DISTRIBUTION LINE APPRENTICE LEVEL 400

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CF50575/Install PVC Conduit/CF50575/pdf-ppt/07-10-2012

SLIDE 1: Install & Repair PVC Conduit

Revision 1-01

Revision Date 07/10/2012

Module CF50575

Revised by Walt Roberts

Reviewed by (SME) Kirk Gomez

Approved by Tim Golden (Supervisor)

SLIDE 2: Install & Repair PVC Conduit

Instructor Notes:

Introduce the module to the students

The purpose of this training is to install and repair PVC conduit to insure that it meets Entergy URD specification and that it is done in a safe manner.

1. Discuss entire presentation in classroom – classroom lecture and hands-on
2. Ask questions as necessary throughout the class-
3. Take Written Exams at the end of the module with a passing grade of 80%
4. After the training is completed we will go outside for hands-on activity and perform competency test

Materials:

Handout—Trench Details and Street/Driveway from conduit and related materials

1 Can PVC cement

1 Repair piece 2"

2 Cable Ties

2 Couplings

Tools:

- Hammer
- Hacksaw or conduit saw
- Nylon String
- 6' Ruler
- Shovel
- Pry Bar
- Trencher

SLIDE 3: OBJECTIVES:

Discuss Safety Considerations

Demonstrate How to Use PVC Cement

Demonstrate How to Store PVC Cement

Demonstrate How to Cut PVC Using Saw or String

Demonstrate How to Install Conduit

Demonstrate How to Repair Conduit

Demonstrate How to Install a Repair Sleeve

Demonstrate How to Plug or Cap Conduit When Required

Terminal Objectives:

Given a job to install PVC conduit, install the conduit in accordance with Entergy's Underground **Specification Manual**

Given a broken PVC conduit, repair the conduit in accordance with Entergy's Underground Specification Manual

SLIDE 4: Safety

Instructor Notes:

Get the students to open the safety manual – talk about applicable sections and clues based on subject matter. Have students participate by reading the rules out of their safety manual

Specific Rule numbers to discuss: 9.1, 9.5, 9.6, 9.14, 9.15, 9.52-55

Materials:

Entergy Safety Manual

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

Question: What is PVC Conduit?- Polyvinyl chloride- PVC is widely used in construction because it is durable, cheap, and easily worked.

Reminder from level 200 module CF50573: PVC conduit comes in 10-foot sections bell end on one end and ranges from 3/4" in diameter to 6" in diameter. The major use for PVC conduit in Entergy's distribution system is to provide an underground passage for conductors. Most common wall thickness used in utility construction is Schedule 40 and Schedule 80. Schedule 80 is used where additional protection (road crossings) or rigidity (dip poles) are required.

SLIDE 5: Prerequisites

One Call

Right of Way and street cleared and final grade completed

Entergy Standards: Trench Details for depth

Bottom of trench: Free of loose rock and debris

Conduit:

PVC—Schedule 40 depths of 12 to 30 inches

Steel—depths of 6 to 12 inches

Backfill: Within 12 inches of the cables shall be clean backfill or sand

Tamping: Mechanical may be needed in some areas

Instructor Notes:

Most of these prerequisites will be discussed in more details in the trenching module

Materials:

Handouts – URD Spec book – Handout 1 – Trench details # UG0502011, Handout 2- Street and driveway crossing # UG0601011

SLIDE 6: PVC Cement

Cements/Glue should be stored in a cool place except when actually in use

Has a limited shelf life

Solvent cements are toxic, flammable and hazardous

Manufacturer precautions should be followed

Instructor Notes:

Storage: Solvent cements should be stored in a cool place except when actually in use at the job site. These cements have a limited shelf life when not stored in a sealed container.

Precautions: Solvent cements are toxic, flammable and hazardous. The manufacturer precautions should be followed

SLIDE 7: CUTTING PVC CONDUIT

Nylon String or Hacksaw

Cutting exposed PVC pipe conduit that is buried in a ditch may be easier to use a string instead of a hacksaw or a conduit saw.

If using a hacksaw make sure all the burrs are removed before attaching to conduit or couplings.

Instructor Notes:

Nylon String: You do not have to dig a big hole to cut a piece of plastic PVC pipe that is buried, instead just dig around it just enough to slip a piece of thin nylon string under the pipe.

Hacksaw: De-burring the ends: Remove the burr from the cut ends of the PVC pipe. De-burring the end/ends make the pipe slide into the fittings easier.

Clean the ends that were cut. (Files used can be called either a rat tail file or a bastard file to remove burrs.

SLIDE 8: Cutting PVC with Nylon String

- Dig just enough to slip a piece of thin nylon string under the pipe

- Wrap the string around the conduit one full time
- With the two ends of the string in separate hands, pull the string ends back and forth until the conduit is cut

The friction will cut the PVC cleanly

- If the string gets wet, then the string will not produce enough friction to cut into the conduit

Instructor Notes:

Nylon String: You do not have to dig a big hole to cut a piece of plastic PVC pipe that is buried, instead just dig around it just enough to slip a piece of thin nylon string under the pipe.

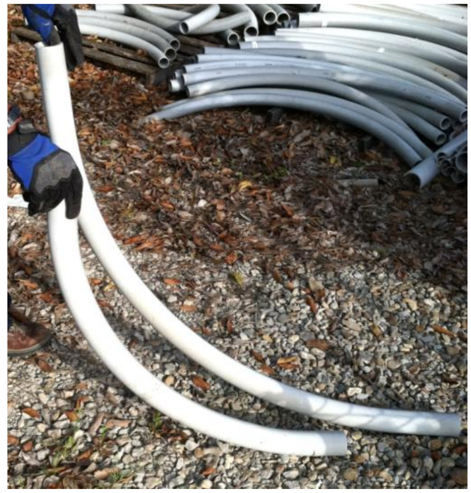
Wrap the string around the conduit one full time.

With the two ends of the string in separate hands, pull the string ends back and forth until the conduit is cut.

The friction will cut the PVC cleanly as quickly as a hacksaw and does not require the space.

If water is present in the cutting area, and the string gets wet, then the string will not produce enough friction to cut into the conduit.

SLIDE 9: Install PVC Conduit

- Plan the route from point of feed (pedestal, URD dip or URD transformer) to meter point
- 45 and 90 degree elbows will be installed when making bends
- If more than three 90 degree bends are installed a pull box is required
- Measure the distances needed for each section of conduit

Instructor Notes:

Make sure you let them know that One Call always has to be called before you digging.

It is important to understand that pulling in wire depends on the number of bends, so look for options which will minimize bends.

Typical conduit sizes for residential applications 2½" diameter, but can be up to 6" in diameter. (Arkansas allows 2" for #4 – 4/0 Al Triplex)

The conduits shall be installed such that when the conduit run has more than three 90-degree bends, including riser bends, (riser bends shall be 36 inches in radius), a pull box shall be install.

SLIDE 10: Install PVC Conduit

With the help of a coworker, layout the route

Dry fit the conduit and coupling

Note: Extreme care should be taken not to gouge or flatten the conduit end

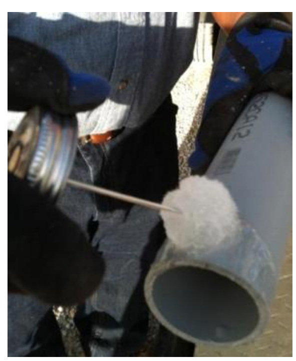
Instructor Notes:

To make it easier, laying out the route will save time.

Test fit the joint: Wipe both the outside and the inside of the fittings with a clean dry cloth to remove foreign matter. Measure and mark with pin the depth of the fitting on the outside of the conduit to be cut to indicate when the conduit end will be bottomed out.

Note: Extreme care should be taken not to gouge or flatten the conduit end

SLIDE 11: Install PVC Conduit



Disassemble

Joints should be cleaned and burrs removed

Apply PVC glue

Insert the conduit into the fitting until it bottoms at the fitting shoulder

Give the pipe a quarter turn twist and let it set for 10 minutes

Instructor Notes:

Disassemble

Before applying cement the surfaces should be wiped clean and free of dirt, oil, grease or moisture and any burrs removed using a life or sandpaper.

Apply PVC cement: apply a thin uniform coating of cement to the inside surface apply light enough to prevent the formation of a bead of cement at the interior shoulder of the fitting.

Next apply a full, uniform coating of cement to the outside surface of the conduit to the depth of the fitting.

Reassemble the unit giving the pipe a quarter turn twist and let this set for 10 minutes

Extremely hot jointing areas (above 90° or hot to the touch) should be cooled prior to cement application.

Hold the conduit in place for about 1 minute to prevent backing out in the case of tight interference fit joints.

Handle the newly assembled joints carefully until the cement has gone through an adequate set time.

Note: Joint damage or loosening may occur up to 48 hours after assembly in temperatures below 40° F if the joints are severely stressed.

SLIDE 12: Repair PVC Conduit

There are several methods to repair damaged conduit

In the next few slides we will discuss these methods

Instructor Notes:

None

SLIDE 13: Repair PVC Conduit

- Break is located
    - make sure all the hazards have been removed
- A backhoe may be used to remove the bulk of dirt
- The dirt around the conduit should be removed with a shovel

Instructor Notes:

We are going to look at the steps to repair a damage conduit

Always clear an area big enough to work in around the damaged conduit

SLIDE 14: Repair PVC Conduit

- Cut off the damaged ends, making all the cuts smooth & square
- Use a hacksaw, conduit saw or nylon string
    - Be careful not to damage the cable with your cutting tool
- Cut repair sleeve to length, allow a minimum of 4” to overlap each end
- Install repair sleeve over conductor and conduit

Instructor Notes:

- Be careful not to damage the cable with your cutting tool.
- Any damage to the concentric neutral wires or insulation/insulation shield can result in future failures.

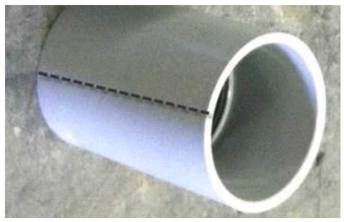
If you don’t have tongue and grooved in stock, one can make a repair sleeve by splitting a piece of PVC in half.

Apply PVC cement to seams and overlaps of repair sleeve.

Secure with plastic tie straps, plastic tape, or copper tie wire.

SLIDE 15: Repair PVC Conduit






- Measure the distance between the ends
- Cut repair sleeve one inch shorter than this measurement
- Take two couplings and split (cut) only one side on them (can also use already split couplings)
- Slide couplings over the existing conductor
- Slide over the existing conduit

Instructor Notes:

Splitting the couplings may allow you to open them up enough to go over the existing conductor and then slide them over the existing conduit by opening them up a little more.

Easier method may be to use the couplings that are already split.

If using the split couplings will need to put PVC cement on the ends and attach to existing conduit/new conduit.

Cable ties can be used to hold coupling together while the glue dries.

SLIDE 16: Plug PVC Conduit

Sealing the conduit opening may not be required in all installations, but there may be locations that require sealing of the conduit ends

a. Keep dirt out of the conduit
b. Keep rodents out of the conduit
c. Sealing of conduit used in dip pole applications to prevent water accumulation.
d. Sealing of the conduit will not require any additional de-rating of the cable's ampacity.
e. Duct seal should not come into contact with the semi-conductive insulation shield of the cable.

Instructor Notes:

a. Dirt entering the conduit, which clogs the conduit up, makes installation or removal of the cable difficult. Ants may build up their mounds in the cable compartment.
    a. Conduit terminating in pull boxes should be sealed as they apply to the same condition.
b. Concern particularly with service dip poles that have a total conduit system to the customer. The humid environment caused by water in the conduit may cause corrosion of the contact assemblies of the customer's meter/breaker panel. For these applications use either a duct seal or a mold rubber end cap.
c. The duct seal is an oil base sealant that can deteriorate the semi-conductive shield.

SLIDE 17: Cap PVC Conduit

Capping of conduit

In the event that there is some time delay between the installation of conduit and the pulling in of cable, the conduit ends should be capped.

Instructor Notes:

Capping reduces the risk of dirt, rodents, or foreign debris from clogging up the conduit.

Pictures are 2 of the caps on standards.

SLIDE 18: Questions

Instructor Notes:

Materials: None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 19: Next Steps

The following steps are required to receive credit for this Module

Locate and take the exam on web

Print the exam results and provide to your instructor

Complete the hands-on competency test administer by the instructor

Check with your instructor if you have any questions

CF50609/Prepare and Operate Pad-mounted Switchgear/CF50609/ PDF-PPT/07-05-2012

SLIDE 1: Operate Pad Mounted Switch Gear

Revision 1-01

Revision Date 07/05/2012

Module CF50609

Revised by djames2

Reviewed by (CMPD)Walt Roberts

Reviewed by (SME) ________________________

Approved by Tim Golden (Supervisor)

SLIDE 2 Operate Pad Mounted Switch Gear

Instructor Notes:

This Module covers the basics of Dead Front and Live Front switching cabinets and some examples of how to operate a switch and remove a fuse from a cabinet. There are probably many more style of switching cabinet designs out there than what this module covers.

Teaching Points:

Put all of these in the order they should be presented.

WIIFM - What's In It For Me....understanding how switching cabinets operate will help keep you from making a switching error and dropping customers unintentionally. The complexity of Underground network switching far exceeds that of overhead switching because virtually every piece of underground equipment can be a switching point. You will learn the basics of how switching cabinets work in this module, this will help you on your way to understanding the pieces that comprise an entire underground network.

Material:

Switch sticks

Grappler Tool

Live Front Switching Cabinet

Dead Front Switching Cabinet

SLIDE 3: OBJECTIVES:

Given an Underground Switching Cabinet Demonstrate the Operation of a Three Phase and Single Phase Switch

Given a Live Front Switching Cabinet remove and Replace a Fuse using the Grappler Tool.

Instructor Notes:

Formal objectives above. In simple terms describe what the students will be learning. This Module is to get the students familiar with switching cabinets design, components and how they operate. This module is not intended to teach switching procedures.

Materials:

- None

Teaching Points:

WIIFM - What's In It For Me: Start a discussion about why it is important to understand how to switch.

- What do you know about underground circuits?
- What do you know about underground switching?
- Would you think it is important to know how an underground switch works?
- What are some of the equipment/devices that are used in a underground circuits?
- Operating Experiences (near misses, incidents.) Tell your own story about having to deal with underground circuits.
- Wrap-up (if needed)

SLIDE 4: Safety

Below are the rules specifically for underground switching. There are other rules associated with underground work that will be covered in other modules.

Instructor Notes:

Get the students to open the safety manual – talk about applicable sections and clues based on subject matter.

Specific Rule numbers to discuss – (not rule text)

- 3.38, 9.3, 9.7, 9.9, 9.11,

Materials:

- Entergy Safety Manual

Teaching Points:

Put all of these in the order they should be presented.

- Questions to promote discussion
- Key Information
- Operating Experiences (near misses, incidents)
- Wrap-up (if needed)

SLIDE 5: Switching Cabinets

There are two major categories of switching cabinets

DEAD FRONT

What do you think the term Dead Front means?

LIVE FRONT

What do you think the term Live Front means?

Instructor Notes:

- Explain what a dead front switching cabinet is….See Teaching Points
- Explain what a Live Front switching cabinet….See Teaching Points

Materials:

- None

Teaching Points:

Dead Front

What do you think the term "Dead Front" means?

Explain: Dead Front cabinets have insulated Cables and terminations. Underground cables are not like an overhead insulated conductors, remember the Underground cables have a concentric neutral that is grounded at both ends. What you see when you open the doors are insulated and grounded components. The Cables are terminated with insulated elbows and connected to the bushings in the switch cabinet. There are no exposed conductors in a dead front switching cabinet.

Live Front

What do you think the term live "Live Front" means?

Live Front cabinets have exposed conductor, switches, fuses, bus work, etc…. Shielded insulated cables are used in a Live Front cabinet the difference is in how they are terminated. Termination is very similar to what you would see on an underground dip pole. What you would see when you open the doors is components that are not insulated. Approach distances must be maintained when exposed to energized components.

- Operating Experiences (near misses, incidents)
- Wrap-up (if needed)

SLIDE 6: Dead Front

Instructor Notes:

The slide pictures a Dead Front switching cabinet. Let the students look over the handout, answer any questions.

Materials:

- Handouts: Dead Front Pad mounted Sectionalizing Equipment Detailed Specification

Teaching Points:

- **Dead Front Pad Mounted Switchgear**- an assembly in which all energized parts are insulated and completely enclosed within a grounded shield system. If you look at the picture you will see insulated connectors and shielded underground cable. The shielding from the cables are grounded in the switching cabinet.

SLIDE 7: Dead Front

Instructor Notes:

The slide pictures a Dead Front switching cabinet. You can clearly see the cable shielding connection to ground.

Materials:

- None

Teaching Points:

- Everything in the cabinet is clearly labeled. You should be able to see that the switches can be operated with a insulated stick. Right in the middle and a little above the switches is a gauge indicating the SF6 Gas pressure. SF6 or Sulfur Hexafluoride is a gas that has very good insulating properties.

Questions to promote discussion

SLIDE 8: Live Front

Instructor Notes:

Picture on the slide is Live Front Pad Mounted switch gear. Get the students to look through the handout. Answer any questions.

Materials:

- Handouts: Three Phase Air Insulated Pad Mounted

Teaching Points:

- Notice, this live front cabinet has covered compartments and arc shields separating the phases. Also there are separate compartments for each switch.

SLIDE 9: Live Front (Switches)

Instructor Notes:

Here you can see the open air switches in the Live Front Cabinet.

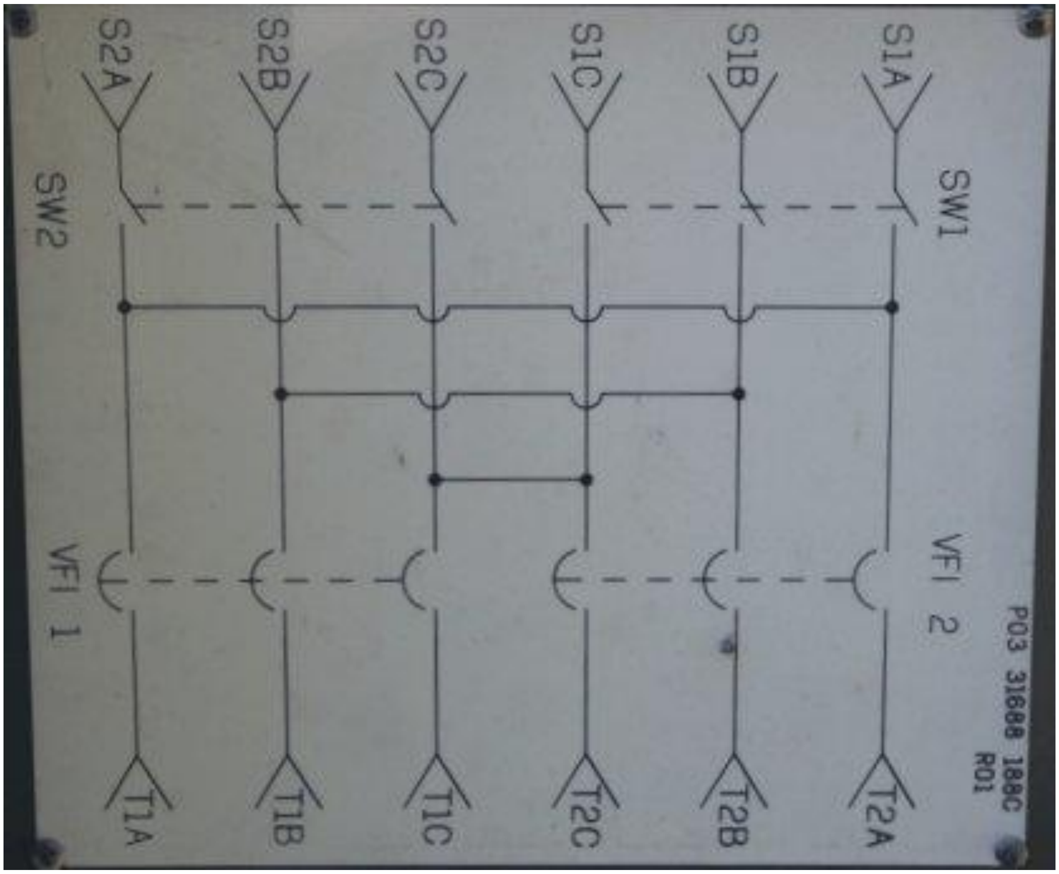
Materials:

- None

Teaching Points:

- Questions to promote discussion
- Key Information
- Operating Experiences (near misses, incidents)
- Wrap-up (if needed)

SLIDE 10: Cabinet Configuration



Cabinets come in in different Configurations

Instructor Notes:

The picture on the slide is one the switch configurations that is used at Entergy. Talk about this diagram of an actual switching cabinet in the Woodlands, Texas network. Get the students to look at the handouts.

Materials:

Handout: Dead Front Pad mounted, Live Front Configurations, Dead Front Configurations, Live Front Configurations

Teaching Points:

- Both type of cabinets dead and live front come with several configurations for switching.
- This the diagram that is located on the inside of a Dead Front SF6 insulated switching cabinet door.
- SW1 and SW2 are source side switches (meaning the main loop) and are gang operated denoted by the dotted lines.
- VF1 and VF2 are Vacuum Fault interrupter switches and are gang operated. They can also

be designed for each phase to operate independently. These 2 circuits would feed pad mounted transformers in a neighborhood and will trip if a fault occurs on the circuit. They are not designed to automatically reclose.

- Key Information
- Operating Experiences (near misses, incidents)
- Wrap-up (if needed)

SLIDE 11: Switch Operation Compartment

Instructor Notes:

Pictured in the slide is the compartment where you would operate a three phase switch.

Teaching Points:

Put all of these in the order they should be presented.

- This the compartment located usually on the side of a switching cabinet where you would operate a three phase underground switch. They will be clearly labeled with the switch number on the outside of the switching cabinet close to the switch compartment.
- PPE is required when operating these switches.

SLIDE 12: Switch Operation

Instructor Notes:

Pictured in the slide is a switchman operating a switch.

Teaching Points:

Put all of these in the order they should be presented.

- Here the switch handle is assembled (2 piece) and attached to the switch operating mechanism. You pull or push the handle to operate the switch. This operates a 3 phase switch.
- Add your own story, information here bout operating this type of switch

SLIDE 13: Single Phase Switch

Instructor Notes:

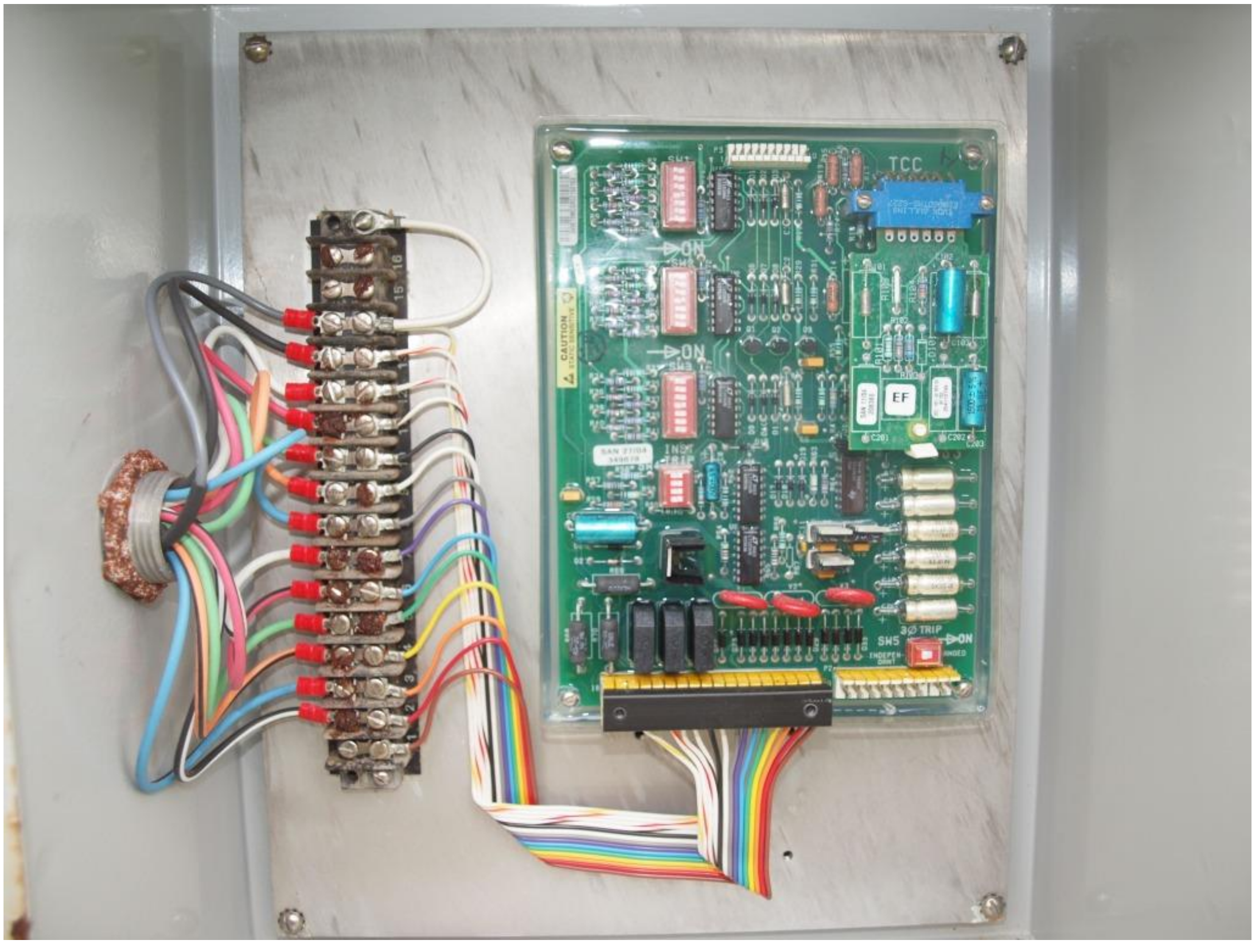
Picture of single phase switches

Teaching Points:

Put all of these in the order they should be presented.

- Here you can see one three phase switch on the left side 1507 and on the right you see three single phase switches 1510,1509 &1508. You will have to open the cabinet doors for access and the switching will be performed using a Hot Stick/Switch stick.

SLIDE 14: Overload Trip Controller



Instructor Notes:

Picture in the slide is of a controller for overload tripping.

Materials:

- None

Teaching Points:

- Here we have a controller that will trip the switches if the current setting or overloaded. It can be set for over current and or instantaneous over current tripping.
- Over current tripping ….usually there is time involved here, meaning that you would have to see a current over the setting for a period of time before the switch would trip open
- Instantaneous Tripping….. This setting is for a very high fault current let’s say 10 times the normal over current setting. There would not be a time requirement it would trip very quickly.
- The switches will not automatically reclose. The controller is only for tripping the circuit under fault conditions.

SLIDE 15: Live Front (Fused)

Instructor Notes:

Here you can see a fuse in the Live Front cabinet.

SLIDE 16: Grappler Tool

Instructor Notes:

Pictures of a Grappler Tool used for removal and installation of fuses in a Live Front Transformer. The Grappler Tool is used for removal of fuses and barriers in Live Front Switching Cabinets.

Teaching Points:

Grappler Tool: By design, this tool helps remove and install fuses and barriers in pad mounted switchgear. It is made to be attached to an insulated universal tool. The tool is an aluminum casting with a plastic type coating on the hooks to help avoid scuffing whatever it contacts.

SLIDE 17: Fuse Removal

Instructor Notes:

The picture in the slide is of a fuse being removed from a Live Front transformer using a Grappler Tool

SLIDE 18: Questions

Instructor Notes:

None

Materials:

- None

SLIDE 19: Next Steps

The following steps are required to receive credit for this Module

Locate and take the exam on web

Print the exam results and provide to your instructor

Complete the hands-on competency test administer by the instructor

Check with your instructor if you have any questions

CF50610/Troubleshoot URD Circuits Using Fault Indicators/CF50610/ PDF-PPT/07-05-2012

SLIDE 1: Installation and Use of Fault Detectors

Revision 1-01

Revision Date 07/05/2012

CF50610

Revised by djames2

Reviewed by (P&CD) Walt Roberts

Approved by Tim Golden (Supervisor)

SLIDE 2: Installation and Use of Fault Detectors

Instructor Notes:

Introduce the module to the students – brief statement on what they're about to do.

1. Discuss entire presentation in classroom
2. Ask questions as necessary
3. Take Written Exams

4. Go outside for hands-on activity
5. Perform competency test

Materials:

- Handouts
  - Power Delivery Product
    - Underground Load tracker information sheet
    - Edison Control Corporation???
    - Fault Indicator Operation Diagram
- Fault indicators
  - 1-Power Delivery Products –
    - Underground Load tracker-small core
    - Underground Load Tracker-large core
    - Three phase to one fiber optic cable
    - Single phase fiber optic cable
  - Edison Control Corporation
    - 1 phase fault indicator
    - 3 phase fault indicator
- Hot Stick/Shotgun Stick
- Hand tools, penta head socket
- Large magnet for reseting indicators
- Sample Materials (or demo)
- Equipment, etc
- PPE
  - Rubber Gloves- high voltage rated
  - Dielectric overshoes-high voltage rated
  - Face Shield
- Pad Mount Transformer and/or Switching Cabinet-3 phase underground wire with termination ends

SLIDE 3: OBJECTIVES:

Given the job to install Fault Circuit Indicators on Underground Equipment, install the Indicators according to Entergy Specifications

Given a job to troubleshoot an underground circuit, troubleshoot an underground circuit using Fault Circuit Indicators until the faulted section of cable is found.

Instructor Notes:

Formal objectives above. In simple terms describe what the students will be learning.

Teaching Points:

- **WIIFM** - **W**hat's **I**n **I**t **F**or **M**e: Create a story where you have been called out and have customers out of lights.

1. You were told the area that lights are out and you know that's its all underground.
2. You arrive on the scene of a blown fuse at the dip pole…..at least you know where to start.
3. You get out your map of the transformers on this loop….Hmm 15 transformers to the open tie point.
4. You go to the first transformer downstream from the dip pole and look for the flashing light of the fault indicator.
5. You see the flashing indicator…..you think cool and you head for the next downstream device.
6. You look for the flashing fault indicator….you see one has not been installed….you go to the next device downstream.
7. You look for the fault indicator…..one has not been installed
8. After check all the rest of the devices….the only one that has a fault indicator was the vey first device from the dip pole.
9. To the class….how are you going to determine where the fault is now?
10. Reinforce the importance to install this very important tool the fault indicator.

SLIDE 4: Safety

Instructor Notes:

Get the students to open the safety manual – talk about applicable sections and clues based on subject matter.

Specific Rule numbers to discuss – (not rule text)

- 3.33,3.37, 5.0, 5.4, 9.0, 9.1, 9.3, 9.10, 9.11, 9.18, 9.19

Materials:

- Entergy Safety Manual

TEACHING POINTS: **Put all of these in the order they should be presented.**

- Talk about Hazard Assessment
    - Snakes, critters, ants, dirt build up
- Discuss opening and working in transformers and switch cabinets
- Discuss grounding of all sources
    - Cable mapping
    - Isolation
    - Voltage testing
    - Grounding
- Operating Experiences (near misses, incidents)
- Wrap-up (if needed)

SLIDE 5: Working with Underground Equipment

- What are some of the differences between overhead construction and underground construction?
- How do the cables/wire differ from overhead wire?
- Hazards?

Instructor Notes:

Start an open discussion about the hazards around underground switching cabinets and transformers.

Tools:

None

Materials:

None

Teaching Points:

Fault indicators have been installed on many primary cable systems. When fault indicators are present, they should be checked as the cable elbow connections are checked. These indicators trip as fault current passes through them and reset when the circuit is energized or reset manually. Fault current is generated from the faulted point and travels along the cable towards the source tripping each indicator until it reaches the isolating device and will operate that device due to an over current. From inspection, the faulted equipment or cable is located between the final indicator that has been tripped and the next successive indicator that has not been tripped.

In the case of a faulty primary cable, the bad section should be isolated and service restored to as many customers as possible. For radial primary systems, locate and repair the damaged cable as soon as possible. On primary loop systems, complete the necessary switching to isolate the bad cable section and restore service to all customers.

All fault indicators will not normally operate when transformer or secondary fault occurs. Fault indicators are used to find a fault on the circuit, not on individual transformers. When a transformer faults, the Bay-O-Net fuse or the isolation link will open and normally will not affect the feed through process of the transformer. Locating a transformer or secondary fault would be relatively easy because the affected area would be limited to a small area operating off a particular transformer.

Single-phase fault indicators are installed on the load side of single phase transformer or equipment.

When checking a fault indicator in a transformer and it shows red (fault), this will indicate that the line-side primary cable and transformer is good and the fault is further on down the line.

SLIDE 6: Power Delivery Products Underground Load Tracker (F.C.I.)

Instructor Notes:

Explain the difference in the 2 power delivery products underground F.C.I.s

- The picture on the left of the slide fits diameter wire from 0.85” to 1.57” (code 14).
- The one on the right of the slide fits diameter wire from 1.0” to 2.52” and will fit over some terminators. (code 15)

Materials:

- None

Teaching Points:

Explain: The two different looking fault indicators are rated for the same voltage and current and are only different in the size of wire or elbow they can be attached

- The Load Tracker Faulted Circuit Indicator offers the highest degree of immunity,
- Reset on current and/or time. They can be reset automatically or reset manually.
- It flashes 30 times a minute has a 1200 hour indicating time and is powered by a 1.2 AH lithium oxide cell that is non replaceable. Battery life is 15 to 20 years
- Self-adjusting to load current
- Max Operating Voltage: 46 KV
- Trip Current Range: 200a to 2400a (200a default)

- Local or remote LED indication.
- Elbow or Cable mounted
- Self-powered
- Can be used in Single or three phase

Questions to promote discussion

- Key Information
- Operating Experiences (near misses, incidents)
- Wrap-up (if needed)

SLIDE 7: Power Delivery Products Underground Load Tracker (F.C.I)

Instructor Notes:

The Fault Indicators are shown in the cocked position. They are ready to be installed on cable or wire.

Be familiar with cocking the mechanism for installation by hand or installation using a hot stick. Demonstrate: how to cock the fault indicators

Caution: Gloves required: pinch points

Materials:

- None

Teaching Points:

- The Fault indicators fit over wire and some elbows, they should be held firmly against the wire with the clamping mechanism. Allow time for the students to cock the indicators and examine them. Discuss pinch points with the students.

Questions to promote discussion

- Key Information
- Operating Experiences (near misses, incidents)
- Wrap-up (if needed)

SLIDE 8: Load Tracker Installation with a Shotgun Stick (F.C.I.)

Instructor Notes:

Explain how to install the power delivery F. C.I.s. Be familiar with cocking the mechanism for installation by hand or installation using a hot stick.

Materials:

- Fault indicators
- Shotgun Hotstick

Teaching Points:

- Explain the installation procedures fault indicators using a shot gun hot stick. The Hot Stick grabs the wire loop that is attached to the fault indicator
- Demonstrate how you would install the fault indicator with a shotgun stick.
- Have the students attach a fault indicator to a shotgun stick.

Questions to promote discussion

- Key Information
- Operating Experiences (near misses, incidents)
- Wrap-up (if needed)

SLIDE 9: Power Delivery Products Underground Load Tracker (F.C.I.)

Instructor Notes:

Explain the fiber optic remote indicator light and how to install them. The cable on the left is for three phases, the one on the right is for a single phase.

- A single cable comes with the fault indicator. A three phase remote fiber optic indicator cable is available, it is connected at each of the three Fault Circuit indicators. The three phase cables are joined together to a single remote fault indicator. This means for a three phase circuit any one of the phases could have a fault and show blinking at the remote indicator. To see which phase actually has the fault you would have to access each individual phase, disconnect the remote indicator and view the Fault Circuit Indicators directly.

Materials:

- Fault Indicators
- Single phase fiber optic cable
- Three phase fiber optic cable

Teaching Points:

- Demonstrate how the 6 foot single phase fiber optic cable attaches to the Fault indicator.
- Demonstrate how the 6 foot three phase fiber optic cable attaches to the fault indicator.
- Demonstrate how to install the fiber optic cable through the transformer or switch cabinet housing
    - The Fiber Optic cable is for mounting through the transformer or switch cabinet housing for remotely viewing the fault indication without having to open the transformer or switch cabinet.
    - The Clear ends snap into the socket that protrudes out from the LED light located on the front of the fault indicator.
    - The threaded end/remote end is taken apart and inserted through a hole in the wall of the transformer or switching cabinet housing and then screwed back

together until hand tight. Some transformers have prearranged knockouts for the installation of the remote indicators.

Questions to promote discussion

- Key Information
- Operating Experiences (near misses, incidents)

SLIDE 10: Edison Control Corporation Single Phase (F.C.I)

Instructor Notes:

Edison Control Single Phase fault Indicator and Indicator face. There are 300a and 800a versions. They have to be installed by hand.

Materials:

Edison Control Corporation F.C.I Single Phase

Teaching Points:

Put all of these in the order they should be presented.

