Inspecting Outside Plant Projects

John C. Adams, RCDD, OSP

Bicsi Certified Trainer

Owner - Adams Telecomm

Inspecting Outside Plant Projects

- Why do we need to inspect OSP projects?
- What does a QA inspector look for during an inspection of an **aerial** cable project?
- What does a QA inspector look for during an inspection of a **direct buried** project?
- What does a QA inspector look for during an inspection of an **underground** project?

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Why do we need to inspect OSP projects?

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Possible answers

1. It probably wasn't done right
2. It might have been improperly designed
3. It probably has multiple code violations
4. The customer deserves a quality project

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Now that I've been brutally honest and probably created some anger and curiosity, let's see why I made these statements.

Bear in mind, these are my opinions and opinions can't be wrong, right?

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Presenters Experience

- ✓ Involved in the telecom world for 53 years
- ✓ Physically installed aerial, direct buried, and underground systems
- ✓Designed all three methods of placement as an engineer
- ✓Completed multiple QA inspections on all three methods
- ✓Taught numerous OSP classes for Bicsi worldwide
- ✓Subject Matter Expert- Team Leader Bicsi OSPDRM

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And I'm just a grouchy old guy that believes we should all get what we pay for. Nothing less but nothing more

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What are some of the traits a person needs to become an excellent quality assurance inspector?

- ✓ Very knowledgeable about outside plant
- ✓ Passion for perfection
- ✓ Willingness to stand by their findings
- ✓ In depth knowledge and understanding of applicable codes, standards, and methodologies
- ✓ Acutely aware of what the contract requires

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Do you have some of these additional traits?

- ✓ The pictures on the wall of your home are perfectly level and all of them took you hours to install
- ✓ Do you know that all the poles you see as you travel down the road are not all “telephone poles”?
- ✓ Do you point out pedestals, cross connect boxes, drop wires, and terminals to your significant others and give them an explanation of each?
- ✓ Do you stare at manhole covers while you’re on vacation in other countries?
- ✓ Do you explain copper and fiber color codes to your friends just in case a question like that comes up in a trivia game?

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If you answered YES to any of those, you'd probably make a great QA inspector

If you answered YES to all of them, there's still time for you to get some professional help

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Inspecting aerial cabling projects

Strand (messenger)

- ✓ What did the project specify? 6M, 6.6M, 10M ?
- ✓ What size was specified for the down guy (stay)?It might not be the same size as the support strand
- ✓ Was extra high strength (EHS) called for?

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Common Strand (messenger) Sizes

6M-	7.9mm (.311 in)	6,000 lbf
*6.6M-	6.4mm (.252 in)	6,650 lbf
10M-	9.5mm (.374 in)	11,500 lbf
16M-	11.1mm (.437 in)	18,000 lbf

* Extra High Strength (EHS) strand/messenger

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Anchor Types

a) Swamp
b) Screw
c) Expansion
d) Plate
e) Cone

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Anchor Types		Soil Types
a)	Cone-	Hardpan, crumbly damp soil
b)	Screw-	Fine moist, wet, or loose soils
c)	Expansion-	Can be used in most soils
d)	Plate-	Can be used in most soils
e)	Swamp-	Swamps, bogs, and marshes

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Poles- What was specified? What was actually used?

- ✓Species
- ✓Height
- ✓Preservation material
- ✓Required class
- ✓Types

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Poles- What was specified? What was actually used?

Species- Different species have higher fiber strength

- ✓Southern Pine (SP)- 7400 psi
- ✓Western red cedar- (WC)- 5600 psi
- ✓Jack Pine (JP)- 6600 psi

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Poles- What was specified? What was actually used?

