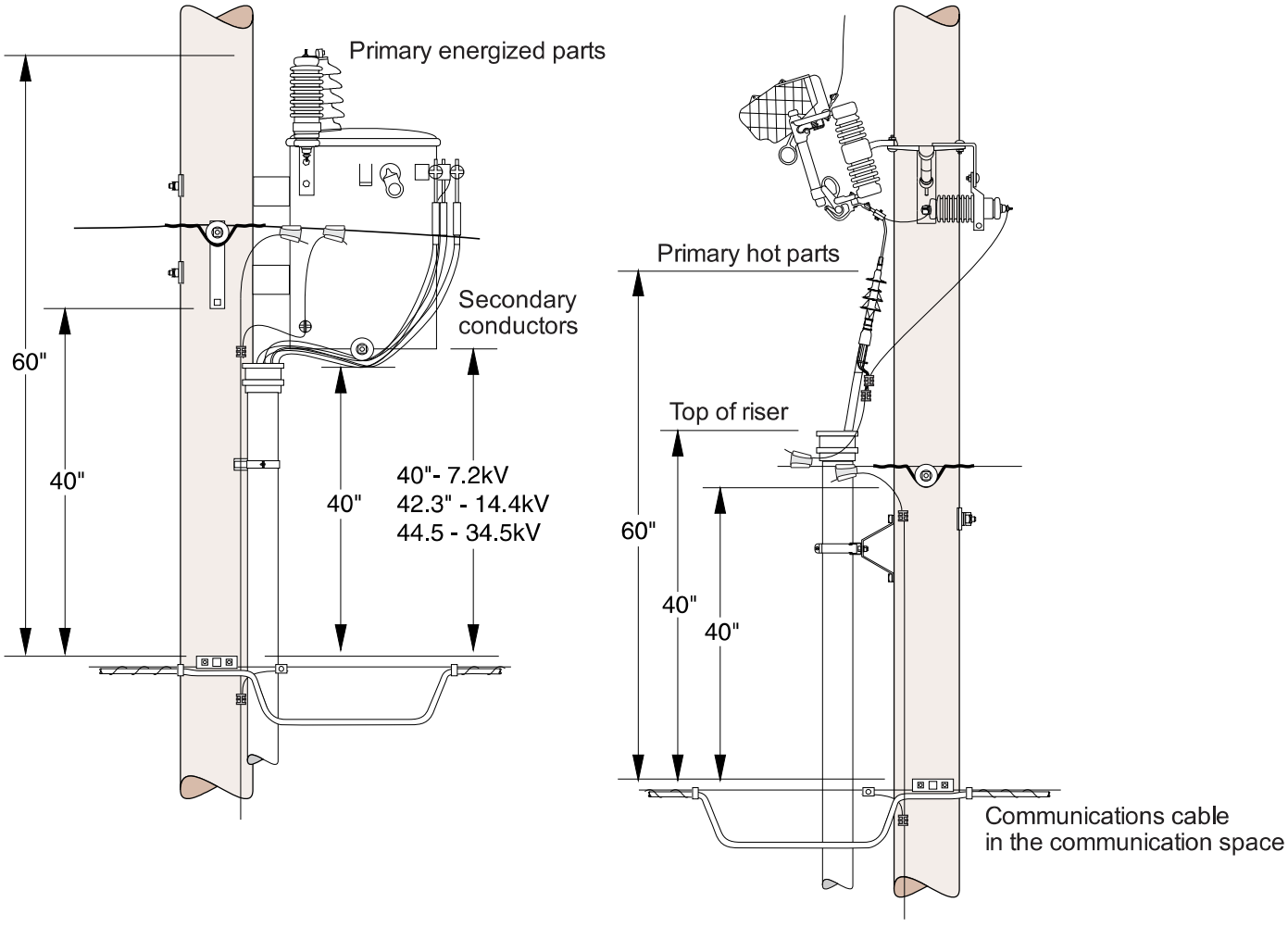


Street Light and Drip Loop Clearances

Clearance from Power Equipment

Clearances between various power equipment and communication equipment are shown below. Clearances are measured between the closest equipment surface or energized parts; not between bolt holes per NESC.

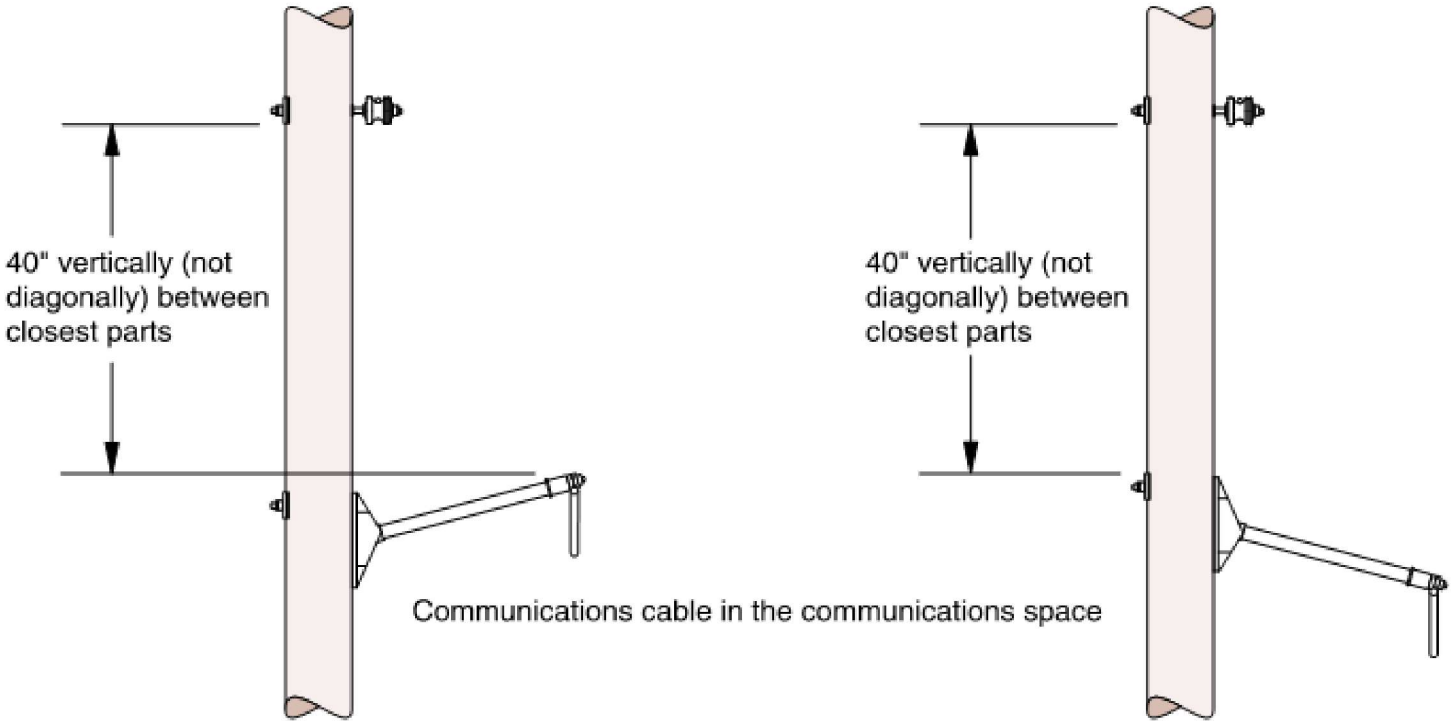
All metallic hardware within two (2) inches of each other must be bonded. This helps reduce radio interference.



Clearance from Power Equipment

Extension Bracket Clearance

Extension bracket clearance is measured vertically from the top of the bracket to the supply space; not diagonally. The use of brackets does not reduce the vertical clearance requirement; see NESC Rules 235 and 238.

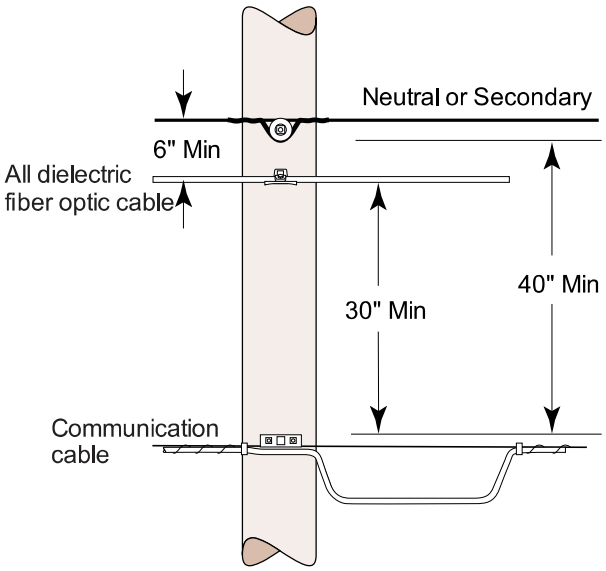


Extension Bracket Clearance Requirement

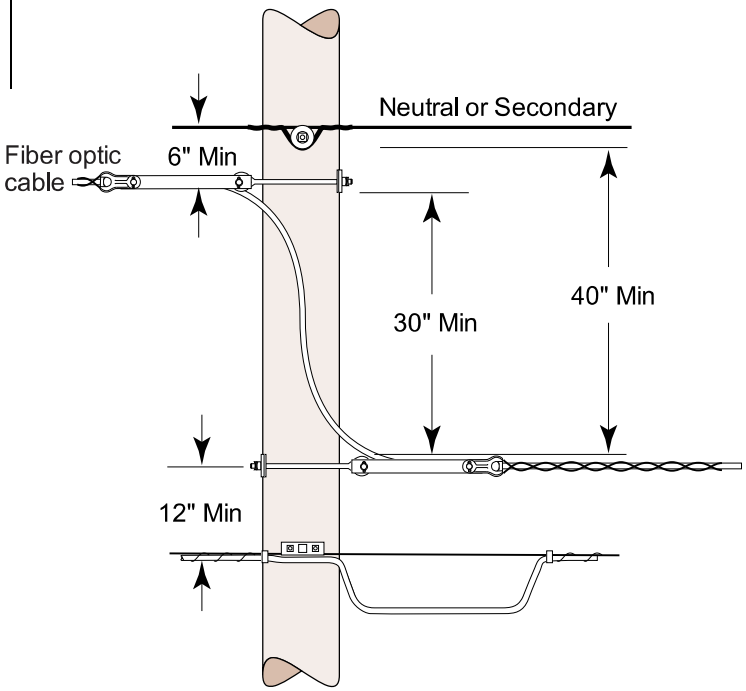
All Dielectric Fiber Optic Cables

The requirements for all dielectric fiber optic cables are as follows:

- Maintain 30 inches vertical clearance from communication space, with 12 inches clearance at midspan.
- Do not touch fiber optic cables and the secondary conductors.
- Maintain a vertical clearance of at least six (6) inches from power equipment.
- Transistion from the supply space to the communications space occurs only at a structure.
- New construction of communication utility ADSS fiber optic cable is not allowed in the supply space.