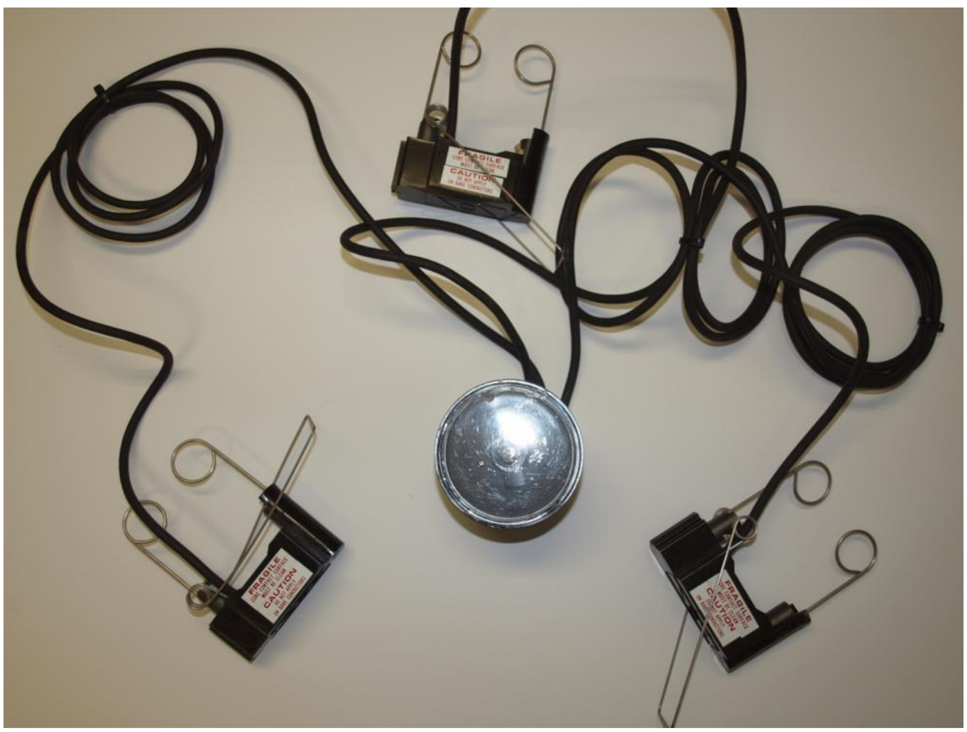
- The current sensing device and the remote indicator are attached by a cable and cannot be disassembled
- Install the sensing device on the cable and then install the remote indicator. They will have to be installed by hand.
- Some transformers have prearranged knockouts and mounting points for the remote indicator.
- Knockout the proper hole and use the brackets supplied with the fault indicator to mount it on the inside of the transformer or switching cabinet housing.

- Make sure there are no gaps that would allow small objects to be pushed into the cabinet.
- 1-phase, 1- 1.5A current reset, with fluorescent orange remote indication flag on 6' cable
- Ten (10) minute timed reset, viewing kit and two point mounting bracket. Can be reset manually.
- Suitable for use behind current limiting fuses.
- Unit to be immune to adjacent fields and trip within +/-10% of current rating
- Over cable diameter range of 0.85"- 1.2".
- Talk about PPE

Questions to promote discussion

- Operating Experiences (near misses, incidents)
- Wrap-up (if needed)

SLIDE 11: Edison Control Corporation 3 Phase (F.C.I)



Instructor Notes:

Edison Control Three Phase fault Indicator and Indicator face. There are 300a and 800a versions.

Materials:

- None

Teaching Points:

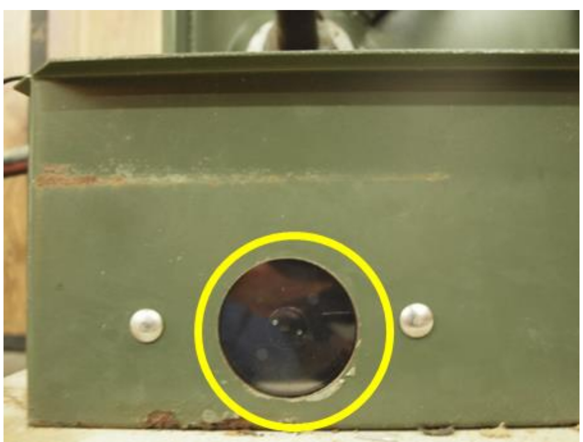
Put all of these in the order they should be presented.

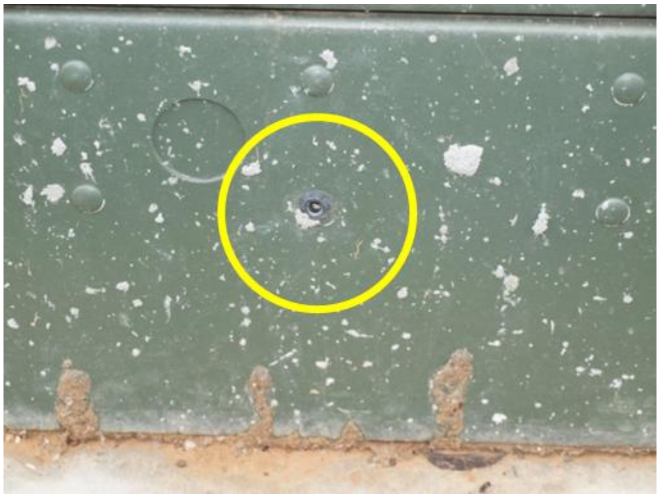
- Demonstrate the installation procedures for single phase and three phase fault indicators.
- The current sensing device and the remote indicator are attached by a cable and cannot be disassembled.
- Install the sensing device on the cable and then install the remote indicator. They will have to be installed by hand.
- Some transformers have prearranged knockouts and mounting points for the remote indicator.
- The fault indicator should be held firmly against the wire with the spring mechanism.
- Knockout the proper hole and use the brackets supplied with the fault indicator to mount it on the inside of the transformer or switching cabinet housing.
- Make sure there are no gaps that would allow small objects to be pushed into the cabinet.
- Discuss pinch points with the students.
- Talk about PPE

Questions to promote discussion

- Key Information
- Operating Experiences (near misses, incidents)
- Wrap-up (if needed)

SLIDE 12: Remote Indicators Mounted in a Transformer





Instructor Notes:

Pictures of the Edison Control Corporation and the Power Delivery F.C.I. Remote indicators installed in a transformer cabinet.

Materials:

- None

Teaching Points:

- On the left is the face of a Edison Controls fault indicator (F.C.I.) installed in the base of a transformer cabinet.
- On the right is the Power Delivery Fault indicator remote indicator installed into the base of a transformer cabinet.
- Wrap-up (if needed)

Instructor Notes:

Examples of the fault indicators showing a fault on the cable. You can use a magnet to put the both types of fault indicators into fault mode for demonstration.

Tools:

- Fault Circuit Indicators
- Large magnet…for activating fault mode and resetting to normal

Materials:

None

Teaching Points

- The Edison control fault indicator will have an orange flag when it is in fault mode.
- The Power delivery fault indicator will have a blinking red led light.
- Operating Experiences (near misses, incidents)
- Wrap-up (if needed)

SLIDE 14: URD Circuits

Instructor Notes:

A picture from AM/FM of a typical underground circuit.

Note: For the underground symbols identification use handout for module CF50618

Materials:

- None

Teaching Points:

- Explain This is an example of the am/fm mapping system and you will be using these type of maps to located underground equipment and cable
- Explain: you will be troubleshooting single phase and three phase circuits using installed fault indicators.
- Draw a simple underground circuit on a white board or use the Fault Indicator Operation Diagram as a guide. Include a dip pole and 6 transformers in a radial feed.
- Show the underground cables connecting them together. Select one of the cables to have a fault and mark it.
- Explain if a cable is bad on the radial feed circuit some customers will be out of service until the cable is repaired or replaced
- Draw a simple loop feed circuit with a normally open point. Include 6 transformers.
- Show the underground cables connecting them together. Select one of the cables to have a fault and mark it.
- Explain is a cable is bad on a loop feed circuit you can switch the bad section of cable out of service and have the service restored to all customers. The cable can then be replaced without affecting customers.
- Explain the process for using the Fault Indicators to troubleshoot an Underground circuit
    - Start at the dip pole….
    - Check fuse…..Blown?
    - Check the fault indicator…..Flashing? ….yes
    - Go to the next device in the circuit line (downstream)
    - Check the Fault indicator…..Flashing? ….yes
    - Go to the next device in the circuit line (downstream)
    - Check the Fault indicator…..Flashing?...yes
    - Proceed with the process until you find a fault indicator that is not flashing?
    - Not Flashing? What does that tell you? this mean the fault indicator did not see a fault which indicates the fault is upstream from the device.
- Operating Experiences (near misses, incidents)
- Wrap-up (if needed)

SLIDE 15: Questions

Instructor Notes:

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 16: Next Steps

The following steps are required to receive credit for this Module

Locate and take the exam on web

Print the exam results and provide to your instructor

Complete the hands-on competency test administer by the instructor

Check with your instructor if you have any questions

CF50611/Switch/Tagging URD Primary Cable/CF50611/PDF-PPT/07-05-2012

SLIDE 1: Switch and Tag URD Primary

Revision 1-01

Revision Date 07/05/2012

Module CF50611

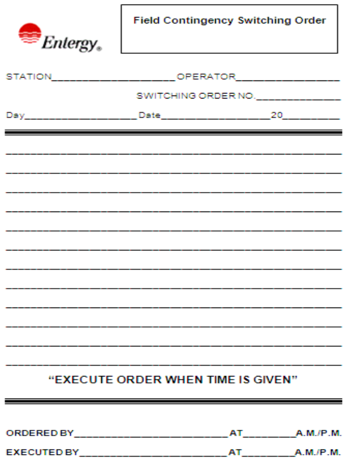
Revised by Walt Roberts

Reviewed by (P&CD) John Miller

Reviewed by (SME) Mark Jordan

Approved by Tim Golden (Supervisor)

SLIDE 2: Switch and Tag URD Primary



Field Contingency Switching Order

STATION___________ OPERATOR___________

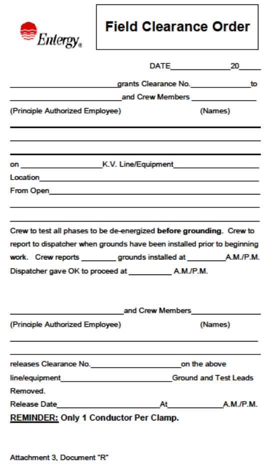
SWITCHING ORDER NO.___________

Day___________ Date___________ 20______

"EXECUTE ORDER WHEN TIME IS GIVEN"

ORDERED BY___________ AT______ A.M./P.M.

EXECUTED BY___________ AT______ A.M./P.M.



Field Clearance Order

DATE___________ 20_____

___________ grants Clearance No.___________ to

___________ and Crew Members ___________

(Principle Authorized Employee) (Names)

on ___________ K.V. Line/Equipment___________

Location___________

From Open___________

Crew to test all phases to be de-energized **before grounding**. Crew to report to dispatcher when grounds have been installed prior to beginning work. Crew reports ______ grounds installed at ______ A.M./P.M. Dispatcher gave OK to proceed at ______ A.M./P.M.

___________ and Crew Members___________

(Principle Authorized Employee) (Names)

releases Clearance No.___________ on the above line/equipment___________ Ground and Test Leads Removed.

Release Date___________ At______ A.M./P.M.

REMINDER: Only 1 Conductor Per Clamp.

Attachment 3, Document "R"

Instructor Notes:

This module is designed to guide you as Switchmen in the switching, tagging and clearance on URD primary. It does not supersede or contradict the Safe Work Procedures Manual. Remind the trainees' that switching, tagging and clearance is part of fatal five.

Discuss entire presentation in classroom

Ask questions as necessary

Take Written Exams

Go outside for hands-on activity

Perform competency test

Materials:

Shotgun/clamp stick

Safety Manual

Switching order forms

Clearance order forms

Hold tags

URD pad mount transformer w/terminated elbow

Feed-thru bushing

All PPE

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 3: OBJECTIVES:

Explain why we switch and tag

Discuss safety considerations

Explain the consequence of inadequate switching and tagging Explain how to identify the controlling authority

Demonstrate how to isolate the URD primary cable

Demonstrate how to properly complete and install a hold tag

Demonstrate how to properly complete a switching order

Demonstrate how to properly complete a clearance order

SLIDE 4: Safety

Instructor Notes:

Get the students to open the safety manual, read and discuss safety rules: 2.2- 2.7, 2.9, 2.10, 2.14, 2.21, 2.23, 2.24

Methods & Procedures pg 224 – URD Grounding Procedures & General Guidelines

Materials:

Entergy Safety Manual

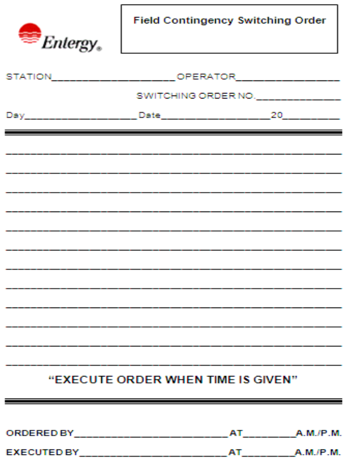
Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 5: Definitions



Entergy.

Field Contingency Switching Order

STATION_________________OPERATOR________________

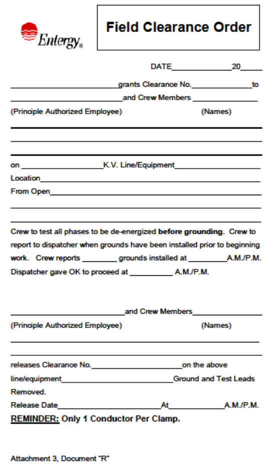
SWITCHING ORDER NO.______________

Day_________________Date__________________20_________

"EXECUTE ORDER WHEN TIME IS GIVEN"

ORDERED BY_______________________AT________A.M./P.M.

EXECUTED BY______________________AT________A.M./P.M.



Entergy.

Field Clearance Order

DATE____________20____

____________________grants Clearance No.____________to

____________________and Crew Members____________

(Principle Authorized Employee) (Names)

on_______________K.V. Line/Equipment______________

Location______________________________

From Open____________________________

Crew to test all phases to be de-energized **before grounding.** Crew to report to dispatcher when grounds have been installed prior to beginning work. Crew reports _______ grounds installed at ________A.M./P.M. Dispatcher gave OK to proceed at ________ A.M./P.M.

____________________and Crew Members____________

(Principle Authorized Employee) (Names)

releases Clearance No.________________on the above line/equipment____________________Ground and Test Leads Removed.

Release Date___________________At__________A.M./P.M.

REMINDER: Only 1 Conductor Per Clamp.

Attachment 3, Document "R"

Clearance Order: A documentation process given to ensure personnel that a piece of equipment or line has been de-energized.

Switching Order: A sequential set of instructions directed by the Controlling Authority and performed by the switchman for the purpose of altering the physical configuration of the electrical system and/or its associated control schemes.

Instructor Notes:

Definitions of a clearance order and switching order

Have the students open their safety manual under definitions and read these definitions

Clearance order: A documentation process identified by a unique number and issued by the DOC/TOC Operator, which is given to ensure personnel that a piece of equipment or line has been de-energized, that at least one secured visible air gap on each side of the cleared section has been established with all potential sources into the clearance area opened and all Hold Tags are attached as part of the switching procedures.

Switching Order: A sequential set of instructions directed by the Operator and performed by the switchman for the purpose of altering the physical configuration of the electrical system and/or its associated control schemes.

Materials:

Safety manual – Definitions

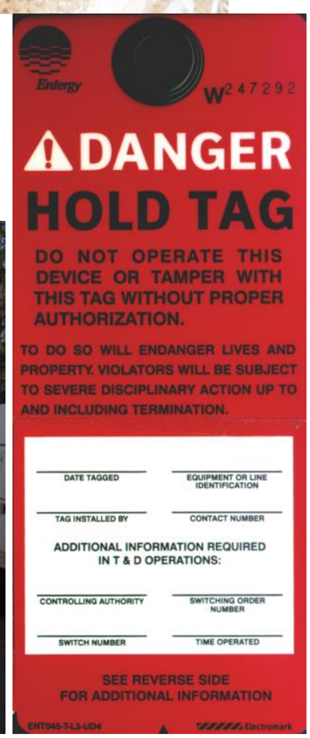
Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents

SLIDE 6: Definitions



Switchman: An Individual that is certified by training and experienced for switching.

Hold Tag: A physical document attached to a device in the field by an authorized Switchman.

ECHO Protocol: The required method where each instruction or action is repeated back to the issuer for verification.

Isolation: A work practice achieved when a de-energized line is isolated from all sources.

Instructor Notes:

- Definitions of Switchman, Hold tag, echo protocol and isolation
- Have the students open their safety manual under definitions and read these definitions
- Switchman: An Entergy employee or an employee of a company hired by Entergy that is certified by training and experienced for switching the physical configuration of the electrical system and/or its associated control schemes.
- Hold Tag: A Hold Tag is a physical document attached to a device in the field by an authorized Switchman. A Hold Tag is not to be used for non-switching functions. A Hold Tag is red or partly red card that has a uniquely identifying number, and is placed on a device under the direction of the appropriate DOC/TOC Operator and indicates that device shall not be operated. Separate Hold Tags are attached to all devices (one per gang operated switch, one per three single phase hook switches) involved in a Clearance Order where operation of the device may compromise that Clearance Order or otherwise place equipment in an undesirable state. Hold Tags are removed only at the direction of the appropriate Operator or authorized person.
- ECHO Protocol: The required method of issuing and receiving all switching instructions where each instruction or action is repeated back to the issuer for verification.
- Isolation: A work practice achieved when a de-energized line is isolated from ALL Transmission and Distribution sources. All phase conductors and shield wires, OPGW, and

distribution neutrals, etc. must have an open air gap established on all sides of work area.

Materials:

- Safety manual – Definitions

Teaching Points:

- Questions to promote discussion
- Key Information
- Operating Experiences (near misses, incidents)

SLIDE 7: Definitions



- Tagging: The placing of the appropriate tag on a disconnecting device or physical opening.
- Grounding: Grounding is accomplished by the checking for voltage and bonding all appropriate conductors to ground.
- Controlling Authority: Responsible for operating the electrical system in an assigned area.

SLIDE 8: Why Do We Switch?

We switch URD distribution power systems to isolate or restore lines and equipment to and from service and to manage load.

By far the most important reason we switch is to keep you safe by creating a barrier between you and the power system.

Instructor Note:

Request class participation, open class discussion of "why we switch" before reviewing answers on next mouse click

Slide Content (Question for class participation):

Why Do We Switch?

Slide Content (Answer):

We switch transmission / distribution power systems to isolate or restore lines and equipment to and from service and to manage load.

By far the most important reason we switch is to keep you safe by creating a barrier between you and the power system

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 9: Barriers Protect You from Known and Unknown Hazards

Instructor Note:

- When applied properly and in the correct sequence, the switching, tagging and clearance barriers protect you against known / unknown hazards and even human error.
- We are in a dangerous business that requires us to use these barriers to prevent injuries and to protect ourselves from known and **unknown** hazards such as back feeds.

Materials:

- None

Teaching Points:

- Questions to promote discussion
- Key Information
- Operating Experiences (near misses, incidents)

SLIDE 10: Controlling Authority

At Entergy the controlling authority for a given area of the power system is responsible for and authorized to:

- Create and direct the execution of switching orders
- Approve, issue and release clearances
- Issue and release switch hold orders
- Issue and release hot line hold orders
- Order the placement or removal of danger hold tags
- Require safety procedures and processes be followed

Note: Depending on who is the controlling authority all or part of the listed responsibilities apply.

Instructor Notes

This slide discusses controlling authority

At Entergy the controlling authority for a given area of the power system is responsible for and authorized to:

- Create and direct the execution of switching orders
- Approve, issue and release clearances
- Issue and release switch hold orders
- Issue and release hot line hold orders
- Order the placement or removal of danger hold tags
- Require safety procedures and processes be followed

Note: Depending on who is the controlling authority all or part of the listed responsibilities apply.

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 11: Controlling Authority

DOC:

- From the high side disconnect of substation power transformer
  - or the demarcation point with the TOC
- To the end of the 3 phase feeder/trunk
  - or first protective device providing there are no other sources of 3phase feed down stream.
- Also responsible for 34.5KV distribution substations

Field:

- Begins and includes the first protective device in series with the feeder/trunk
  - except when feeder/trunk loops back or has another source of feed
- To the end of the line

Instructor Notes:

- Slide discusses who and when they have the controlling authority

- There is animation on this slide
- DOC: What does the DOC control?
- High side disconnect of substation power transformer or the demarcation point (boundary/separation between the two)with the TOC and ending at the end of the 3ϕ feeder/trunk or first protective device providing there are no other sources of 3ϕ feed downstream. They are Responsible for 34.5KV distribution substations.
- Field: Distribution line facilities begin at and include the first protective device in series with the feeder/trunk except when feeder/trunk loops back or has another source of feed. (details on following slide)

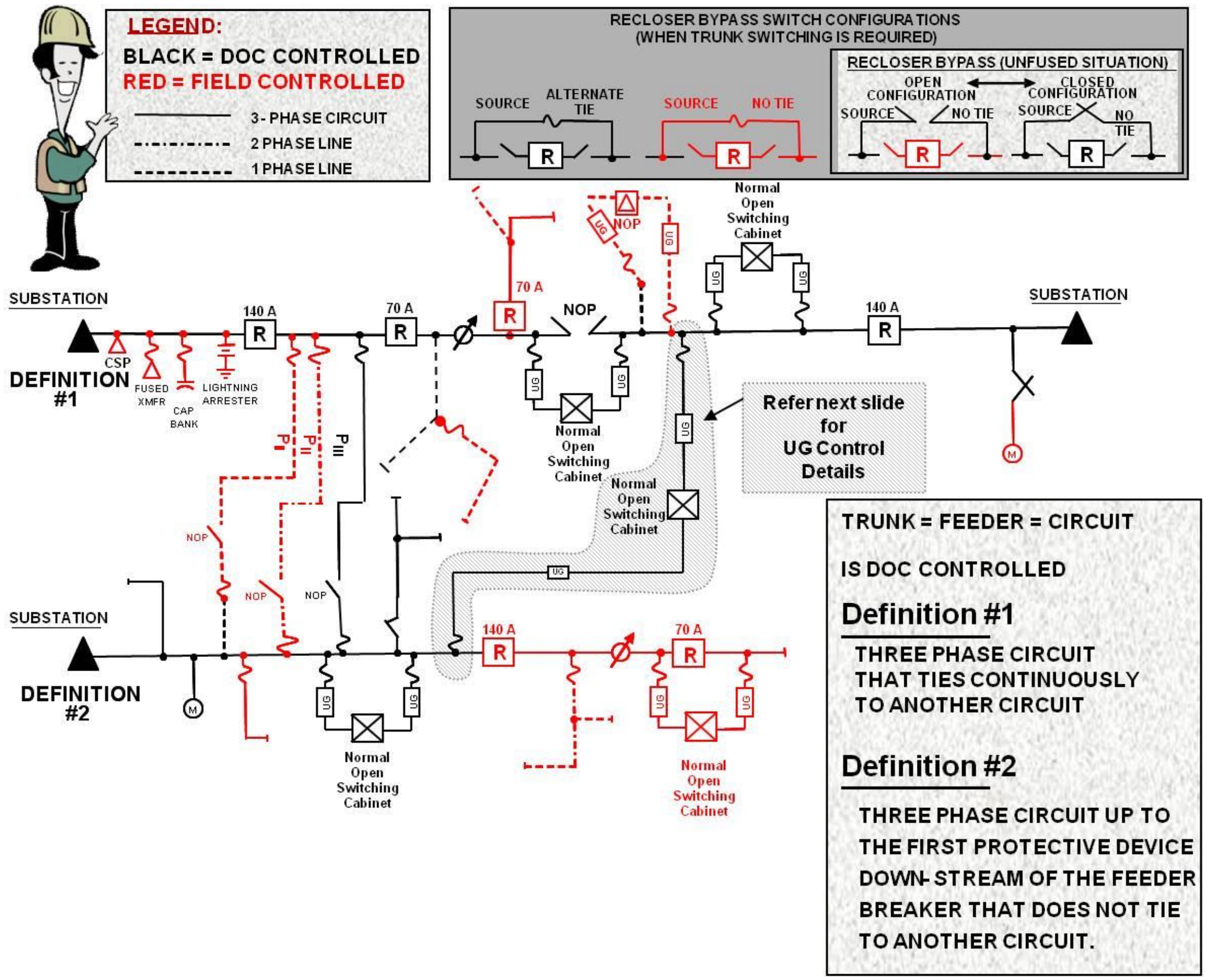
Materials:

- None

Teaching Points:

- Questions to promote discussion
- Key Information
- Operating Experiences (near misses, incidents)

SLIDE 12:



Instructor Notes:

- Slide gives the details for area of control boundaries between DOC and distribution field / network controlled lines and equipment
- There is no animation on this slide
- This diagram gives the details for who (DOC or Field) controls what and under what conditions
- It is divided into too basic feeder circuit definitions.

Definition #1 is shown on the upper half of the diagram

Three phase circuit that ties continuously to another circuit. (Circuit that can be tied to another source in the field)

Definition #2 is shown on the bottom half of the diagram

Three phase circuit up to the first protective device down-stream of the feeder breaker that does not tie to another circuit or source.

- The legend in the upper left hand corner indicates black is DOC controlled and red is Field controlled and also shows the coding for three phase, two phase and single phase circuits
- Point out the URD information

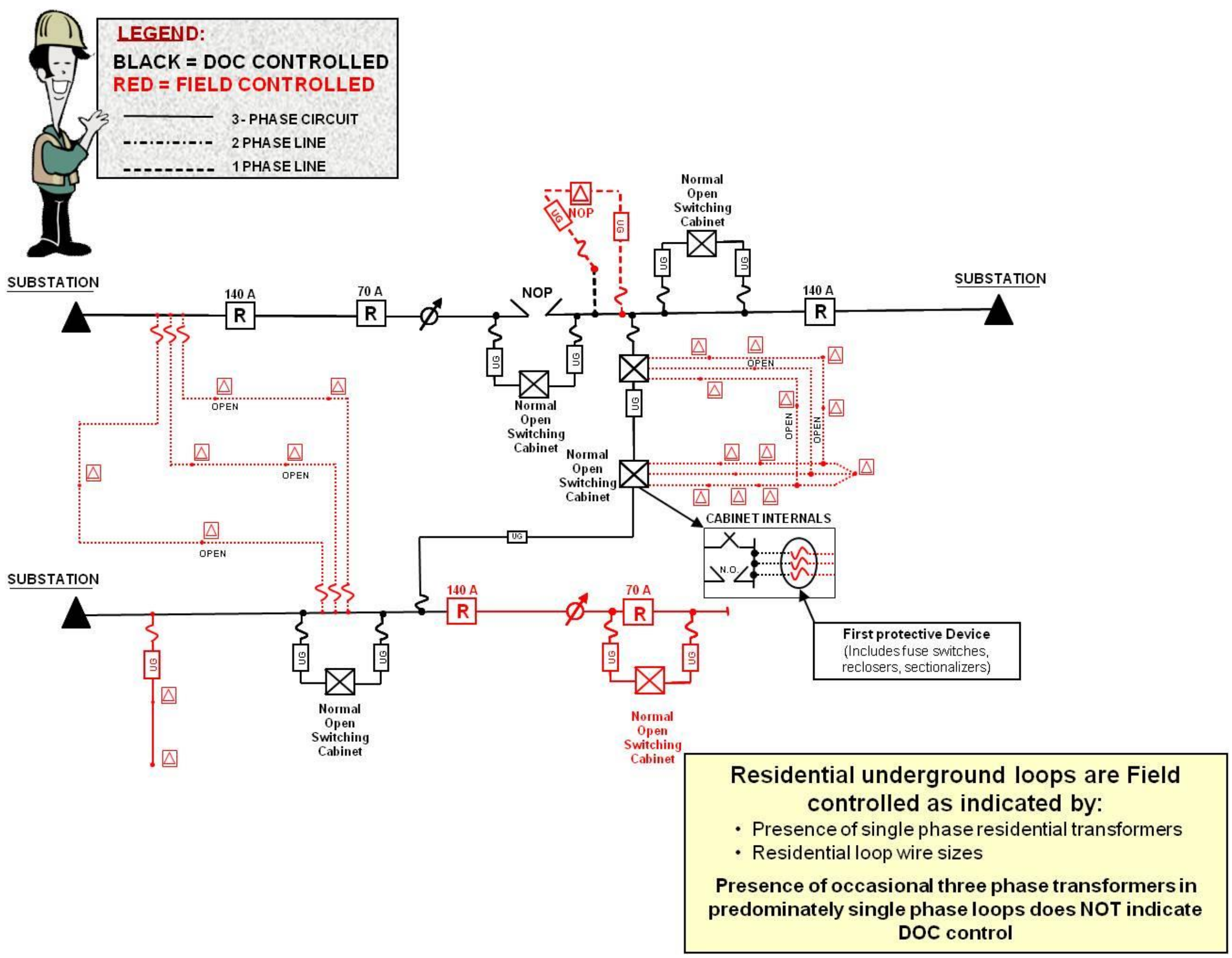
Materials:

- Controlling authority laminates

Teaching Points:

- Questions to promote discussion
- Key Information
- Operating Experiences (near misses, incidents)

SLIDE 13:



Instructor Notes:

- Slide gives the details for area of control boundaries between DOC and distribution field /

network controlled lines and equipment
- There is animation on this slide

This diagram gives the details for who (DOC or Field) underground lines and equipment

- The legend in the upper left hand corner indicates black is DOC controlled and red is Field controlled and also shows the coding for three phase, two phase and single phase circuits
- Point out the URD information
- Click and then ask the question who is in control of this section of line (A red circle will appear and the legend in the left hand corner is gone)

Materials:

Controlling authority laminates

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 14: Isolate URD Primary

Source side transformer

- With a clamp stick, slide the two-way feed-thru device onto the transformer accessories bracket.
- With a clamp stick, remove the load-break elbow and install the arc follower pin (probe) into the two-way feed-thru.
- With a clamp stick, install an insulated bushing cover over the transformer bushing.
- Install hold tag on the cable

Repeat the same steps on the load side transformer

Instructor Notes:

- This slide discusses the procedure to isolate URD Primary
- Explain to the trainees' that Isolation, tagging and execution of switching order often occur simultaneously.
- Remove the protective caps from a two-way feed through device.
    - Clean the bushing surfaces and lubricate with silicone grease.

- Install an insulated cap over one of the two-way feed through device bushings.
- With a clamp stick, slide the two-way feed through device onto the transformer accessories bracket. Tighten the eye bolt by rotating clockwise with the clamp stick until snug. **Do not over tighten**.
- With a clamp stick, remove the load-break elbow on the cable to be tested from the transformer bushing.
    - Install the load-break elbow arc follower pin (probe) into the receiving part of the two-way feed through device. Firmly push the load-break elbow forward until it is solidly in place and the locking ring is seated.
- With a clamp stick, install an insulated bushing cover over the transformer bushing.
- Put hold tag on cable on the stand-off bracket. You should wear rubber gloves and insulated overshoes.
- Repeat the same steps on the load side transformer

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 15: Isolate URD Primary


Caution:

- Always clean and lubricate the bushing surfaces of the two-way feed-thru device before using.
- If the grounding elbow is accidentally closed in on an energized bushing, both the bushing and the grounding elbow should be discarded and replaced.
- You shall never leave the manufacturer's bushing dust cover on a transformer bushing that is to be energized or use it as an insulated bushing cover.

Instructor Notes:

- This slide discusses some precautions that should be taken when isolating URD primary
- There is Animation on this slide
- Always clean and lubricate the bushing surfaces of the two-way feed-thru device before using.
    - Keep all surfaces to be inserted or that have an interface with the bushings absolutely clean.
    - Failure to do so can damage the bushing or elbow, resulting in the failure of either or both
- If the grounding elbow is accidentally closed in on an energized bushing, both the bushing and the grounding elbow should be discarded and replaced.
- You shall never leave the manufacturer's bushing dust cover on a transformer bushing that is to be energized or use it as an insulated bushing cover.
- To prevent contamination from falling into the bushing interface of a submersible transformer, excessive mud, dirt, and water shall be removed before disconnecting an elbow.
    - Do not operate an elbow if water is within twelve (12) inches of the elbow.

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 16: Hold Tags

- Hold Tags shall be placed on each device, as directed by the controlling authority.

- Hold Tag numbers associated with a Switching Order shall be recorded on the Switching Order form and/or Clearance Order and shall not be removed until authorized by the Controlling Authority.
- After Hold Tags have been removed from use they shall be turned in to the Manager/Supervisor.

Instructor Notes:

- Discuss the use of hold tags
- There is animation on this slide
- Hold Tags shall be placed on each device, as directed by the Operator. If tagged device is lockable, the Hold Tag shall be attached to the locking device. If Hold Tag cannot be placed on the device, the Hold Tag shall be placed near the device as directed by the Operator
- Hold Tag numbers associated with a Switching Order shall be recorded on the Switching Order form and/or Clearance Order and shall not be removed until authorized by the Controlling Authority.

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 17: Hold Tags

- Hold Tags shall have a unique number.
- Hold Tags shall indicate that the device tagged is not to be operated
- Hold Tags shall contain:

- Date tagged
- Tag installed By
- Controlling authority
- Switch Number
- Equipment or Line identification
- Contact Number
- Switching Order Number
- Time Operated

Instructor Notes:

- Discuss filling in the required information on hold tags
- The animation will bring in a bullet and the info on the hold tag together
- Hold Tags shall be placed on each device, as directed by the Operator. If tagged device is lockable, the Hold Tag shall be attached to the locking device. If Hold Tag cannot be placed on the device, the Hold Tag shall be placed near the device as directed by the Operator
- Hold Tag numbers associated with a Switching Order shall be recorded on the Switching Order form and/or Clearance Order and shall not be removed until authorized by the Controlling Authority.
- Hold Tags shall contain:
    - Date tagged
    - Tag installed By
    - Controlling authority
    - Switch Number
    - Equipment or Line identification
    - Contact Number
    - Switching Order Number
    - Time Operated

Materials:

Hold Tags??

Teaching Points:

Questions to promote discussion

Key Information

SLIDE 18: Switching Order

All switching operations include these basic steps:

- Pre-switching check list
- Communication and documentation of the switching order
- Agreement by the Controlling Authority and switchman

- Pre switching inspection of lines and facilities
- Step by step execution of switching order

Instructor Notes:

- This slide is a summary of the switching operations
- All switching operations include these basic steps:
  - Pre-switching check list
  - Communication and documentation of the switching order
  - Agreement by the Controlling Authority and switchman
  - Pre switching inspection of lines and facilities
  - Step by step execution of switching order

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 19: Switching

Pre-switching checklists help remind us to check certain items before we switch

Instructor Notes:

- This slide is a summary of the switching operations
- There is animation of this slide
- All switching operations include these basic steps:
  - Pre-switching check list
  - Communication and documentation of the switching order
  - Agreement by the Controlling Authority and switchman
  - Pre switching inspection of lines and facilities
  - Step by step execution of switching order

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 20: Switching Order

- All verbal communications for Switching Orders shall use ECHO protocol.
- The steps in the switching order shall be communicated and executed in logical sub sets.
- All switching orders scheduled, contingency and emergency, require some form of documentation.
- Refusing a line fuse switch to re-energize following an outage does not require a written switching order but is still documented as a switching step on the JSA form.

Note: Some local policies require refusing a line switch as stated above to be documented on a contingency switching form.

Instructor Notes:

- This slide discusses the proper way to communicate and execute a switching order
- There is animation of this slide.
- Remind the students of the definition of ECHO Protocol: The required method of issuing and receiving all switching instructions where each instruction or action is repeated back to the issuer for verification.
- All verbal communications for Switching Orders shall use ECHO protocol to prevent the misunderstanding of instructions or device numbers
- The steps or instructions in the switching order shall be communicated and executed in logical sub sets or groupings to be determined by the controlling authority
- All switching orders scheduled, contingency and emergency require some form of

documentation.

- Refusing a line fuse switch to re-energize following an outage does not require a written switching order but is still documented as a switching step on the JSA/ Hazard Assessment form
    - Note: Some local policies require refusing a line switch as stated above to be documented on a contingency switching form.

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 21: Switching Order

Entergy

Field Contingency Switching Order

STATION Mchale OPERATOR Beaumont DOC

SWITCHING ORDER NO. 12345

Day Tuesday Date 02-28 20 12

open and tag location # 12345, tag number
W247292 and checked to be open.

"EXECUTE ORDER WHEN TIME IS GIVEN"

ORDERED BY Joe operator AT 12:36 A.M./P.M.

EXECUTED BY Bill switchman AT 12:39 A.M./P.M.

Attachment 4, Document "Q"

Instructor Notes:

- This slide discusses the proper method to fill out a switching order
- There is animation of this slide
- This is a field contingency switching order form, we also have a DOC switching form that is similar and used by the DOC/TOC.
- All fields should be filled out accordingly with accurate information

Materials:

Handout a field switching order form

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 22: Switching Order

How do you avoid making a mistake or being a victim of someone else's mistake?