Height- Required clearances? Road, sidewalks, driveways

✓Normal pole lengths for telecommunications are:

9.14m (30 ft) 10.67m (35 ft) 12.19m (40 ft) 13.7m (45 ft)

✓Height is usually stamped on the pole

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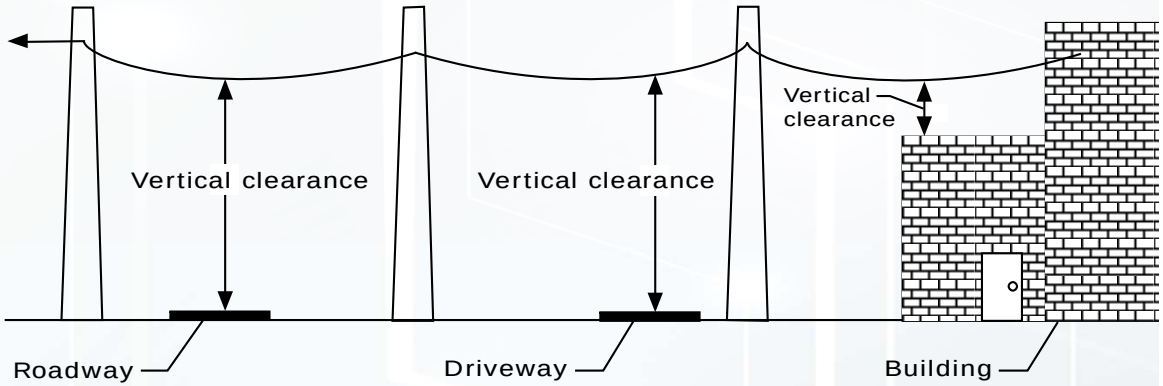
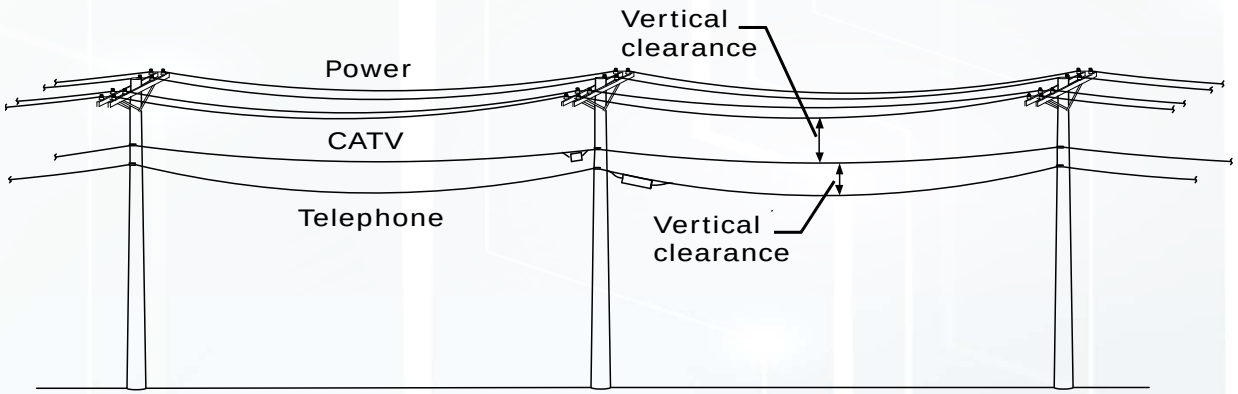
What are some of the required clearances?
Road, sidewalks, driveways, distance from signs