All Dielectric Fiber Optic Cable in the Supply Space



Transition from Supply to Comm Space

Communication Risers

Means of Attachment

There are three ways to attach communication riser cables to wood poles; conduit, molding, and direct. For steel-pole attachments, see Overhead Manual 04-02-01.

For any attachement, the first step is to bundle all cables together. Based on the outer diameter (OD) of the bundle, follow the instructions below.

- OD 1-1/2" and larger—install the riser cables in a conduit attached to standoff brackets; see Conduits below.
- OD smaller than 1-1/2"—install the riser cables in non-conductive conduit, non-conductive molding, or direct attachment.

When using direct attachment, Joint Users accept the risk of damage by gaffs, pedestrians, traffic, etc., see NESC Rule 239D.

All conduit must start at the ground and extend to within 18" of main line attachment.

NOTE–Offset the risers as necessary to allow clearance for down guy(s) on deadend poles.

Conduits

Non-conductive conduits smaller than 1-1/2" OD may be attached directly to the pole in at least 36" intervals using pipe straps or long barbed square shank staples, see NEC Article 352-30B.

Conduits 1-1/2" OD and larger must be attached using 6" standoff brackets (Cat ID 5510).

NOTE–All cables and conduits owned by the same Joint User must be combined and attached using the appropriate method.

Stand Off Brackets

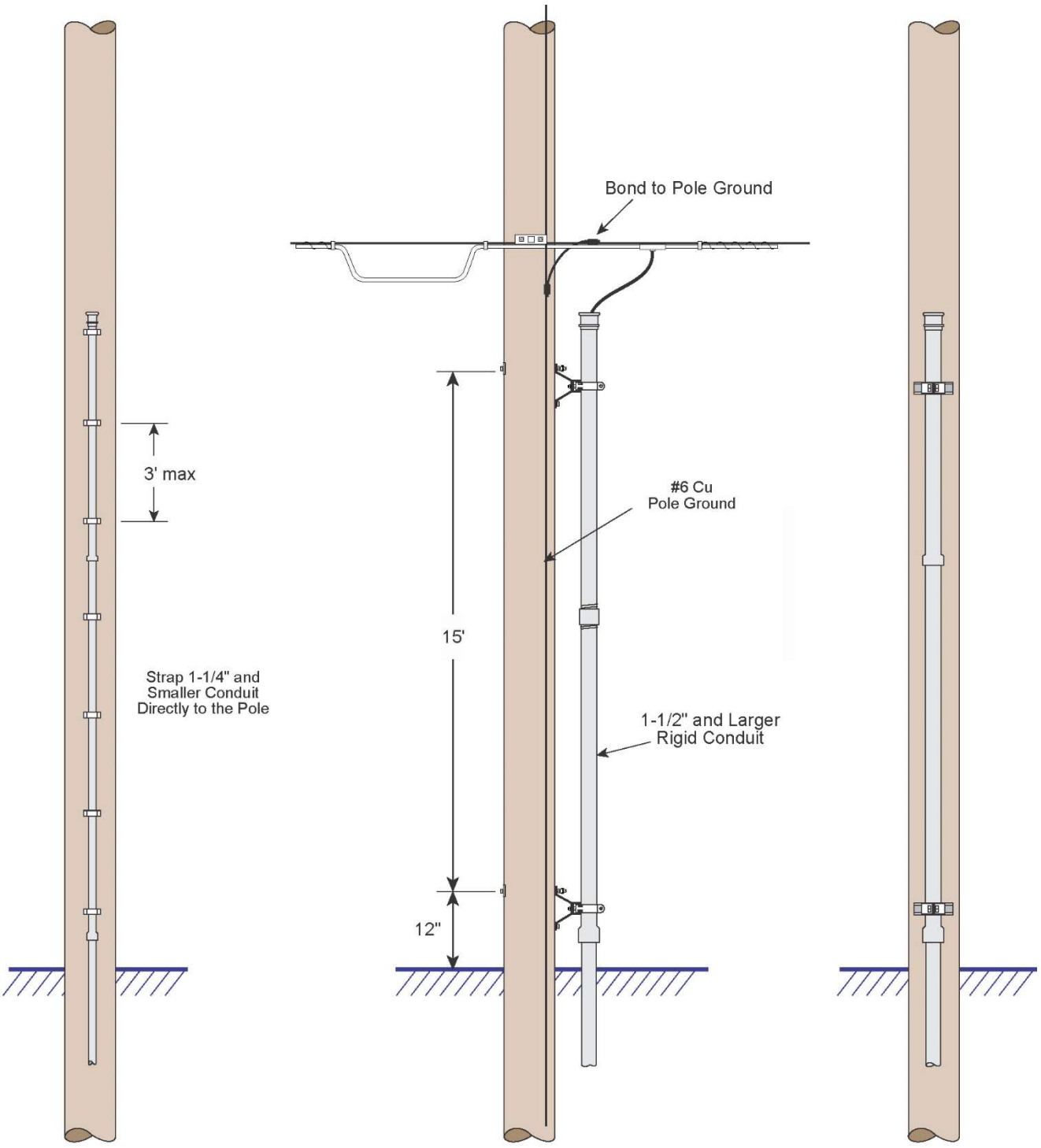
Stand off brackets are required to meet the following, see NESC Rule 217:

- One set of standoff brackets are allowed per pole.
- Minimum vertical clearance of 8-feet between the first two brackets on the pole or between equipment such as control boxes and the next bracket up.
- Any permanent object within 3-feet horitzontally from the pole that can be used as a step is considered a bracket. For example, a fence near the pole.
- Install additional riser conduit on the front or back side of the existing channel. Idaho Power can install wider channels up to 24" (Cat ID 5794) at the Joint User's expense.
- The second riser installed 16 feet from the ground is the preferred framing method.

Bonding

All metallic riser conduit must be bonded. This is done by bonding to the highest standoff bracket attached to the metallic conduit to the pole ground. If no pole ground exists, use non-conductive conduit or submit a request to Idaho Power Joint Use for one to be installed.

NOTE–NESC Rule 92C3 requires that all messengers and neutrals must connect to the grounding conductor any time one exists.



Typical 1-1/4" and Smaller Communication Riser

Typical 1-1/2" and Larger Communication Riser

Preservation of Climbing Space

Climbing space must be preserved by consolidating all equipment to one section of the pole. Follow the steps and guidance below to preserve the climbing space:

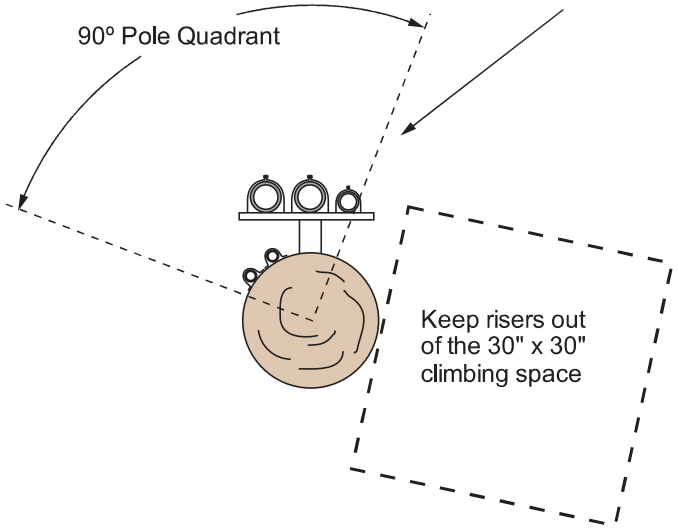
1. Determine the normal 30×30 inches climbing space, see Overhead Manual 04-02-04.
2. Locate communication risers outside of the normal climbing space.
3. Consolidate risers into one 90º quadrant.
   - ♦ All risers, including direct attached, must fit within the 90º quadrant.
   - ♦ The maximum number of risers that can be attached to a pole depends upon the size of the conduits used. All conduits must fit on a single channel set; maximum size is 24".

NOTE–Bond the metallic conduit to the pole ground via the highest standoff bracket attached to the metallic conduit.

Place the standoff bracket and all conduits within the same 90º quadrant of the pole.

Place power and Joint Use risers on the same standoff bracket. Use channels, up to 24", as needed.

One set of standoff brackets per pole is allowed.



Special Circuits and Equipment

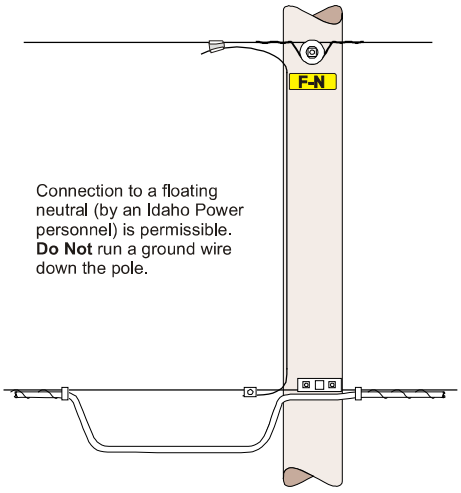
Floating Neutral

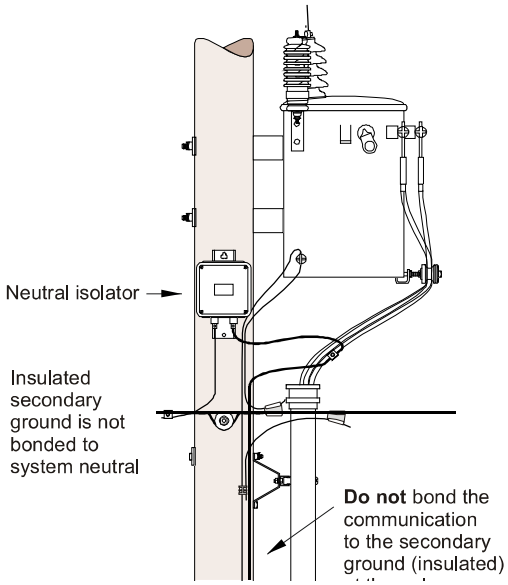
When a structure with a floating neutral (F-N) is encountered, contact the Idaho Power Joint Use representative for specific instructions.