- Read the order, take nothing for granted or assume anything
- Verify the order against the switching one line / feeder diagram / actual equipment
- Look at the equipment that can affect your order and verify it is in the correct position
- Ask someone if you are concerned about the order before you start switching
- Know the expected result of each action and if you don't get that result

Instructor Notes:

- This slide is a summary of the switching operations
- There is animation of this slide
- All switching operations include these basic steps:
    - Pre-switching check list
    - Communication and documentation of the switching order
    - Agreement by the Controlling Authority and switchman
    - Pre switching inspection of lines and facilities
    - Step by step execution of switching order

Materials:

None

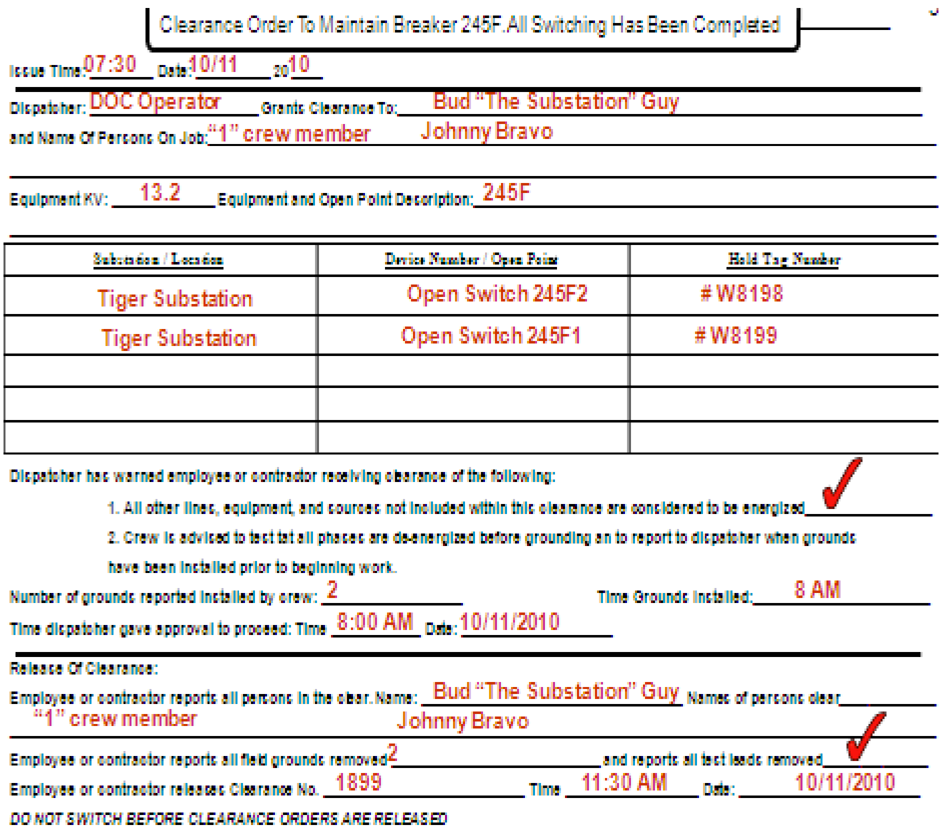
Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 23: Clearance Order



Clearance Order To Maintain Breaker 245F.All Switching Has Been Completed

Issue Time: 07:30 Date: 10/11 2010

Dispatcher: DOC Operator Grants Clearance To: Bud "The Substation" Guy

and Name Of Persons On Job: "1" crew member Johnny Bravo

Equipment KV: 13.2 Equipment and Open Point Description: 245F

Substation / Location	Device Number / Open Point	Hold Tag Number
Tiger Substation	Open Switch 245F2	# W8198
Tiger Substation	Open Switch 245F1	# W8199

Dispatcher has warned employee or contractor receiving clearance of the following:

1. All other lines, equipment, and sources not included within this clearance are considered to be energized ✓
2. Crew is advised to test tat all phases are de-energized before grounding an to report to dispatcher when grounds have been installed prior to beginning work.

Number of grounds reported installed by crew: 2 Time Grounds Installed: 8 AM

Time dispatcher gave approval to proceed: Time 8:00 AM Date: 10/11/2010

Release Of Clearance:

Employee or contractor reports all persons in the clear. Name: Bud "The Substation" Guy Names of persons clear "1" crew member Johnny Bravo

Employee or contractor reports all field grounds removed 2 and reports all test leads removed ✓

Employee or contractor releases Clearance No. 1899 Time 11:30 AM Date: 10/11/2010

DO NOT SWITCH BEFORE CLEARANCE ORDERS ARE RELEASED

- Entergy and OSHA require a clearance before any work is performed on de-energized Distribution lines
- All primary sources and back feeds must be isolated
  - Isolation points must be visible gaps
  - Isolation points must be tagged
- Lines and equipment must be tested and grounded

Instructor Notes:

Slide discusses:

The types of lines and equipment that require clearances

The requirements for establishing a proper clearance

There is animation on this slide

Slide Content:

- Entergy and OSHA require a clearance before any work is performed on de-energized
  - Distribution lines
  - Transmission lines

    - Substation equipment or busses
- The clearance order must be written and confirmed before the grounds are installed, likewise the grounds must be removed before the clearance is released.
- All primary sources and back feeds must be isolated
    - Isolation points must be visible gaps
    - Isolation points must be tagged
- The clearance order must be written and confirmed before the grounds are installed, likewise the grounds must be removed before the clearance is released.
- Lines and equipment must be tested and grounded

Materials:

- None

Teaching Points:

- Questions to promote discussion
- Key Information
- Operating Experiences (near misses, incidents)

SLIDE 24: Primary and Back Feed Sources

Station service or residential service transformers

Substation power transformers

Distribution potential transformers

Transmission potential transformers

Capacitor Banks

Residential or customer backup generators

Cogeneration

Alternate sources from other stations, lines or feeders

It does not matter if they are actual or potential back feeds or sources they all must be ISOLATED

Instructor Notes:

- Slide provides examples of primary sources and back feed sources
- There is animation on this slide

Slide Content:

- Examples of Primary and Back Feed Sources
- Station service or residential service transformers
- Substation power transformers
- Distribution potential transformers

- Transmission potential transformers
- Cap Banks
- Residential or customer backup generators
- Cogeneration
- Alternate sources from other stations, lines or feeders
- It does not matter if they are actual or potential back feeds or sources they all must be ISOLATED

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 25: Clearance Order

The clearance order will document:

- Clearance order number
- Date
- Controlling authority (TOC/DOC operator or distribution lineman)
- Clearance holder
- Number of grounds or type grounding installed
- Crew members
- The field copy will list the names of the crew members
- Description of the cleared area:
    - Isolation points for primary sources and back feeds (switches, open jumpers, pulled fuses, etc)
    - Danger hold tag numbers for all isolation points

Instructor Notes:

- Slide discusses the details of a properly issued clearance
- There is animation on this slide

SLIDE CONTENT:

- The clearance order will document:
- Clearance order number
- Date
- Controlling authority (TOC/DOC operator or distribution lineman)
- Clearance holder
- Number of crew members

- The field copy will list the names of the crew members
- Description of the cleared area:
    - -Isolation points for primary sources and back feeds (switches, open jumpers, pulled fuses, etc)
    - -Danger hold tag numbers for all isolation points

Additional Slide Content:

The requirement to <u>“Provide a clear description of the clearance area or zone” </u>is a tool and a double check to help you avoid being a victim. As described in the incident on the previous slide you may not have performed the switching that isolated the work area. This requirement is based on incidents, injuries and fatalities that have occurred all over the Entergy system involving customers, contractors and Entergy employees.

Materials:

None

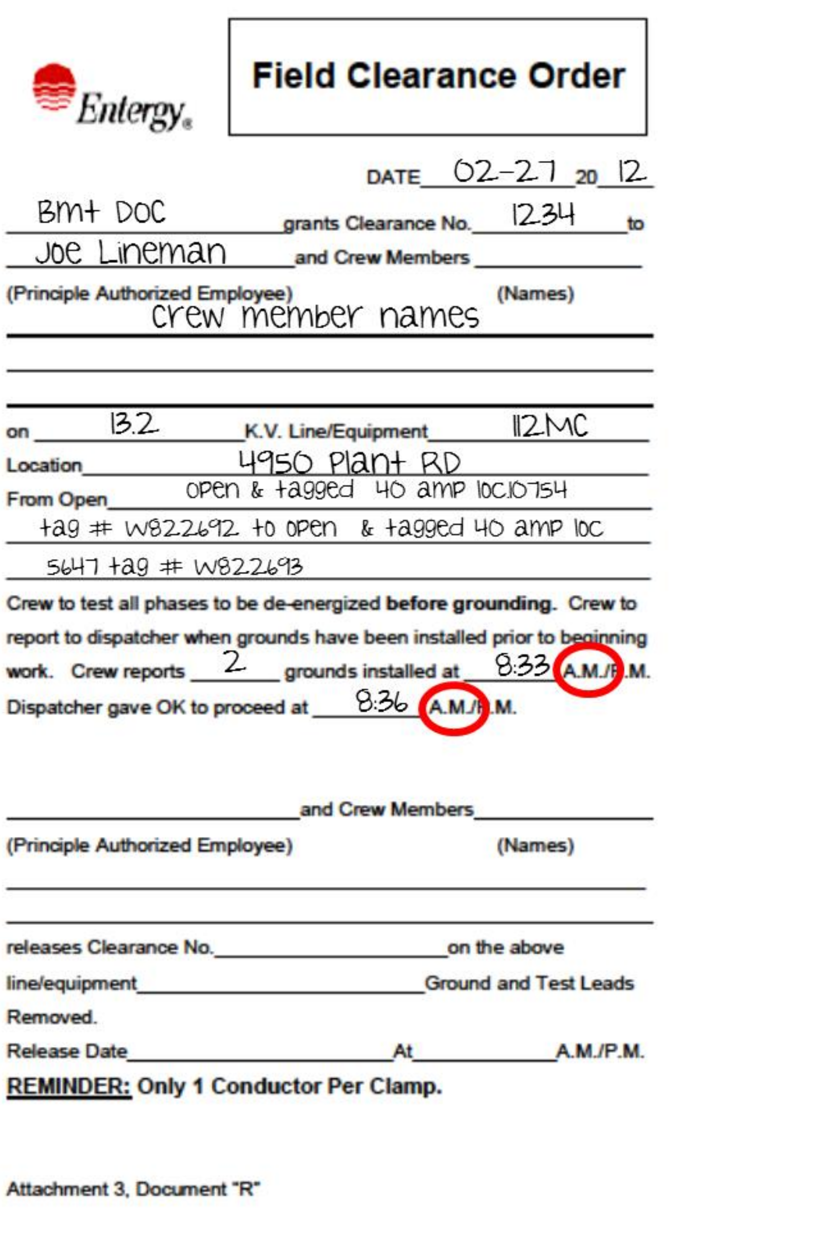
Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 26: Clearance Order



Entergy

Field Clearance Order

DATE 02-27 20 12

Bmt DOC grants Clearance No. 1234 to

Joe Lineman and Crew Members

(Principle Authorized Employee) (Names)

crew member names

on 13.2 K.V. Line/Equipment 112MC

Location 4950 Plant RD

From Open open & tagged 40 amp 10C10754

tag # W822692 to open & tagged 40 amp 10C

5647 tag # W822693

Crew to test all phases to be de-energized **before grounding**. Crew to report to dispatcher when grounds have been installed prior to beginning work. Crew reports 2 grounds installed at 8:33 A.M./P.M.

Dispatcher gave OK to proceed at 8:36 A.M./P.M.

and Crew Members

(Principle Authorized Employee) (Names)

releases Clearance No. on the above line/equipment Ground and Test Leads Removed.

Release Date At A.M./P.M.

REMINDER: Only 1 Conductor Per Clamp.

Attachment 3, Document "R"

Instructor Notes:

- This slide points out the individual field and what should be in each field
- There is animation on this slide

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 27: Clearance Order

Testing for voltage and grounding

- The clearance holder utilizing an approved voltage tester and the proper PPE, test the line and/or equipment to be de-energized
- The clearance holder has the necessary grounds installed on the line and/or equipment

Instructor Notes:

- This slide discusses the testing for voltage and grounding that takes place after a clearance is issued

KEY POINT:

- Students must understand that grounding cannot take place until a clearance is issued and there is no excuse

ADDITIONAL SLIDE CONTENT:

- The clearance holder utilizing an approved voltage tester and the proper PPE test the line and/or equipment to be de-energized **(there is no excuse to ever place grounds on a hot line ever again if we check for voltage first)**
- Example: Crew is going to repair a damaged pole on a 13KV line. The outage was scheduled and the section of line was de-energized and they knew exactly where to place the grounds the only problem was it had rained and there was water standing where they were going to install one of the sets of grounds. No problem just move down the line a little and install the grounds except he went past the open switch did not check for voltage and grounded the hot line. (We all have our head in the wrong place some times and that is why you stick to the procedure “test first ground second”)

Materials:

None

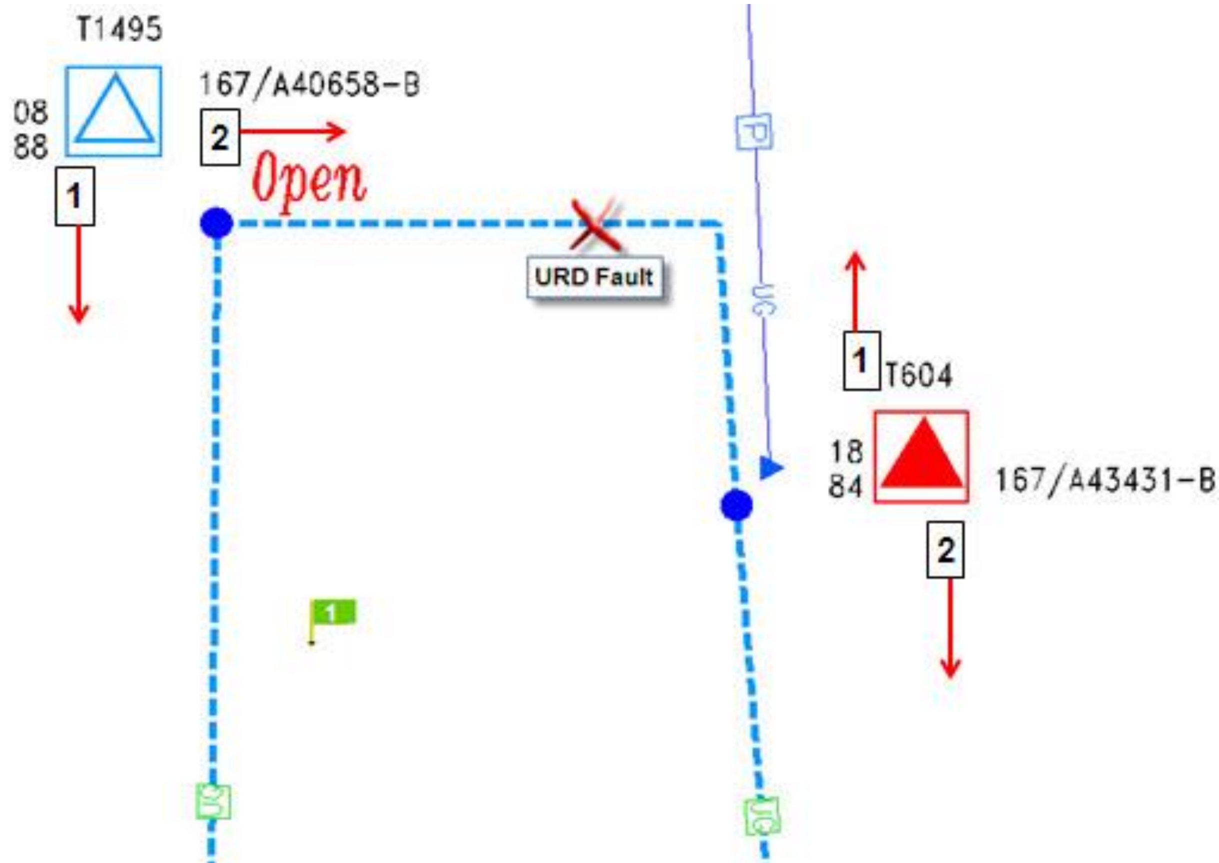
Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 28: Exercise



Instructor Notes:

- The slide is an exercise to write switching orders, isolate, tag & write clearance order
- There are 2 maps on the slide
  - An overall showing the line fuses
  - Click and there is a map with the fault between 2 URD transformers
- As stated in the marking & tagging module, areas mark and tag different ways. For this exercise, we have used a number system to identify the feeds of the transformer
- Remind the students to be familiar with the local marking/tagging process

Materials:

Hold tags

Switching order

Clearance Order

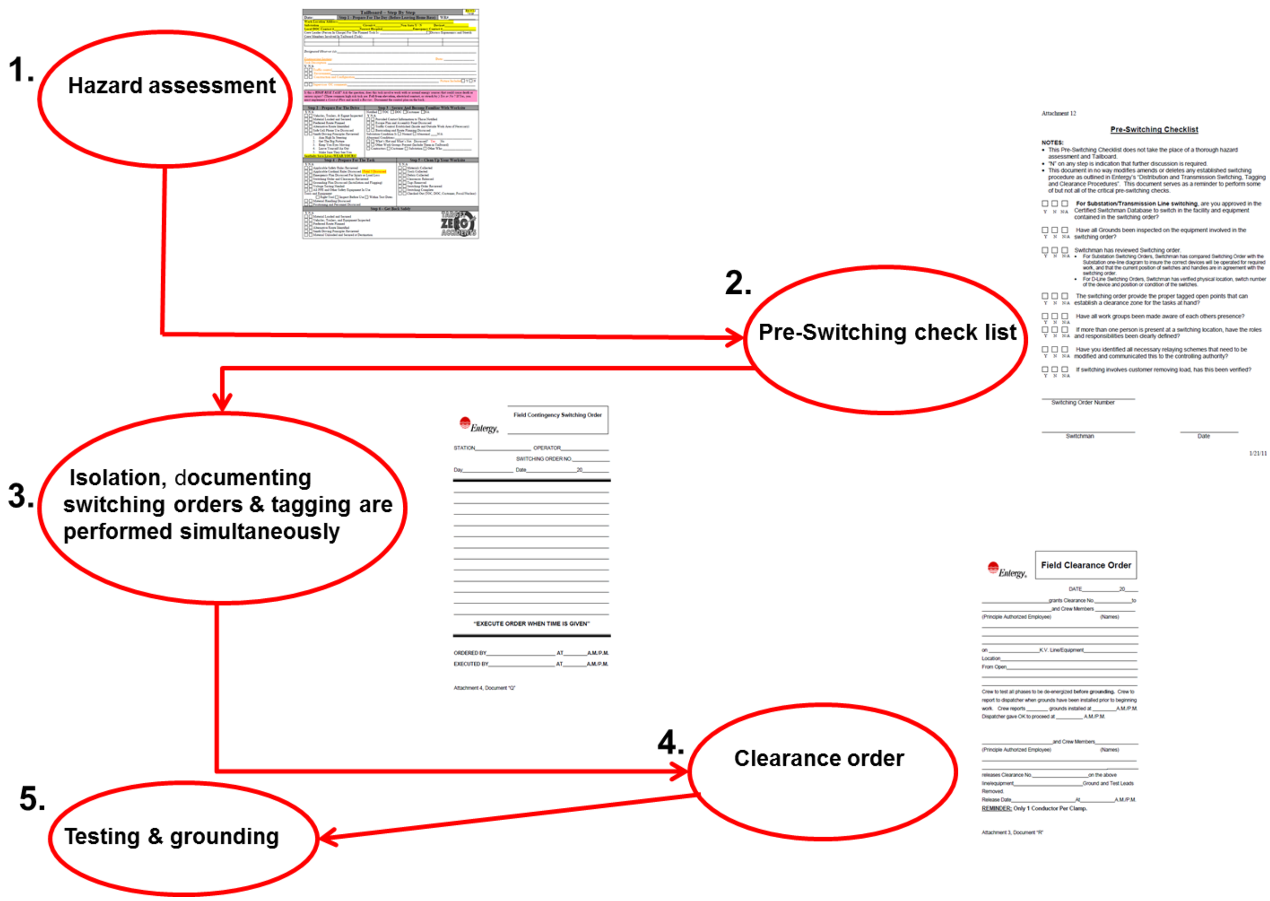
Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 29: Review



Instructor Notes:

- The slide is a review
- The is the order that should be followed when performing switching, tagging & clearances

Note: This is one scenario, each task is different, but the process should be the same.

Materials:

Hazard assessment

Pre-switching checklist

Hold tags

Switching order

Clearance Order

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 30: Questions

Instructor Notes:

None

Materials:

- None

SLIDE 31: Next Steps

The following steps are required to receive credit for this Module

Locate and take the exam on web

Print the exam results and provide to your instructor

Complete the hands-on competency test administer by the instructor

Check with your instructor if you have any questions

CF50612/Test For Voltage and Apply Grounding Elbow/CF50612/PDF-PPT/09-30-2012

SLIDE 1: Test for Voltage & Apply Grounding Elbow on URD Primary

Revision 1-02

Revision Date 09/30/2012

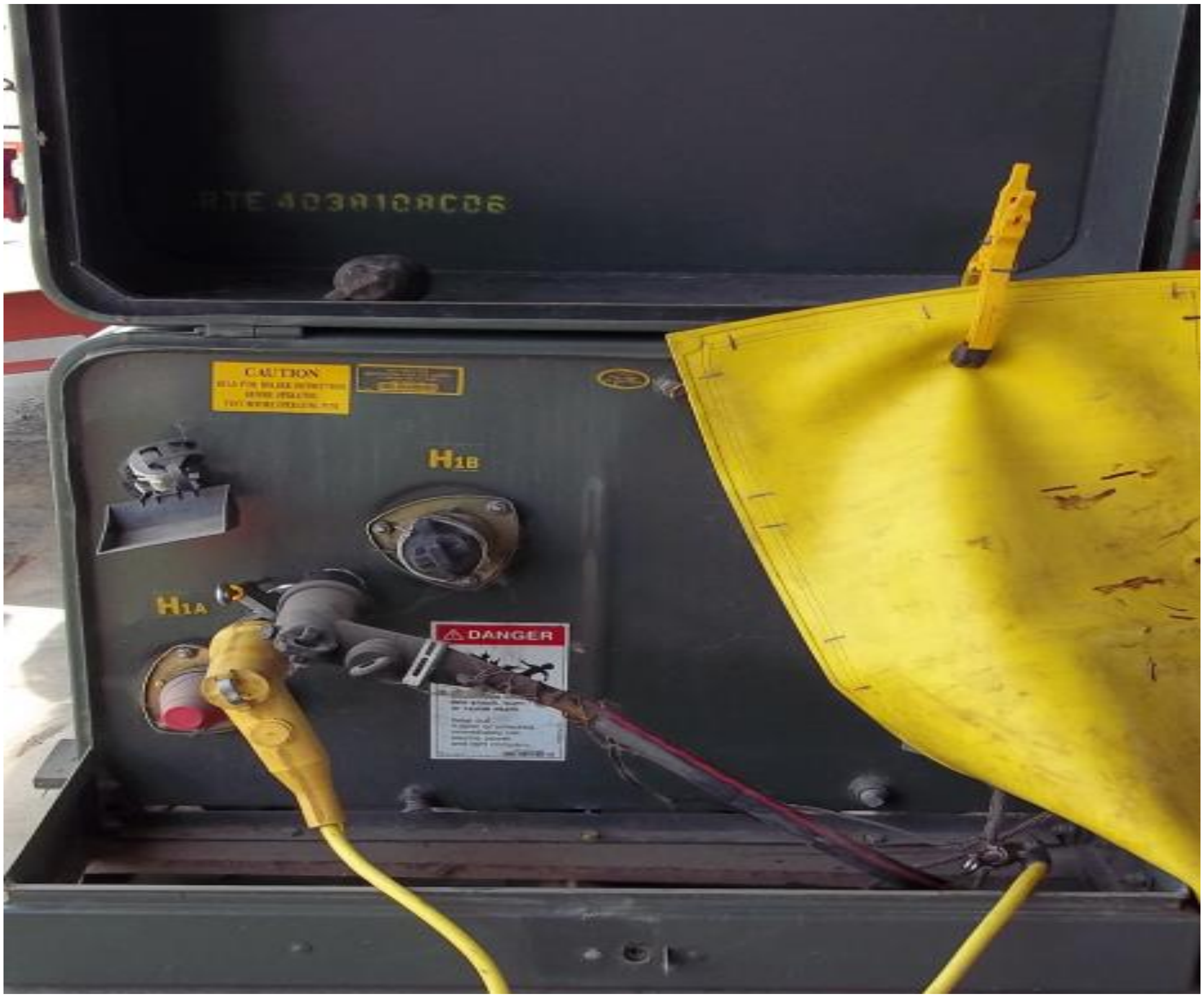
Module CF50612

Revised by Walt Roberts

Reviewed by (SME) Chris Leblanc

Approved by Tim Golden (Supervisor)

SLIDE 2:



TEST FOR VOLTAGE AND APPLY GROUNDING ELBOW ON URD PRIMARY

Instructor Notes:

In this module we will be learning how to test primary cable for voltage and install a grounding elbow to ground the cable

1. Discuss entire presentation in classroom
2. Ask questions as necessary
3. Take Written Exams
4. Go outside for hands-on activity
5. Perform competency test

Materials:

- Personal protective equipment
- Grounding elbow
- Bushing cover
- Feed-thru

- Elbow connector tool
- Shotgun stick
- Rubber blanket and clothes pins
- Secondary connection covers
- Voltage tester or phasing sticks
- Padmount transformer

SLIDE 3: Objectives

Explain the purpose of training

Discuss safety considerations

Explain the consequence of inadequate performance during grounding procedure

Demonstrate how to properly test for voltage

Demonstrate how to properly ground URD primary

Instructor Notes:

- Explain the purpose of training
- Discuss safety considerations
- Explain the consequence of inadequate performance during grounding procedure
- Demonstrate how to properly test for voltage
- Demonstrate how to properly ground URD primary

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 4: Safety

Instructor Notes:

Get the students to open the safety manual – talk about applicable sections and clues based on subject matter.

Specific Rule numbers to discuss

- 3.0, 3.33 – 3.39, 6.3, 9.0, 9.3, 9.6, 9.7, 9.11, 9.12, 9.14, 9.18, 9.19
- Also, Methods and procedure- Underground Grounding Procedures –Pg 224

Materials:

Entergy Safety Manual

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 5: Why Do We Ground?

- The installation of grounds protect against the hazards of static charges, induced voltage, backfeed and accidental energizing of lines.
- In a nut shell, to protect employees and the public from electrocution hazards!!

Instructor Notes:

- Why Do We Ground?
- There is animation on this slide
- The installation of grounds protect against the hazards of static charges on the line, induced voltage, backfeed and accidental energizing of the line.
- In a nut shell, to protect employees and the public from electrocution hazards!!

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 6: Consequence of Inadequate Grounding

Inadequate grounding or not grounding at all can be **FATAL**

- Between 20 to 50 milli-amperes you become helpless because you can not let go of the energized circuit

Over 100ma or 1/10 of an amp is where severe internal and external burns begin

The power required to light one Christmas light is enough to kill you (about 80ma.)

Instructor Notes:

- Consequence Of Inadequate Grounding
- There is animation on this slide
- Inadequate grounding or not grounding at all can be **FATAL**
- Between 20 to 50 milli-amperes you become helpless because you can not let go of the energized circuit
- Over 100ma or 1/10 of an amp is where severe internal and external burns begin.
- The power required to light one Christmas light is enough to kill you **(about 80ma)**

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 7: Test for Voltage and Apply Grounding Elbow on URD Primary

When opening any enclosure:

- All PPE – High voltage gloves, hard hat safety glasses or face shield

- Area cleared of all vegetation and obstructions that could cause one to trip
- Door hinges checked
- Use both hands for positive control
- Door shall be blocked so that it cannot close accidentally

Instructor Notes:

Can contain

- This slides discusses the preparation that should be completed before the testing and grounding can be completed.
- Before opening any enclosure such as a live or dead-front transformer or switching cubicle which contains exposed energized equipment, employees shall adhere to the following precautions:
    - personal protective equipment;
    - weeds, grass and other vegetation that obstructs the work shall be cleared from the area;
    - all loose objects which could cause an employee to stumble and fall into the energized equipment shall be removed from the area.
    - Door hinges of each enclosure shall be checked before it is opened.
    - Both hands shall be used to keep positive control of the lid of the enclosure.
    - Door shall be blocked so that they cannot close accidentally.
    - Employees shall check for hazardous conditions before proceeding with work.
    - Before opening any enclosure, all unauthorized persons shall be required to leave the immediate work area and remain in the clear.
    - Where the public is endangered, the work area shall be roped off, barricaded or otherwise marked to prevent entry.

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 8: Test for Voltage and Apply Grounding Elbow on URD Primary

When opening any enclosure:

- Check for hazardous conditions
- All unauthorized persons shall be required to leave the immediate work area
    - Rope off or barricade if necessary
- Energized enclosures shall not be left unattended when unlocked or open
- Cables or equipment shall be considered energized unless de-energized, tested and

grounded

Instructor Notes:

- This slides discusses the preparation that should be completed before the testing and grounding can be completed.
- There is animation on this slide
- Employees shall check for hazardous conditions before proceeding with work.
- Before opening any enclosure, all unauthorized persons shall be required to leave the immediate work area and remain in the clear.
- Where the public is endangered, the work area shall be roped off, barricaded or otherwise marked to prevent entry.
- Energized enclosures shall not be left unattended when unlocked or open.
- Cables or equipment shall be considered energized unless de-energized, tested for voltage, and grounded in accordance with approved procedures.

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 9: SWITCHING AND CLEARANCE PROCEDURE

Entergy's Switching and Clearance Procedures apply to URD Systems also.

- Cable or terminators shall be switched out of service and tagged with "HOLD" tags.
- Open, test and tag all normal ways of feed.
- Check to verify that the cable is de-energized.
- After the cable is switched out and tested to be de-energized, the cable shall be grounded at each end and as close to the work area as possible.

Instructor Notes

- This slide discusses the switching and clearance procedure
- There is animation on this slide
- Entergy's Switching and Clearance Procedures apply to UG Systems also.
- Cable or terminators that are to be worked on shall be switched out of service and tagged with "HOLD" tags.
- Care should be taken to open, test and tag all normal ways of feed.
- Before installing grounds a check shall be made to verify that the cable is in fact de-energized.
- After the cable to be worked, is switched out and tested to be de-energized, the cable

shall be grounded at each end and as close to the work area as possible.

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 10: Test for voltage


DANGER

- Check voltage tester for proper operation
- Install a temporary feed-thru on the parking stand
- Pull the elbow with a shotgun stick and install on the feed-thru
- Insert voltage tester with bushing adapter on the feed-thru bushing
- The reading should be zero on both bushings

Instructor Notes:

An approved voltage tester or phasing sticks can be used to test for voltage. We will use the voltage tester in this example.

There are several voltage testers on standards.

- There is animation on this slide
- Check voltage tester for proper operation before use
- Install a temporary feed-thru on the parking stand
- Pull the elbow with a shotgun stick and install on the feed-thru
- Insert voltage tester with bushing adapter on the feed-thru bushing and the transformer bushing
- The reading should be zero

Note: When checking voltage on an underground cable that has just been de-energized, you will see a 7620 volts reading at first and in a second or two it will go to 0. T

Materials:

Voltage tester

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 11: Test for voltage

- When checking voltage on an URD cable that has just been de-energized, you could see a voltage reading at first and in a second or two it will go to zero.
- Use a clamp stick/shotgun and install a bushing cover over the transformer bushing.

NEVER LEAVE A TRANSFORMER BUSHING UNCOVERED.

Instructor Notes:

An approved voltage tester or phasing sticks can be used to test for voltage. We will use the voltage tester in this example.

There are several voltage testers on standards.

- There is animation on this slide
- When checking voltage on an underground cable that has just been de-energized, you could see a voltage reading at first and in a second or two it will go to zero.
  - This is caused by a capacitive charge that you are draining from the insulated conductor.
  - A primary underground cable is capable of holding a charge like a capacitor.
- Always use a clamp stick and install the bushing cover over the transformer bushing.
- NEVER LEAVE A TRANSFORMER BUSHING UNCOVERED.

Materials:

Voltage tester

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 12: Test for voltage

CAUTION: After testing for voltage and you find the cable is still energized, this could indicate there has been a switching error that has to be corrected before going to the next procedure.

Instructor Notes:

An approved voltage tester or phasing sticks can be used to test for voltage. We will use the voltage tester in this example.

There are several voltage testers on standards.

CAUTION: After testing for voltage, if you find that the cable is still energized, this could indicate there has been a switching error that has to be corrected before going to the next procedure.

Materials:

None

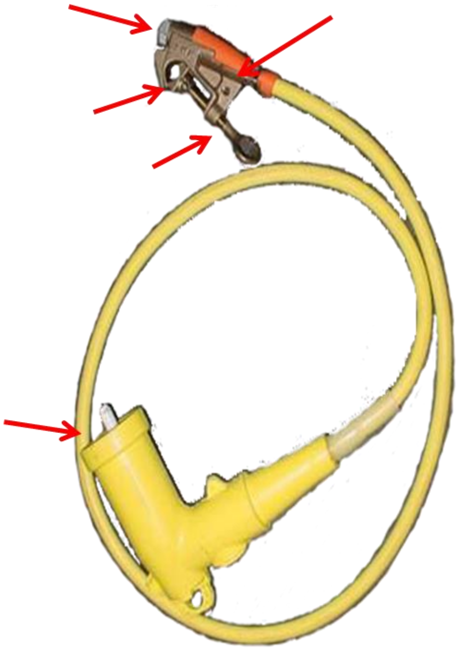
Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 13: Apply Grounding elbow



Inspect the grounding elbow before use

- Ferrule nuts and ferrules to be tight
- Cable restraining clamps/devices to be tight
- Jaws to be undamaged and clean
- Adjustment eye bolt functions properly
- Cable test date to be current
- Inspect the conductor for damage that may affect the amp rating
- Inspect elbow and probe:
    - elbow / probe undamaged
    - probe tight, clean / free of dirt
- Check for Continuity

Instructor Notes:

- This slide discusses the inspection of the grounding elbow. You should have one in class to demonstrate
- There is animation on this slide

The primary has already been tested

- Inspect the grounding cable before use
- Ferrule nuts and ferrules plain/threaded to be tight
- Cable restraining clamps/devices to be in place, tight and cable snug
- Jaws to be undamaged and clean
- Adjustment eye bolt or device to function properly

- Cable test date to be current as per Entergy and OSHA
- Inspect the conductor for damage that may affect the amp rating
- Ground elbow should have silicone grease inside the elbow for easier installation and removal
- Check the grounding elbow for continuity

Materials:

Grounding elbow

Teaching Points:

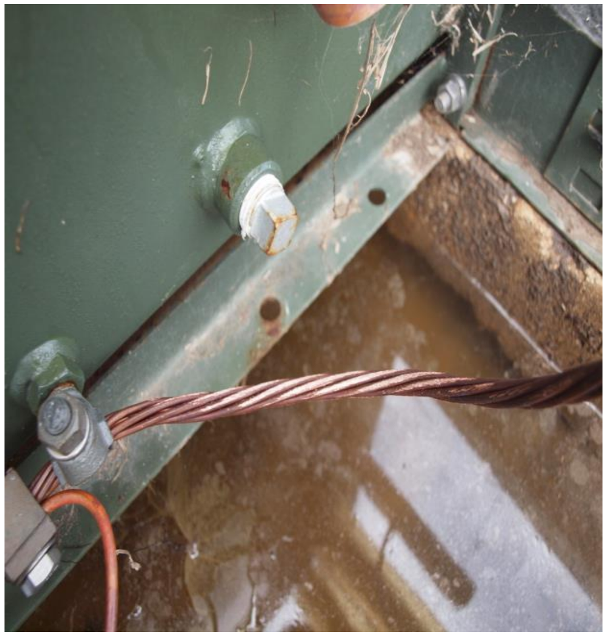
Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 14: Apply Grounding elbow

SLIDE CONTENT:



- Clean the ground wire with a wire brush
- Install the ground clamp on the ground wire using a shotgun stick
  - The ground connection shall always be installed first
- Install the grounding elbow into the feed-thru bushing using the shotgun stick

QUESTION: Anything wrong in this pic??

Instructor Notes:

- This slide discusses the steps to install the grounding elbow
- There is animation on this slide

Once the grounding elbow has been inspected

- Clean the ground wire where the ground clamp will be installed with a wire brush
- Install the ground clamp on the ground wire using a shotgun stick
  - The ground connection shall always be installed first
- Install the grounding elbow in the feed-thru bushing using the shotgun stick
- NOTE: The pic provided at the end has one of the red shipping caps still installed. In an energized transformer that should not be there – should be replaced by a bushing similar to the one in the center top of the pic

Materials:

Grounding elbow

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 15: Review

- Be aware of all hazards when opening a transformer or switching cabinet
- All switching and clearance procedures will be followed
- All conductors will be tested for voltage before grounding
- Install the grounding elbow

Instructor Notes:

- This slide discusses an overview of the module
- There is animation on this slide
- Be aware of all hazards when opening a transformer or switching cabinet
- All switching a clearance procedures will be followed
- All conductors will be tested for voltage
- Install the grounding elbow

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 16: Questions

Instructor Notes:

None

Materials:

- None

SLIDE 17: Next Steps

The following steps are required to receive credit for this Module

Locate and take the exam on web

Print the exam results and provide to your instructor

Complete the hands-on competency test administer by the instructor

Check with your instructor if you have any questions

SLIDE 1: Replace SMU-20 & SM-4 Fuses

Revision 1-01

Revision Date 07/05/2012

Module CF50613

Revised by Walt Roberts

Reviewed by (SME) Kirk Gomez

Approved by Tim Golden (Supervisor)

SLIDE 2: Replace SMU-20 & SM-4 Fuses

SMU 20

SMU 4

Instructor Notes:

1—SMU 20 used

This module will take a look at what you must do to fuse, refuse a blown fuse and replace an unblown fuse in pad-mounted switchgear. This module will deal with a SMU-20 and SMU-4 either one which can be used overhead or underground (inside appropriate equipment panels)

Introduce the module to the students – brief statement on what they're about to do.

Discuss entire presentation in classroom

Ask questions as necessary

Take Written Exams

Go outside for hands-on activity

Perform competency test

Materials:

Fuse Link

Fuse barrel-SMU-20

SM-20 Components

SM-4 Barrel

SM-4Z Silencer

Wrench

Rag

Approved knife

All PPE – work gloves, safety glasses, hard hat

9/16 socket & ratchet

SLIDE 3: OBJECTIVES:

Preparing and Replacing a SMU 20 Power Fuse

- Removing the upper and lower ends
- Aligning the upper end with locating pin
- Re-installing the upper and lower ends
- Explain guidelines for use of silencer
- Installing or removing the silencer

Instructor Notes:

TERMINAL OBJECTIVE:

Given a power fuse assembly that the link needs to be replaced, replace the fuse to meet manufacturer's standards.