Vertical Clearances over Obstacles

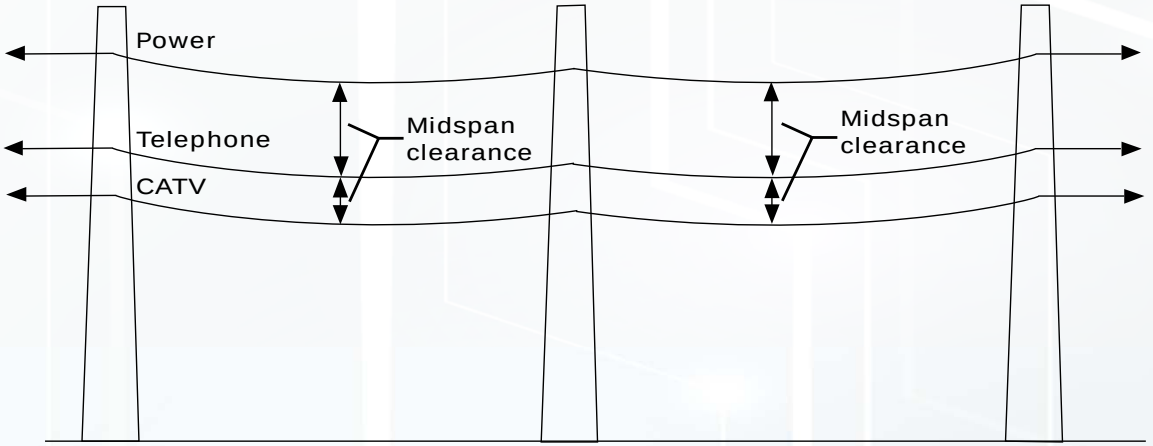


Vertical Clearances between Utilities



CATV = Community antenna television

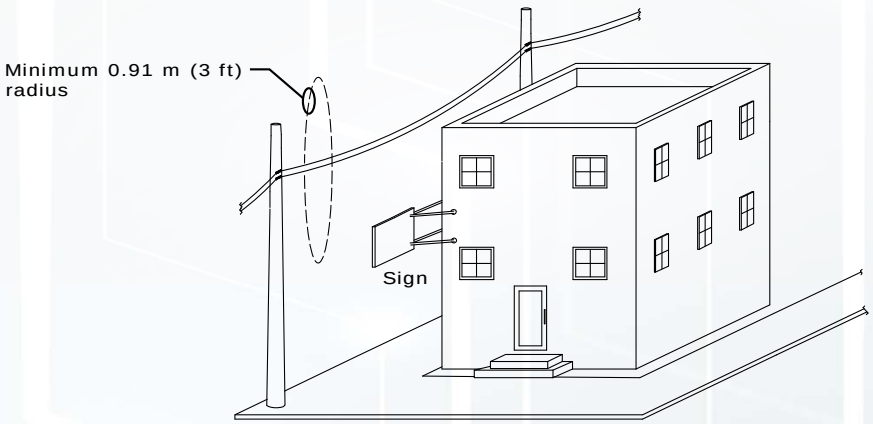
Midspan Clearances



CATV = Community antenna television

Radial Clearances

- The *NESC* (2017) requires a 1.4 m (4.5 ft.) horizontal and a 3.2 m (10.5 ft.) vertical clearance from:
  - Antennas
  - Signs
  - Pole structures
  - Storage tanks
  - Chimneys



ft = Foot
m = Meter

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Poles- Preservatives What was specified? What was actually used?

Types of Preservatives-

- ✓ Pentachlorophenol (Penta)
- ✓ Chromatic Copper Arsenate (CCA)
- ✓ Copper Naphthenate
- ✓ Ammoniacal Copper Arsenate
- ✓ Creosote

You may see the type of preservative stamped on the pole using one, two, or possibly three letters. NOTE-Issues may be raised by environmentalists

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Poles- **Classes** What was specified? What was actually used?

Class of pole- Based on minimum circumference at the top of the pole.
Nine classes are from 1 – 8 and also 10

Normal classes used by telecom

4, 5, 6, and 7

NOTE- Higher numbers indicate smaller circumferences

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Poles- What was specified? What was actually used?

Types of poles-

- ✓Wood
- ✓Concrete
- ✓Steel

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Other inspection items:

- Lashed, overlashed, double lashed
- Maximum span lengths
- Slack span distances, weight of cables, building anchoring
- Bonding and grounding
- Cable guards
- Code violations (distance between power at the pole and at midspan)
- Spacing between individual telecom cables

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Inspecting direct buried cabling projects

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Inspecting direct buried cabling projects

What's the difference between buried and direct buried?

What's the difference between either one of those terms and underground?

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Inspecting direct buried cabling projects

What's the difference between buried and direct buried?

None whatsoever

However, direct buried helps to explain the difference between buried and underground.

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Inspecting direct buried cabling projects

Direct buried cables are in “direct” contact with the ground (earth).