Floating Neutral Sign (3″x 8-3/4″, Black Letters on Yellow Background)

Delta Circuits and Others with No Neutral

Idaho Power has a limited amount of delta primary distribution circuits and some wye primary circuits with no neutral installed. A neutral should be installed on these circuits before the communication utility attaches.



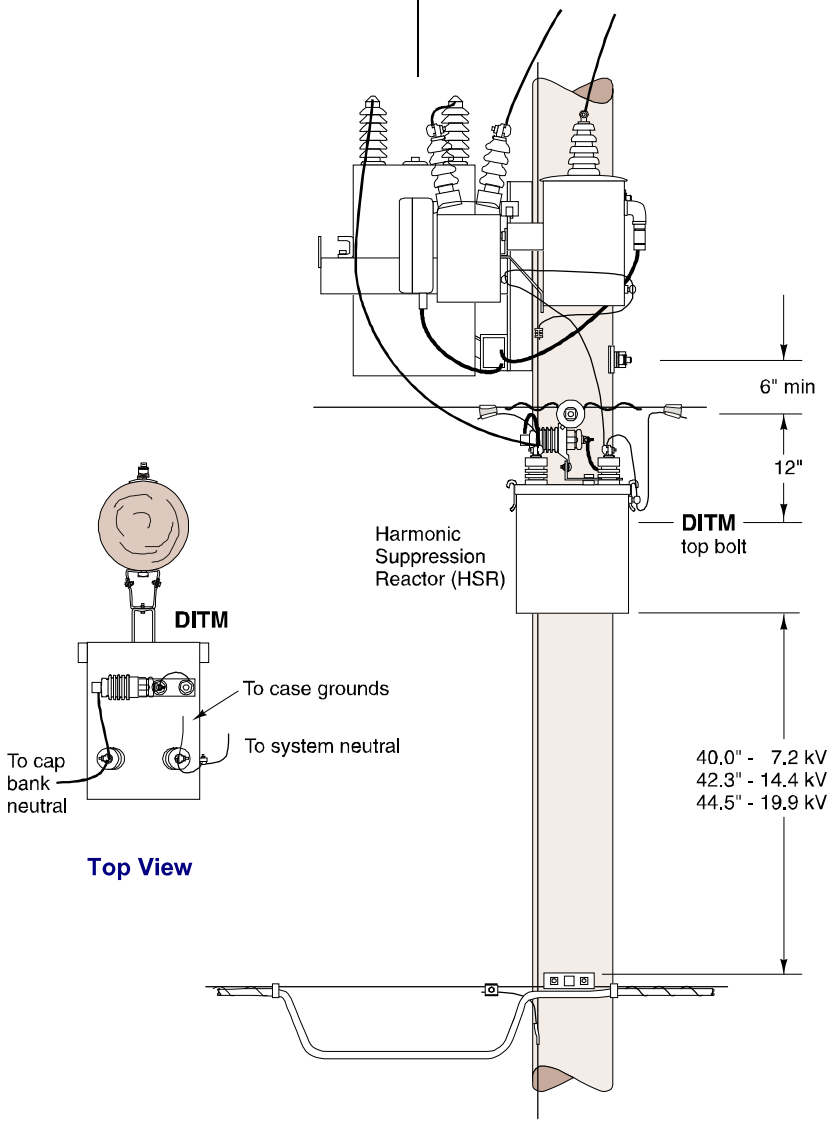


Neutral Isolator

When a neutral isolator is encountered, contact the Idaho Power Joint Use representative for specific instructions.

Harmonic Suppression Reactor

At some locations the Joint Use Licensee may request that a harmonic suppression reactor be installed at a capacitor bank to reduce interference. The Joint Use Licensee will supply the reactor, and an Idaho Power crew will install it. Under unbalanced conditions, the reactor could have high voltage on it. Two-bushing capacitor cans must be used, so that the bank midpoint can be isolated. For 14.4 and 19.92 kV, special cans with canted bushings on one side must be ordered. See page 20-03-64 for grounding details.



Top and Side View of a Harmonic Suppression Reactor

Smart Grid Monitors

Overview

Smart Grid Monitors (SGMs) are 1-Ø voltage monitoring devices designed and installed by Idaho Power on the Distribution System. These devices monitor and report voltage to do the following.

- Regulate system voltage by providing voltage feedback to dispatch.
- Report outages to dispatch.
- Record momentary outages.

All SGMs record temperature data, and some are configured to record wind speed and direction.

Legacy Devices

Idaho Power has been installing SGMs and devices like them since the early 2000s. The first generation of these devices were called Sentrys.
Sentrys are outage monitoring devices that were installed in customer meter bases. Active ones will still show up in GIS Maps and will be replaced with an SGM as needed.
Contact Power Quality with any questions.

SGM Locations

SGMs are generally placed downstream of Substation Breakers, Reclosers, and Regulators. They can also be placed downstream of fuses and Sectionalizers as needed.
SGM locations are determined by Power Quality and Reliability Engineers.

SGM Installation

SGMs are installed on Overhead and Underground Service transformers. See UG 69-04 for information on UG installations. Overhead SGMs are generally installed 10ft above the ground on a service transformer pole. The device connects to the 120V secondary service wires using PG Connectors or similar.
Please contact the regional Power Quality Technician to install and commission an SGM.

CU Codes

Description	CU Code
Standard Smart Grid Monitor	DSGM
SGM w/ Weather Station	DSGMW

Weather Stations

Purpose

This section provides the standards for installation and maintenance of IPC owned and managed weather stations and their associated equipment.

Installation

Each IPC weather station shall consist of an Anemometer (for wind speed and direction) and a temperature/humidity sensor supported on a support mast, a solar panel and communication module on a support bracket, and an equipment controller box secured to the pole via two Unistrut channels.

Each weather station will be solely powered with the integrated solar panel and a battery located in the equipment controller box.

All weather station power and communication cabling must be securely fastened to the pole or associated support brackets with wire clips, U-brackets, staples, or weather rated cable ties.

Grounding and Bonding

Any metallic brackets used for mounting weather station equipment must be bonded to the pole ground wherever a pole ground exists. This includes but is not limited to the following brackets:

- Anemometer Support Mast
- Equipment Control Box Uni-strut Bracket
- Solar/Communication Module Mounting Plate

Location Selection

Span Guy Poles: Where practical, weather stations should be installed on span guy poles to avoid interference with the supply space.

Secondary Poles and Light Poles: Another preferred location is on Secondary or Light Poles. Weather station anemometers and brackets should be placed 12 inches above or below any secondary connection.

Primary Distribution Poles: Where span guy poles, secondary poles, or light poles are not available, weather stations may be installed on primary distribution poles when the appropriate line clearances are met.

Weather Station Clearances

Weather Station equipment must meet the following minimum clearances as they apply and not impede climbing space as outlined in OH 03-11-01. Framing dimensions are displayed on the following page.

Anemometer and Support Mast

- Above ground level–30 feet
- To primary conductors–three (3) feet in any direction
- Above or below the neutral–three (3) inches vertically
  Note– If below the neutral, this distance is measured from the top of the anemometer.
- Above Communication Lines–30 inches vertically
- To secondary conductors or street light drip loops–12 inches vertically
- Over a roadway–18 feet vertically

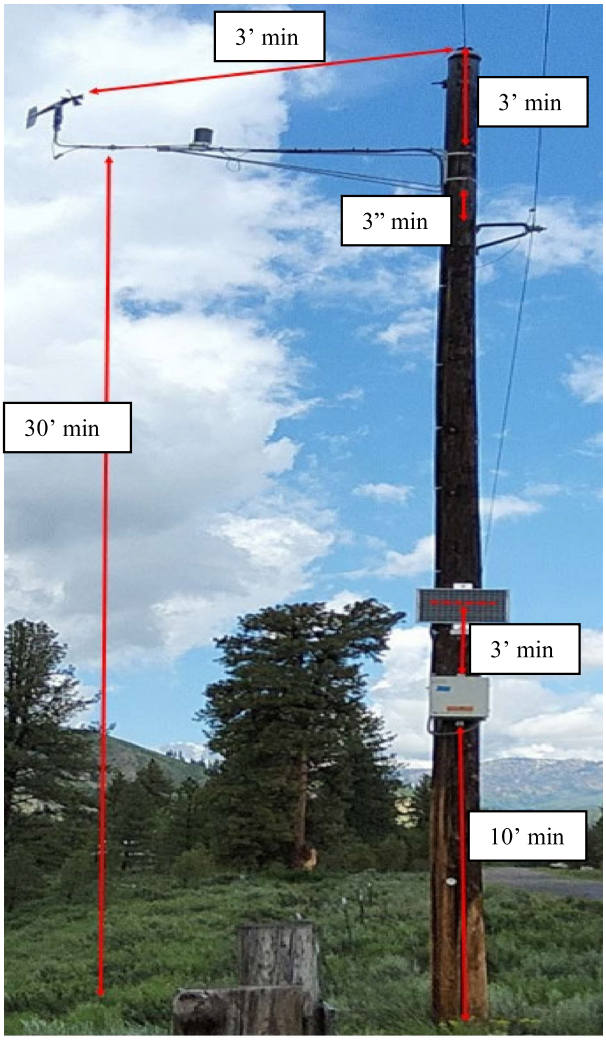
Equipment Control Box

- Above ground level–10 feet vertically

Solar and Communications Module

- Above control box–three (3) feet vertically

Weather Station with Street Light



Weather Station with Primary Distribution

Weather Station with Communications

Fiber Optic Cable

General Information

This section covers the requirements for a single-mode fiber optic cable installation for Idaho Power Communications along the company owned transmission and/or distribution system. Communications routes can be found on the Communications Dashboard.

Outside of Substations: Install fiber optic cables in accordance with the Idaho Power *Overhead Manual* (Sections 04-06-21, -31, Section 10) and the *Underground Manual* (Sections 64 and 65). Inside Substations: Install fiber optic cable in accordance with the Idaho Power *Stations Construction Specifications.*

Safety

In addition to safety procedures for working around overhead power lines and with underground conduit systems, observe the following when working with fiber optic cables:

Glass–Beware of glass shards, especially when cutting, stripping and splicing cables. The shards are sharp, thin, tiny and can be nearly invisible. Always wear safety glasses when working with optical glass.