ENABLING OBJECTIVES:

- Explain the purpose of the training
- Discuss Safety considerations
- Explain consequences of incorrect performance

- Explain why we use power fuses instead of QR?
- Show the fuse and parts- SM4 and SMU20

Materials:

None on this slide

Teaching Points:

Ask open ended questions to promote discussion

Key Information

Share operating experiences (near misses, incidents)

SLIDE 4: OBJECTIVES:

Preparing and Replacing a SM 4 Power Fuse

- Removing/replace the exhaust-control device
- Removing replace holder cap
- Removing/replacing the spring and cable assembly
- Replace fuse
- Purpose of silencer
- Installing or removing the silencer

Instructor Notes:

Note: Exhaust-control device has several names (silencer, snuffler, super snuffler, muffler or sneezer.)

Materials:

None on this slide

Teaching Points:

Ask open ended questions to promote discussion

Key Information

Share operating experiences (near misses, incidents)

SLIDE 5: Safety

Instructor Notes:

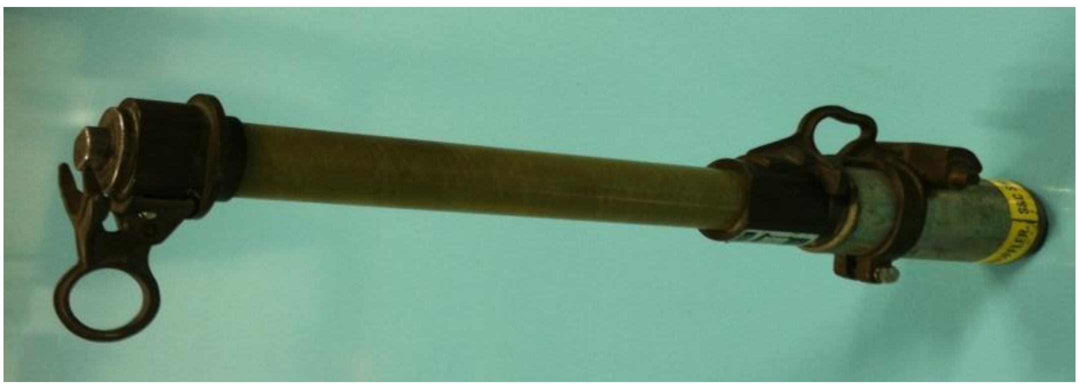
- Get the students to open the safety manual – talk about applicable sections and clues based on subject matter.
- No Animation on this slide

Specific Rule numbers to discuss – 5.4, 9.0 to 9.19 *All notes

Materials:

- Entergy Safety Manual

SLIDE 6: SMU-20 and SM-4



Power fuses are used for fault protection:

- Transformers
- Capacitor banks
- Cables in outdoor distribution stations
- Switch gear
- Indoor vault applications

Instructor Notes:

- SMD is the power fuse housing. SMU-20 and SM-4 are fuse units. SMU-20 has two different types used in different areas
- Animation instructions: Click to get pictures to fade and appear simultaneously.
    - URD-SMU-20 with silencer---
    - SM-4 with silencer for use in URD Metal switchgear and indoor applications
    - OH-SMU-20–click (some locations used this type more in an OH application without the silencer/snuffler.

Materials:

None on this slide

Teaching Points:

Put all of these in the order they should be presented.

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

Wrap-up (if needed)

SLIDE 7: SMU-20 and SM-4 Advantages over QR fuses

- Higher Fault Current and Higher Ampacity
    - QR Applications: 10 thru 150 amps (100 amp fuse barrels)
    - SMU-20 offers up to 200 amps
    - SMU-4 offers up to 400 amps
- More Durable
- Longer Life
- Less likely to miss-operate in non-fault conditions
- Less likely to blow during fuse overload
- Easier to assemble and install

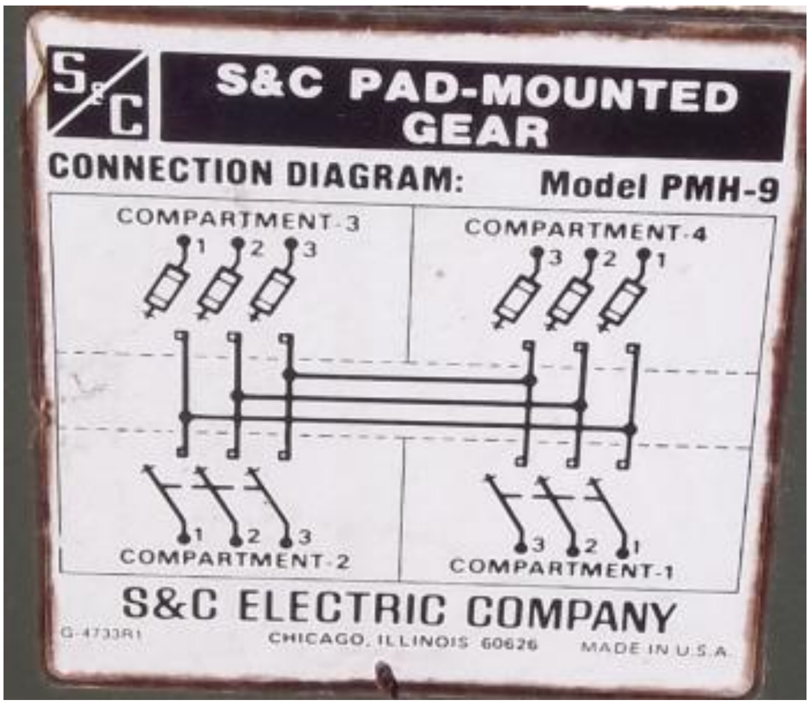
Instructor Notes:

Bullets above giving you the basic information, below are more details.

- Power fuses are specified for fault protection of 750kVA transformer banks and pad-mounts and above. In this application they offer several advantages over QR fuses:
    1. Higher fault current and higher ampacity. The QR is only available in models from a range of 1 to 200 amps of continuous current. At Entergy we use QR fuses for applications of 10 amp thru 150 amps in 100 Amp fuse barrels. The SMD-20 offers up to 200 amps and the SMD-40 offers up to 400 amps.
    2. The power fuse is a more durable fuse. The device is designed to hold up better over time to factors like age, corrosion, vibration, and electrical surges.

3. It is less likely to miss-operate due to non-fault conditions such as daily and repetitive high peak loads, and hot-load and cold-load inrush currents.
4. It's less likely than a QR fuse to blow during extended periods of fuse overloading.
5. It's easier to assemble and correctly install a power fuse; it only goes together one way. Proper QR fuse installation takes more skill, knowledge and technique to ensure correct operation, particularly under high percent of rating load. Since power fuses are used to protect larger transformer banks and pad-mounts, it's more critical that they operate correctly.

SLIDE 8: Padmount Switchgear



The nameplate below is typical of what you will see inside the switchgear. The nameplate will show you the connection diagram and the model.

Instructor Notes:

- Each padmount switch gear will have a nameplate stating what the model number and connection diagram for each side of the switchgear.
- No Animation on this slide

Materials:

None on this slide

Teaching Points:

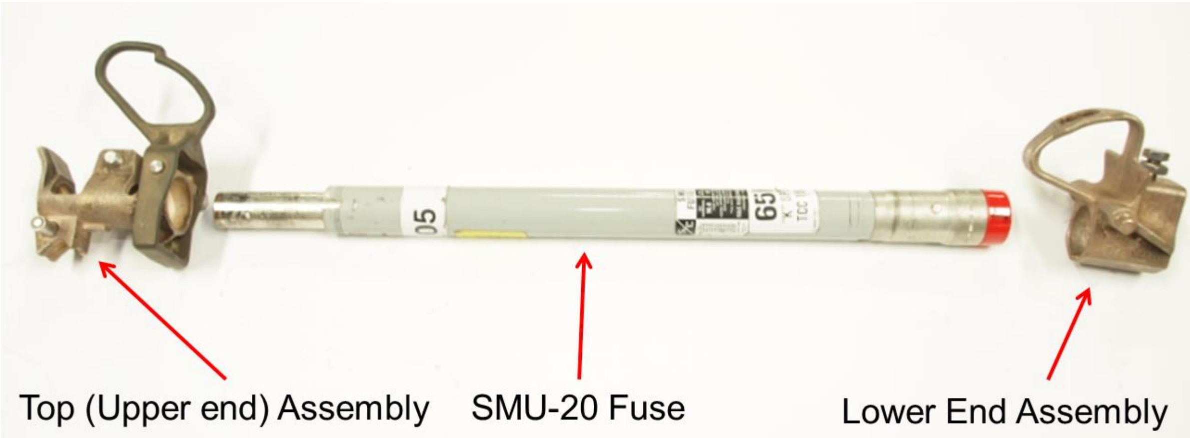
Ask open ended questions to promote discussion

Key Information

Share operating experiences (near misses, incidents)

Wrap-up (if needed)

SLIDE 9: SMD/SMU-20 Fuse Assembly Parts



Instructor Notes:

- None

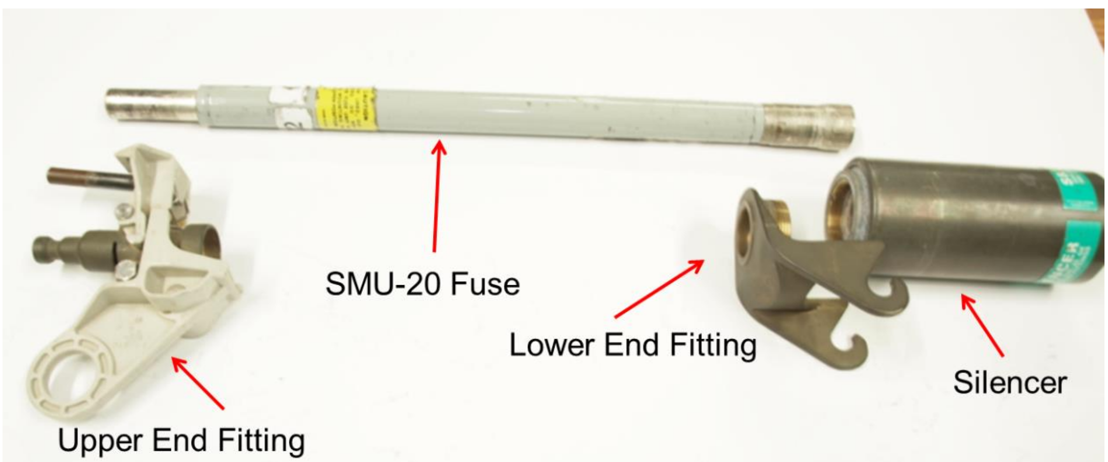
Materials:

None

Teaching Points:

None

SLIDE 10: SMD/SMU-20 Fuse Assembly Parts



Instructor Notes:

- None

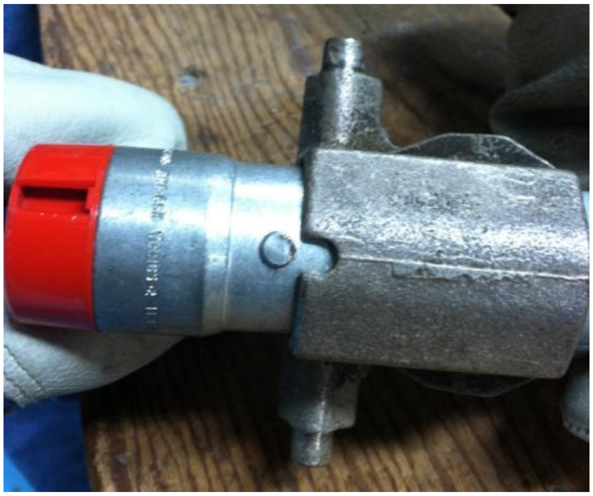
Materials:

None

Teaching Points:

None

SLIDE 11: Installation of SMU-20 Fuse



Step1. Attach the lower end fitting first

Slip the lower end over upper end until it seats on top of the red cap

Instructor Notes:

A long sequence of pictures are animated on this slide. Please check the presentation in slideshow mode to see how it flows. You may want to time your comments appropriately.

Even though this is for underground, these SMU 20 and SMU 4 fuses can be used in both overhead and underground applications.

Most areas use these fittings for the SMU 20 in the switch cabinets for underground.

- SMU-20 has to be assembled. The components to assemble the SMU-20 fuse will consist of upper and lower ends, fuse unit with a removable red cap and a silencer that is used in underground cabinets only.
- The 1st set of components are used in the URD assembly (underground fuse).
- The 2nd set of components are used in the OH assembly

SLIDE 12: Installation of SMU-20 Fuse



05


Step 2: Slip the upper end over fuse unit until the fuse seats into the designated slot (Inside the upper end fitting).

Tighten the bolt firmly

Instructor Notes:

This slide has animation— click for to start for both UG and OH assembly

1. Underground fuse link assembly
2. Overhead fuse link assembly

SMU-20 has to be assembled. The components to assemble the SMU-20 fuse will consist of upper and lower ends, fuse unit with a removable red cap and a silencer that is used in underground cabinets only.

- Slip the upper end on top of the fuse while aligning the locating pin inside upper end with the top of the fuse.
- After fitting the upper end firmly on the fuse unit, tighten bolt to secure the unit.

SLIDE 13: Installation of SMU-20 Fuse

Step 3: Follow instructions which appear on the bottom of the red cap (rain shield) located on the lower end of fuse unit.

Instructor Notes:

Animation 2nd picture will come in after 1st fades out

“Do not disturb this cap if fuse is to be used outdoors (overhead)”.

As a point of information, this cap protects the fuse unit from water entry.

SLIDE 14: Installation of SMU-20 Silencer for Underground



Step 4: Remove red cap at the lower-end fitting by unscrewing the cap, allows you to attach the silencer at the end of the barrel.

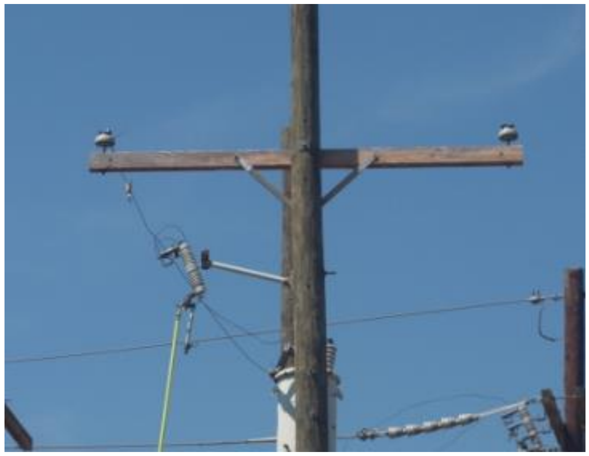
Instructor Notes:

Animation pictures come in after other fades out

Silencer is used in URD mounted switchgear

Note: If this installation had been for an overhead application, omit installing silencer

SLIDE 15: Refusing SMD Assembly



This pin shows when a SMU 20 fuse is blown

Overhead Power fuse

- Overhead SMD Power fuse operates same as a QR fuse
- Fuse unit swings to open position
- Remove it from the mounting using a hot stick

Instructor Notes:

Picture on the right shows how a SMU 20 indicates the fuse is blown

Refusing the SMD overhead assembly

Examine the end of the fuse unit to determine that the actuating pin extends through the upper seal, indicating that the fuse unit is blown.

- Loosen the upper- and lower-end fitting clamp screws (pry apart, slightly, the upper-end-fitting clamp using a screwdriver), and slide **both** end fittings off the upper end of the fuse unit.
- Next, attach the end fittings to a new fuse unit, replace with same amperes size, unless told otherwise, following the instructions given earlier. A blown fuse unit cannot be salvaged. Discard it.
- To avoid delay due to transferring of end fittings, spare sets of end fittings may be kept on hand for attachment to new fuse units before re-fusing is to be performed.
- When closing an SMD-20 Power Fuse, insert the prong of the switch stick into the pull ring on the fuse-unit upper-end fitting and swing the fuse unit to within approximately 45° of the fully closed position. Then, while looking away, fully close the fuse using a vigorous thrust. Carefully disengage the switch stick, taking care to avoid opening the fuse.

Note: Some fuse Units have silver or nickel-chrome fusible elements that are non-damageable; consequently, there is no need to replace unblown companion fuses on suspicion of damage following a fuse operation.

SLIDE 16: Refusing SMU-20 Fuse

This pin shows when a SMU 20 fuse is blown

Underground SMU-20 fuse

- Fuse unit has a blown-fuse indicator
- Remove it from the mounting

Instructor Notes:

Refusing the SMU-20 underground assembly

- When the fuse operates, the fuse unit does not swing open but the blown-fuse indicator moves to the extended position, providing visual evidence that the fuse is blown.
- Move the fuse unit to the open position and then remove it from the mounting using a grappler attachment to your hot stick.
- Attach the fittings and silencer to a new fuse unit, following the instructions given earlier. A blown fuse unit cannot be salvaged. Discard it

Caution: Depending on the switching procedures and the design of the underground system the bottom or the top of the fuse assembly could be energized. Make sure you folow all company switching and testing to verify WHAT YOU are about to DO

SLIDE 17: SMU-20 Precautions

1. Do not leave fuse units installed in SMD-20 outdoor distribution mountings hanging open.
2. Do not remove the fuse unit from its carton until ready to use.
3. Handle fuse units with care—do not drop or throw
4. Do not disturb the red cap (rain shield) at the lower end of the fuse unit. (unless installing a silencer for URD purposes)

Instructor Notes:

1. Once closed in the fuse unit will not be damaged by rain or high-humidity.
2. When in storage these fuse units should be protected from excessive moisture.
3. Red cap only to be removed when unit is going to be used in a underground cabinet.

SLIDE 18: Fusing a SM-4

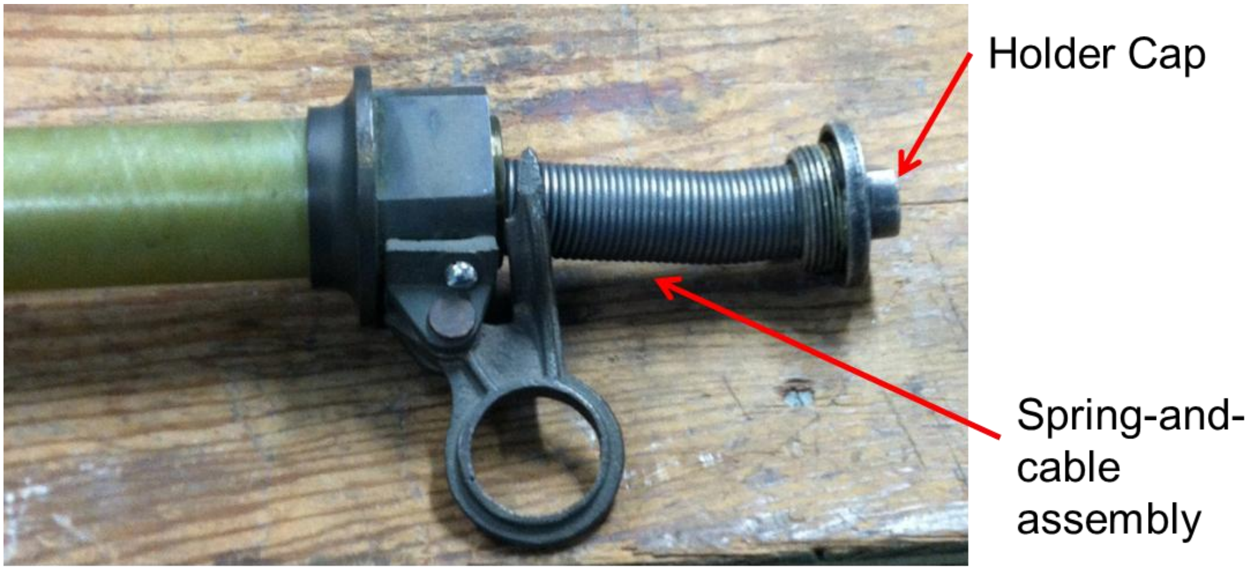
Step1. Unscrew and remove the exhaust-control device.

Instructor Notes:

SMU-4 and SMU-20 both have exhaust-control devices which can all be called: silencer, snuffler, super snuffler, muffler or sneezer. A bar or wrench handle can be used to loosen it

Step 1: Unscrew and remove the exhaust-control device.

Important: Refill units should be stored in a dry place and kept in the carton until used.



Step 2: Unscrew and withdraw the holder cap to which is attached the spring-and-cable assembly

Instructor Notes:

Step 2: Unscrew and withdraw the holder cap-- attached the spring-and-cable assembly

SLIDE 20: Fusing a SM-4

Step 3: Screw a refill unit of correct ampere and voltage rating tightly onto the lower end of the spring-and-cable assembly.

Check to see that the knurled collar at the other end of the refill unit is tight against the shoulder of the refill unit ferrule

Instructor Notes:

Note: Use the knurled terminal on the spring-and-cable assembly to make a final, hard twist.

Do not use a wrench

Note: Check to see that the knurled collar at the other end of the refill unit is tight against the shoulder of the refill unit ferrule.

What is a ferrule? A sleeve that provides a seal when compressed between two mating fitting components.

SLIDE 21: Fusing a SMU-4

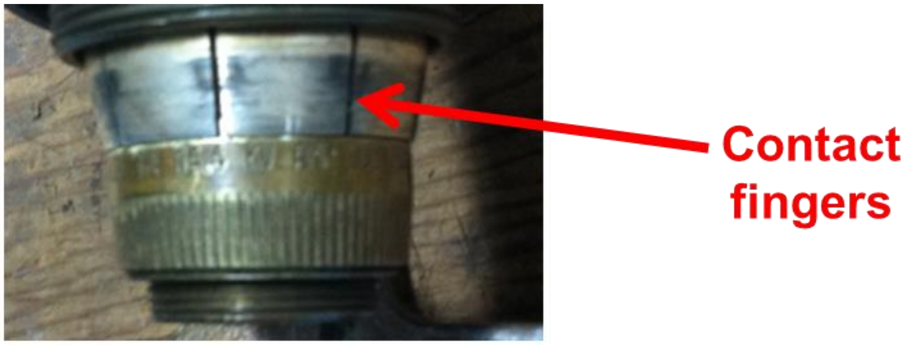
Step 4

- Insert the combination of spring-and-cable assembly and refill unit into the holder
- Screw the cap down hand tight

Instructor Notes:

- The pull cord will be hanging out the end of the holder

SLIDE 22: Fusing a SM-4



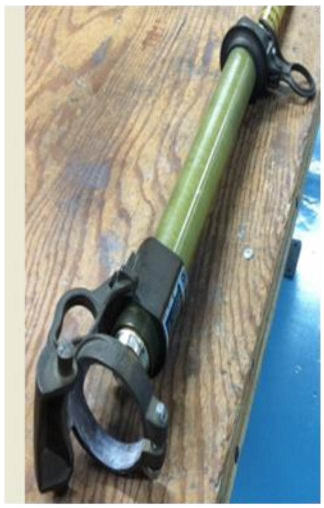
Step 5

- Carefully draw the refill pull-cord out through the holder
- Release the refill pull-cord slowly, permitting the collar to rest on the contact fingers.
- Do not bend or alter the shape of the contact fingers.

Instructor Notes:

- Note: Avoid jerking and excessive pulling, may damage low-ampere refill units.

SLIDE 23: Fusing a SM-4



Step 6

- Replace the exhaust-control device, screwing on firmly.
- The final, fractional turn of the exhaust-control device may have to be made with a wrench handle

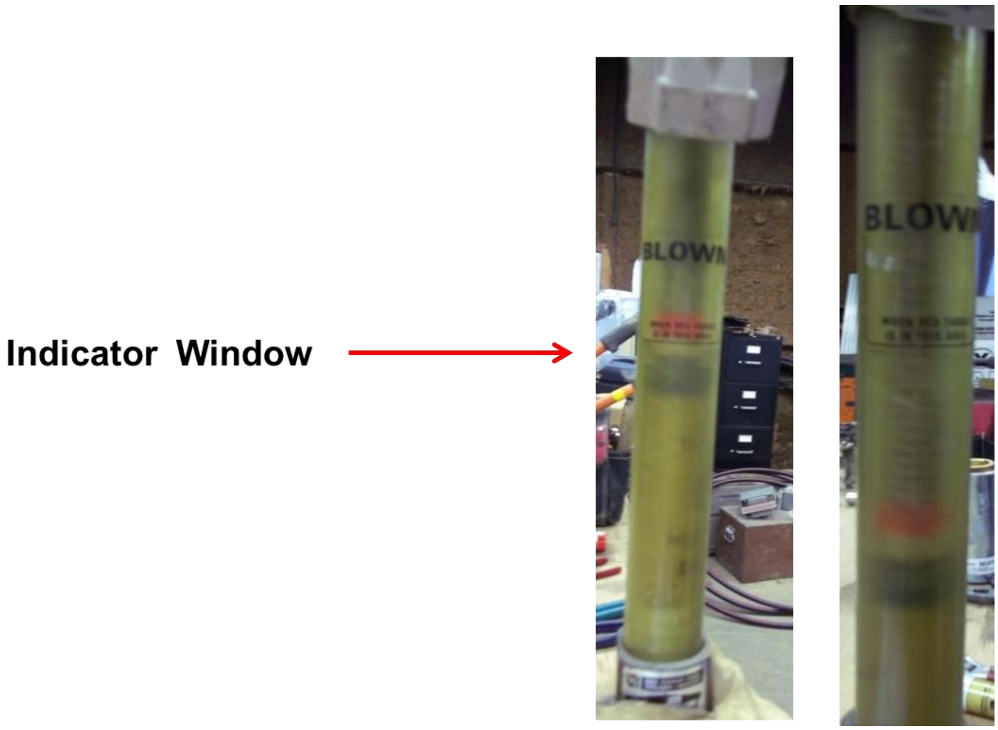
Instructor Notes:

- Note: To ensure adequate electrical contact with the contact fingers—which is essential to the proper performance of the fuse.

SLIDE 24: A Blown SM-4

Determine if a SM-4 fuse is blown—The fire orange target appears in the indicator window.

A. Fuse not blown
B. Fuse blown



Instructor Notes:

Note: If the fuse has operated it will be visible through the translucent holder

SLIDE 25: Questions

Instructor Notes:

None

Materials:

- None

SLIDE 26: Next Steps

The following steps are required to receive credit for this Module

Locate and take the exam on web

Print the exam results and provide to your instructor

Complete the hands-on competency test administer by the instructor

Check with your instructor if you have any questions

SLIDE 1: Spike or Cut URD Cable Remotely

Revision 1.01

Revision Date 07/10/2012

Module CF50615

Revised by Walt Roberts

Reviewed by (CMPD)

Reviewed by (SME) Kirk Gomez

Approved by Tim Golden(Supervisor)

SLIDE 2: Spike or Cut URD Cable Remotely

Instructor Notes:

Introduce the module to the students – brief statement on remotely cutting or spiking URD cable. Remind trainees' that grounding is a fatal 5 rule

We spike URD cable to assure the primary is dead and cut with a grounded cutter head for added protection

1. Discuss entire presentation in classroom
2. Ask questions as necessary
3. Take Written Exams
4. Go outside for hands-on activity
5. Perform competency test

Materials:

- Shotgun stick
- Remote cable cutter
- Hydraulic pump & hoses
- Spiking tool
- URD primary Cable
- Screw ground rod
- All PPE
- Safety Manual
- Fatal 5 cards

SLIDE 3: Objectives

- Explain the purpose of training
- Discuss safety considerations
- Explain the consequence of improper cutting or spiking
- Demonstrate how to remotely cut a URD Primary cable
- Demonstrate how to spike a URD primary cable

Instructor Notes:

TERMINAL OBJECTIVE(S):

Given a faulted URD primary cable, remotely cut or spike the cable with 100% accuracy.

ENABLING OBJECTIVES:

Explain the purpose of training

Discuss safety considerations

Explain the consequence of improper cutting or spiking

Demonstrate how to remotely cut a URD Primary cable

Demonstrate how to spike a URD primary cable

Materials:

None

SLIDE 4: Safety

Instructor Notes:

Some of these safety rules are on the exam

Get the students to open the safety manual, read and discuss safety rules

5.3.9, 5.3.10, 5.3.11 (Fatal 5) the students should have their fatal 5 cards and read them

2.8, 3.33, 3.35, 3.36, 5.0 (make sure you cover the Note), 5.4, 9.1, 9.5, 9.46

Materials:

Entergy Safety Manual

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 5: Spike or Cut URD Cable Remotely

Why should we take extra precautions while working on underground circuits?

- Underground circuits present special hazards in that one cannot trace out the circuits visually.

Instructor Notes:

- This slide discusses why we have to take extra precautions with URD
- There is animation on this slide
- Ask the question: Why should we take extra precautions while working on underground circuits?
- Answer: Underground circuits present special hazards in that one cannot trace out the circuits visually.

Materials:

None

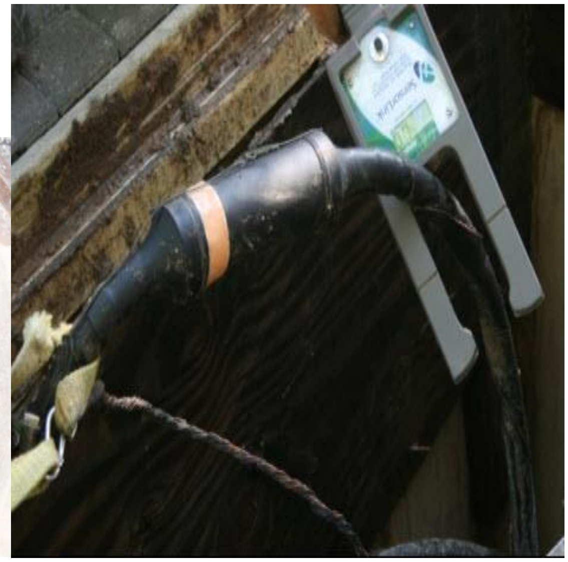
Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 6: Cut URD Cable Remotely



Cut URD Primary Remotely

- Primary is switched, tagged, tested & grounded
  - An amp reading can be taken before and after the conductor has been de-energized to assure the correct conductor is being cut
- Place remote cable cutter in proper position

Note: There is a grounded cutting tool on standards that is approved for use if a hydraulic cutting tool is not available

Instructor Notes:

- This slide discusses the operation of a remote hydraulic cutter
- There is animation on this slide
- Cut URD primary cable using a remote cable cutter according to Entergy safe work practices
- Have cable switched out, tested for voltage, tagged and grounded.
- An amp reading can be taken before and after the conductor has been de-energized to assure the correct conductor is being cut
- Place remote cable cutter in position where you want to cut cable with cable laying in cutting jaw.
- Note: There is a grounded cutting tool on standards that is approved to use if you do not have a hydraulic cutting tool
    - There may be a remote location where120volt power to operate hydraulic pump is not available.

Materials:

Hydraulic cutter

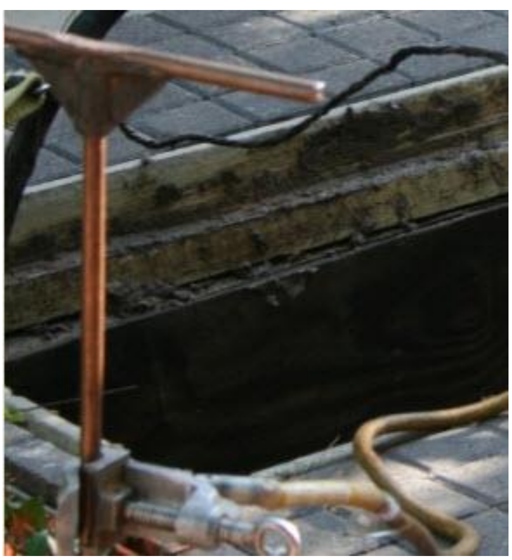
Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 7: Cut URD Cable Remotely



Cut URD Primary Remotely (Continued)

- Attach a hydraulic hose

- Install temporary ground rod
- Attach a ground from the rod to the cutting head or connect to system neutral

Instructor Notes:

- This slide discusses the operation of a remote hydraulic cutter
- There is animation on this slide
- Cut URD primary cable using a remote cable cutter according to Entergy safe work practices
- Have cable switched out, tested for voltage, tagged and grounded.
- Place remote cable cutter in position where you want to cut cable with cable laying in cutting jaw.
- Attach a minimum 10 foot hydraulic hose to remote cable cutter.
- Install temporary ground rod in cutting area
- Attach a ground from the rod to the cutting head.

Materials:

Hydraulic cutter

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 8: Cut URD Primary Remotely (Continued)

- Move pump to remote location
  - Place pump on rubber blanket or mat
- Operate pump until by-passed
  - You should hear cable cutter snap closed

Caution: Anytime that URD primary cable is to be cut this procedure shall be used

Instructor Notes:

- This slide discusses the operation of a remote hydraulic cutter (Continued)
- There is animation on this slide
- Move pump to remote location and make sure everyone is clear of cutting area.
  - Place pump on rubber blanket or mat for operation.
- Operate pump until by-passed.
- While operating pump, you should hear cable cutter snap closed, cutting cable in two.

Materials:

Hydraulic cutter

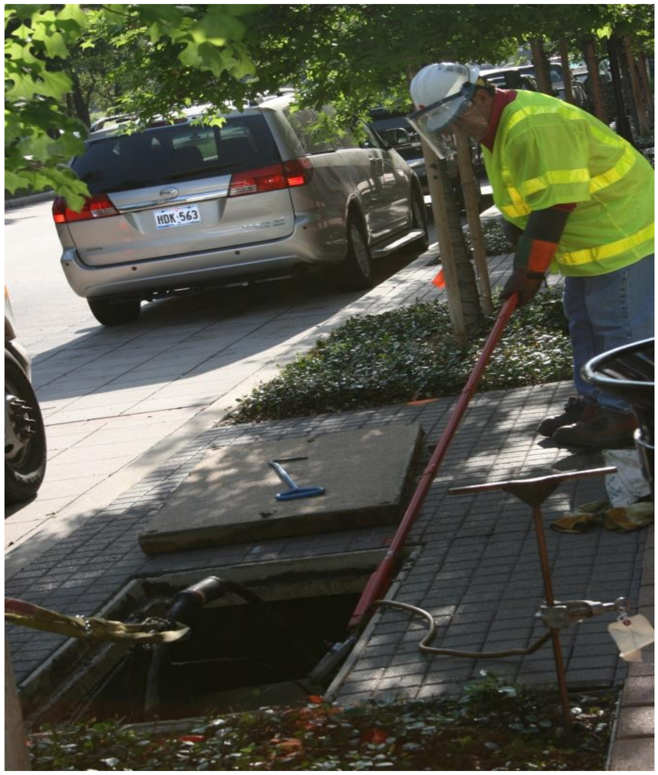
Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 9: Spike URD Cable Remotely



Spike Primary cable

- Primary is switched, tagged, tested, grounded & amp reading taken
- Position spiking clamp where the cable is to be spiked
- Ground spiking clamp to system ground or ground rod
- Place clamp stick onto spiking clamp ring

Instructor Notes:

- This slide discusses the spiking of a URD primary cable remotely according to Entergy safe work practices
- There is animation on this slide
- The SPIKE is a safety tool designed for the protection of lineworkers by providing positive assurance underground electric power cables are de-energized prior to cutting
- Have the cable switched out, tested for voltage, tagged and grounded.
- Place spike clamp in position where you want to cut or spike cable laying in spiking clamp.
- Attach ground clamp cable from spiking clamp and attach to system ground or ground rod.
- Place clamp stick onto spiking clamp ring.

Materials:

Spiking tool

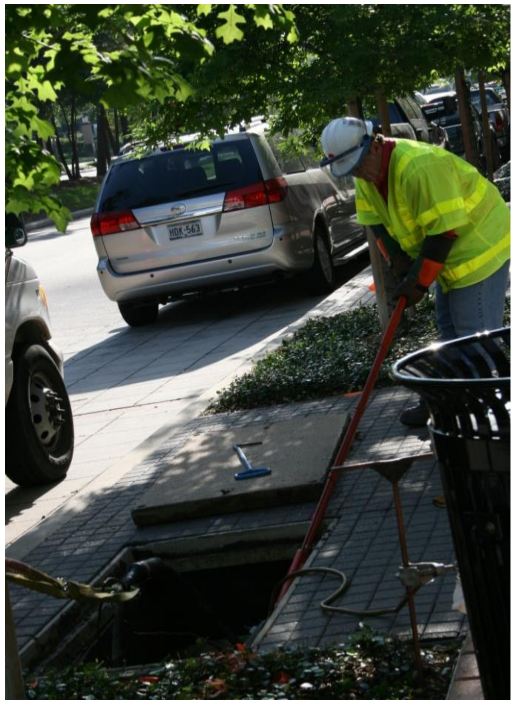
Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 10: Spike Primary cable (Continued)



- Move as far away as possible
- Tighten down the spiking tool onto the cable using a clamp stick
- Move stick side to side and try to rotate clamp again

Instructor Notes:

- This slide discusses the spiking of a URD primary cable remotely according to Entergy safe work practices (Continued)
- Move as far as you can away and to the side, then make sure everyone is clear of spiking area
- Wearing personal protective equipment, tighten down the spiking tool onto the cable using a 8' clamp stick
- After you have screwed down as far as you can, move stick side to side and try to rotate clamp again.