Underground cables are not in “direct” contact with the ground (earth)

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Now that you're directly buried with too much information, let's see what we need to inspect

Inspecting direct buried cabling projects

Inspecting Outside Plant Projects

Inspecting direct buried cabling projects

Direct buried cable can be placed using several placement methods:

Trenching

backhoe, chain trencher, hand digging, horizontal directional drilling (HDD), auger boring, etc.

Plowing

Using a vibratory plow, static plow, or rip plow

Rock Saws and other specialized equipment

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Inspecting direct buried cabling projects

Depth of the cable- What was required? What did you get?

- Copper cable depth ranges from 610mm (24 inches) to .919mm (36 inches) and possibly 1.22m (48 inches)
- Fiber optic cable depth ranges from 1m (39.37 inches) to 1.22m (48 inches)
- Did you dig it up to verify you got the right depth?
- “almost” measurements are a common occurrence

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Inspecting direct buried cabling

Types of fiber optic cable-
Armored, non-armored, filled, non-filled.

Did you get what you asked for?

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Fiber optic cable -

- Indoor/outdoor, loose tube, tight buffered
- Armored and non-armored
- Armored is recommended by most OSP designers
- Does the cable contain Kevlar or is it aramid yarn

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Inspecting direct buried cabling projects

Copper cable- filled, non-filled, gauge, number of pairs, solid or foam pair insulation, sheath type, jacket, and shield types

- ✓On the outer jacket, verify the manufacturer's code meets what you specified
- ✓Physically look at the cable with the jacket removed

These same inspection items could apply to aerial and underground as well

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Inspecting direct buried cabling projects

Above ground housings/terminals-

- ✓ Pedestals- Were the dimensions/colors/shapes used that were specified?
- ✓ Cross connect boxes- Colors, maximum number of pairs, placed on concrete slabs
- ✓ Adequate space for fiber optic splice cases and compliance to bend radii
- ✓ Termination blocks used matched the specifications
- ✓ Are they properly supported? Are they straight?
- ✓ Gravel and/or moisture barriers placed?

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Ground Restoration-

- ✓Dirt level and properly compacted?
- ✓Grass seed placed? Hydroseeding/mulching? Hay?
- ✓Sod removed and replaced? Same type of sod that was removed? Watered?
- ✓Rocks removed?

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Surface Restoration-

- ✓All concrete cracks and damage properly repaired/replaced? Original thickness? Rebar placed?
- ✓Asphalt/Blacktop replaced or repaired? T cuts used? Dips or ruts leveled as much as possible?
- ✓Proper backfill of trenches as dictated in the contract

These items also apply to underground system placement

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Inspecting direct buried cabling projects

Cable route markers and warning tapes

- ✓Were above ground marker posts required? Were they placed according to the contract specifications? What do they indicate?
- ✓Were warning tapes required? What size? What depth were they to be placed at? What should be noted on the tape? Is it metallic/toneable? What color?

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Let's go underground!

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Maintenance hole with splayed entry of conduits

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Inspecting underground cabling projects

Maintenance Holes (MH)-

What type was required? What type did you get?

- ✓Type A- Both end walls only
- ✓Type J-3- Both end walls and one side wall
- ✓Type J-4- Both end walls and both side walls on the same end
- ✓Type L- One end wall and one side wall
- ✓Type T- One end wall and both side walls on the same end

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Maintenance Holes (MH)-

What type of MH is this?

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Maintenance Holes (MH)-

Racking and Hangars-

- ✓How many racks per wall were required? How many were placed? Some specs call for 5 on the long walls and 2 on the short walls
- ✓How many hangars were needed to properly support the cables? How many extra hangars were specified?