Chemicals–Become familiar with Safety Data Sheets (SDS) for cleaning products and gel-filled fiber optic tubes. Always work in well-ventilated areas and keep flammable materials away from ignition sources including fusion splice machines.

Laser–Never look directly into the end of fiber cables (particularly with a microscope) until it is certain that there is not an active light source at the other end of the cable.Refer to the cable and hardware manufacturers' detailed instructions for additional information and safety precautions.

Single-Mode Fiber Optic Cables

Single-mode fiber optic cable is a small diameter fiber optic tube that transmits a single ray of light for data communication and is suited for use over long distances.

Consult with the Idaho Power Planning, Engineering and Construction (communications) Group for project-specific fiber optic cabling requirements.

Optical Ground Wire Cable (OPGW) performs the duties of a shield wire, while providing a path for data signals by incorporating optical fibers into the design of the cable. OPGW cable can be integrated into new and existing high-voltage transmission (or distribution) systems and is typically placed at the highest point on structures.

All-Dielectric Self-Supporting Aerial Cable (ADSS) has high-tension strength capability required for various environmental and electrical conditions without the need for a support messenger. ADSS cables are unaffected by electromagnetic fields at distribution voltages.

ADSS cables may also be installed underground where practical to avoid a cable transition and splice from an overhead run to a short underground section. Typical situations for this practice include entering a substation or when crossing a roadway.

Non-Armored All Dielectric Loose Tube Cable (AD) is for use in long runs of duct buried applications or where transitioning from OPGW cable to an underground section. The cable can be obtained pre-installed in armored conduit for direct burial or pulled through an innerduct installed in PVC conduit.

Single-Mode Fiber Optic Cable CU Codes and Manufacturers

Cat ID	Description	CU Code	Manufacturer	Part Number
45870	OPGW, 24-Count	TROPGW24	AFL Telecom	AC-12/62/552 (DNO-5484)
44556	OPGW, 48-Count	TROPGW48	AFL Telecom	AC-40/46/646 (DNO-4382)
48381	ADSS, 24-Count	FADSS24	AFL Telecom	AE0249C521BA1 (DNA-27261)
53618	ADSS, 48-Count	FADSS48	AFL Telecom	AE0489C521BA1 (DNA-30216)
42513	AD Loose Tube, 12-Count	FAD12	AFL Telecom Corning	LE0129C5101N1 012EU4-T4701D20
37396	AD Loose Tube, 24-Count	FAD24	AFL Telecom Corning	LE0249C5101N1 024EU4-T4701D20
53659	AD Loose Tube, 48-Count	FAD48	AFL Telecom Corning	LE0489C5101N1 048EU4-T4701D20

Single-Mode Fiber Optic Cable Properties

Cable Property	 OPGW (48-Count)	 OPGW (24-Count)	 ADSS	 AD Loose Tube
Cable Diameter	0.646"	0.552"	0.512"	0.410"
Cable Weight	0.402 lbs/ft	0.372 lbs/ft	0.088 lbs/ft	0.060 lbs/ft
Rated Breaking Strength	16,879 lbs	18,606 lbs	2,916 lbs	--
Maximum Rated Cable Load	13,053 lbs	14,049 lbs	1,696 lbs	--
Maximum Stringing Tension*	3,376 lbs	3,721 lbs	583 lbs	--
Maximum Tensile (Pulling) Load				
Short Term	--	--	1,696 lbs	600 lbs
Long Term	--	--	583 lbs	200 lbs
Minimum Bull Wheel Diameter	46"	39"	36"	--
Minimum Stringing Sheave Diameter**				
First and Last Structures	26"	23"	21"	--
Stringing Angle ≤ 20°	20"	17"	12"	--
20° < Stringing Angle ≤ 45°	26"	23"	21"	--
45° < Stringing Angle ≤ 60 °	33"	28"	26"	--
60° < Stringing Angle ≤ 90°	39"	34"	31"	--
Minimum Bending Radius				
Cable Static (no load)	10"	9"	6"	4.1"
Cable Dynamic (under tension)	13"	11"	11"	8.2"
Fiber (no load)	1.5"	1.5"	1.5"	1.5"
Buffer Tube (no load)	3.0"	3.0"	3.0"	3.0"
Sag10™ Chart Number	1-355	1-1166	--	--
Coefficient of Linear Expansion	9.73E-06 1/°F	8.39E-06 1/°F	8.69E-06 1/°F	--
Cable Modulus				
Initial	--	--	749.5 kpsi	--
Final	--	--	808.2 kpsi	--
10 Year	--	--	624.5 kpsi	--
Short Circuit Rating	175 $(kA)^2$•sec	87 $(kA)^2$•sec	--	--
Short Circuit Ambient Temperature	104°F	104°F	--	--
Short Circuit Duration 1 sec	13.2 kA	9.3 kA	--	--
Short Circuit Max Cable Temperature	410°F	410°F	--	--
Temperature Range				
Storage	-58°F to 185°F	-58°F to 185°F	-58°F to 158°F	-58°F to 167°F
Installation	-40°F to 185°F	-40°F to 185°F	-22°F to 158°F	-22°F to 158°F
Operation	-40°F to 185°F	-40°F to 185°F	-40°F to 158°F	-40°F to 158°F

*Measure stringing tension at the tensioner side. Never exceed 20% of the cable's rated breaking strength.

**Angle is measured both horizontally and vertically. Do not string fiber optic cable at angles exceeding 90°.

Splices and Closures

Splice locations of the fiber optic cable must be planned, and the reels specified to locate splices at predetermined points along the route. Cable can be ordered in lengths of up to approximately 20,000' per standard reel. Order reels of cable between 10,000'-15,000' in length. Use reels with longer or shorter lengths only when necessary to facilitate the cable run.

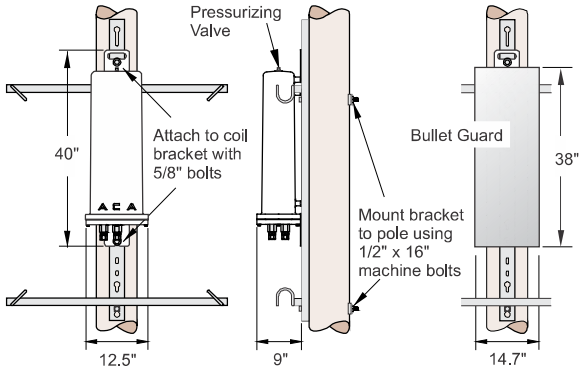
Keep splices to a minimum to reduce light transmission loss. Splicing must be performed in a clean and air-conditioned environment such as a work trailer or van specifically equipped for fiber optic splicing. For that reason, locate all splices along roads or easements that allow for easy access with a vehicle.

Use the fusion method for all fiber optic cable splices with a fusion splice machine that is equipped with a method for estimating the achieved splice loss. A "Local Injection Detection" or "Core Alignment Loss Estimation" system is acceptable. This machine must be serviced and certified by the factory or its authorized representative within the previous six months before making splices.

CAUTION–Observe minimum bending radius of all fiber optic cables into and inside splice closures.

Pole-Mounted Splice Closure–This closure can be mounted to wood or metal poles or lattice structures and will accommodate OPGW, ADSS and AD Loose Tube type fiber optic cables.

Mount the bottom of the closure a minimum of 15' above grade while also providing 40" minimum clearance below the neutral (grounded) conductor or 60" minimum clearance below primary (energized) conductors, whichever is greater. Inside substations, mount the bottom of the closure at 40" above grade.



Pole-Mounted Splice Closure

Train the fiber optic cable down the tower/pole to the ground for splicing. Include the appropriate quantity and type of cable connecting kit for the cable being spliced. Install a bullet guard on every closure.

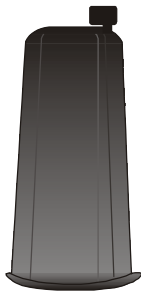
Pole Mounted Splice CU Codes

Description	CU Codes
Pole-Mounted Splice Closure*	FSPM72
Connector Kit for 0.552" OPGW 24	FSCOPGW24
Connector Kit for 0.646" OPGW 48	FSCOPGW48
Connector Kit for 0.410" AD	FSCAD
Connector Kit for 0.512" ADSS	FSCADSS

NOTE–Include 1 connector kit per cable entering and exiting the closure.
*Code includes all necessary mounting hardware and bullet guard for a wood pole and equipment for up to 72 splices.

Provide a minimum of 75' of fiber slack on each side of the splice. This will allow the closure to be removed and lowered to the ground if necessary for maintenance. Bundle fiber cable slack and coil together in a neat manner. Properly secure at each splice point.

Underground Splice Closure–All underground splices shall be installed in an underground handhole. Utilize a sealed splice closure. This closure will accommodate ADSS and AD Loose Tube type cables. For transition to OPGW running overhead, utilize an overhead splice closure.



Underground Splice CU Codes

Description	CU Codes
UG Splice Closure up to 24 splices	FSUG24
UG Splice Closure up to 48 splices	FSUG48

NOTE–Select code based on the maximum number of splices required in the closure. Call for handhole separately.

Provide a minimum of 75' of slack fiber cable beyond the underground handhole to facilitate splicing. Bundle and coil the slack together and place neatly in the handhole.

Splice Closures CU Parts List

Splice Closure Hardware

CU Code Cat ID	Description	Manufacturer	Part Number
CU Code FSPM72			
41753	"Opti-Guard" Pole-Mounted Closure*	AFL Telecom	OG03
41759	Bullet Guard for "Opti-Guard" Closure	AFL Telecom	OGBG01
40886	External Coil Bracket	AFL Telecom	CB-44
47389	Splice Tray, "Opti-Guard" for 72 fibers	AFL Telecom	OGST01-72
41757	Splice Protection Sleeve (5 ea)	AFL Telecom	SPS60
CU Code FSCOPGW24			
46111	Connector Kit, "Opti-Guard" OPGW, 0.552	AFL Telecom	OCK12/62552
CU Code FSCOPGW48			
41845	Connector Kit, "Opti-Guard" OPGW, 0.646	AFL Telecom	OCK40/46646
CU Code FSCADSS			
47600	Connector Kit, "Opti-Guard" ADSS, 0.512	AFL Telecom	ACK512080
CU Code FSCAD			
49759	Connector Kit, "Opti-Guard" AD 0.410	AFL Telecom	LCK410
CU Code FSUG24			
51217	LG-150 Inline/Underground Closure**	AFL Telecom	LG-150-U-0
49401	Splice Tray, "Lightlink" for 24 fibers	AFL Telecom	LL-2000
41757	(5 ea) Splice Protection Sleeve	AFL Telecom	SPS60
CU Code FSUG48			
51217	LG-150 Inline/Underground Closure**	AFL Telecom	LG-150-U-0
49401	(2 ea) Splice Tray, "Lightlink" for 24 fibers	AFL Telecom	LL-2000
41757	(5 ea) Splice Protection Sleeve	AFL Telecom	SPS60

*Maximum of (5) splice trays per closure.
**Maximum of (3) splice trays per closure.