Materials:

Spiking tool

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 11: Review

- Primary shall always be switched, tagged, tested & grounded
- Anytime that URD primary cable is to be cut this procedure shall be used
- Cutting head and spiking tool shall be grounded before use
- While cutting or spiking a cable with a grounded head a minimum of 6 feet of insulated distance will be maintained to the operators location or the full length of the tool being used to perform the task, whichever is greater

Instructor Notes:

- This is a review slide
- There is animation on this slide
- Primary shall always be switched, tagged, tested & grounded
- Anytime that URD primary cable is to be cut this procedure shall be used
- Cutting head and spiking tool shall be grounded before use
- While cutting or spiking a cable with a grounded head a minimum of 6 feet of insulated distance will be maintained to the operators location or the full length of the tool being used to perform the task, whichever is greater (Safety rule 9.5)

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 12: Questions

Instructor Notes:

None

Materials:

- None

SLIDE 13: Next Steps

The following steps are required to receive credit for this Module

Locate and take the exam on web

Print the exam results and provide to your instructor

Complete the hands-on competency test administer by the instructor

Check with your instructor if you have any questions

CF50616/Refuse Pad-mount Transformer/CF50616/PDF-PPT/07-10-2012

SLIDE 1: Refuse Padmount Transformer/Bay-O-Net Fuse Holder

Revision 1-01

Revision Date 07/10/2012

Module CF50616

Revised by Walt Roberts

Reviewed by (CMPD) Shirley Davis

Reviewed by (SME) Jody Overbeck

Approved by Tim Golden(Supervisor)

SLIDE 2: Refuse Padmount Transformer/Bay-O-Net Fuse Holder

Instructor Notes:

This module discusses refusing a padmount transformer with a bay-o-net fuse.

1. Discuss entire presentation in classroom
2. Ask questions as necessary
3. Take Written Exams
4. Go outside for hands-on activity
5. Perform competency test

Materials:

Bay-O-Net Fuse

Fuse Link

Sand Fuse

NX Fuse

Adjustable Wrench

Shotgun stick

All PPE

Padmount transformer with Bay-O-Net fuse

Voltmeter to check continuity

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 3: Objectives

- Identify Safety rules pertaining to URD
- Remove Bay-O Net Fuse holder
- Replace Fuse
- Reinstall Bay-O-Net Fuse holder

Instructor Notes:

None

Teaching Points:

Ask open ended questions to promote discussion

Key Information

Share operating experiences (near misses, incidents)

Wrap-up (if needed)

SLIDE 4: Safety

Instructor Notes:

Get the students to open the safety manual – talk about applicable sections and clues based on subject matter.

Section 9 Underground Distribution Section:

9.0, 9.0*, 9.3, 9.5, 9.6, 9.10, 9.11

*- All notes

Materials:

Entergy Safety Manual

Teaching Points:

Ask questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 5: Deadfront Transformers

- The term “deadfront transformer” means that the primary connections in the operating compartment is insulated and the outside of the connections are maintained at ground potential.
- The sealed tank holds the transformer, primary bus, fuses, and switch.
- The internal bus can be energized from either primary bushing and the transformer is tapped off this internal bus.

Instructor Notes:

- We will explain what a deadfront transformer is and how it operates in this and the next few slides
- Point out the primary and secondary bushings, the pressure relief valve, grounding leg and Bay-O-Net fuse before going to the next click

- There is Animation on this slide – the transformer will appear so it can be introduced, then on the next click(s) the transformer will disappear and the bullets/talking points will appear
- The term “deadfront transformer” means that the primary connections in the operating compartment is insulated and the outside of the connections are maintained at ground potential. (Same voltage/potential as the earth)
- The sealed tank holds the transformer, primary bus, fuses, and switch.

The internal bus can be energized from either primary bushing and the transformer is tapped off this internal bus.

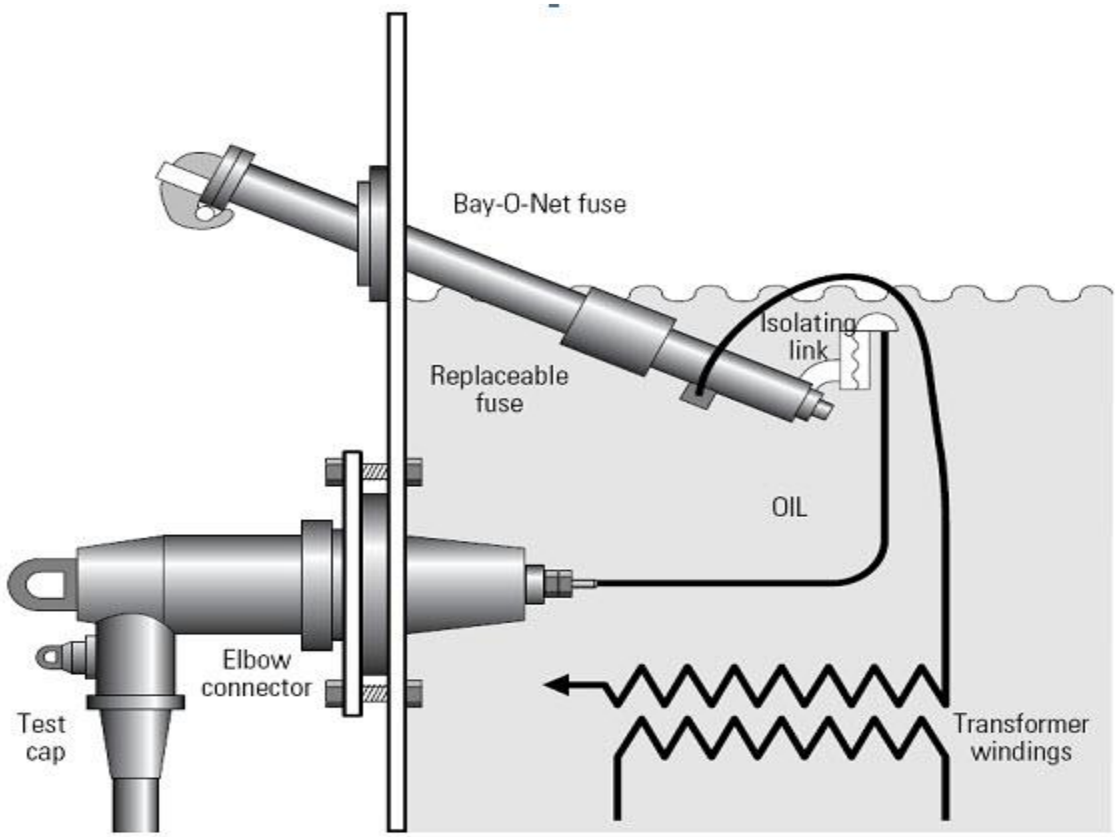
SLIDE 6: Deadfront Transformers

- The transformer fuse is connected between the internal primary bus and the transformer, therefore when an internal fuse blows, the primary bus inside the transformer is still energized.
  - Only the transformer primary coil has been interrupted.

Instructor Notes:

- Continued explanation of what a deadfront transformer is and how it operates
- There is no Animation on this slide
- The transformer fuse is connected between the internal primary bus and the transformer, therefore, when an internal fuse blows the primary bus inside the transformer is still energized. Only the transformer primary coil has been interrupted.

SLIDE 7: Bay-O-Net Fuses



Instructor Notes:

- Point out the different parts of the transformer
- There is no Animation on this slide
- The oil-immersed Bay-O-Net fuse assembly is used in majority of the single and three phase underground padmount transformers.
- The Bay-O-Net fuse is a single element fuse sensitive to both current and oil temperature.
- This link is used to sense secondary faults, excessive load current, and transformer faults.
- It will also limit long time transformer overheating due to overloads and environment temperatures.
- Bay-O-Net fuses are connected in series with an isolation link that melts if it is exposed to fault currents in excess of the Bay-O-Net fuse rating.
- The isolation link has no interruption rating and is used only to prevent fault current beyond the Bay-o-Net's fault handling capacity.

SLIDE 8: Instructor Notes:

Explain how a deadfront operates

The fuses in deadfront transformers protect the transformer in the event of a secondary fault and serve to isolate the transformer from the distribution system if a transformer fault occurs.

The majority of the single phase deadfront transformers are protected by a series combination of a replaceable expulsion fuse and a backup current limiting fuse.

Materials:

None

Teaching Points:

Ask open ended questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

The fuses in deadfront transformers:

- protects the transformer of a secondary fault
- serve to isolates the transformer from the distribution system if a fault occurs.

The majority of the single phase deadfront transformers are protected by a series combination of:

- a replaceable expulsion fuse
- a backup current limiting fuse.

SLIDE 9: Understanding Dead-Front Transformers

The expulsion fuse is designed to protect :

- against overloads
- against faults on the secondary side.

The current limiting fuse protects against:

- short circuits on the primary winding
- and limits the energy that is dissipated in the transformer tank

Instructor Notes:

- The expulsion fuse is designed to protect against overloads and faults on the secondary side.
- The current limiting fuse protects against short circuits on the primary winding and limits the energy that is dissipated in the transformer tank.

Materials:

none

Teaching Points:

Ask open ended questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 10: Understanding Dead-Front Transformers

- The current limiting fuse is mounted inside the transformer tank and is not replaceable in the field.
- There are some older types of padmount transformers in service that are only protected by a replaceable expulsion fuse.

Instructor Notes:

- Explain how a deadfront operates
- There is Animation on this slide
- The current limiting fuse is mounted inside the transformer tank and is not replaceable in the field.
- There are some older types of padmount transformers in service that are only protected by a replaceable expulsion fuse.

Materials:

None

Teaching Points:

Ask open ended questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 11: Fuse Types

- Deadfront transformer may be equipped with either the Bay-O-Net or Sand current limiting fuse.
- Bay-O-Net fuses can break load under energized situations.
  - Oil is an insulator and allows this type of fuse to be pulled/opened under load.
- With the NX and Sand type fuses you **must** de-energize the transformer in order to pull these types of fuses.
  - The NX and Sand type are in a dry type environment.

Instructor Notes:

- Explain the different types of fuse that are used on deadfronts
- Have the different types of fuses available to display as you talk about each one
- There is Animation on this slide
- Deadfront transformer may be equipped with either the Bay-O-Net or Sand current limiting fuse.
  - The standard on new deadfront pad mounts come with Bay-o-net fuse.
  - Some of the older models of padmount have sand fuses.

    - The Live front had either NX or sand fuses.
- The manufacturer says Bay-O-Net fuses can break load under energized situations.
- The reason the Bay-O-Net can be pull under load and energized is because the fuse is submerged in oil.
- Oil is an insulator and this allows this type of fuse to be pull under load.
- With the NX and Sand type fuses you must de-energize the transformer in order to pull these types of fuses.
    - If the transformer has attachment to use a loadbust tool, if not then you must de-energize on a live front.
    - The NX are only on live front transformers.
    - If there is a sand fuse that is plugged into a padmount just like a bay-o-net then those type of sand fuses have a load break tip on the end of the fuse that allows it to be pulled under load.
    - It has been a practice in some areas the practice is to de-energize the padmount because the sand fuse loadbreak tip on the sand fuse breaks while pulling it and causes a flash.
- The NX and Sand type are in a dry type environment.

Materials:

Have the various types of fuse in the classroom to show the students

SLIDE 12: Re-Fuse Padmount Transformer

- **Step 1**- Vent transformer by pulling the Pressure Relief Valve (PRV)
- **Step 2**- Attach clamp stick to fuse handle eye
  - Unlock handle by rotating clamp stick counter clock-wise.

Caution: You should always stand to the side when removing or installing fuses

Instructor Notes:

- Discuss pulling the PRV & why
- Discuss where you should stand to remove or install

- There is some Animation on this slide

Step-1

- Vent transformer by pulling the Pressure Relief Valve(PRV)
- Padmount transformers will build up pressure due to heat and load inside the enclosure.
- When there is a Pressure Relief Valve(PRV) as pictured, it **shall** first be relieved by either pulling the ring or by pushing the valve core.
- Hold this valve open until the pressure is relieved.
- To pull the PRV to release pressure use a Universal (shotgun) stick to grab onto the pull ring.

Important: The PRV shall be operated so that any pressure inside the enclosure is released. If not, the pressure will be release through the bay-o-net fuse holder opening when pulled. This will cause oil to siphon out through the bay-o-net holder opening. To stop the siphoning effect pull the PRV. If this happens there will now be oil on the elbow. Not a good thing!

Step-2

- Attach clamp stick to fuse handle eye, check to see that the handle eye is rotated to the left- stand to the left side of the transformer, unlock handle by rotating clamp stick counter clock-wise.

Caution: You should always stand to the side when removing or installing fuses in transformers

SLIDE 13: Re-Fuse Padmount Transformer

Step 3 - Pull the fuse holder out approx. 3 inches

– Wait a few seconds for the oil to drain back into the tank
– Slowly remove the fuse holder

Caution: The Bay-O-Net fuse when removed will de-energize the Primary and Secondary coils only. The Primary elbows and bushings will remain energized.

Instructor Notes:

- Discuss removing the fuse and the caution that should be taken
- There is some Animation on this slide

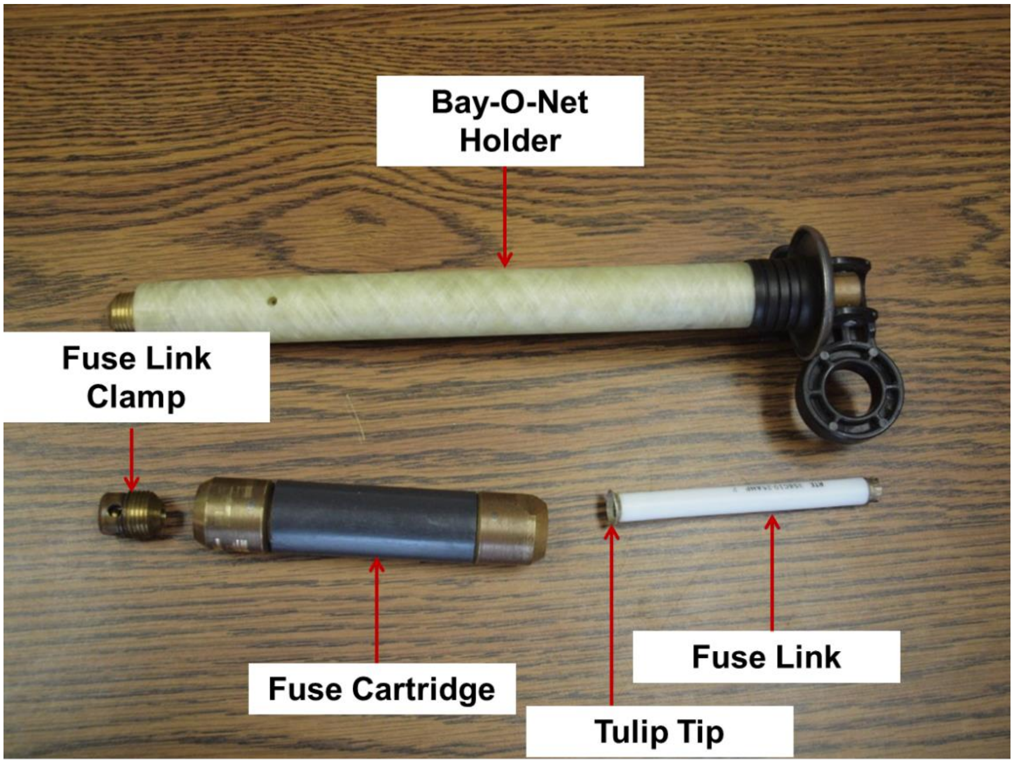
STEP 3

- Pull out the fuse holder approximately three inches.
    - This interrupts the load.
- Wait a few seconds for the oil to drain back into the tank from the Bay-O-Net fuse holder.
- The inner fuse holder assembly can now be removed slowly.
    - Be careful not to let oil drip on the elbow.
    - Wipe any oil from the holder before removing fuse cartridge and fuse link.

Caution: The Bay-O-Net fuse when removed will de-energize the Primary and Secondary coils only. The Primary elbows and bushings will remain energized.

CAUTION: If you should get some oil on the elbow, use rubber gloves and clean rags to clean the oil off. Oil left on the elbow will start to deteriorate it and later a failure could occur because it will cause the rubber to swell to extremes.

SLIDE 14: Parts of Fuse Holder/Link



Instructor Notes:

- Discuss the parts of the fuse holder/link before moving on to refusing– you should have all of this in the class to demonstrate
- There is Animation on this slide
- The fuse holder has sever different parts
    - The actual Bay-O-Net holder
    - The fuse cartridge that has brass ferrules on both ends
    - The Fuse link clamp that holds the fuse tight in the cartridge
    - And then the fuse link

Materials:

Bay-O-Net fuse

Bay-O-Net fuse holder

SLIDE 15: Replace Fuse Link

Step 4 - Wipe the oil from holder

- Unscrew fuse cartridge from holder using wrench.
- Unscrew fuse link clamp using wrenches
- Remove fuse link from cartridge from fuse link clamp end

Note: Check continuity on the old fuse to assure it is blown and the new fuse to assure it is good

Instructor Notes:

- Discuss replacing the fuse and the caution that should be taken-you should have all of this in the class to demonstrate
- There is Animation on this slide
- Check continuity

STEP 4

- After the fuse holder has been removed from the transformer, wipe the oil from holder in preparation to remove fuse link.
- Unscrew fuse cartridge from holder using wrench.
- Unscrew fuse link clamp using wrenches, unless cartridge is marked with lettering stating that complete cartridge must be replaced.
- Remove fuse link from cartridge from fuse link clamp end. If Teflon tube is not melted, it is necessary to straighten the Tulip Tip that has been upset by fuse link clamp before fuse link can be removed from cartridge.
- Inspect cartridge bore to make sure it is clear.

Note: Check continuity on the old fuse to assure it is blown and the new fuse to assure it is good

NOTE: Do not use utility pliers (channel locks) on brass ferrules of cartridge. Wrench shall be used on fuse link clamp.

Materials:

Bay-O-Net fuse

Voltmeter

Hand tools

PPE (wear gloves)

SLIDE 16: Replace Fuse Link

- Insert new Fuse Link into cartridge from either end.
- Tighten cartridge onto Bay-O-Net holder with tulip tip at opposite end of Bay-O-Net holder.
- Screw fuse link clamp into other end of cartridge.

NOTE: Make sure that the replacement fuse is the proper ampere size.

Instructor Notes:

- Discuss replacing the fuse and the caution that should be taken-you should have all of this in the class to demonstrate
- There is Animation on this slide

STEP 4 (Continued)

- Insert new Fuse Link into cartridge from either end. Exercise care not to damage the tulip fingers that must flare out evenly for proper contact against the screw-in plug.
-
- With fuse link in cartridge, tighten cartridge onto Bay-O-Net holder with tulip tip at opposite end of Bay-O-Net holder. Tighten with a wrench to 50 to 70 inch lbs (do not over tighten).
- Always make sure cartridge is hand tightened on Bay-O-Net holder.
- Screw fuse link clamp into other end of cartridge. Wrench can be used on fuse link clamp. As fuse link clamp is tightened with a wrench, complete assembly will be securely fastened on Bay-O-Net holder.

NOTE: Make sure that the replacement fuse is the proper ampere size. Some large ampere sizes require that the entire cartridge be replaced along with the fuse; these will be stamped on the fiberglass portion of the fuse cartridge.

SLIDE 17: Re-Fuse Padmount Transformer

Step 5 -Attach the handle eye of the inner fuse holder assembly to the clamp stick.

Place fuse holder assembly into the Bay-O-Net outer tube assembly and push it in with one sure movement, slight force should be used.

Instructor Notes:

- Discuss re-installing the Bay-O-Net fuse and the caution that should be taken-
- There is Animation on this slide

STEP 5

In order to re-install the Bay-O-Net:

- Attach the handle eye of the inner fuse holder assembly to the clamp stick.
- Place fuse holder assembly into the Bay-O-Net outer tube assembly and push it in with one sure movement, slight force should be used.

SLIDE 18: Re-Fuse Padmount Transformer

- When the inner fuse holder assemblies is inserted as far as possible, push down, and rotate the locking handle, hooking it over the shoulder of the outer tube assembly.

Instructor Notes:

- Discuss re-installing the Bay-O-Net fuse and the caution that should be taken-
- There is Animation on this slide

STEP 5 (Continued)

In order to re-install the Bay-O-Net:

- When the inner fuse holder assemblies is inserted as far as possible, push down, and rotate the locking handle, hooking it over the shoulder of the outer tube assembly.
    - When handle is in locked position, make sure the stainless steel cover washer is seated against the shoulder of the outer tube assembly.

SLIDE 19: Questions

Instructor Notes:

Allow time for questions and a brief overview if needed.

Materials:

- None

SLIDE 20: Next Steps

The following steps are required to receive credit for this Module

Locate and take the exam on web

Print the exam results and provide to your instructor

Complete the hands-on competency test administer by the instructor

Check with your instructor if you have any questions

CF50617/Underground Grid System/CF50617/PDF-PPT/07-10-2012

SLIDE 1: Maintain Distribution Grid Accuracy

Revision 1.01

Revision Date 07/10/2012

Module CF50617

Revised by Walt Roberts

Reviewed by (SME) Kirk Gomez

Approved by Tim Golden(Supervisor)

SLIDE 2: Maintain Distribution Grid Accuracy

Instructor Notes:

- This module discusses some of the information that is required for AM/FM (Automated Mapping and Facilities Management) to be an accurate tool that helps us to perform our job safely and efficiently
- This is in no way all the information needed, but just a high level view

1. Discuss entire presentation in classroom
2. Ask questions as necessary
3. Take Written Exams
4. Go outside for hands-on activity
5. Perform competency test

Materials:

- Handouts- OH ID Tag, URD ID Tag & DCO Form
- Safety manual

Voltmeter to check continuity

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 3: Objectives

- Explain the purpose of training
- Discuss safety considerations
- Explain why we use DLOC #’s
    - Importance
    - Where it should be documented
    - How it should be installed on the pole or URD equipment

  - Identify which equipment requires a DLOC #
- Demonstrate how to identify a DLOC number

Instructor Notes:

This slide discusses the objectives of the course

There is no animation on this slide

Given a one line map or GT Viewer identify the correct piece of equipment using the DLOC (Distribution Location) number

State the importance of recording and returning correct information through jobs worked and other related paper/electronic work.

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 4: Safety

Instructor Notes:

Get the students to open the safety manual – talk about applicable sections and clues based on subject matter.

Specific Rule numbers to discuss

4.0

4.14

Materials:

Entergy Safety Manual

Teaching Points:

Ask questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 5: Why Is Accurate Data So Important?

- Having timely, accurate and complete data affects many people
  – Employees- allows us to perform tasks safely and efficiently

- Customers- outages can be restored quickly which in turn gives Entergy a positive image
- Regulators- fewer complaints, plus good outage indicators (SAIFI , SAIDI and CAIDI) improve our stance with regulators
- Shareholder – when customer and Regulators are satisfied profits are good

Instructor Notes:

- This slide discuss the importance of accurate data
- There is animation on this slide
- Employees - allows us to do our job safely and efficiently
- Customers- outages can be restored quickly which in turn give Entergy a positive image
- Regulators - fewer complaints, plus SAIFI (system average interruption frequency index), SAIDI (system average interruption duration index) and CAIDI (customer average interruption duration index) is low
    - SAIFI is the average number of interruptions that a customer would experience. Is measured in units of interruptions per customer. It is usually measured over the course of a year
    - SAIDI is the average outage duration for each customer served. SAIDI is measured in units of time, often minutes or hours. It is usually measured over the course of a year.
    - CAIDI gives the average outage duration that any given customer would experience. CAIDI can also be viewed as the average restoration time. CAIDI is measured in units of time, often minutes or hours. It is usually measured over the course of a year
- Shareholder – when customer and Regulators are satisfied profits have the potential to be maximized. Many areas have formula based rate plans where we are actually able to earn a small extra rate of return in exchange for providing reliable service and short outage durations.

Materials:

None

- SLIDE 6: What Happens if Data is Inaccurate?
- Increased costs
- Poor source info will cause rework
- Crews dispatched to wrong locations
- Incorrect number of customers out
- Safety issues

Instructor Notes:

- This module discusses inaccurate data and the problems it causes
- Ask the students to give examples or ideas for how they could see incorrect data causing the problems listed here – have they ever been in a work situation where they have seen

this happen?

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 7: Scenario

- DOC dispatches you to a lights out call at LF XYZ @ the corner of Pine & 1st St
- When you arrive @ the location the fuse is still closed
- You backtrack and discover the recloser is out
- Your stress level goes up because of the wasted time to restore power to the customers

Instructor Notes:

- This slide is a scenario of how inaccurate data may affect worker in the field
- There is animation on this slide
- DOC = Distribution Operation Center

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

- SLIDE 8: Scenario (Continued)

Let's ask some questions

- Where did the DOC get their information?
    - AM/FM
- Where did the information in AM/FM come from?
    - Data Maintenance
- Where did Data Maintenance get their information?
    - YOU

Instructor Notes:

- This slide ask questions about what happened in the scenario
- There is animation on this slide
- AM/FM = Automated Mapping/Facilities Management

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 9: Connected Electric Model

Understanding how the system work

- In the AM/FM system, there is a 10 digit Distribution location number (DLOC)
    - The DLOC is created based on an X (longitude) and Y (latitude) coordinate grid system
- All customers are tied to a Transformer 'bank' or Primary Metering point
    - The term 'bank' is not the same as a multi-transformer bank in the field
    - A 'bank' is a point in the AM/FM system where a company transformer is tied
- The DLOC number is tied to the 'bank', not the transformer

Instructor Notes:

- This slide discusses the connected electric model and how it functions
- There is animation on this slide
- If the transformer fails and the DLOC was tied to it, the DLOC would follow the transformer. Even if the pole is moved that particular DLOC never moves because of the XY coordinates.

Materials:

None

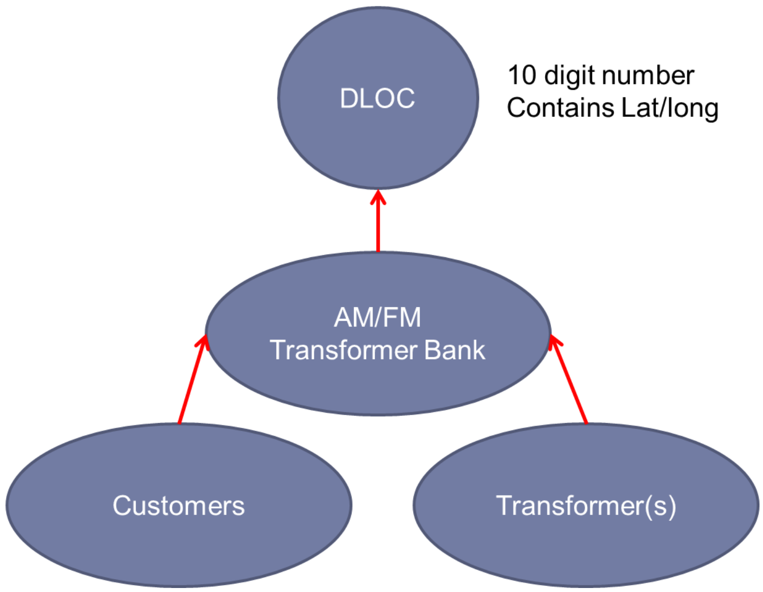
Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 10: Connected Electric Model



Instructor Notes:

- This slide continues the discussion of the connected electric model
- There is animation on this slide
- Let's look at the electric module a little closer

Materials:

None

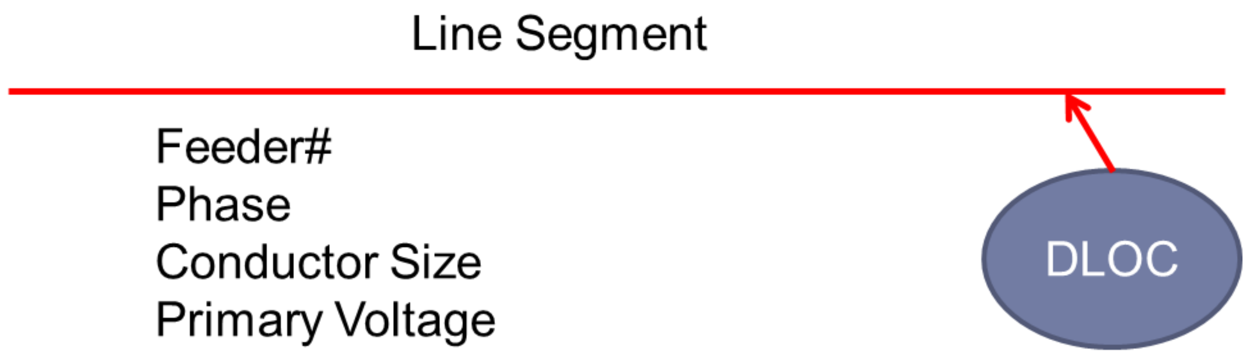
Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents

SLIDE 11: Connected Electric Model



So how does this help me do my job???

Instructor Notes:

- This slide continues the discussion of the connected electric model
- There is animation on this slide
- Now complete the picture of the connected electrical model here – now that you've shown how the bank/customer/dloc is connected, need to show how the DLOC (with xfmr and customers connected through the bank) is connected to a line segment.
- This connects the DLOC and associated items to the correct feeder, phase of the feeder, and by that connection establishes primary voltage and conductor size.
- This happens for EVERY transformer that's connected to the system…

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 12: Connected Electric Model

- For example, when a customer calls with lights out, a lights out ticket is created
- Outage Management (OM) uses Prediction Logic to determine what device has opened
- If that is the only lights out call, OM will predict the transformer out
- If several customers call that are on the same phase of primary, OM will predict the line fuse out
- If several customers call that are on two or three phases of primary, OM will predict either 2 or 3 line fuses, a recloser or even the breaker out depending on the location of the calls

Instructor Notes:

- This slide continues the discussion of the connected electric model
- There is animation on this slide

Materials:

None

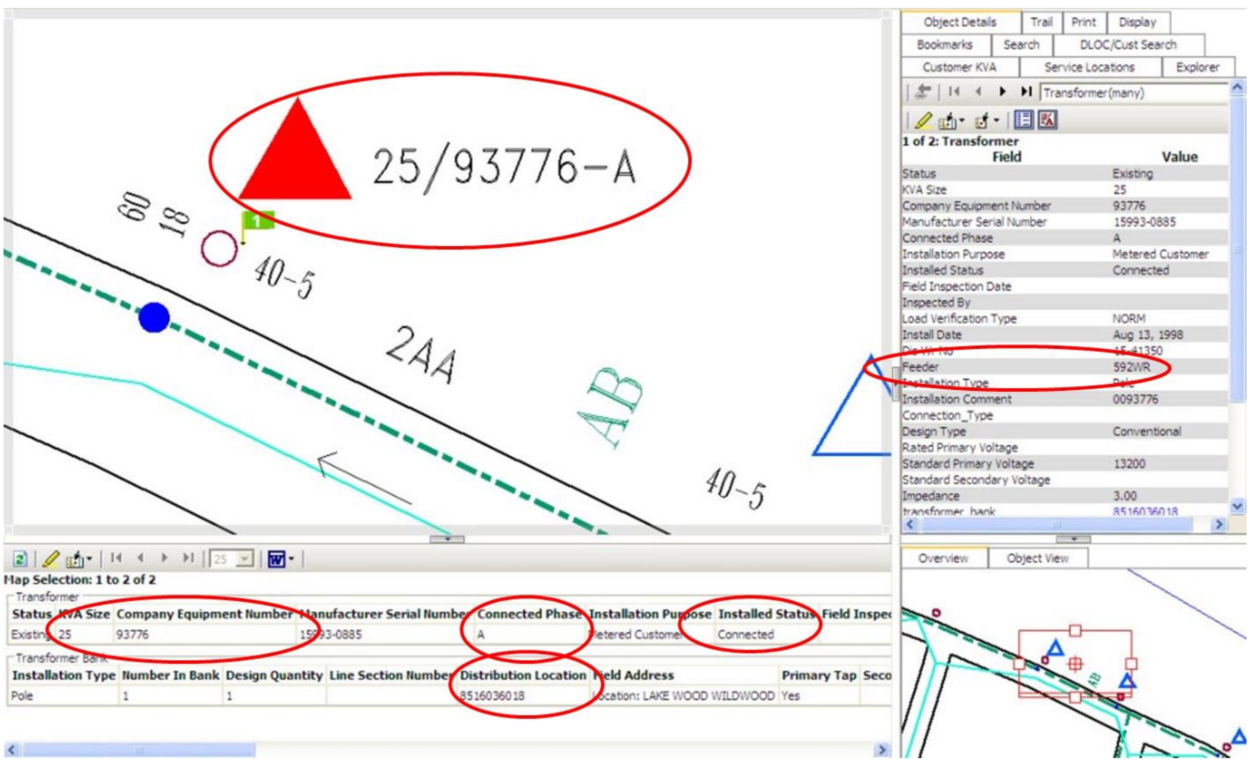
Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 13: Connected Electric Model



Instructor Notes:

- This slide discusses the Connected Electric module and looks at a typical residential customer in AM/FM – the data that is on DCO (Distribution Change Order) forms, job jacket and even on the service order make up the connected electrical module
- There is animation on this slide
- Let's look at a typical resident customer
- Click 1 displays the transformer size, Company # and the connected phase
- Click 2 displays the Installation status – Connected

- Click 3 displays the DLOC #
- Click 4 displays the Feeder/Circuit #
- All this information plus much more connect the customer and when there is an outage it will give the DOC a lot of information to give to the serviceman to send him to the correct location

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 14: DLOC

Equipment locations will be labeled in the field with a 10 digit DLOC number

A DLOC number is require to be installed on:

- Padmounted Distribution Transformers
- Overhead Distribution Transformers
- Capacitor Units
- Primary Meter Installation
- Padmounted Switchgear
- Overhead Switching Stations
- Line Regulators
- OCRs (oil switches)

Instructor Notes:

- This slide discusses the installation of Distribution location number (DLOC) and on what equipment that it should be installed on
- There is no animation on this slide

Materials:

None

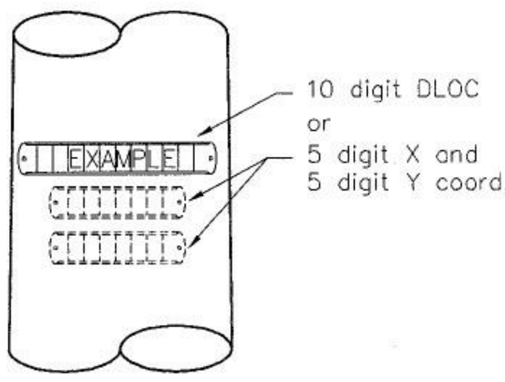
Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 15: DLOC Installation OH



- DLOC is placed horizontal on the pole
- Minimum of 7 feet off the ground
- Place all tags on the area of the pole that will permit greatest visibility from the road
    - Do not cover the brand/birth mark

Instructor Notes:

Can contain

- This slide covers the correct installation of a DLOC on the pole

- There is animation on the slide
- The information on this slide is from the Overhead constructions manual: section 5 pg 2

Materials:

Handout OH ID Tag

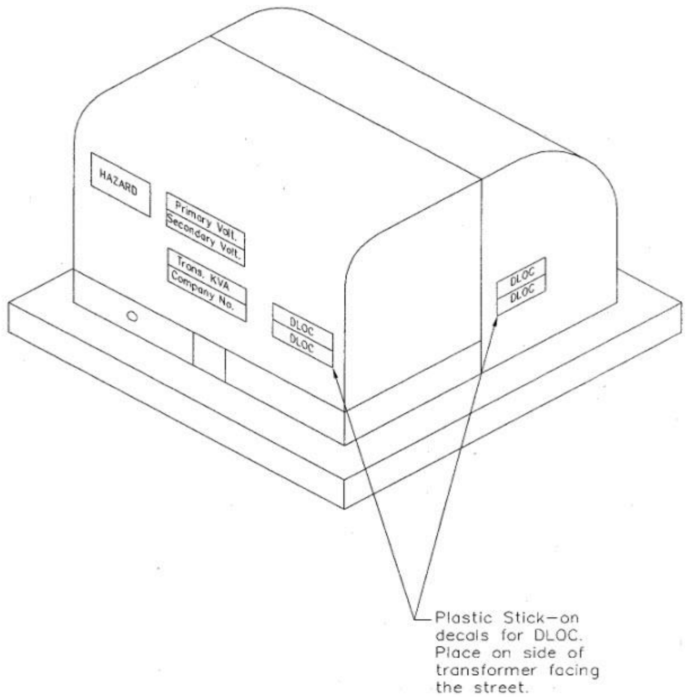
Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 16: DLOC Installation URD



- DLOC Stick-on tags are placed on transformer facing the street
- DLOC numbers are placed on 2 tags, for riser poles and underground equipment
- Place all tags on the area of pole that will allow greatest visibility from road

Instructor Notes:

- This slide covers the correct installation of a DLOC URD Equipment
- There is animation on the slide
- The information on this slide is from the Underground construction specification manual: pg 133

Materials:

Handout URD ID Tag

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 17: DLOC Installation

- DLOC numbers are not transferable
- When a number is issued from Engineering, that number is issued for that point only
- If poles are relocated more than 10 feet while working a design job, design should be contacted to obtain a new DLOC number and tag
- When removing poles or equipment from service the tags shall be removed
- When replacing existing poles or equipment, this tag shall be transferred

Instructor Notes:

- This slide covers the correct installation of a DLOC
- There is animation on the slide

Materials:

None

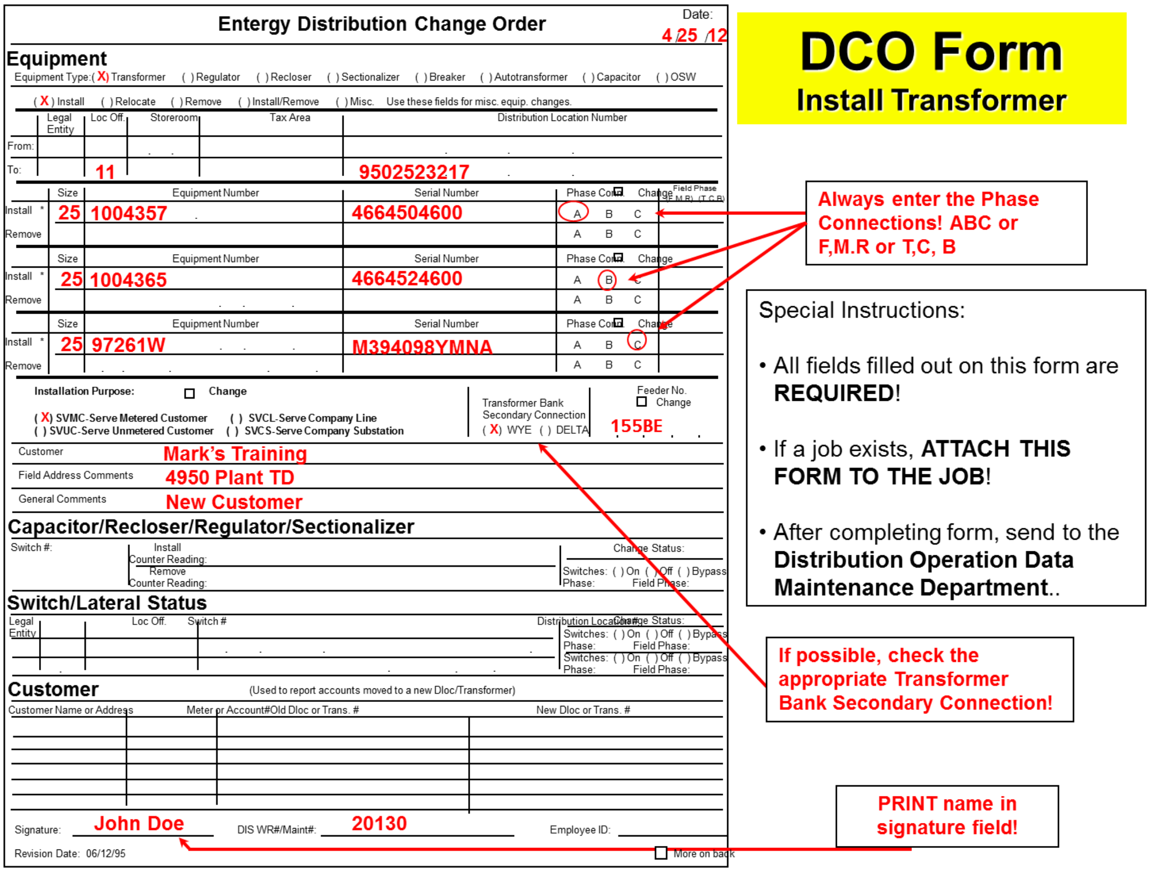
Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 18:



Instructor Notes:

- This slide discusses the information required on a DCO form – this is an example of a new 3 phase transformer installation
- There is **no** animation on this slide
- A copy of all Distribution Change Order (DCO) forms with all fields filled out properly, including any customer information to be relocated should always be sent to Data maintenance
- Point out the information in red and especially discuss the phase connections and why that is important. – the connection affects AM/FM connectivity – refer back to the scenario

Materials:

Hand-Out DCO Form

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 19: Construction Checklist

- ☑ Any time a crew deviates from the job-sketch that will affect Data Maintenance, the job should be Red-Lined
  - ☑ Cover Sheet should indicate that there are Red-Lines
  - ☑ Any changes should be noted in RED on the job sketch/print
  - ☑ Any changes should be noted in RED on the DIS Work Sheet
- ☑ What will affect Data Maintenance
  - ☑ New or Rearranging phasing & configuration
  - ☑ Pole size
  - ☑ Devices installed, removed or relocated
  - ☑ Conductor size
  - ☑ Changes to the secondary that affect customers
    - ☑ Customer on different transformer
  - ☑ Changes to open points

Instructor Notes:

- This slide discusses redlining and what will affect data maintenance
- There is animation on this slide

Materials:

None

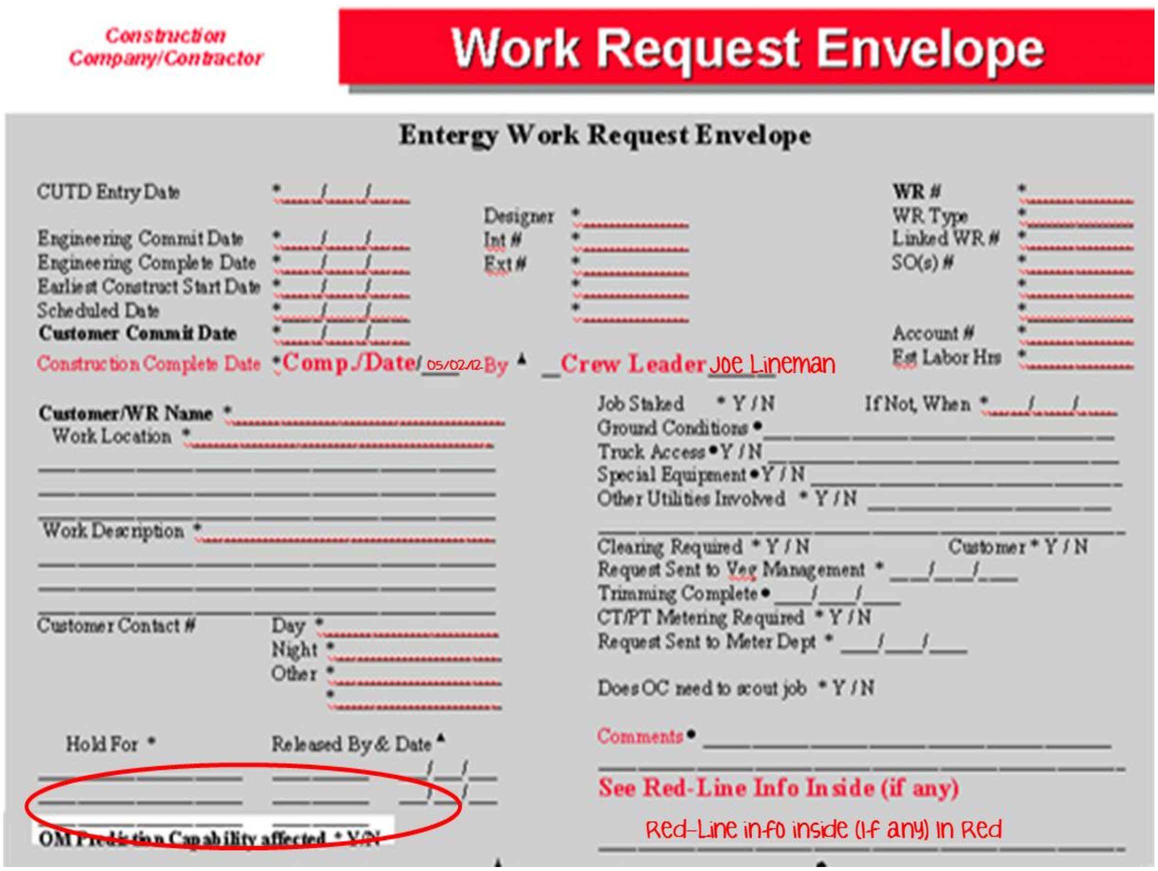
Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 20:



Instructor Notes:

- This slide discusses the completion and red-lining of a WR cover sheet – remind the trainees as stated on the previous slide the Red-line information should also be on the WR cover sheet, Job sketch and DIS worksheet in **RED**
- There is animation on this slide
- As mentioned on the previous slide the cover sheet should be red-lined if the job was changed.
- The construction completion date should be included
- Crew leader – if there are any questions, data maintenance knows who to contact
- Red line info inside (if there are any, should be written in a red pen)
- OM prediction should be circled either Yes or No. So what affects outage predict?
    - Change to backbone feeder due to open point change (reconfiguration)
    - Installation, removal, or relocation of Breakers, Reclosers, Sectionalizers, Gang and Disconnect Switches and fuses on all (existing) primary
    - Installation, removal, or relocation of switches at tie points
    - Line extension to another feed source tying 2 feeders together

Materials:

None

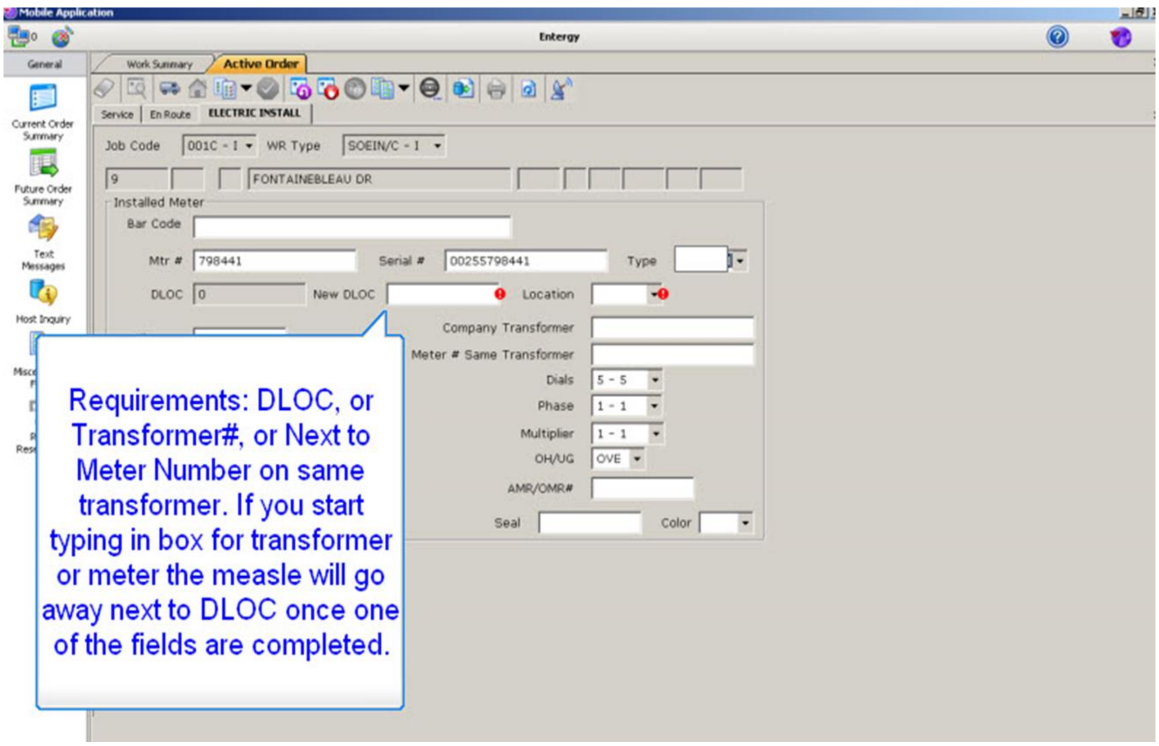
Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 21: Service Order Completion



Instructor Notes:

- This slide discusses the requirements of DLOC information on a new install service order.
- There is no animation on this slide
- The Red Dot is called a measle
- The DLOC is the 1st choice
- The transformer company number is the 2nd choice
- A meter number on the same transformer that you are installing the new service is the 3rd choice
- When data maintenance is entering the information this will tie the customer to the correct equipment
- If you have a question about the red measle by “Location” this is the actual location of the meter on the house, apartment etc.

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 22: The Bottom Line

An accurate Data System reflects the work we do, makes our job easier & safer, makes us all more profitable

Instructor Notes:

- This slide wraps up by discussing the bottom line – there is a lot of information that affect data maintenance
- There is not animation on this slide

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 23: Questions

Instructor Notes:

Allow time for questions and a brief overview if needed.

Materials:

- None

SLIDE 24: Next Steps

The following steps are required to receive credit for this Module

Locate and take the exam on web

Print the exam results and provide to your instructor

Complete the hands-on competency test administer by the instructor

Check with your instructor if you have any questions

CF50618/Identify URD Work Order Symbols/CF50618/PDF-PPT/07-02-2012

SLIDE 1: Identify Work Order Symbols, Work Orders and One-Line Diagrams

Revision 1-01

Revision Date 07/02/2012

Module CF50618

Revised by Walt Roberts

Reviewed by (SME) Chris LeBlanc

Approved by Tim Golden (Supervisor)

SLIDE 2: Identify Work Order Symbols, Work Orders and One-Line Diagrams

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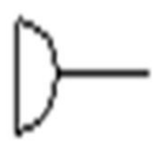


Instructor Notes:

Introduce the module to the students – You will identify and state the meaning of each URD/OH symbol that will be used to interpret a work order and a one line diagram.

1. Discuss entire presentation in classroom
2. Ask questions as necessary
3. Take Written Exams

Materials:

Handouts- HO#1-Symbols Table, HO#2=AMFM Symbols

Sample Work Order (instructor provides)

Sample One line diagram (Instructor Provides)

IMPORTANT: Training computers must have GT viewer installed prior to the start of this module.

Teaching Points:

Put all of these in the order they should be presented.

SLIDE 3: Objectives

Identify symbols used in both underground (URD) and overhead (OH)

Identify and explain the objective of a work order and prints used to complete the work

Define symbols used on the one-line diagram

Identify basic steps to operate GT Viewer

Instructor Notes:

After this training you will be able to accomplish the following objectives:

1. Identify: The symbols used in both URD/OH work orders
2. State: The meaning of these symbols
3. State / Identify: Explain the objective of a work order and print used to complete a job.
4. Define: The symbols used on a one-line diagram.

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 4: Safety

Instructor Notes:

Get the students to open the safety manual – talk about applicable sections and clues based on subject matter.

Specific Rule numbers to discuss

> 9.0

> All boxed items up to 9.2

Materials:

Entergy Safety Manual

Teaching Points:

Ask questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 5: URD/OH Symbols

- Padmount

- OH Transformer

- 3 Phase OH Transformer

Instructor Notes:

- This slide introduces some of the symbols used in AM/FM
- There is animation on this slide
- PADMOUNT TRANSFORMER: COLOR INDICATES ATTACHED PHASE

Materials:

Handouts: HO#1-Symbols Table, HO#2=AMFM Symbols

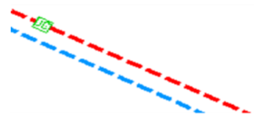
Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 6: URD/OH Symbols

- Three Phase URD Primary
- Two Phase URD Primary  
- Single Phase URD Primary

Instructor Notes:

- This slide is a continuation of some of the symbols used in AM/FM
- There is no animation on this slide
- COLOR on URD INDICATES the PHASE of the primary
- Green = Three phase
- Red = A
- Blue = B
- Yellow = C

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

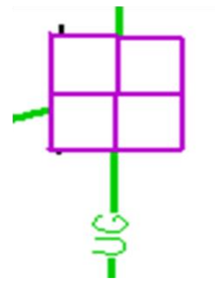
Operating Experiences (near misses, incidents)

SLIDE 7: NO TITLE

- Secondary Pedestal

- Pull Box

- Switching Cabinet



Instructor Notes:

- This slide is a continuation of some of the symbols used in AM/FM
- There is animation on this slide

Materials:

None

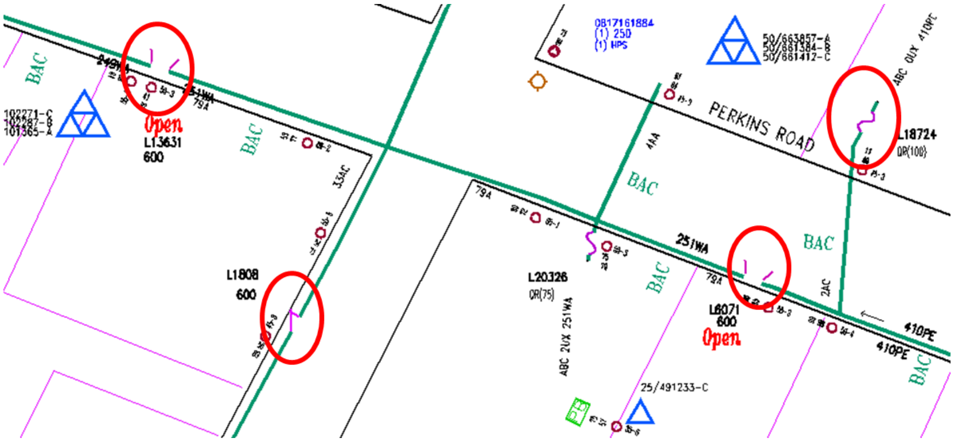
Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 8: URD/OH Symbols

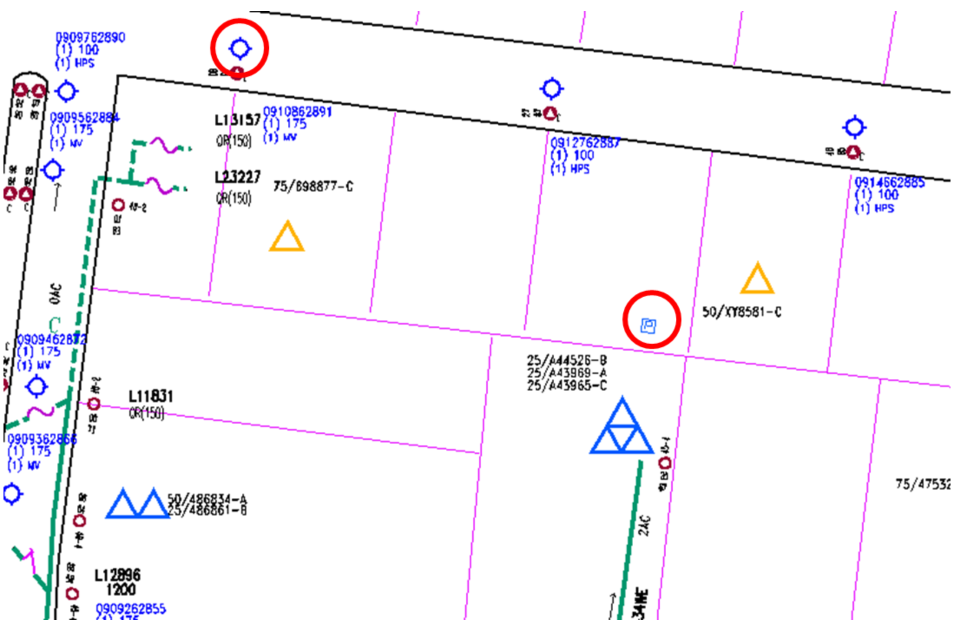


Instructor Notes:

- Ask these questions one at a time

1. Where is a closed 600 amp disconnect?
2. Where is a normal open point (Gang operated)?
3. Where is a pull box?

SLIDE 9: URD/OH Symbols

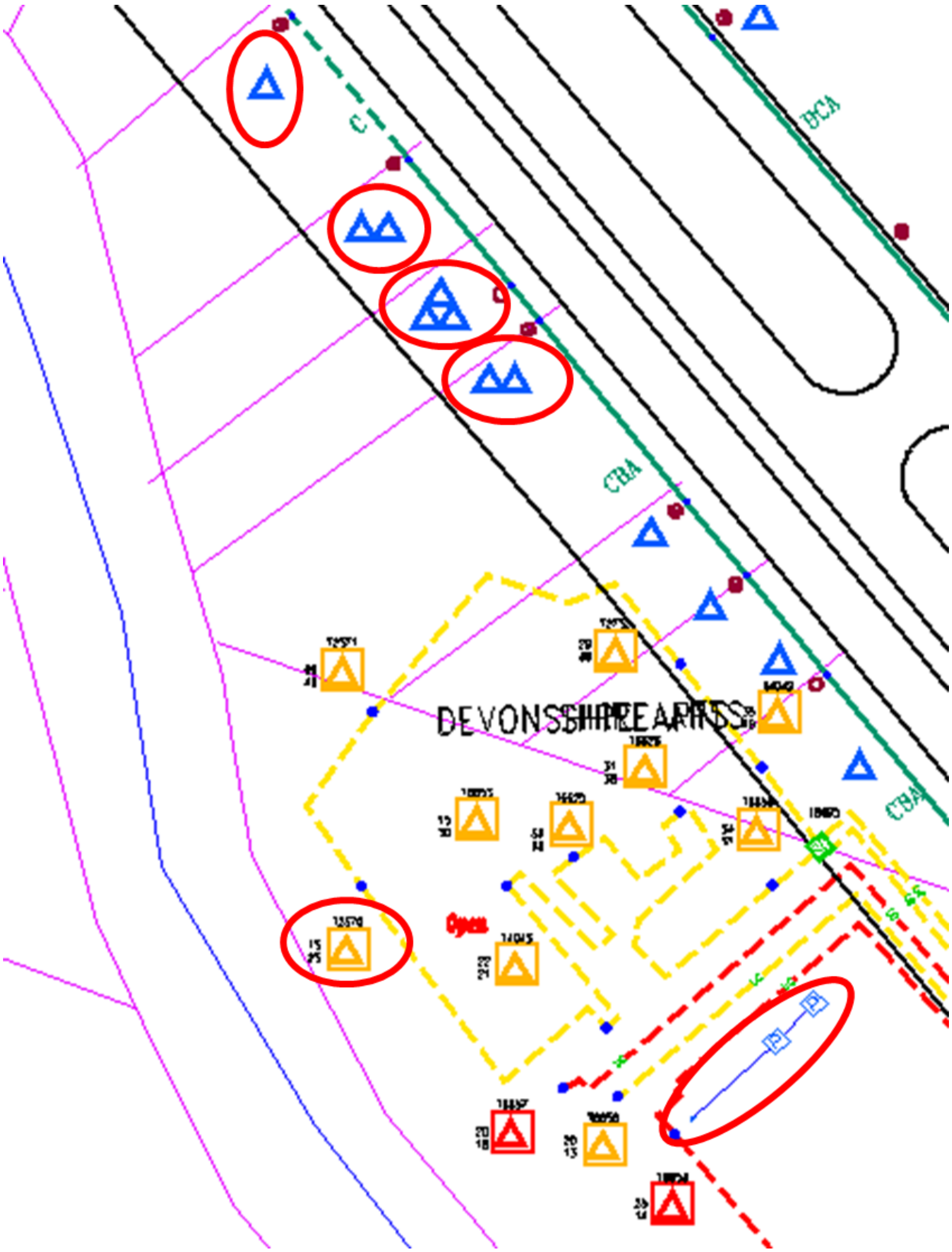


Instructor Notes:

- What does this symbol represent? Pedestal for u/g

- What does this symbol represent? Street Light –Point out that it is a 175 MV

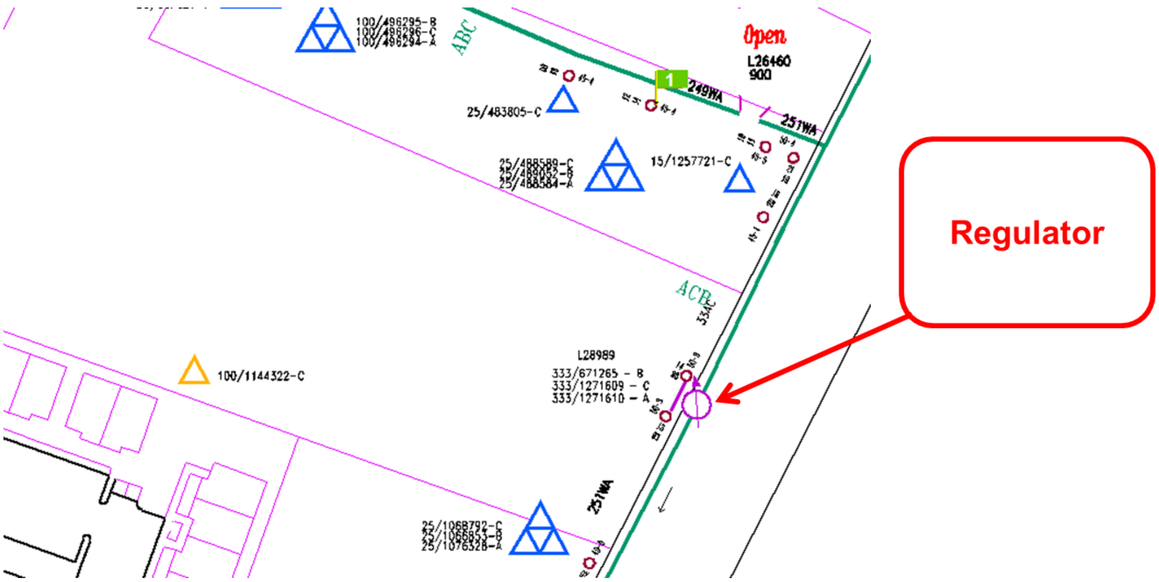
SLIDE 10: URD/OH Symbols



Instructor Notes:

1. What does this symbol represent?
    1. Single Overhead transformer
    2. Two pot/transformer Overhead bank
    3. Three pot/transformer Overhead bank
    4. URD single transformer on C Phase
    5. Point out that this is how the primary is constructed –
        - Crossarm construction
        - A phase is on the street, B is middle and C is field
    6. URD Secondary with 2 pedestals

SLIDE 11: URD/OH SYMBOLS



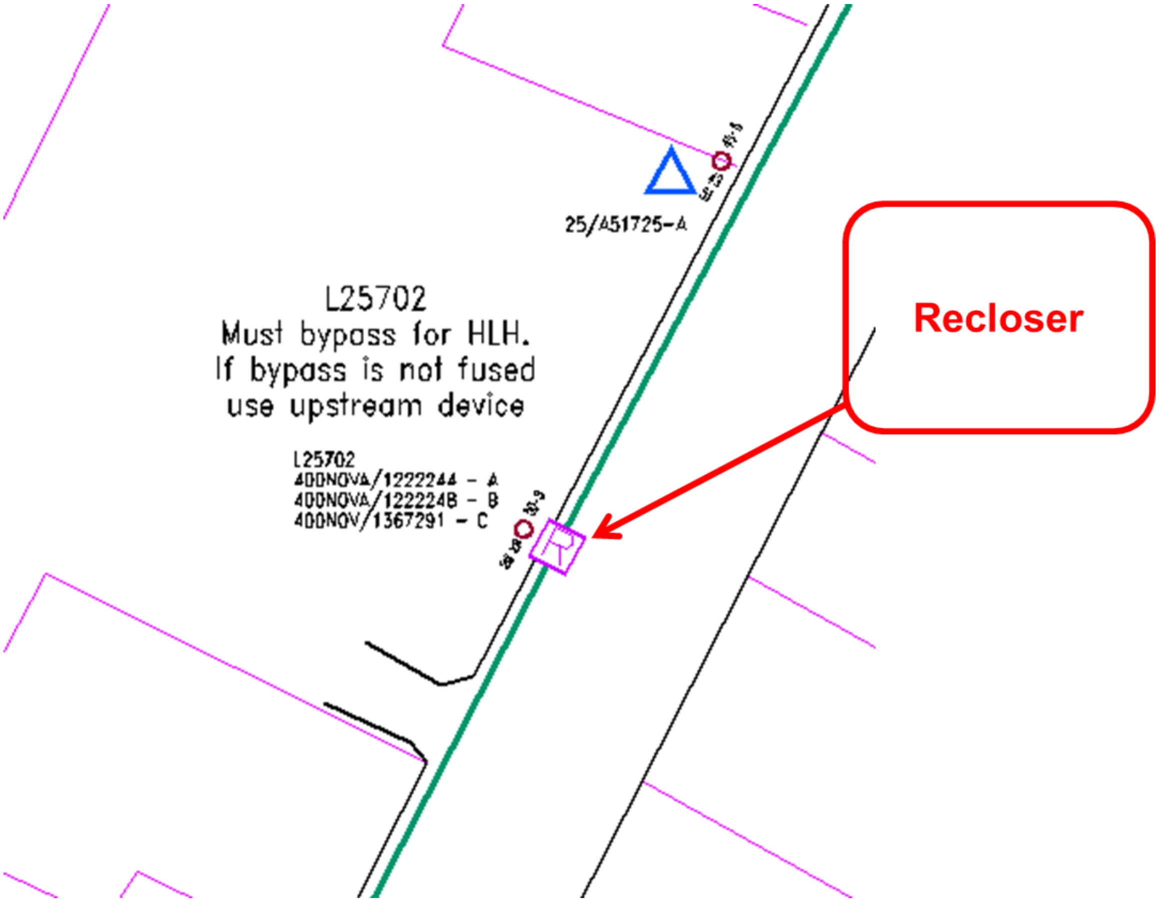
Instructor Notes:

- Regulator: Regulators Are Used To Provide Voltage Control On The Distribution System. They Typically Raise Or Lower The Voltage Up To 10% Across 32 Steps, 16 Raised Or 16 Lowered. Regulators Must Be In The Neutral Position When By-passing.

Regulators Can Also Be Used At Conversion Points Where The System Primary Voltage Changes

The green flag with the #1 is the location searched for in AM/FM

SLIDE 12: URD/OH Symbols

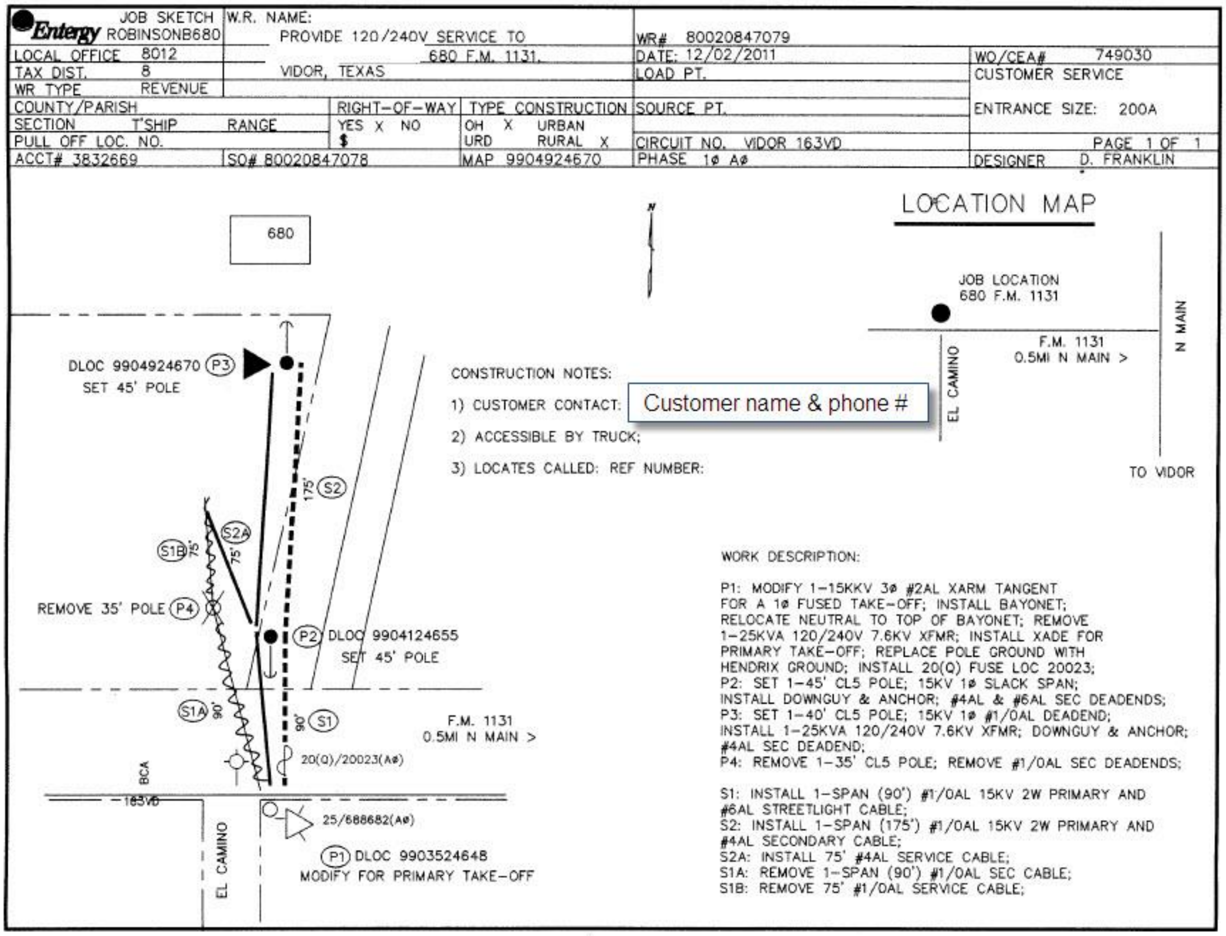


Instructor Notes:

Example of a symbol used in AMFM

- Recloser: Recloser Are Used To Isolate Faults And Provide Additional Reclose Opportunities. They May Be Used To Drop Load, Pick Up Load, And Interrupt Fault Current.

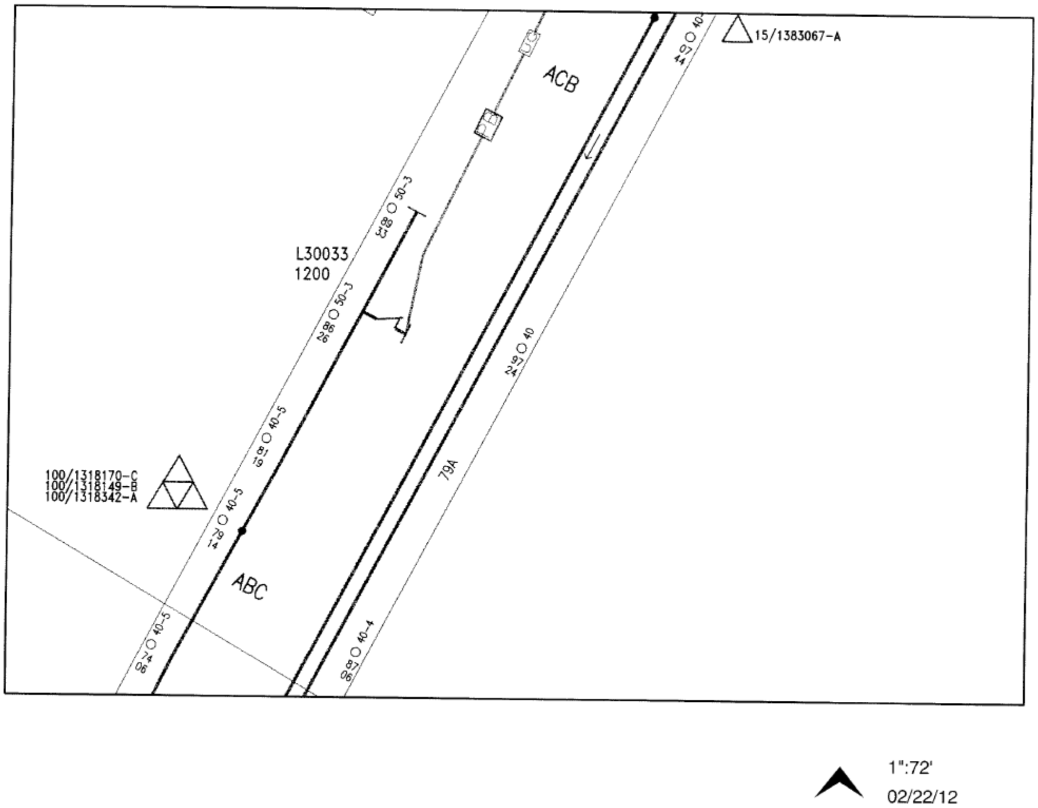
SLIDE 13: Work Order



Instructor Notes:

What is a work order? Work orders are maintenance or construction orders that are worked by field personnel. They are typically designed by personnel in the engineering/design group.

SLIDE 14: Work Order Templates



Instructor Notes:

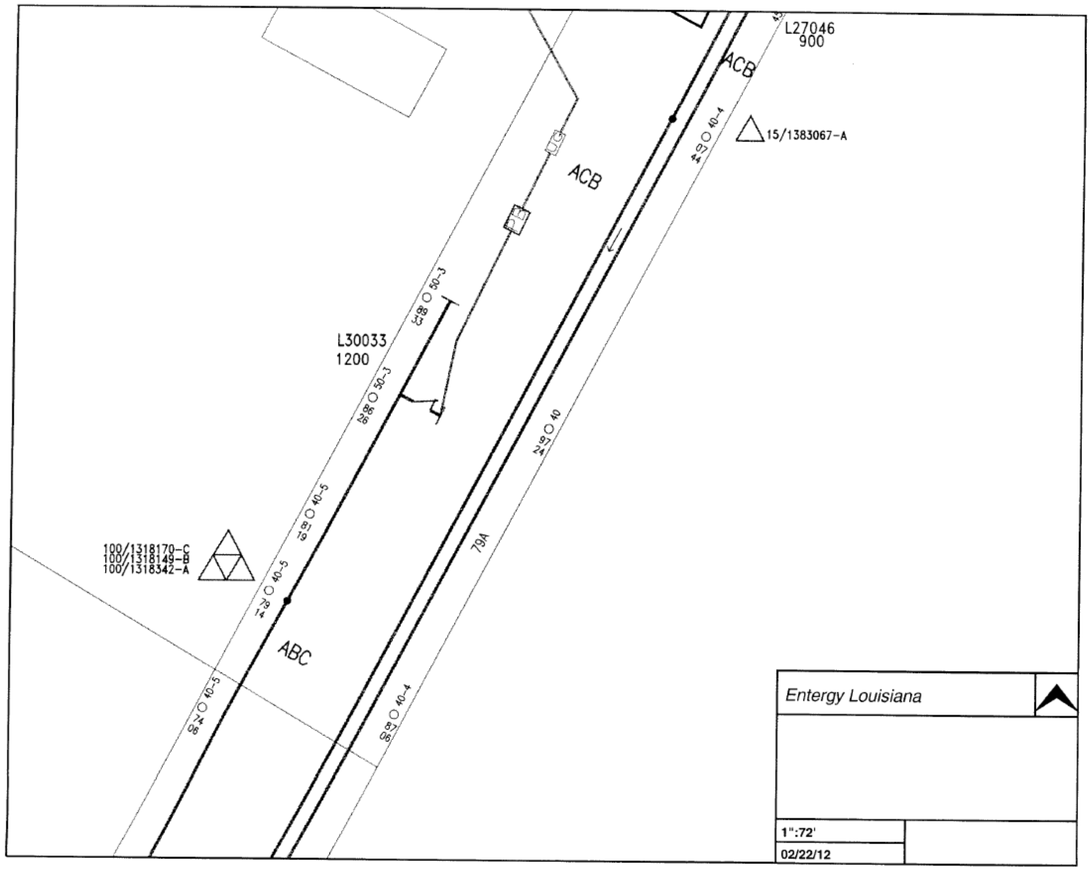
This template is a generic map print

Engineering group goes into AMFM (Automated Mapping Facilities Management) to retrieve the templates to draw the job on. On these templates they can either hand draw or enter into computer to generate a printed version.