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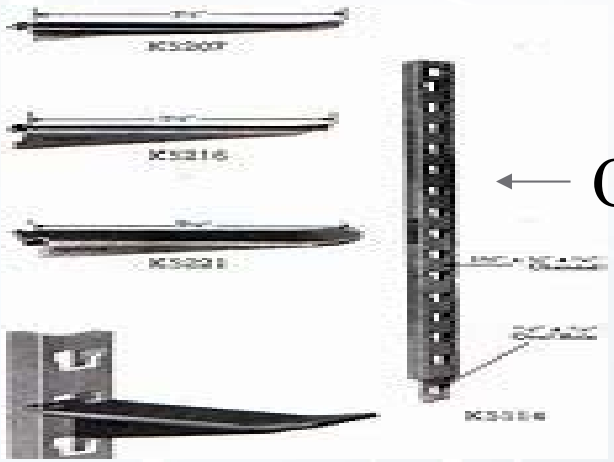
Cable Hangars

Assembled Units



Cable Racks

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Maintenance Holes (MH)- Inspection items

- ✓Is the frame and cover the correct size
- ✓Collar(s) are the correct size and have
- ✓Were bolt down frames and collars req

Hinged Frame and Cover

Concrete Collar

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Maintenance Holes (MH)- Inspection items

- ✓Frame and cover is the correct size
- ✓Collar(s) are the correct size and have no overlaps
- ✓Were bolt down frames and collars required?
- ✓Is the MH placed at the right grade level as specified?
- ✓Does the distance between MHs exceed the specified lengths?

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Maintenance Holes (MH)- Inspection items

✓Properly rated MH placed?

H-5- Pedestrian traffic

H-10- Sidewalk applications and occasional non-deliberate traffic

H20- Deliberate heavy vehicular traffic

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Conduit- Items to inspect

- ✓Is the type correct? SCH 40, SCH 80, DB60, DB120, EB35
- ✓Is the size of the pipe correct? Inside and outside diameters
- ✓Are bends accomplished correctly?
- ✓Were spacers specified?
- ✓Was concrete encasement specified? Slump and psi?

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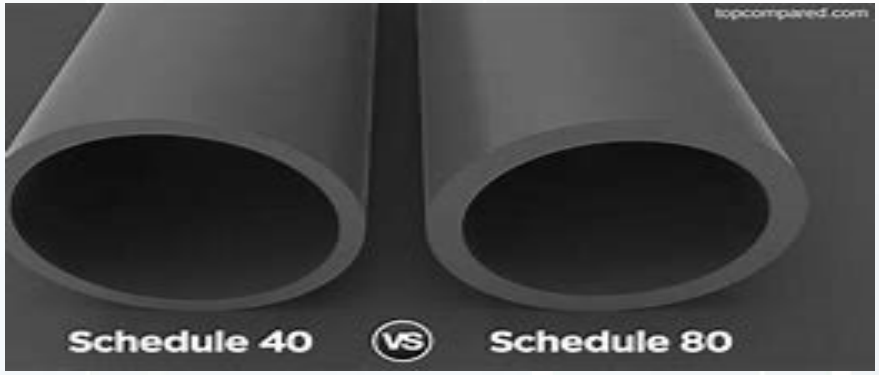
Conduit- Items to inspect



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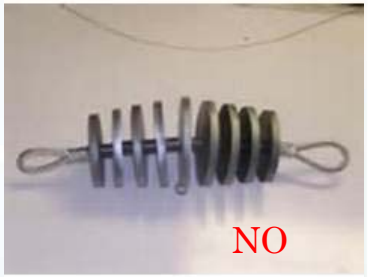
Conduit- Items to inspect

✓Was each conduit tested with the proper size mandrel?

Mandrel Testing

Correct Mandrel Used ?



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Conduit- Items to inspect

- ✓Proper depth of conduit?
- ✓Were tie downs required for concrete encasement?
- ✓Was the proper backfill used? Aggregate size?
- ✓Was each conduit tested with the proper size mandrel?
- ✓Were minimum spaces between your conduit and those of others maintained?
- ✓Were the new conduits placed at the lowest level?

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Hand Holes (HH)- Inspection items

- ✓Were incoming and exiting conduits placed on the proper walls?
- ✓Number of conduits in and out exceeded? Industry recommendation is no more than three in and three out
- ✓Are splice cases placed in the HH?