Conduit and Risers

The Idaho Power Planning, Engineering and Construction (communications) Group will provide guidance as to the quantity and type of conduit required. For single fiber optic cable runs, typically only one conduit is required. For multiple runs, or where spare duct is requested, use a single PVC conduit with multiple innerducts.

PVC conduit with innerduct is preferred and will typically be installed in open trenches or where spare innerducts are desired for future expansion of the fiber network.

Armored conduit may be used for single runs of fiber cable being plowed in over a long distance, or where PVC might be susceptible to damage from rodents or adverse soil conditions.

> **REMINDER**–Install a #14 AWG tracer wire with all underground fiber optic cables.

PVC Conduit with Innerduct–Use schedule 40 PVC conduit in non-traffic areas. Refer to the *Underground Manual,* Section 62 for PVC conduit requirements. In traffic areas use schedule 80 PVC or schedule 40 PVC encased in concrete 6" thick on top and 2" thick on the sides and bottom of the conduit. Install conduit or concrete encasement to a minimum depth of 30" below finished grade.

Use 1-1/4" smooth-walled, SDR-11, High Density Polyethylene (HDPE) innerduct. Single runs colored orange is on 8000' reels (Cat ID 53685). Three runs colored orange, green and blue are on a single 2500' reel (Cat ID 53686).

CU Codes for Schedule 40 Ducts and Risers

Description	2" PVC w/1 Innerduct	4" PVC w/3 Innerduct
Straight Sections*	FDB2	FDB4
45° Bend*	FDB452	FDB454
90° Bend*	FDB902	FDB904
Pole Riser**	FPR2	FPR4

*Includes conduit, innerduct and tracer wire. Call for excavation and backfill (CU Code FTR30) or boring costs separately.

**Code includes all necessary mounting hardware for conduit and innerduct to wood poles.

Armored Conduit–Use pre-lubricated, armored conduit colored orange (Cat ID 53687). If fiber optic cable is to be pre-installed, coordinate requirements with the Idaho Power Planning, Engineering and Construction (communication) Group.

Risers–All underground risers shall be rigid conduit installed on the first 20 feet. The minimum bending radius for all conduits is 24" with 36" radius bends preferred. Refer to the *Overhead Manual* section 04-04, Communications Risers, for more information.

Handholes

Handholes are 24"×36"×30" deep polymer concrete with slip-resistant covers and solid floors. Covers are Rated Tier 15 for occasional non-deliberate vehicular traffic. Do not locate handholes where they are subject to deliberate vehicular traffic.

All handholes shall be installed level with tamped backfill. Conduits should enter the handholes through the side. Refer to Section 66-07-01 of the *Underground Manual* for specific installation requirements.

Cat ID	Description	Rated
49564	Handhole 24"x36"x30"	Tier 15
49565	Cvr W/2 bolts F/hndhl	Tier 15

Provide handholes (CU Code **FSBX233**) at all fiber optic cable splice points and at other locations along the project route to facilitate cable installation. Place a handhole approximately every half mile (3000') of cable length. Do not exceed 360° of bends between handholes.

Provide a minimum of 200' slack cable in each handhole. Coil or arrange the slack cable in a "figure-8" pattern in the hole to help prevent it from binding or kinking.

For plowed-in armored conduit or special conditions, longer distances may be allowed between handholes. Consult with the Idaho Power Planning, Engineering and Construction (communications) Group and/or Methods and Materials Group for more information.

Fiber Optic Cable Installation

Handle and install the cable properly. Maintain the minimum bend radius and do not kink the cable. Never crush or twist fiber optic cables. Any such damage will alter the transmission characteristics of the fiber and may require replacement of that cable section.

Overhead Installations. Refer to Sections 04-06-21 and 04-06-31 of the *Overhead Manual* for information on overhead ADSS and OPGW fiber optic cable installation.

Underground Installations. Refer to Section 64 of the *Underground Manual* for trenching and backfill requirements.

Fiber optical cable can be pulled by hand for shorts runs of a few hundred feet or less with not more than 180° of bends.

For a long-distance pull, the Aramid Yarn and strength member of the cable can be attached to a pulling eye. Use a pull rope that is sturdy enough to avoid stretching. Do not use steel due to its tendency to cut into the innerduct. Use a break-away swivel rated for less than 600 pounds pulling force to avoid exceeding the maximum pulling tension of the fiber optic cable.

High air speed blowing (HASB) is a method of installing fiber optic cable, in which high air volume (300-600 cfm) is blown through an open conduit and pushes on the cable to advance it forward at whatever speed the pusher will support. In this method, there is no pulling force on the front end of the cable; only a mechanical pushing force at the back and an air drag force distributed along its length. For this reason, duct bends (including waves from reel memory) do not limit the HASB process as much as they do traditional cable pulling.

In some situations, beginning the cable installation from the center of a run is the best method. With the cable reel positioned at a handhole near the midpoint of the section to be installed, the cable is installed in one direction. The remaining cable is then removed from the reel and laid out in a “figure-8” pattern to prevent tangling. The free end of the cable is then fed into the duct in the opposite direction and installed toward the next handhole.

Identification Devices

Overhead. Install an adjustable cable marker (Cat. ID 50333) on ADSS cable at every pole or structure. OPGW cable is not required to be identified.

Underground. Install two coiled cable markers (Cat. ID 53238) in every handhole (2 markers are included in CU Code for handhole). Covers may be labeled “Fiber Optic” but DO NOT indicate that they are owned by Idaho Power.

Install Warning Tape (CU Code **FBTAPE**) 6" above top of conduit or concrete encasement. Warning tape is not required if conduit is installed by directional boring.

Install Post Markers (Cat. ID 53239) along cable route every 10th of a mile (or approximately every 500'); and where preformed conduit bends exceeding 22° alters a cable route that does not follow a roadway, or established transmission/-distribution route.

Identification Device Cat. ID

Cat. ID	Description
50333	Adjustable Cable Marker for Overhead
53237	Underground Warning Tape (1000')
53238	Coiled Cable Marker for Underground
53239	Buried Line Post for Fiber Route
53240	Label for Buried Line Post (Replacement)

Testing Fiber Optic Cable

Pre-Installation Testing. Test each individual fiber in the cable with an optical time domain reflectometer (OTDR) for length and transmission anomalies while on the reel.

Post-Installation Testing. Test all single-mode fiber strands end-to-end for bi-directional attenuation (1310 nm/1550 nm) to verify performance. Comply with TIA/EIA-526-7 or OFSTP 7 Method B, according to the manufacturer's instructions for the test set being utilized.

Tests must ensure that the measured link loss for each strand does not exceed the "worst case" allowable loss defined as the sum of the connector loss, splice loss, and the optical loss as specified in the table in the next column.

After splicing, termination, and bulkhead mounting each fiber shall be tested with an OTDR for length, transmission anomalies, and end-to-end attenuation.

Single-Mode Fiber Optic Performance

Parameter	Maximum Attenuation
1310 nm Wavelength	0.40 dB/km
1550 nm Wavelength	0.30 dB/km
Splice Loss	0.3 dB or less
Return Loss	26 db or greater
Connector Loss	0.75 dB or less

Results are to be recorded and supplied to the Idaho Power SPC Regional Leader in the form of hard-copy printouts, photographs of screen traces, or electronic copies.

NOTE. Fiber optic cable that does not meet these parameters must be repaired or replaced so that the required performance is met.

All-Dielectric Self-Supporting Fiber Optic Cable (ADSS)

General Information

ADSS cable is mounted in the communications space on distribution poles and meets the requirements of the NESC for joint use. Refer to sections 04-01 thru 04-05 for additional information regarding joint-use requirements.

Precautions

Observe all Idaho Power safety precautions when placing ADSS on energized structures, or structures involving power crossings. Although ADSS is an all-dielectric cable, some conductivity can result from moisture on the cable and in the surrounding air. In high voltage environments, the cable and metallic attachment hardware require grounding.

Leakage current can be induced onto ADSS and attachment hardware even when the cable is a relatively long distance from the phase conductors.

Dry Weather Conditions. When the cable is suspended by insulators or on wooden poles, a voltage potential may be induced in the metal suspension grips and support hardware. To avoid dangerous electrical shock, ground the metal grips before touching them.

Wet Weather Conditions. When the cable is wet, the resistance to ground is low near the tower or grounded structure, so there is little voltage potential on the metal grips or cable at these points. However, at distances of 10' to 15' or further from the metal grips, a voltage potential may exist. To avoid dangerous electrical hazards, ground the cable within 3' to 5' on both sides of the area to be touched.

Additional safety tips to be familiar with can be seen on page 04-06-01.

Sag and Tension Methods

The methods used for placing ADSS fiber optic cable are similar to those used for placing power utility phase conductors. Do not over-tension the cable. The table on page 04-06-02 provides information that can be used to model ADSS cable in Sag10 software.

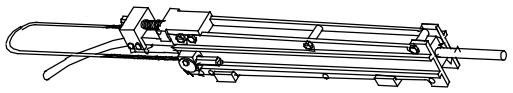
Sag ADSS cable following the sag of the neutral conductor. A minimum of 40" separation between the ADSS cable and neutral conductor is required at maximum sag.

If the cable is over-tensioned beyond the maximum rated cable load, fiber damage may occur that will alter the transmission characteristics of the fiber and/or require replacement of the cable.

Do not sag/tension the cable with angles larger than 15°. This will cause a crushing force to be placed on the cable. Always sag/tension the cable from deadend segment to deadend segment.

Maximum Span Length. ADSS cable can be installed on a maximum span of 850' under NESC medium loading and 600' under NESC heavy loading.

Temporary Grips. Temporary grips can be used when stringing the ADSS, during sagging, or where it is necessary to make short-term catch on the ADSS.