Each work order you receive to work in the field will have the information you need to build the job along with materials needed, right of way and what type of construction it will be (URD or OH)

This is why it is so important that you know and understand what the symbols represents

SLIDE 15: Work Order Templates

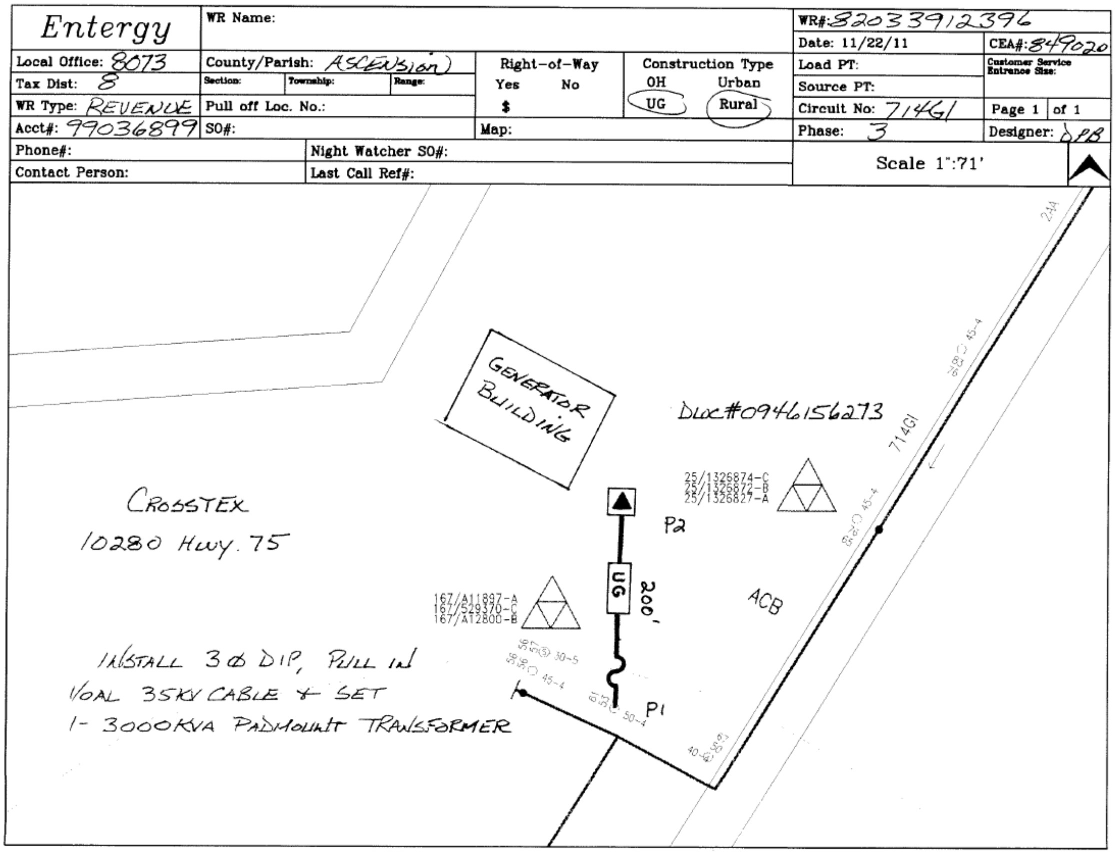


Instructor Notes:

This template is a generic 8X11 landscape map print

As you can see from the generic version retrieved from AMFM it will show any existing equipment for that location.

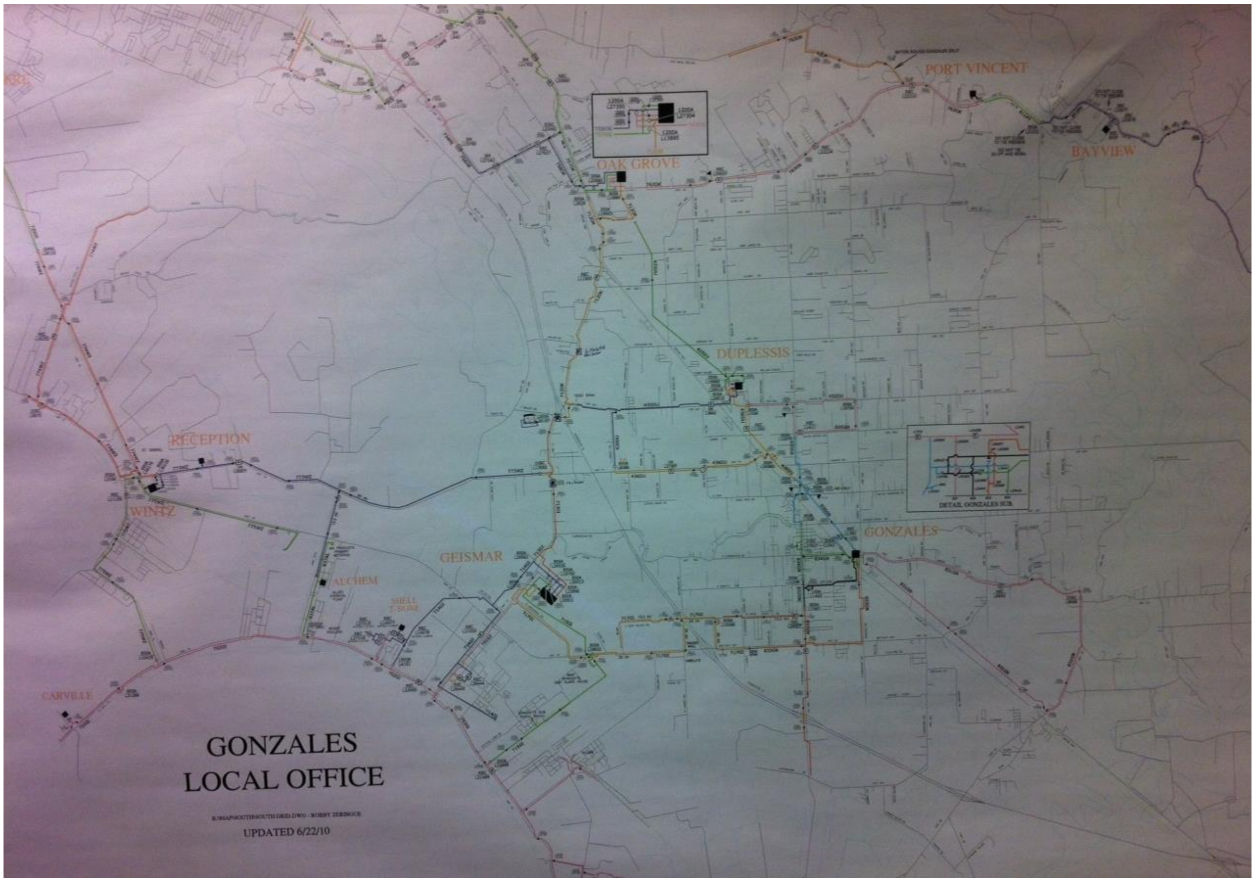
SLIDE 16: Work Order Example



Instructor Notes:

- This is a hand drawn DRB (Design Ready to Build) template found in AMFM.
- You can see the existing equipment and what is hand drawn is the work needed at this location.
  - The job would be to install a 3 phase dip, pull in 200’ of 3 phase 1/0 al primary and install 1- 3 phase 3000 KVA padmount transformer.

SLIDE 17: One-Line Diagram



Instructor Notes:

What is a one-line diagram?

A diagram that uses single lines and graphic symbols to indicate the path and components of an electrical circuit.

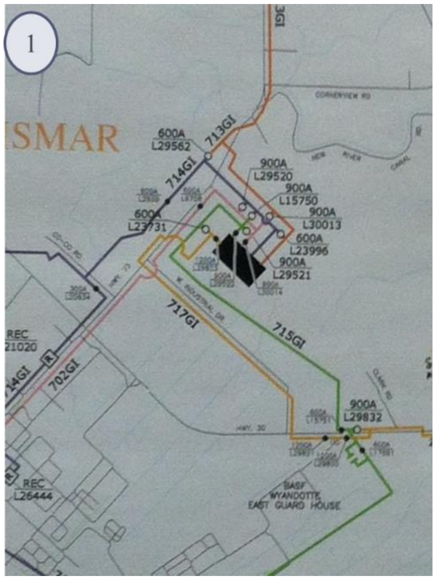
One-line diagrams are used when information about a circuit is required but detail of the actual wire connections and operation of the circuit are not.

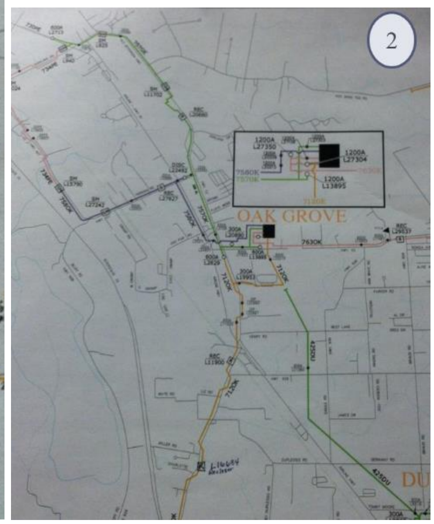
SLIDE 18: One-Line Diagram

Instructor Notes:

The most basic type of electrical print. A one-line diagram shows the relationship of electrical components along just one line. Only major equipment is shown – little or no individual poles, transformers, street lights. Primarily switching devices (reclosers, fused switches, disconnects, gang operated air breaks, etc) The prints here shows how several circuits in the same area interact but they can also be printed or drawn to show only a single circuit.

SLIDE 19: One-Line Diagram

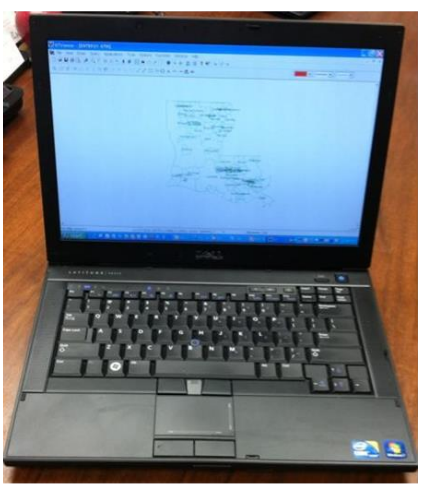


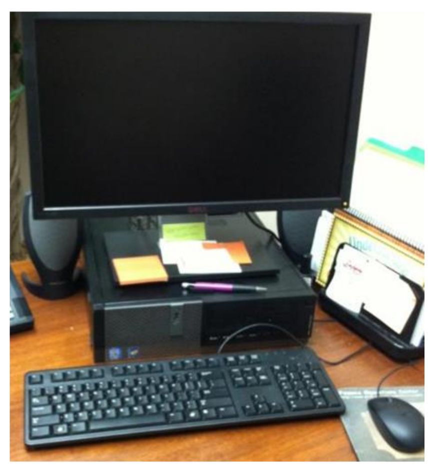


Instructor Notes:

1. One-line diagram coming from a substation
2. Details of the substation

SLIDE 20: GT Viewer





Instructor Notes:

GTViewer is an application to download Entergy's existing electrical and gas facilities and land base information. GTViewer is capable of creating redlines, counting features, attribute review, locate queries and printing.

GTViewer will be used to deliver the hands-on for this module. Each computer should have the GTViewer loaded on each desktop.

SLIDE 21: GT Viewer

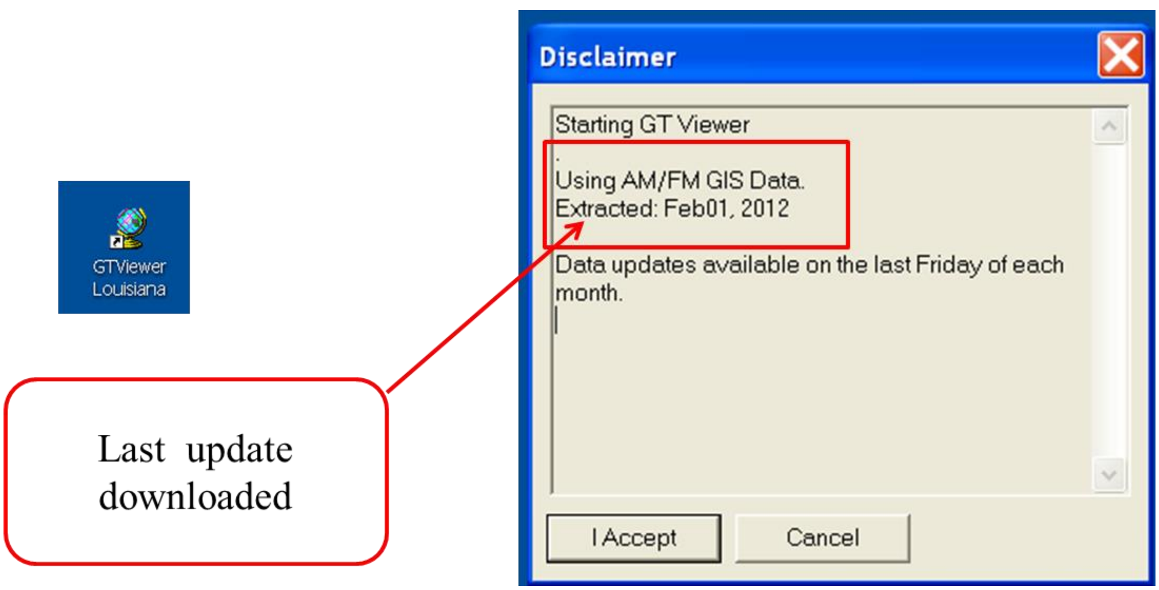
- Logging in to the GT Viewer using Icon on the desktop
- Top icons on toolbar used in the viewer
- How to zoom, pan and draw box
- How to query
- Student will demonstrate using the GT Viewer
- Student will demonstrate how to fine attribute information

Instructor Notes:

Get students to open the GTViewer icon on their desktop

The hands-on portion of this module will be done by going over the next several slides.

SLIDE 22: GT Viewer Basic Login



1. Double click on GTViewer icon on your desktop (Each state has their own icon)
2. Click “I Accept” on disclaimer on screen

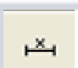
Instructor Notes:

Get the student to look at the “Disclaimer” before clicking on “I Accept” it will show them where they can find the date that the information was last downloaded for updates.

Get each student to open the GTViewer from their desktops

SLIDE 23: Introducing the GT Viewer

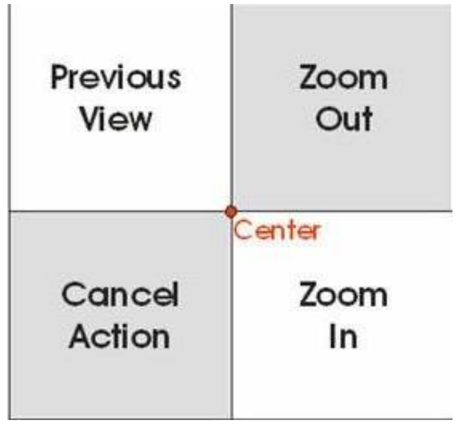
Key buttons used for the hands-on exercise

Icon	Description
	Zoom
	Pan
	Attribute Info
	Previous Location
	Dimension

Instructor Notes:

- Ask student to look behind the tab for this module to go over some of the symbols
    - HO#3-How to get to the GTViewer using myEntergy
    - HO#4- Key Buttons used from toolbar

SLIDE 24: Using Zoom and Pan Features



Zoom In: Place the mouse or stylus to the upper left of the area you would like to Zoom In on. Pull down to the right.

Zoom Previous: Place the mouse or stylus onto the screen and pull to the upper left.

Zoom Out: Place the mouse or stylus onto the screen and pull to the upper right.

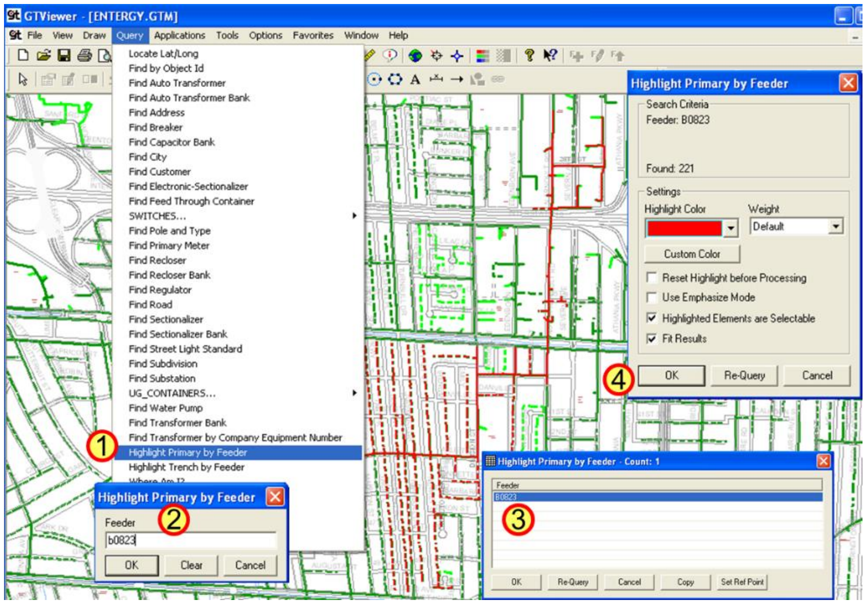
Zoom Cancel: Place the mouse or stylus onto the screen and pull to the lower left.

Pan: Touch any area of the screen with the mouse or stylus and move screen. The system will move that point to the center of the screen.

Instructor Notes:

Directions for the zoom and pan mode is written for both a desktop computer and toughbook used in the field. Since the toughbooks are touch screen using the stylus (pen) may be easier to use.

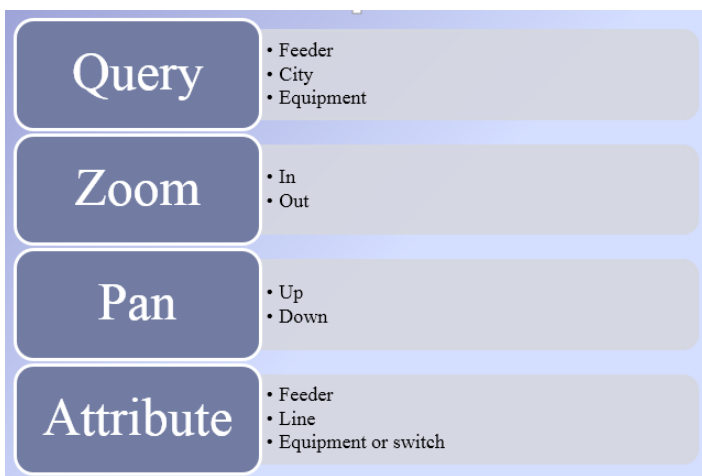
SLIDE 25: Query by Feeder



Instructor Notes:

How to find information by using the “query” mode

SLIDE 26: Hands-On Using GTViewer



Instructor Notes:

You will need to pull up the feeder before class so that you can become familiar with the symbols on that map.

Each student will use the instructor’s computer to complete his hands-on portion of this module. You will ask him to query by a feeder number or another way so they can show you the symbol you are requesting.

Student:

1. Query by feeder
2. How do you zoom in
3. How do you pan
4. How do you find the attribute (characteristic of an object) on what you are looking at.
    - Click on the equipment, line, fuse, switch etc. (some may have multiple selections)

Below are some URD feeders in the different states for you to use for your area, if you know of some that you are more familiar with you may use those

Arkansas: G750 and Recloser Bank—7G51

Louisiana: North—N5052, N1103 and N5024

EGSI—URD Downtown-361

URD/OH Nesser Sub- 3123

Southeast—K0521

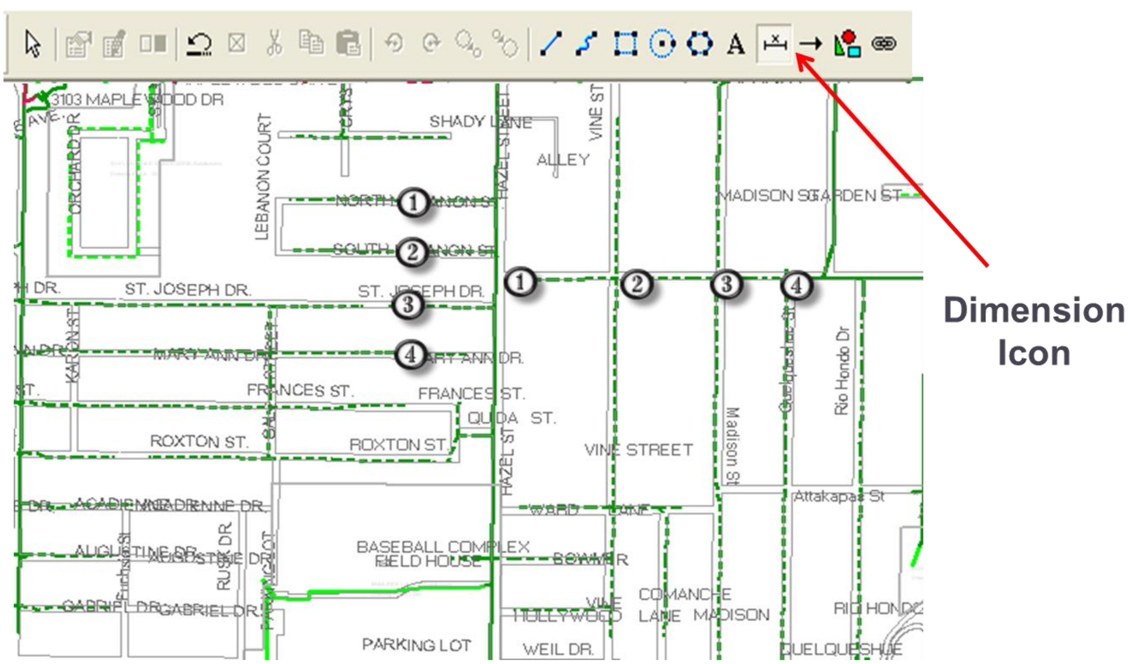
New Orleans-- 402

Mississippi: GM07 or GB05

Query by UG Containers: Switchgear# 50P0051

Texas: 745OK, 716ME, 717ME, 718ME, 719MW, 722ME

SLIDE 27: Hands-On Using GTViewer Finding Dimension

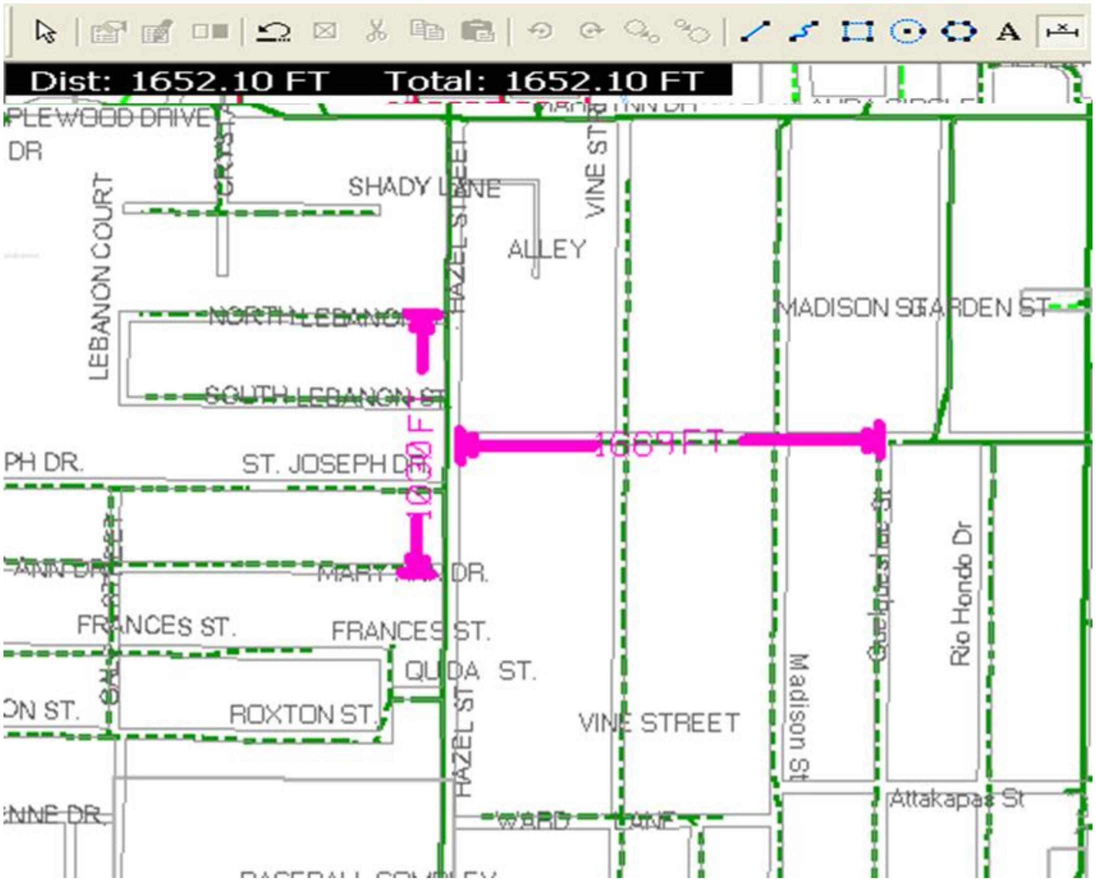


Instructor Notes:

Click on the "Dimension" icon from start to finish of 4 complete blocks for them to see how easy it can be to measure the distance from point A to point B. Make sure they change the color and weight of the line so that can be seen on the map.

They will have to drag their mouse from point A to point B.

SLIDE 28:



Instructor Notes:

As the student moves his pointer from one point to another it will also show him at the top of the map what the distance is as he goes. Once he releases the pointer the distance will show on the map and the editor above will disappear.

SLIDE 29: Questions

Instructor Notes:

None

Materials:

- None

SLIDE 30: Next Steps

The following steps are required to receive credit for this Module

Locate and take the exam on web

Print the exam results and provide to your instructor

Complete the hands-on competency test administer by the instructor

Check with your instructor if you have any questions

CF50623/Tag and Color Code URD Cables/CF50623/ PDF-PPT/07-10-2012

SLIDE 1: Tag and Color Code URD Cable

Revision 1-01

Revision Date 07/10/2012

Module CF50623

Revised by Walt Roberts

Reviewed by (SME) Kirk Gomez

Approved by Tim Golden (Supervisor)

SLIDE 2: Tag and Color Code URD Cable

Instructor Notes:

- In this module we will discuss the proper method to mark and tag URD cable
- There will be no hands-on for this module, so you will need to have the tape and tags in the classroom to demonstrate and allow the student to see and install on a piece of cable

Materials:

None

Teaching Points:

None

SLIDE 3: Objectives

Explain the purpose of training

Discuss the safety considerations

Explain the consequence of inadequate cable marking

Demonstrate how to properly install marking tape

Demonstrate how to properly install cable tags

Instructor Notes:

Given a URD primary or secondary cable, properly install cable tags and marking tape according to Entergy standard procedures

- Explain the purpose of training
- Discuss the safety considerations
- Explain the consequence of inadequate cable marking
- Demonstrate how to properly install marking tape
- Demonstrate how to properly install cable tags

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 4: Safety

You should discuss the importance of the marking and tagging procedure

Instructor Notes:

Get the students to open the safety manual – talk about applicable sections

Specific Rule numbers to discuss –

9.5, 9.7, 9.10, 9.11

Materials:

Entergy Safety Manual

Teaching Points:

SLIDE 5: TAG AND COLOR CODE URD CABLE

- We have a large amount of cable that runs underground and we cannot see where it goes.
  - Cannot be traced as easily as an overhead system.
- Identifying and marking the cable at the time of installation is an absolute necessity for the safety of personnel involved and proper operation.
- Terminal points must be clearly marked.

Instructor Notes:

- This slide discusses why we tape and tag cable and the consequences of not

We have a large amount of cable that runs underground and we cannot see where it goes.

Underground cable cannot be traced as easily as an overhead system.

Identifying and marking the cable at the time of installation is an absolute necessity for the safety of personnel involved and for the proper operation of the system.

Therefore, terminal points must be clearly marked so that crews in the field can identify the section of cable they are to work on.

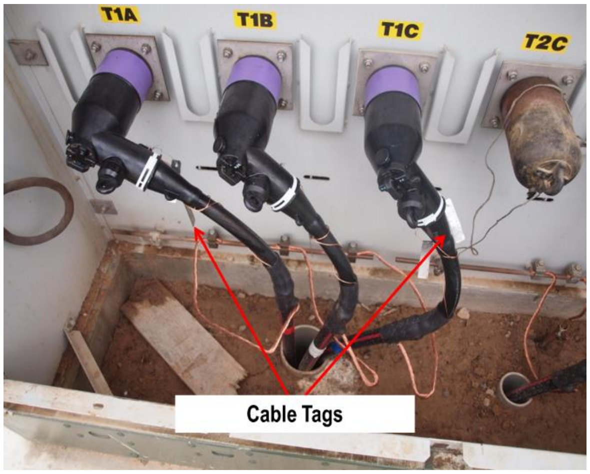
Materials:

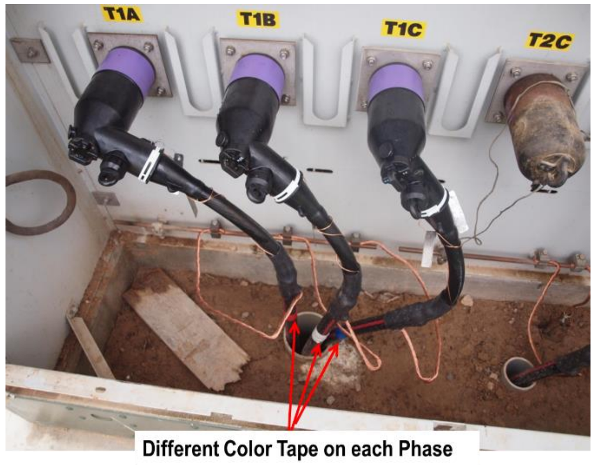
None

Teaching Points:

None

SLIDE 6: Tag and Color Code URD Cable





Instructor Notes:

- This slide discusses the need to tag and tape conductors
- As stated in the previous slide we must tag and tape conductors

IMPORTANT: Some areas use different methods to tape and tag, so you should become familiar with the local process

In this example A phase is red, B phase is white and C phase is blue

Tape should be minimum 5 wraps

Materials:

None

Teaching Points:

None

SLIDE 7: Tag and Color Code URD Cable

CABLE TIE AND TAG

- Provides the location of the other end of a cable run.
- Information that could be included on the tag
  - Equipment type
  - Distance
  - Direction
  - Location number
  - Any other pertinent information

Instructor Notes:

Given a URD primary or secondary cable, properly install cable tags and marking tape according to Entergy standard procedures

- Explain the purpose of training
- Discuss the safety considerations
- Explain the consequence of inadequate cable marking
- Demonstrate how to properly install marking tape
- Demonstrate how to properly install cable tags

Materials:

None

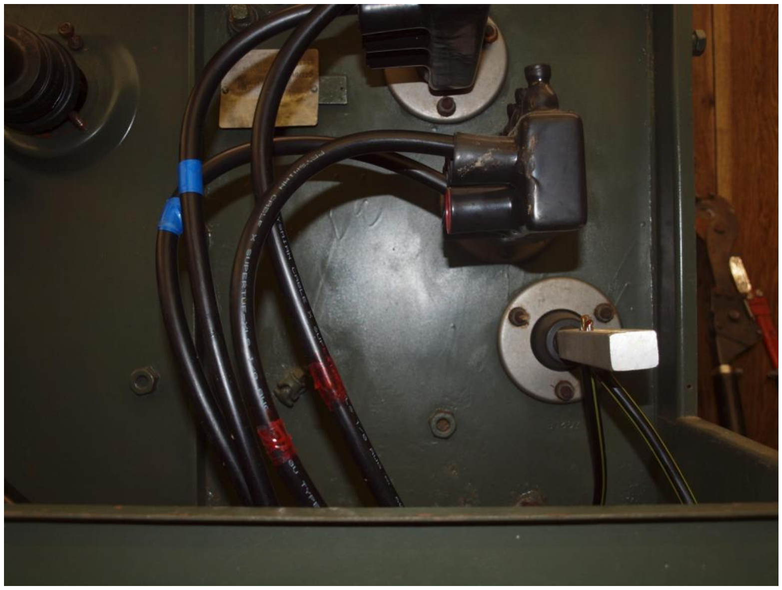
Teaching Points:

None

SLIDE 8: Tag and Color Code URD Cable

Secondary/Service

- Colored tape is used to designate the ends of a single run of secondary or service cable. (termination to termination)



Instructor Notes:

This slide discusses taping of URD secondary and services

You should demonstrate the proper method of installing tape

- Colored tape is used to designate the ends of a single run of secondary or service cable (termination to termination). Notice that each service has a different color tape

Materials:

Colored tape

URD secondary cable

Teaching Points:

None

SLIDE 9: Tag and Color Code URD Cable

REVIEW

- Identifying and marking the cable at the time of installation is an absolute necessity for the safety of personnel involved and proper operation.
- Therefore, terminal points must be clearly marked so that crews in the field can identify the section of cable they are to work on.
- Some areas use different methods to tape and tag, so you should become familiar with the local process.

Instructor Notes:

- This slide is a review
- There is no animation on this slide

Review

Identifying and marking the cable at the time of installation is an absolute necessity for the safety of personnel involved and proper operation.

Therefore, terminal points must be clearly marked so that crews in the field can identify the section of cable they are to work on.

Some areas use different methods to tape and tag, so you should become familiar with the local process

Materials:

None

Teaching Points:

REMINDER: Some areas use different methods to tape and tag, so you should become familiar with the local process

SLIDE 10: Questions

Instructor Notes:

None

Materials:

None

SLIDE 11: Next Steps

The following steps are required to receive credit for this Module

Locate and take the exam on web

Print the exam results and provide to your instructor

Complete the hands-on competency test administer by the instructor

Check with your instructor if you have any questions

CF50634/Load and Bind Trenching Equipment/CF50634/PDF-PPT/07-18-2012

SLIDE 1: Load and Bind Equipment & Material

Revision 1-01

Revision Date 07/18/2012

Module CF50634

Revised by Walt Roberts

Reviewed by (SME) Kirk Gomez

Approved by Tim Golden (Supervisor)

SLIDE 2:

Instructor Notes:

- This module discusses the loading and binding of equipment. You should always follow DOT rules

1. Discuss entire presentation in classroom
2. Ask questions as necessary
3. Take Written Exams
4. Go outside for hands-on activity
5. Perform competency test

Materials:

Safety manual

CDL manuals

Gloves, hardhats & safety glasses

Track-hoe, trencher or backhoe

Trailer

Various binders & tie-down straps

SLIDE 3: Objectives

- Explain the purpose of training
- Discuss Safety considerations
- Pre-check trailer and tow vehicle
- Identify DOT requirements
- Demonstrate securing equipment and material
- Demonstrate loading equipment

Instructor Notes:

This slide discusses the objectives of the module

Materials:

None

SLIDE 4: Safety

Instructor Notes:

Have the students open the safety manual and read

Rule numbers: 8.32, 15.2, 15.3, 16.33

Materials:

Entergy Safety Manual

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 5: Definitions You Should Know

- Gross Vehicle Weight (GVW)- The total weight of a single vehicle plus its load
- Gross Combination Weight (GCW)-The total weight of a powered unit, plus trailer(s), plus the cargo
- Coupling Device Capacity- Coupling devices are rated for the maximum weight they can pull and/or carry

Instructor Notes:

This slide discusses some common terms that you should know

There is animation on this slide

Materials:

None

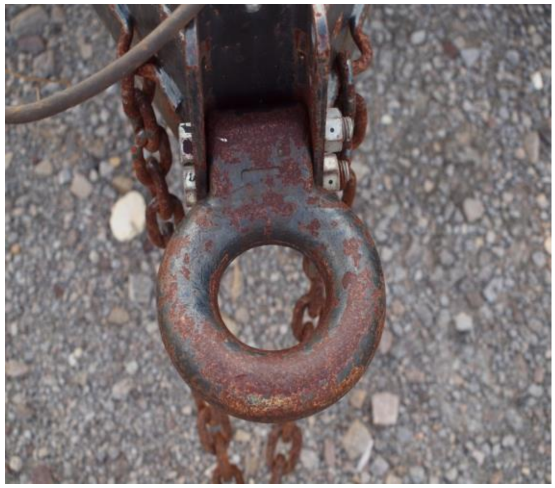
Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 6: Pre-Check Trailer & Tow Vehicle



Pre-check trailer

- Inspect the towing eye and safety chains
  - Cracks
  - Excessive wear
  - Bolt
  - Safety chains should be crossed under the towing eye when connected to tow vehicle

Instructor Notes:

This slide discusses inspection of a towing eye and safety chains

Regardless of what type of trailer used, it will have a towing eye

There are many styles and shapes of eyes

This will depend upon the height of the trailer bed

The towing eye is designed to go over the pintle hook

Safety chains are on each trailer.

The chains are crossed under the towing eye and attached to the towing vehicle.