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Hand Holes (HH)- Inspection items

- ✓ Correct number of cable and hangers placed?
- ✓ Drainage previsions?
- ✓ Does the handhole exceed industry recommendations or contract language?
- ✓ Handhole material correct? Concrete, polymer, composite materials

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Safety Inspections-

- ✓Proper shoring, sloping, or stepping of trenches
- ✓Confined space entry practices being used
- ✓Hard hats
- ✓Safety glasses
- ✓Vests

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Safety Inspections-

- ✓Traffic control
- ✓Signs, cones, barricades, and taped off areas
- ✓MH testing
- ✓Proper clothing
- ✓Continuous ventilation? Monitoring?
- ✓Adherence to local safety policies of the customer

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Maintenance Holes (MH)- Inspection items

- ✓Sump hole placed/positioned with correct dimensions?
- ✓Number of racks placed? Number of cable hangers placed?
- ✓Was a grounding halo placed if required?

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Maintenance Holes (MH)- Inspection items

- ✓Pulling irons properly placed per specifications?
- ✓Were conduits required to be sealed?
- ✓Are holes available in the floor for placement of ground rods?
- ✓Were ground rods placed and properly bonded to metallic components?

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- ✓Were conduit terminators required? For each conduit?
- ✓Is there a gap between the conduit and the terminator?
- ✓Was that gap filled in?

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- ✓Were innerducts specified? Were they actually placed?
- ✓What size of innerduct? Material type? Fabric or plastic?

HDPE Innerduct

Fabric Mesh Innerduct

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- ✓Bicsi recommends a maximum of two 90 degree bends or a total of 180 degrees between any two pulling points. What was specified on your projects? Was it exceeded?
- ✓Did you include the sweep that comes up through the floor when entering the building?

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Inspecting OSP projects

<u>General items to inspect on all projects:</u>

Grounding (earthing) connections

Safety practices during installation

Safe equipment

Proper use of equipment

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Inspecting OSP projects

<u>General items to inspect on all projects:</u>

Grounding (earthing) connections

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Inspecting cabling projects

General items to inspect on all projects:

Respect for the owners employees and property

Staging areas are kept neat and orderly

Marking of existing utilities (correct type of paint, colors, and flags)

Compliance to tolerance zones while excavating

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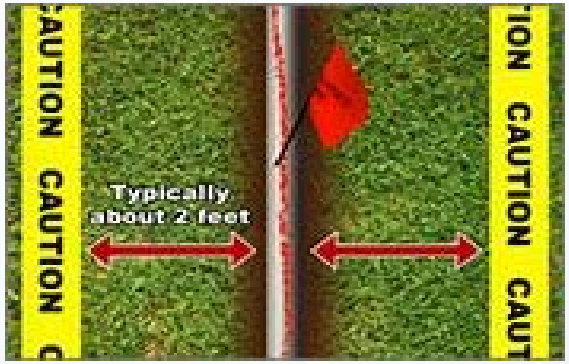
Inspecting OSP projects

<u>General items to inspect on all projects:</u>

Compliance to tolerance zones



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General items to inspect

- ✓Splice closures are properly supported
- ✓Splice closures are bonded
- ✓Splice closures are filled, pressurized, or non-re-enterable
- ✓How much air pressure was used to pressure test the splice case for air leakage?

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General items to inspect

- ✓Were there any historical areas? Were they properly handled?
- ✓Were there any environmentally sensitive areas? How were they handled?

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General items to inspect

- ✓Were incoming “exposed” cables protected?
- ✓What type of protection modules were used? Specified?

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General items to inspect

- ✓What type of protection modules were used? Specified?

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General Items to Inspect

What type of protectors and protector modules were used? Specified?

Units are sometimes referred to as:

- ✓Protected Entrance Terminals (PET)
- ✓Building Entrance Terminals (BET)