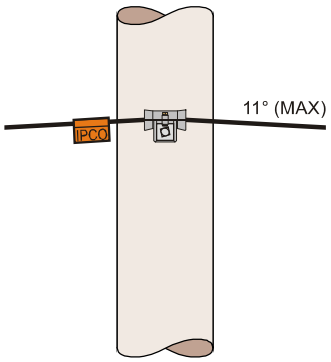


ADSS Temporary Grip

Attachment Hardware

The hardware described in this section and associated CU Codes are intended for mounting ADSS cables on wood poles. Contact Methods & Materials for other pole types.

Tangent Support. Use a trunion clamp in applications where the line angle is from 0° to 22° (11° each side).

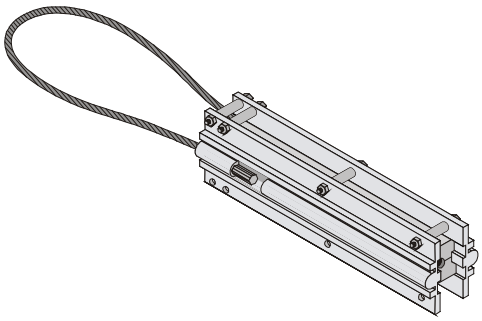


Trunion Clamp

The trunion clamp may also be used for stringing the ADSS cable prior to installing the bushing insert up to a maximum of 15° (7.5° each side) and 30 poles. Use sheaves for larger line angles.

Torque the bolt holding the ADSS cable to 15 lb-ft after the line has been properly sagged and tensioned.

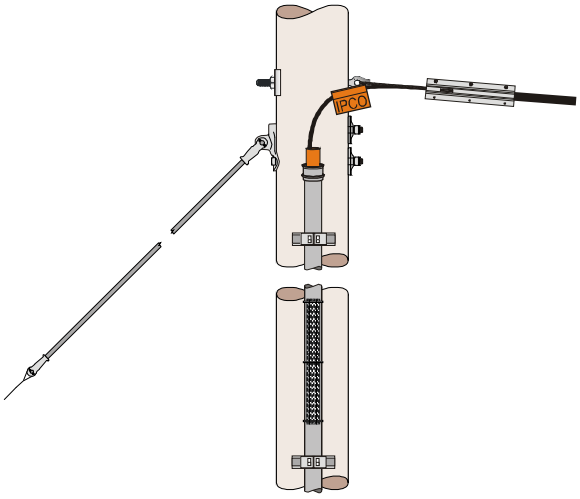
Deadends. Deadend ADSS cable at all road, river, or railroad crossings; and at points of cable termination for splices. Deadends are also required for spare cable storage systems (snowshoes) and risers.



ADSS Wedge Deadend

This type of non-formed-wire deadend dramatically increases the speed of installation by using fitted wedges to grip the cable instead of formed wire.

At the last structure, establish a deadend assembly that maintains the minimum bend radius requirements where the cable is run down the structure. If the ADSS cable is run down the structure, install a pole riser to protect the cable as it makes the transition of aerial cable to conduit. Refer to the *Underground Manual* section 63.



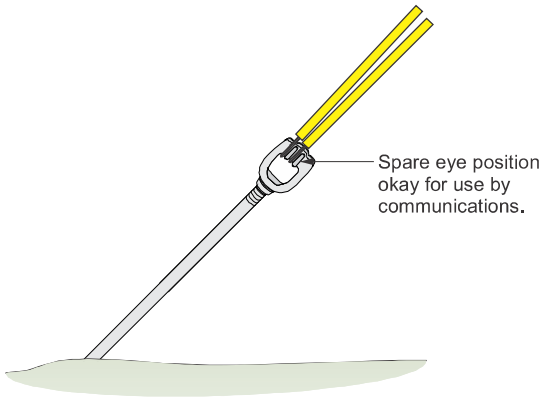
Deadend and Pole Riser

Use deadends on poles where the line angle is greater than 22°. Cutting the cable at a double deadend is not necessary, but allow for 2' of cable on the inside turn of the pole to minimize contact between the pole and ADSS cable.

Anchors and Down Guys

Design and build ADSS systems to the same grade of construction as the distribution line. Provide down guys where cable tensions or pole angles require it. Refer to section 06 of the *Overhead Manual* for requirements.

When the span length for a deadend exceeds 100' in length, it must be guyed and anchored. If there is not an open position on an existing anchor, then a new anchor must be installed. Refer to page 04-02-05 of the *Overhead Manual* for additional information.

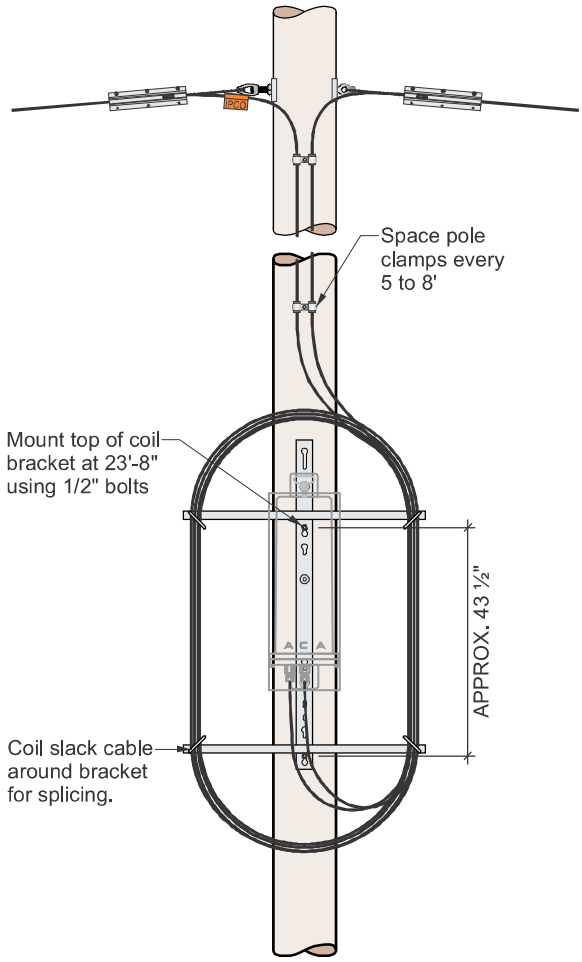


Existing Anchor Attachment

Place guys and anchors before applying tension to the ADSS cable. Install guy guards in high exposure areas.

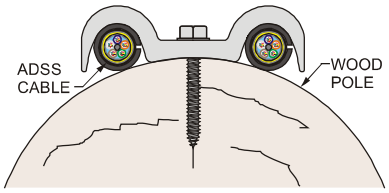
Splice Points

Provide a minimum of 75' of excess cable on both sides of a splice to allow the splicing process to be accomplished on the ground. Refer to page 04-06-04 for splice CU Codes.



ADSS Deadend and Splice Closure

Pole clamps are used to secure the cable to the pole. Place one clamp every 5-8' down the length of the pole.



ADSS Wood Pole Clamp

Spare Cable

Spare ADSS cables are placed on cable storage loops, sometimes called "snowshoes". Install a pair of snowshoes approximately every one-half mile (2500-3000'). Since snowshoes require the use of deadends, consider locations where deadens are already required. Also consider placing spare cable loops where pole damage is more likely such as intersections.

The amount of spare cable required is the length of the longest span plus 100'. This will allow for a cable splice in that section in the event that the ADSS cable is damaged or broken mid-span.

Example. In a section of cable with a maximum span distance of 350' the required length of spare cable is 450'. The snowshoes would be mounted approximately 110' on either side of a pole.

Install cable wraps (Cat ID 53699) every 3-4' along the spare cable to bind it to the tensioned cable. CU Code **FADSSSNO** includes 7 wraps to be installed on the snowshoe.

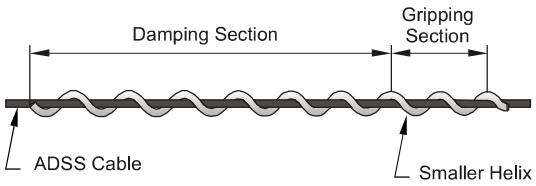
Call for CU Code **FCWADSS** (contains 5 wraps) for every 20' of bundled cable. For the above example, there is approximately 220' of bundled cable, which requires (11)FCWADSS.

CAUTION. Do not over-tighten cable wraps. They should be snug and hold the cable securely, but not crush the cable.

Vibration Dampers

Aeolian vibration is caused by low velocity wind blowing across a cylindrical conductor under tension. Although the vibration will not typically affect the optical or mechanical performance of the ADSS fiber optic cable, it can damage the support hardware.

Use spiral vibration dampers when the cable spans exceed 350' and/or the cable tension exceeds 15% of the cable breaking strength, and there is a prevailing laminar wind 2-20 mph.



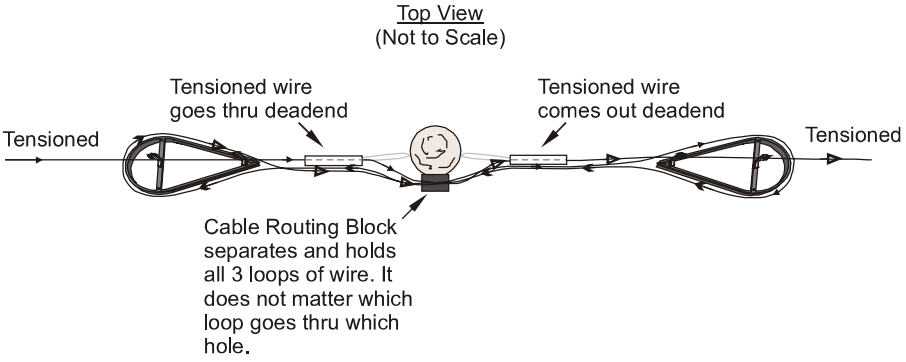
ADSS Spiral Vibration Damper

Vibration dampers can be installed anywhere in the span, but must be at least one hand-width away from each other or support hardware.

Number of Vibration Dampers per Span

Span Length (ft)	Percent of Rated Breaking Strength* 0-10	11-15	16-20	21-25	25+
< 350	0	1	1	2	2
351-600	1	1	2	2	4
601-1000	1	2	2	4	4

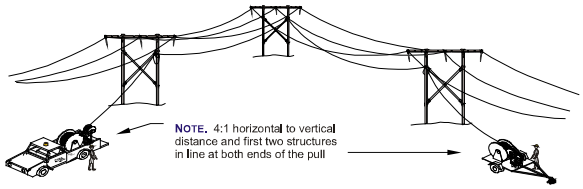
* Take the initial sag tension and divide by the cable's rated breaking strength to determine this percentage



Spare Cable Storage System

Cable Installation

The location of the tensioner and puller relative to the structure must be selected so that the structure is not overloaded. Where possible, a pulling slope of four or five horizontal to one vertical is considered good practice. This ratio will minimize the load on the cable, traveler, and structure.



Equipment Locations

The minimum diameter of the bullwheel (measuring at the bottom of the groove) must be at least 70 times the diameter of the cable. Use bullwheels having semicircular, elastomer lined grooves with depths of 50% or more than the cable diameter, and with a flare angle of 5° to 15° from the vertical center line reference.

Operate the pulling and braking smoothly to prevent any sudden jerking or bouncing of the cable during deployment. Control each system to maintain a constant and even tension and pulling velocity. Use pullers and tensioners that are equipped with tension indicating and limiting devices. Positive braking systems are required for pullers and tensioners to maintain cable tension when pulling is stopped. Fail safe type braking systems are recommended.

Pulling rates of 180 to 440 feet per minute usually provide safe, smooth, efficient passage of cable. Once the cable movement has started, maintain the pulling rate at a constant speed until the cable segment has been pulled into place.

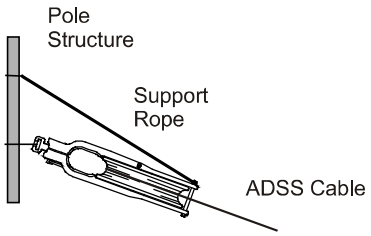
Do not exceed more than one-half the maximum initial sagging tension when pulling ADSS cable. If greater tensions are required, consideration must be given to the fact that when long lengths of cable are pulled, the tension at the pulling end may exceed the tension at the tensioner by significant amounts.

First and Last Structures. The minimum diameter of the sheave must not be less than 21". Larger diameter sheaves are acceptable, and offer some advantages by reducing the radial (crushing) load applied to the cable.

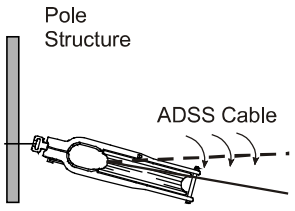
Tangent and Angle Structures. The diameter of the sheaves must not be less than 12" at mid-span suspension points. Where the cable line makes either a vertical or horizontal angle of 20° or greater, the sheave diameter must be 21" or larger.

The minimum radius of the sheave groove must be 0.8" and the minimum depth of the groove must be 0.64". The sides of the groove should flare between 15° to 20° from the vertical, to facilitate passage of grips, swivels, etc. and to contain the cable within the groove.

Do not allow the cable to twist as it is pulled through the sheaves. Due to the light weight of ADSS in relation to most sheaves, and the relative low stringing tensions used during installations, the traveler will require support at the base to help prevent the cable from riding out of the groove of the traveler or excessive twisting during installation.



Properly Adjusted Pulley



Improperly Adjusted Pulley
(Note twist present as cable leaves pulley)

Sheave Adjustment

Monitor cable twisting by using either a cloth "tail" wrapped around the cable, by spray painting a broad and visible stripe on the cable, or by watching the cable markings.

Grounds. Grounding attachments are required when stringing fiber optic cable under energized phase conductors. At a minimum, equip the first and last traveler of a pull with a traveler ground attached to the structure grounding system.

A running ground provides constant contact with the moving cable without excessive tension. Locate the running ground prior to first support structure. The spring tension on the running ground should be adjustable, and the rollers sized for the diameter of cable.

ADSS Hardware CU Parts List

ADSS Fiber Optic Hardware for Wood Poles

CU Code Cat. ID	Description	Manufacturer	Part Number
CU Code FADSSDETEB			
48666	Wedge Deadend, 0.512" ADSS	AFL Telecom	ADEW16-J2AL0512
44108	Thimble Eye Bolt, 5/8"×14"		
5170	Curved Washer, 3"×3"×1/4"		
50333	Adjustable Cable Marker for Overhead		
CU Code FADSSDETEN *			
48666	Wedge Deadend,0.512" ADSS	AFL Telecom	ADEW16-J2AL0512
5346	Thimble Eye Nut, 5/8"		
5170	Curved Washer, 3"×3"×1/4"		
CU Code FADSSTFB			
44187	Trunion Clamp, 0512" ADSS	AFL Telecom	ATGN475/525
4109	Machine Bolt, 5/8"×14"		
5170	Curved Washer, 3"×3"×1/4"		
53251	Square Washer, 2"×2"×1/4"		
14652	Lock Washer 5/8"		
50333	Adjustable Cable Marker for Overhead		
CU Code FCWADSS			
53699	(5) Stainless Steel Cable Wraps	Panduit	MLT4SH-LP
CU Code FADSSWPC			
44192	Wood Pole Clamp, 0.512" ADSS	AFL Telecom	AGW469/561
CU Code FADSSVD			
43017	Spiral Vibration Damper, 0.512" ADSS	AFL Telecom	AVD 462/563
CU Code FADSSWPC			
44192	Wood Pole Clamp, 0.512" ADSS	AFL Telecom	AGW469/561
CU Code FDGKIT			
32924	Guy Wire EHS Kit		
4726	Guy Strain Insulator		
5325	Guy Guard		

* Add to FADSSDETEB for double deadend on tangent poles. For double deadend on angle poles, call for (2) FADSSDETEB.

** Requires double dead end FADSSDETEB and FADSSDETEN along with additional cable wraps FCWADSS for every 20' of bundled spare cable.

Optical Ground Wire Fiber Optic Cable (OPGW)

General Information

OPGW is constructed of aluminum clad steel strands and/or aluminum alloy strands surrounding a fiber unit (core) which contains optical fibers. More information regarding OPGW cables and system design can be found on the T&D Design SharePoint site.

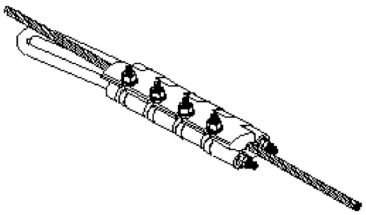
Precautions

Take care to avoid damaging the OPGW during handling and stringing operations. The transmission quality of the optical fibers can potentially be degraded if the cable is subjected to excessive pulling tensions and/or small bend diameters.

Sag and Tension Methods

The methods and procedures for sagging OPGW cables are basically the same as those for normal overhead shield wires. For determining sags, refer to the OPGW cables in the table on page 04-06-02.

Install a temporary grip on the OPGW to tension the cable. The grip must be designed to hold the OPGW without damage, and in particular not pinch the cable or crush the aluminum pipe. Only use grips specified for the diameter of the OPGW cable being installed.



OPGW Temporary Grip

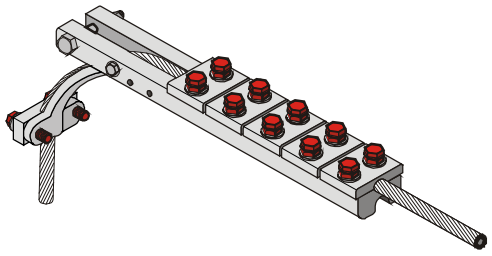
The maximum tension limit on the temporary grip is 5,000 pounds or 50% of the rated strength of the OPGW cable. Two or more grips may be used if tension exceeds 5, 000 pounds and the grips can be attached anywhere along the length of an OPGW.

> **CAUTION.** Other types of grips are strictly prohibited for use on OPGW as they might damage the fiber optic core of the cable. Temporary grips are not intended for use as dead ends and shall not hold conductors at sag tension limits for longer than 6 hours.

Include 3 or 4 temporary grips with each project.

Attachment Hardware

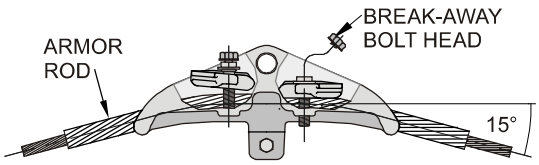
Deadends are installed on OPGW spans that terminate at splicing towers or ends of the system. Use deadends at angle structures when the angles are too great for the use of suspension clamps.



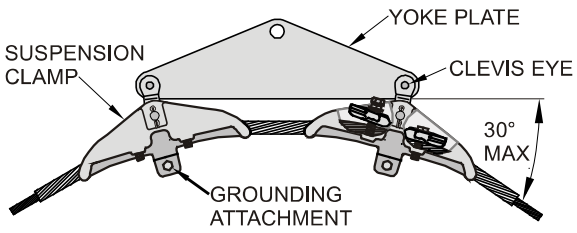
OPGW Bolted Type Deadend

Suspension clamps are normally used at towers where deadends are not necessary. A single suspension clamp can have a maximum of 15° sag below the horizontal.

> **NOTE.** Armor rod is required at all suspension clamps.



Single Suspension Clamp



Double Suspension Clamp

The general rules for suspension clamp uses are:

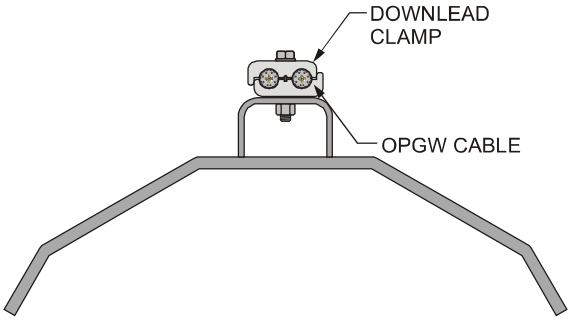
- Use a Single Suspension at structures with line angles less than 30°
- Use a Double Suspension with line angles between 30° and 60°
- Use a Deadend at structures with line angles over 60°

In the instance when double suspensions are not desired, a deadend can be used starting from line angles of 30°.

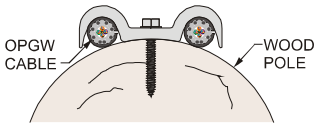
Cable Support Hardware

OPGW Cable Support Clamps. For applications on lattice steel towers, use the **Downlead Clamp** to attach the cable to the lattice steel angle.

Pole Clamps are used to secure the cable to wood poles. Place one clamp every 6-8' down the length of the pole.