A PET or BET is a two part system

Protected Entrance Terminals

Building Entrance Terminals

5 Pin Surge Protection Modules

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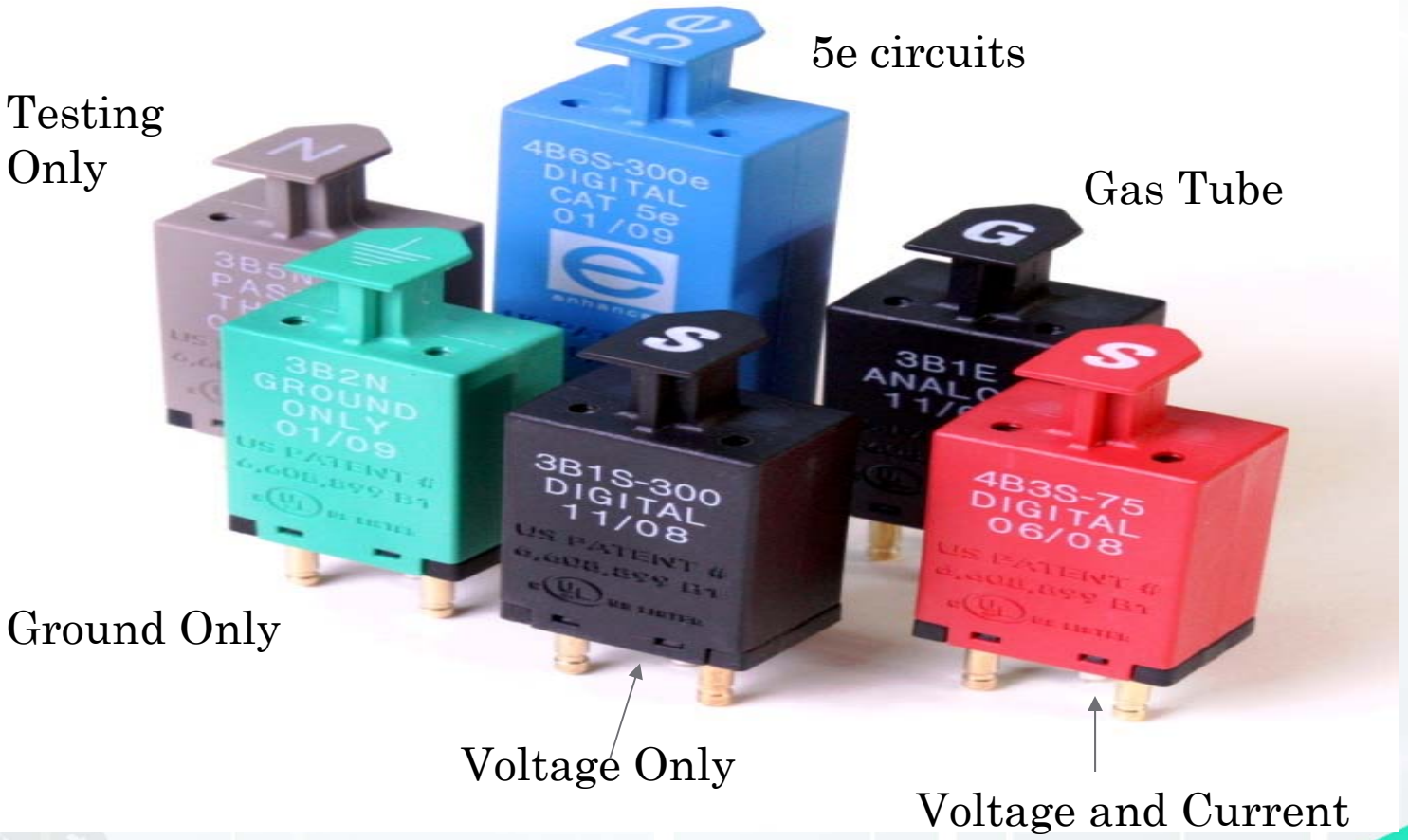
5e circuits
Testing Only
Gas Tube
Ground Only
Voltage Only
Voltage and Current
5e
4B6S-300e
DIGITAL
CAT 5e
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Summary of slides:

1. OSP is inherently dangerous. Use safety practices, equipment, and codes wisely
2. Codes, standards, and methodologies vary greatly. But, general installation practices are quite similar
3. As you can tell, GOOD quality assurance inspectors have very few friends

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Summary of slides:

DID I COVER EVERYTHING ?

NO

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THANK YOU VERY MUCH
FOR
YOUR ATTENTION

Hopefully, everyone learned a few things

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