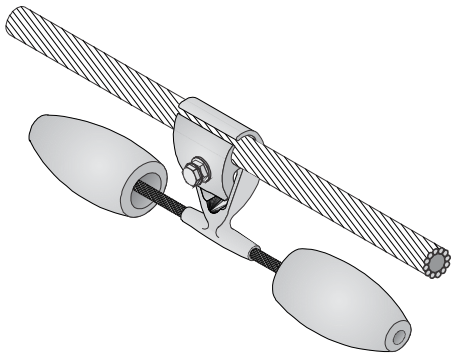
Downlead Clamp



Pole Clamp

Vibration Dampers

Vibration dampers are used on OPGW cable to reduce the effects of certain damaging wind-caused vibrations (called Aeolian vibrations). This section provides some general guidance for applying dampers, but their proper selection and application requires careful engineering.



OPGW Vibration Damper

Where required, vibration dampers may be installed directly to the OPGW cable–armor rods are not necessary. Dampers are typically installed in pairs with the second damper installed at an equal distance from the first damper as the first damper is installed from the deadend or suspension point.

Dampers may be installed at one or both sides of a deadend or suspension. If dampers are installed on only one end of a span containing a single dead end, apply them to the suspension side of that span.

Selective Damping places dampers only on sections of line where the span is subject to damaging vibrations.

The effectiveness of a damper can be reduced through vibration in adjacent, undamped spans even if the vibration in the undamped span is not at a damaging level. Therefore, when applying selective damping, spans adjacent to those spans are recommended to also be damped at the same spacing.

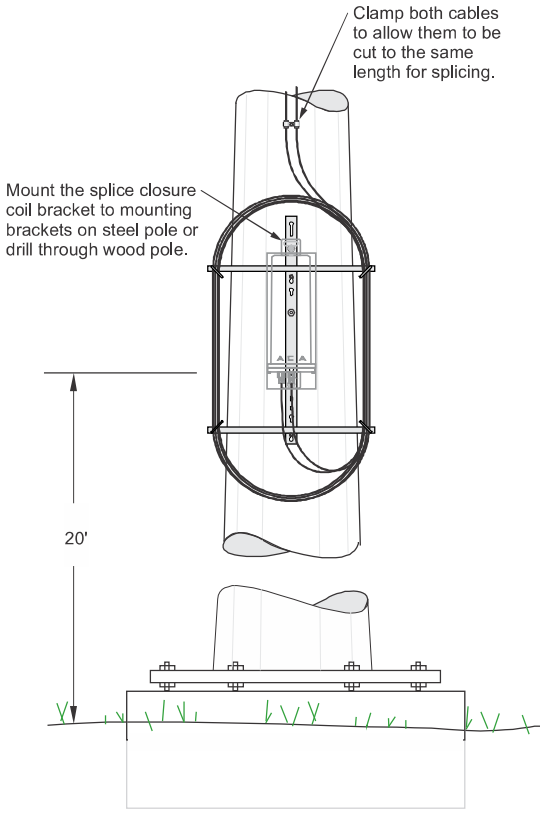
Mid-Span Damping. When dealing with long spans and/or higher tensions, dampening around the structures may be insufficient for protection of the span. Mid-Span damping supplements dampers installed near the suspension points with additional dampers within the span.

The number of additional dampers required for mid-span damping is based on the length of the span versus the maximum span length protected with dampers on both ends. Place mid-span dampers at equal distances apart along the span.

Splice Points

Provide a minimum of 75' of excess cable on both sides of a splice to allow the splicing process to be accomplished on the ground. Note that an additional 15' may be needed to eliminate any stressed cable. Store the excess cable on the pole.

After the cable has been sagged and clipped into its final position, coil the surplus OPGW in preparation for splicing. Make the coils approximately 3-1/2' to 5' in diameter and attach them to the structure to prevent any damage to the OPGW cable.



Splice Closure Mounting to Steel Pole

Re-seal the exposed ends of the OPGW to prevent moisture from entering the fiber units. The cable reel may be supplied with a pair of plastic caps for sealing the cable ends. Electrical tape, RTV silicone, or other means can also be used.

> **CAUTION.** Do not cut the cable under any circumstances without prior approval of the engineer responsible for the design of the project.

Changes to the total number of splice points can potentially degrade quality of transmission of the system. The number and location of splices are usually determined in the initial system design.

When cutting is necessary, do not cut OPGW with ratchet cutters, or other types of tools that could crush the fiber unit. Use a hacksaw so the fiber optic units are free to move within the pipe while being cut.

OPGW Splice CU Codes

Description	CU Code
24 fiber OPGW	TOPGWSPL24
48 fiber OPGW	TOPGWSPL48
24 fiber OPGW to ADSS	TOPGWADSSSPL24
48 fiber OPGW to (2) 24fiber ADSS	TOPGWSPL48-2X24
24 fiber OPGW to AD in substation	TOPGWADSPL24
48 fiber OPGW to AD in substation	TOPGWADSPL48

NOTE. CU Codes include splice closure, coil mounting bracket, bullet guard, pole hardware, splice trays, splice kit, heat shrink sleeves kit and fiber connectors. IPCo M&M Dept

Grounding

OPGW cable must be grounded at every pole or structure. Connect the ground wire to the suspension clamp where available, or use a properly sized ground clamp at deadend structures.

Cable Installation

Use the controlled tension stringing method of installation. Ordinary stringing equipment can be utilized as if installing standard overhead shield wire. Suitable equipment includes pullers, tensioners, reel winders, and stringing blocks.

Use stranded wire pulling lines or nylon ropes rated strong enough to withstand the required stringing tensions with the same direction lay (left hand) as the OPGW to help resist the tendency to rotate under stringing load.

Use a bull-wheel type tensioner with round (not "V") type, polyurethane lined contact grooves. Use a tensioner with two bullwheels, both having multiple grooves to minimize cable damage. The minimum diameter of the bullwheels must be at least 70 times the diameter of the OPGW.

The tensioner must be capable of maintaining the required tensions at various pulling speeds. Positive braking systems are necessary for pullers and tensioners to maintain the tension when pulling is stopped. It is important to monitor the tensions and ensure that excessive tension is not applied as the OPGW passes from the reel to the tensioner.

The maximum OPGW stringing tension (at the tensioner) is 20% of the rated breaking strength of the cable. The maximum recommended pulling speed is 195' per minute.

First and Last Structures. The minimum, required stringing (sheave) block diameter of 40 times the diameter of the OPGW if the pulling line slope is at least three horizontal to one vertical from the traveler to the site. This is based on a sheave through angle of 45° and maximum stringing tension (at tensioner) of 20% of the rated strength of the OPGW.

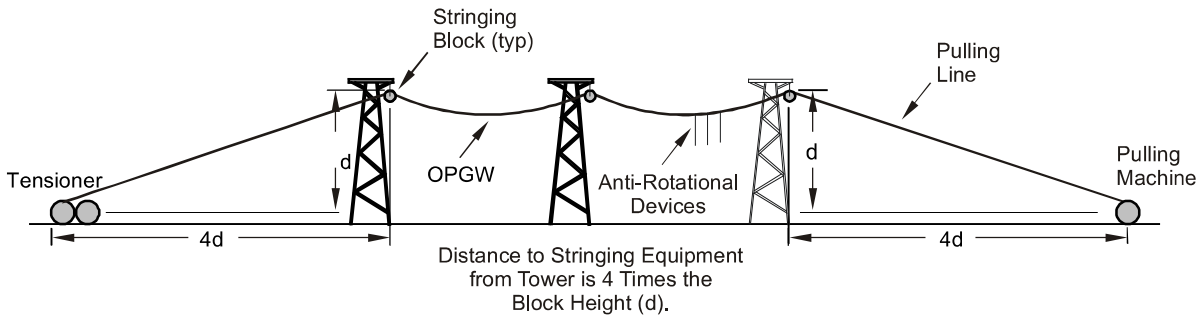
Tangent and Angle Structures. For tangent structures and stringing angles refer to the following table for required sheave diameters:

Minimum Sheave Diameters

Stringing Angle	Sheave Diameter
0° - 20°	30 × OPGW diameter
21° - 45°	40 × OPGW diameter
46° - 60°	50 × OPGW diameter
61° - 90°	60 × OPGW diameter

An Anti-Rotational Device is necessary to prevent the OPGW from twisting while being pulled. Attach the anti-rotational device to the OPGW with a Kellum type grip appropriately sized for the cable diameter and pulling tensions.

OPGW Stringing Method



Typical OPGW Stringing Method

OPGW Fiber Optic Cable Hardware and Catalog IDs

Cat. ID	Description	Manufacturer	Part Number
48-Count OPGW			
40806	Bolted Deadend	AFL Telecom	ODE40/46646G7
16746	Temporary Grip (comealong)	AFL Telecom	OCA640/649
40805	Single Suspension Clamp	AFL Telecom	SUME615/646
51215	Double Suspension Clamp	AFL Telecom	ODSME615/646
28510	Link Plate	AFL Telecom	ODELP15
41657	Downlead Clamp for Lattice to 0.72"	AFL Telecom	ODC601/700B
49366	Downlead Clamp for Steel Pole	AFL Telecom	FDOA-B6B6
41656	Downlead Clamp for Wood Pole	AFL Telecom	OGW562/655
28519	Downlead Clamp with Banding Bracket	AFL Telecom	FDOA-B6B6A
16738	Vibration Damper	AFL Telecom	OVD571/675
51213	Ground Clamp for #2/0 AWG	AFL Telecom	OBCN2W11
51214	Ground Clamp for #6 AWG	AFL Telecom	OBCN2D11
24-Count OPGW			
45871	Bolted Deadend	AFL Telecom	ODE12/62552G8
46444	Temporary Grip (comealong)	AFL Telecom	OCA550/559
45873	Single Suspension Clamp	AFL Telecom	SUME528/555
47603	Double Suspension Clamp	AFL Telecom	ODSME528/555
45872	Link Plate	AFL Telecom	ODELP10
47513	Downlead Clamp for Lattice to 0.72"	AFL Telecom	FDOA-B5B5B
45881	Downlead Clamp for Steel Pole	AFL Telecom	FDOA-B5B5
45875	Downlead Clamp for Wood Pole	AFL Telecom	OGW469/561
46133	Downlead Clamp with Banding Bracket	AFL Telecom	FDOA-B5B5A
45874	Vibration Damper	AFL Telecom	OVD461/570
48050	Ground Clamp for #2/0 AWG	AFL Telecom	OBCF2W11
45880	Ground Clamp for #6 AWG	AFL Telecom	OBCF2D11