CHAINS SHALL BE CONNECTED TO THE TOWING VEHICLE

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 7: Pre-Check Trailer & Tow Vehicle

Pintle Hook

- Different types of pintle hooks
  - To tow small trenchers, air compressors or trailers
  - To tow heavy duty load
    - Backhoe, trackhoe, etc
  - The pintle hook shall be inspected before each use

Instructor Notes:

This slide discusses pintle hooks

There is animation on this slide

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 8: Pre-Check Trailer & Tow Vehicle

- Trailer Lights
  - Each trailer will be equipped with a male connection

– Check for any cuts or cable damage
– Cable should be free from all chains when connected to tow vehicle
– Once connected to the tow vehicle all light should be operational

- All repairs should be made before leaving the work center

Instructor Notes:

- This slide discusses trailer lights
- Once the transport trailer has been connected to the towing vehicle, have a co-worker check:
  – Lights
  – Stop lights
  – Turn Signals

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 9: DOT Requirements

What Vehicles Are Covered

- Commercial vehicles (including a combination of vehicles) that are operated on a highway and have a gross vehicle rating over 4,500 kg (10,000 lb.)
- Gross Vehicle Rating = Greater Than 4,500 kg (10, 000 lb.)

Instructor Notes:

- This slide discusses what vehicles are covered at Entergy
- There is no animation on this slide
- All of our vehicles at Entergy except ¾ ton and below exceed the 10,000 lbs GVWR

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 10: Slide Title: What Vehicles Are Covered?

- The trencher weighs 7000 lbs
- An extended cab ¾ ton pickup GVWR is 8800 lbs
- 7000 + 8800 = 15800 lbs
- This combination is DOT regulated

Instructor Notes:

This slide discusses what vehicles are covered under DOT regulations

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 11: What Shall be Secured With Tie-Downs?

- Backhoes
- Trackhoes
- Trenchers
- Transformers
- Poles
- Alley machines
- Wire reels

Instructor Notes:

This slide discusses what shall be secured

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 12: Types Of Securing Devices

- Chains
- Rope
- Webbing
- Wire rope

- Tie-downs must be adjustable
- No knots between attachment points

Instructor Notes:

This slide discusses the types of securement devices and specifications

- All tie-downs must be adjustable
- Tie-downs must not contain knots.
  - Rope is OK as long as there were no knots between attachment points

Notes for the instructor

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 13: Working Load Limit

- The maximum load that may be applied to a component of a cargo securement system during normal service
  - Normally assigned by the component manufacturer
  - The WLL for a tie-down is the lowest WLL of any of its parts or anchor points it is attached to, whichever is less
  - Each device contributes to the WLL of the securement system
  - The minimum WLL requirement for the securement system is 50%
  - More tie-down capacity should be used if you need to secure an article against any movement.

Instructor Notes:

This slide discusses working Load limit (WLL)

- The maximum load that the rope is designed to carry

- Working load limit (WLL), which is the maximum working load designed by the manufacturer.
- WLL of 50% is the minimum for stationary objects

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 14: Aggregate Working Load Limit

- Sum of the working load limits of each device used to secure an article on a vehicle
  - 50% of the WLL of each end section of a tie-down that is attached to an anchor point
  - 50% of the WLL of each end section that is attached to the cargo
- The AWLL of any securement system must be at least 50% of the weight of the cargo being secured

Instructor Notes:

This slide discusses the aggregate working load limit

Aggregate = formed by adding together two or more amounts: or total

Materials:

None

Teaching Points:

Questions to promote discussion

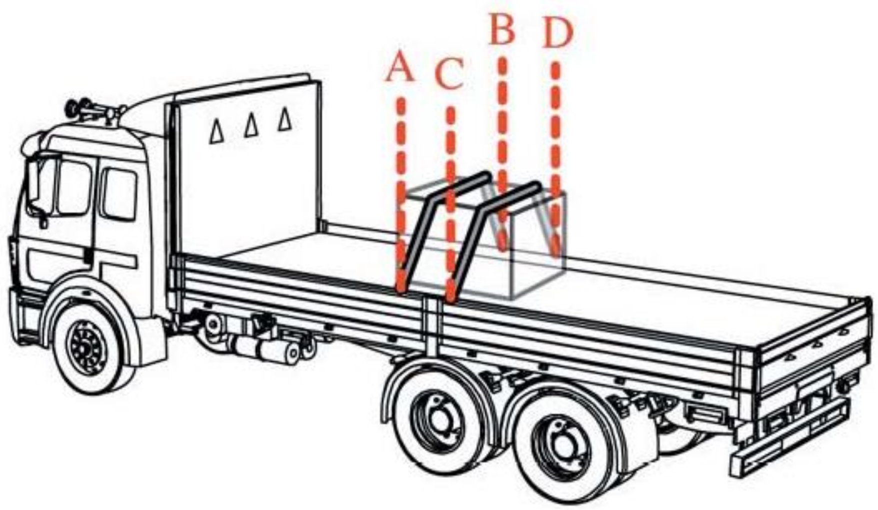
Key Information

Operating Experiences (near misses, incidents)

SLIDE 15: Aggregate Working Load Limit

Example:

50% of A + 50% of B + 50% of C + 50% of D= Aggregate Working Load Limit



Instructor Notes:

This slide is an example of how to figure the aggregate working load limit

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 16: SECURING OBJECTS WITHOUT WHEELS OR TRACKS

Instructor Notes:

This slide is the introduction of securing objects without wheels or tracks

Materials:

None

Teaching Points:

Questions to promote discussion

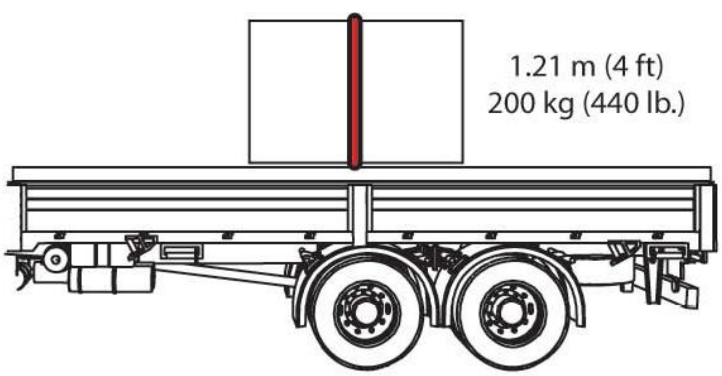
Key Information

Operating Experiences (near misses, incidents)

SLIDE 17: How Many Tie-Downs Are Required?

- If cargo is not prevented from forward movement
- Is 5 ft. or shorter and 1,100 lb. or less

Minimum of 1 Tie down



Instructor Notes:

Notes for the instructor

This slide discusses securing a load that is 5 ft or shorter and is 1,100 lb or less

- There is no animation on this slide
- If cargo is not prevented from forward movement (for example, by the headboard, bulkhead, other cargo, or tie-down attached to the cargo), secure the cargo according to the following requirements:
- Tiedowns must be used so that they are not able to rub and be cut

Materials:

None

Teaching Points:

Questions to promote discussion

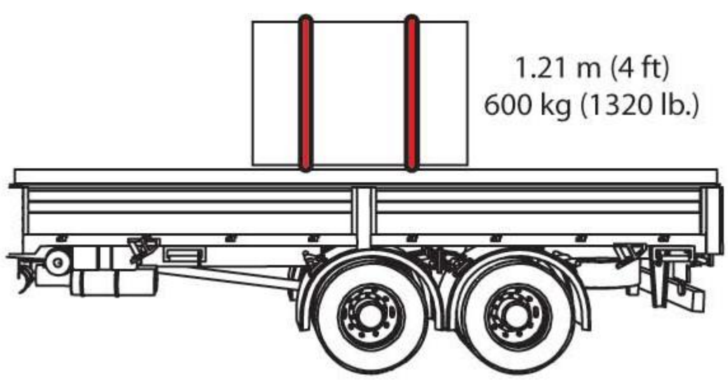
Key Information

Operating Experiences (near misses, incidents)

SLIDE 18: How Many Tie-Downs Are Required? (Continued)

- If cargo is not prevented from forward movement
- Is 5 ft or shorter and over 1,100 lb

Minimum of 2 Tie downs



Instructor Notes:

This slide discusses securing a load that is 5 ft or shorter and over 1,100 lb

Materials:

None

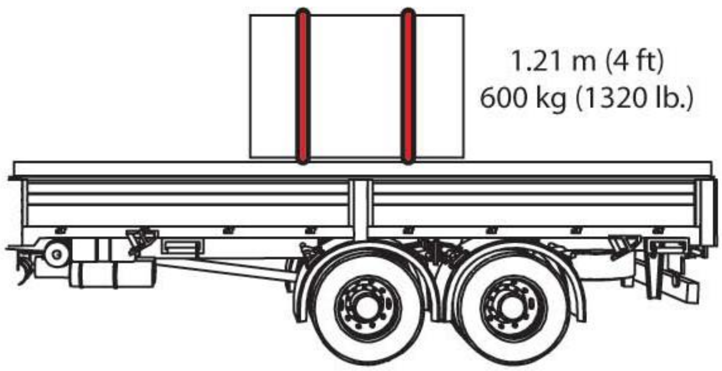
Teaching Points:

None

SLIDE 19: How Many Tie-Downs Are Required? (Continued)

- If cargo is not prevented from forward movement
- Is 5 ft but less than 10 ft.

Minimum of 2 Tie downs



Instructor Notes:

This slide discusses securing a load that is more than 5 ft, but less than 10 ft

Materials:

None

Teaching Points:

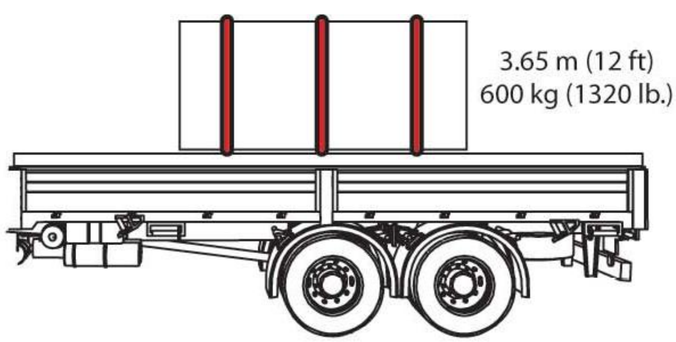
None

SLIDE 20: How Many Tie-Downs Are Required? (Continued)

If cargo is not prevented from forward movement

Longer than 10 ft

Minimum of 2 + 1 Tie down for every additional 10 ft, or part thereof



Instructor Notes:

This slide discusses securing a load that is longer than 10 ft

Materials:

None

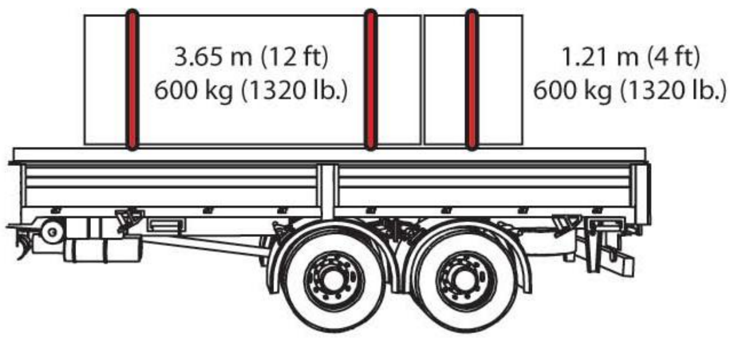
Teaching Points:

None

SLIDE 21: How Many Tie-Downs Are Required? (Continued)

- When Headboard is Provided
  - If cargo is prevented from forward movement
- All Cargo

Minimum of 1 Tie down for every additional 10 ft, or part thereof



Instructor Notes:

This slide discusses securing a load when a headboard is provided

There is no animation on this slide

When cargo is prevented from forward movement, for example, by the headboard, bulkhead, other cargo.

Some 100 KVA transformers are above the 1100 lb limit, and if hauled on a trailer will need 2 tie-downs.

If they are placed in the back of a bucket truck against the outriggers then you only have to use 1

Materials:

Handouts

Tools

Sample Materials (or demo)

Equipment, etc

Teaching Points:

Put all of these in the order they should be presented.

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

Wrap-up (if needed)

SLIDE 22: Securing Poles on Trailer

A pole must be secured by at least one tie-down at each bunk, or alternatively, by at least two tie-downs that encircle the entire load at locations along the load that provide effective securement.

Instructor Notes:

This slide discusses the securing of poles on a trailer

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 23: Loading Equipment on Trailers

- Two types of trailers
  - Bed tilts
  - Moveable ramps
- Trailer should match the equipment
- Place trailer off road if possible

  - Prevent damage to the road
  - Be aware of vehicular traffic and pedestrians
- Place trailer on firm, flat surface

Instructor Notes:

- This slide discusses the loading of equipment on a trailer
- There is animation on this slide
- There are two common types of trailers; one which the bed of the trailer tilts and the other type trailer has moveable ramps.
- The weight distribution of a trailer is very important;
  - That is why the trailer should match the equipment.
- When loading or unloading, if possible, both the ramp and tilt type trailer should be off the road bed.
  - This will prevent damage to the road bed.
- If it is to be loaded or unloaded on the road, caution should be exercised to prevent damage to the road, to watch for other vehicular traffic and to watch for pedestrians.

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 24: Loading Equipment on Trailers

- Chock tires
- Fasten seat belt

- Use spotter
- Move slowly onto trailer
- Back on & drive off if possible

Instructor Notes:

This slide discusses the loading of equipment on a trailer

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 25: Securing Equipment

Accessory equipment, such as hydraulic shovels (backhoe), must be completely lowered and secured to the vehicle

Articulated vehicles shall be restrained in a manner that prevents movement while in transit

Heavy equipment or machinery with crawler tracks or wheels must be restrained against movement in the lateral, forward, rearward, and vertical direction using a minimum of four tie-downs

Instructor Notes:

This slide discusses the securing of equipment

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 26: Securing Equipment (Continued)

- Each tie-down must be attached as close as practicable to the front and rear of the vehicle, or mounting points on the vehicle that are specifically designed for that purpose
- Restrain cargo using a minimum of four tie-downs, each having a WLL of at least 50% of the equipment being transported
- This is different from cargo without wheels of tracks

Instructor Notes:

This slide discusses the securing of equipment

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 27: Securing Equipment

- Lower the attachments
  - Apply down pressure
  - Set the park brake
- Use proper tie-down procedure
  - Securely tie-down all four corners using tie-downs with adequate WLL
- This trencher weighs 7000 lbs so each tie-down must have a WLL of at least 3500 lbs

Instructor Notes:

This slide discusses the securing of equipment

Aggregate load limit calculations do not apply to objects with wheels or tracks

Materials:

None

Teaching Points:

None

SLIDE 28: Entergy Trailering / Hauling Best Practices

- Operator has the proper licenses / certifications for the tow vehicle / trailer / cargo
- Tow vehicle and trailer are compatible and rated for the load
- Are special permits or escort required
- Plan the route considering
  - Load's height, weight, width and length
  - Traffic, weather, road conditions
  - Road restrictions
- Inspect tow vehicle and trailer before towing
  - Tires
  - Lights
  - Safety chains and breakaway emergency brake connections
  - Trailer hitch / coupler / pintle hook / towing eye
    - To be good condition
    - Rated for the load
    - Properly latched and safety pins in place

- Trailer brakes
- Loading ramps or tilt trailer assemblies to be working and secured for travel

– Loading and securing equipment or materials
  - Apply parking brake or chock tow vehicle and/or trailer as necessary to prevent movement while loading or unloading
  - Use a spotter while loading / unloading and stay clear of loading / unloading operations
  - Drive on or off trailer as recommended by Fleet Management and/or manufacture
  - Secure all equipment or loads using properly rated cordage, chains, wire rope, binders and anchor points
  - Use only ratchet binders
  - Protect cordage, ropes and webbing that secures the load from cuts or abrasion
  - Check the load to be secure often and after hard breaking, swerving actions or any time you suspect a problem

All anchor points, binders, chains, webbing, rope, etc. must be rated as follows:

– Anchor point on trailer/truck to anchor point on equipment/load
  - Rated for ½ the weight of the equipment/load

– Anchor point on trailer/truck over the equipment/load to anchor point on truck/trailer
  - Rated for the weight of the equipment/load

Securing equipment/loads less than 10,000

– Minimum of 2 tie downs that prevent forward/rearward/lateral and vertical movement. For equipment tie downs should be attached at the front and rear. (See Note)

Securing equipment/loads 10,000 or more

– Minimum of 4 tie downs that prevent forward/rearward/lateral and vertical movement.

– The tie downs 2 at front and 2 at rear should be placed where one is attached to the front right on equipment then bound down on the left side of trailer then one is attached to left front on equipment then bound down on the right side of trailer. Continue the attachment process at rear the same as front. (See Note)

Note: Articulated equipment such as backhoes dipper and loader buckets must be lowered and secured by binding down to prevent forward/rearward/lateral and vertical movement.

Be aware of: Longer breaking and acceleration times, Longer turning radius, Blind spots

Instructor Notes:

This is a review slide

Materials:

Entergy Trailering/Hauling Best Practices handout

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 29: Questions

Instructor Notes:

None

Materials:

None

SLIDE 30: Next Steps

The following steps are required to receive credit for this Module

Locate and take the exam on web

Print the exam results and provide to your instructor

Complete the hands-on competency test administer by the instructor

Check with your instructor if you have any questions

CF50661/Install and Operate a Servisavor/CF50661/PDF-PPT/1-05-2015

SLIDE 1: Revision 1-01

Revision Date 08/09/2012

Module CF50661

Revised by Walt Roberts

Reviewed by (SME) (CMPD) Jerry Sepulvado

Reviewed by (SME) Mark Jordan

Approved by Tim Golden (Supervisor)

SLIDE 2: Install and Operate a Servisavor

Instructor Notes:

Introduce the module to the students – servisavor.

1. Discuss entire presentation in classroom
2. Ask questions as necessary
3. Take Written Exams
4. Go outside for hands-on activity
5. Perform competency test

Materials:

Servisavor instruction guide

Servisavor

Single phase Meter Base and meter

Section of buried URD secondary with one faulted conductor

Voltmeter

Hand tools – Pliers, screwdriver, socket & ratchet

All PPE

Teaching Points:

None

SLIDE 3: Objectives

- Explain the purpose of the servisavor
- Discuss Safety considerations
- Explain the consequence of inadequate installation
- Demonstrate how the servisavor functions
- Demonstrate how to install it properly

Instructor Notes:

- Given a URD service with a faulted conductor, restore power temporarily using a servisavor.
- Explain the purpose of the
- Discuss Safety Considerations
- Explain the consequence of inadequate installation of servisavor
- Demonstrate how the servisavor functions
- Demonstrate how to install servisavor properly

Materials:

None

Teaching Points:

- Questions to promote discussion
- Key Information
- Operating Experiences (near misses, incidents)

SLIDE 4: Safety

Instructor Notes:

Get the students to open the safety manual, read & discuss safety rules:

- 3.3, 9.0, 9.3, 9.6, 12.8, 12.9, 17.0

Materials:

Entergy Safety Manual

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 5: Install and Operate a Servisavor

Why install a Servisavor?

- When a customer has a fault on their URD service, we must restore service as soon as possible.
- The Servisavor is designed to temporarily restore power
- Power can be restored without
  - locating and repairing the cable fault
  - running temporary above ground conductors.

Instructor Notes:

- This slide discusses why we install a servisavor
- When a customer has a fault on their URD service, we must restore service as soon as possible.
- The SERVISAVOR is a mobile unit designed to temporarily restore power to customers served with underground secondary cable and with one faulted conductor.
  - Most faults are opens in one of the hot legs or the neutral.
- By connecting the SERVISAVOR between the customers meter socket and his meter, power can be restored without immediately locating and repairing the cable fault or running temporary above ground conductors.

- This permits quick customer response and allows cable fault location and repair during normal work hours.

Materials:

None

Teaching Points:

- Questions to promote discussion
- Key Information
- Operating Experiences (near misses, incidents)

SLIDE 6: Install and Operate a Servisavor

Can contain

- This slides discusses some of the consequences of not installing the servisavor properly
- There is animation on this slide
- Consequence of inadequate installation:
- Possible damage to customer equipment (burn up meter pan, appliances etc.)
- Possible damage to the Servisavor
- Possible bodily injury to employees or public

Instructor Notes:

Notes for the instructor

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 7: Purpose of the Servisavor

- Restores load current on an open hot leg up to its current rating.
- Restores unbalanced load current up to its current rating, when the neutral is open.
- Preclude restoration of power when two conductors have faults.

NOTE: The Servisavor should NEVER be installed on a service with two faulted cables.

Instructor Notes:

- This slide discusses how the servisavor functions
- Servisavor restores load current on an open hot leg up to its current rating.
- When the neutral is open the Servisavor restores unbalanced load current up to its

current rating. (at this point you may need to explain how you detect an open neutral. When checking voltage, one hot leg will have high voltage and the other hot leg will have low voltage. EX: 145 volts on one leg and 95 volts on the other.)

  – The Servisavor will not restore power when two conductors have faulted. Either 2 hot leg or a hot leg and the neutral.

- The Servisavor should **NEVER** be installed on a service with two faulted cables.
- The Servisavor consist of a magnetic circuit breaker protected 240 volt autotransformer.
  – An autotransformer is commonly used for the voltage conversion of local power line voltage to some other Voltage value needed for a particular piece of electrical equipment. Most often, this conversion is from 125 Volts to 250 Volts, or 250 Volts to 125 Volts.
- The servisavor comes is 3 different sizes 15, 20 & 25 kva.

Notes for the instructor

Materials:

None

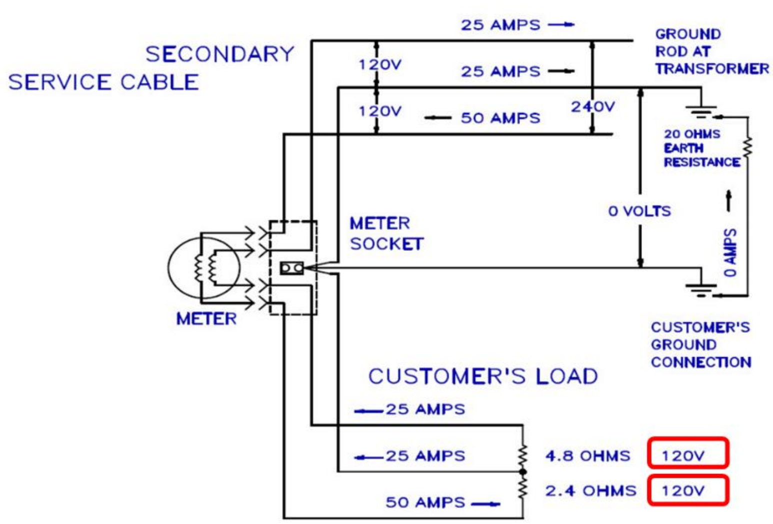
Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 8: No Fault



CUSTOMER SERVICE EXAMPLE WITHOUT FAULTED CABLE

Instructor Notes:

This slide show a normal, no fault service

There is animation on this slide (voltages at the meter)

You should point out the voltage from the transformer and the voltage at the meter.

Materials:

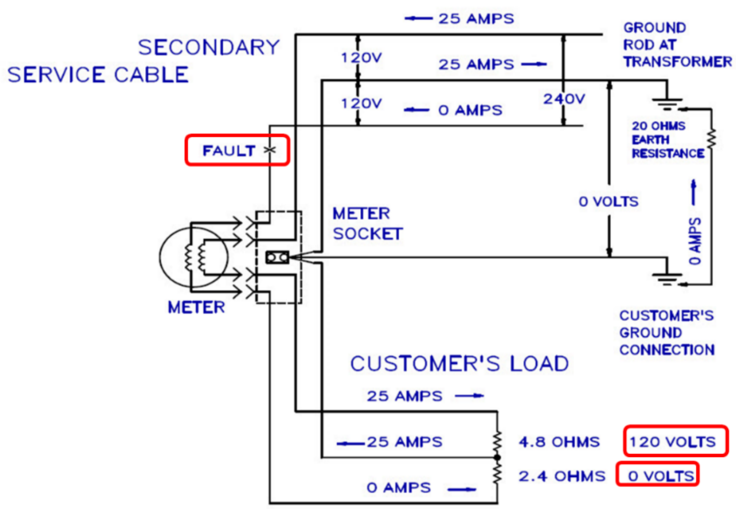
None

Teaching Points:

- Questions to promote discussion
- Key Information
- Operating Experiences (near misses, incidents)

SLIDE 9: Open Hot Leg

SLIDE CONTENT



CUSTOMER SERVICE WITH FAULT ON ONE HOT LEG

Instructor Notes:

- This slide show an open leg on the service
- You should point out the fault and then voltage from the transformer and the voltage at the meter.
- When there is one faulted hot leg the customer loses that portion of his load.
- The neutral now carries exactly the same current as the good hot leg.

Materials:

None

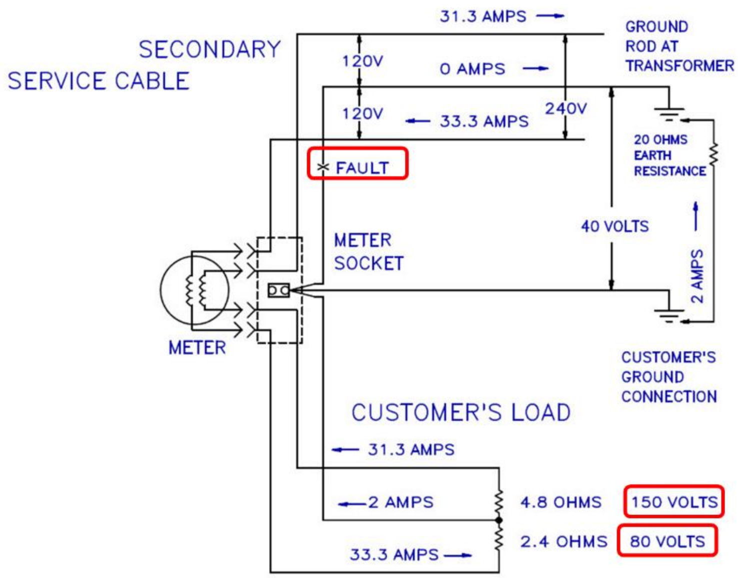
Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 10: Open Neutral



CUSTOMER SERVICE WITH AN OPEN NEUTRAL

Instructor Notes:

Can contain

- This slide show an open neutral on the service
- There is animation on this slide (Fault & voltages at the meter)
- You should point the out fault and then voltage from the transformer and the voltage at the meter.
- When a large load such as a motor attempts to start, the resistance of its hot leg will be lowered.
- Since the voltage divides across the resistances, the voltage on the other hot leg will increase as the voltage between the customer's ground and the source transformer ground increases.

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 11: Install Servisavor

- The type of fault has already been determined
- Have customer turn their main breaker off
- Use caution when opening the pedestal or padmount
  - Open connections
  - Snakes or insects etc

Instructor Notes:

- Installation of servisavor
- You should always do a hazard assessment and wear all PPE
- You have already determined the type of fault on the URD service.
- Have customer turn off his main breaker.
- To eliminate an outage during fault location, you may determine which leg is bad and disconnect at both the source and the meter pan.

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 12: Install Servisavor

- Disconnect service at the source
  - Proper PPE

    – Proper tools
    – Correct body position
- To eliminate an outage during fault location, determine which leg is bad and disconnect at both the source and the meter pan

Instructor Notes:

Installation of servisavor

This slide discusses the importance of safety while disconnecting the service

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 13:


30
60
90
120
0
AC VOLTS
150
PHASE1 OFF PHASE2
I/ON
ON
125A
OFF
10 kA
DANGER
HAZARD OF ELECTRIC SHOCK, BURN OR EXPLOSION


Haulmark

INSTALL SERVISAVOR

- Customer's main breaker is off
- Position the servisavor near the meter pan
  - install ground rod and ground wire
- Install the ground tab on the servisavor meter adapter under the ground lug in meter pan
- Turn the servisavor breaker to the "OFF" position

- Install servisavor meter adapter into the meter pan

Instructor Notes:

- Installation of servisavor
- You have already determined the type of fault on the URD service.
- Have customer turn off his main breaker.
- To eliminate an outage during fault location, you may determine which leg is bad and disconnect at both the source and the meter pan.
- Position the SERVISAVOR near the meter pan away from buried utilities.
- Install a temporary screw type ground rod close to the servisavor, connecting it to the brass ground stud on the left side of the servisavor.
- Install the ground tab on the SERVISAVOR meter adapter under the ground lug in meter pan.
  - Make sure this connection is tight because it may carry most of the current.
- Turn the SERVISAVOR breaker to the "OFF" position to avoid inrush current damage to its meter adapter contacts.
- Install servisavor meter adapter into the meter pan

Materials:

None

Teaching Points:

None

SLIDE 14: Install Servisavor

- Turn the Servisavor breaker to the "ON" position
- Check voltage
- Install meter
- Instruct customer to turn on main breaker
- Barricade area with safety cones


ON
200
OFF
MAIN
DANGER:
TURN OFF POWER


DANGER / PELIGRO

Instructor Notes:

- Installation of servisavor
- Turn the SERVISAVOR breaker to the "ON" position
- Check voltage
- Install meter.
  - Seal both the meter and the SERVISAVOR meter adapter
- Notify customer that service has been restored temporarily.
- Instruct customer to turn on his main breaker.
  - If the breaker on the SERVISAVOR trips, the customer should be advised to reduce his load until permanent repairs can be completed.
- Temporarily barricade immediate area with safety cones.

Materials:

None

Teaching Points:

None

SLIDE 15: Review

- Determine whether there are two good conductors available
  - The Servisavor must not be used unless there are two good conductors
- Have customer turn off their main breaker
- Disconnect service at the source
  - To eliminate an outage during fault location, determine which leg is bad and disconnect at both the source and the meter pan
- Position the Servisavor near the meter pan away from the buried utilities

Instructor Notes:

- This is one of three review slides
- Determine whether there are two good conductors available
  - The Servisavor must not be used unless there are two good conductors.
- Have customer turn off their main breaker
- Disconnect service at the source
  - To eliminate an outage during fault location, determine which leg is bad and disconnect at both the source and the meter pan
- Position the Servisavor near the meter pan away from the buried utilities

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 16: Review

- Install a temporary screw type ground rod close to the Servisavor
- Install a short jumper from the brass ground stud on the left side of the Servisavor to the ground rod
- Install the ground tab on the Servisavor meter adapter under the ground lug in meter pan
- Be sure the connection is tight because it may carry the most current when the Servisavor is operating
  - Turn the Servisavor breaker to the “OFF” position to avoid inrush current damage to its meter adapter contacts
- Install Servisavor meter adapter into the meter pan

Instructor Notes:

- This is two of three review slides
- Install a temporary screw type ground rod close to the Servisavor

- Install a short jumper from the brass ground stud on the left side of the Servisavor to the ground rod
- Install the ground tab on the Servisavor meter adapter under the ground lug in meter pan
  - BE sure the connection is tight because it may carry the most current when the Sevisavor is operating
- Turn the Servisavor breaker to the “OFF” position to avoid inrush current damage to its meter adapter contacts
- Install Servisavor meter adapter into the meter pan

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 17: Review

- Reconnect service at the source. Turn the Servisavor breaker to the “ON” position and check voltage
- Install meter. Seal both the meter and the Servisavor meter adapter
- Notify customer that service has been restored temporarily
- Instruct customer to turn on his main breaker
  - If the breaker on the Servisavor trips, the customer should be advised to reduce his load until permanent repairs can be completed
- Barricade area with safety cones
- Follow all applicable company safety rules

Instructor Notes:

This is three of three review slides

Reconnect service at the source. Turn the Servisavor breaker to the “ON” position and check voltage

Install meter. Seal both the meter and the Servisavor meter adapter

Notify customer that service has been restored temporarily

Instruct customer to turn on his main breaker

If the breaker on the Servisavor trips, the customer should be advised to reduce his load until permanent repairs can be completed

Barricade area with safety cones

Follow all applicable company safety rules

Materials:

None

Teaching Points:

Questions to promote discussion

Key Information

Operating Experiences (near misses, incidents)

SLIDE 18: Questions

Instructor Notes:

None

Materials:

None

SLIDE 19: Next Steps

The following steps are required to receive credit for this Module

Locate and take the exam on web

Print the exam results and provide to your instructor

Complete the hands-on competency test administer by the instructor

Check with your instructor if you have any questions

CF50790/Basic Switching and Tagging/CF50790/PDF-PPT/8-09-2012

SLIDE 1: Basic Switching, Tagging and Clearance Procedures

Revision 1.03

Revision Date 01/05/2015

Module CF50790

Revised by Sarah Dozier – 01/05/2015, Jerry Sepulvado – 02/22/2012

Approved by Mark Callender – 02/13/2015 (Supervisor)

Instructor Notes:

v1.00 – 06-11 This was a new module developed for boot camp

v1.01- 09-11 Clean-up after boot camp pilot v1.02 – 02-12 updated safety manual rule references to reflect changes in 2011 safety manual

V1.03 – 01/08/2015 Updated safety rules, fixed template and formatting – Sarah Dozier

Instructor comment and slide content

Welcome to Introduction

Basic Switching, Tagging and Clearance Procedures

General

This is an instructor led program requiring digital projection equipment and PC

Each slide has instructor notes, instructor comments and may have student interaction questions and key points the student must understand.

This presentation when printed in the notes page view creates an instructor manual / guide for the instructor's use during the program

Testing

There is a final exam in electronic format

There are no graded hands on activities for this program

Program flow

Instructor led presentation

Final exam

Instructional resources

Safety manual preferably electronic so it can be projected for the class

Student resources

Safety manual

Entergy Switching, Tagging and Clearance Procedures (T-OP-TOP-012)

Student handout / job aids

None

Student prerequisites

None

SLIDE 2: Course Objectives

- Identify switching and clearances
- Identify Switchman and clearances holder requirements for:
  - Inside substations
  - On transmission lines

        - On distribution lines and equipment controlled by the field
- Identify Entergy's 5 controlling authorities and their areas of control

Instructor Notes:

- Slide discusses the objectives of this training program
- Slide is animated first bullet is automatic additional bullets and information appear on mouse clicks.

Instructor Comment

After this training you will be able to accomplish the following objectives:

Slide Content

1. State:
    - What is switching
    - What are clearances
2. State:
    - Switchman / clearances holder requirements for:
        - Inside substations
        - On transmission lines
        - On distribution lines and equipment controlled by the field
3. State/Identify:
    - Entergy's 5 controlling authorities and their areas of control.

SLIDE 3: What is Switching and Clearances?

- Switching is modifying the transmission and distribution power systems by opening and closing devices to isolate or restore lines and equipment to and from service and to manage load.
- Clearances are a lock out tag out procedure to insure equipment or lines are properly isolated before de-energized work is performed.

Instructor Notes:

Slide discusses the "what" of switching and clearances are by using student inter action questions.

Slide is animated first question is automatic answer comes in on mouse click. Additional questions, answers and information appear on mouse clicks.

Slide Content

Question for class participation

What is switching? (wait for class response)

Answer

Switching is modifying the transmission / distribution power systems by opening and closing devices to isolate or restore lines and equipment to and from service and to manage load.

Question for class participation

What are clearances? (wait for class response)

Answer

Clearances a lock out tag out procedure to insure equipment or lines are properly isolated before de-energized work is performed.

Instructor Comment:

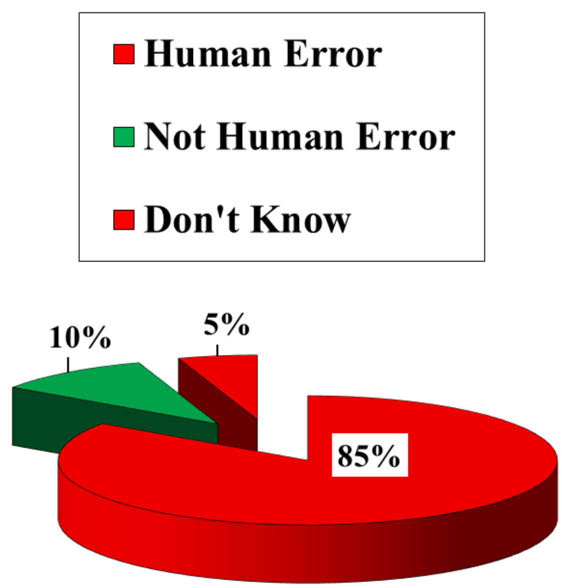
The Fatal 5 rule “Follow Critical Switching, Tagging and Clearance Rules” is a preventative barrier

Switching, Tagging and Clearances are first the steps in performing de-energized work and must be performed before de-energized can begin. There are no exceptions.

SLIDE 4: Why do we Have Processes and Procedures for Switching and Clearances?

We know:

- Switching and/or performing de-energize work can be dangerous.
- There are proven switching and clearance processes that reduce the risks to workers.
- 85% of switching/clearances errors are human error.
- Written processes/procedures reduce human error
- Written switching and clearance processes are tools that keep you safe.



Instructor Notes:

- Slide discusses the why we have defined switching and clearance processes by using student inter action questions.

- Slide is animated question is automatic answers comes in on mouse clicks. Additional information appears on mouse clicks.

Question for class participation

Why do we have processes and procedures for switching and clearances? (Wait for class response)

Answer

We know:

- Switching and/or performing de-energize work can be dangerous.
- There are proven switching and clearance processes that reduce risks to the workers.
- 85% of switching/clearances errors are human error.
- Written processes and procedures reduce human error

Written switching and clearance processes are tools that keep you safe.

SLIDE 5: Entergy’s 5 Controlling Authorities

Slide Content:

1. TOC: All transmission lines and related facilities in the substation
2. DOC: All distribution substation facilities including the 3ϕ feeder/trunk up to first protective device on the line providing there are no other sources of 3ϕ feed downstream.
3. Field: Distribution line facilities beginning at and including the first protective device in series with the feeder/trunk except when feeder/trunk loops back or has another source of feed.

Instructor Notes:

- Slide discusses the 5 controlling authorities and the area of the power system they control
- Slide is animated first bullet is automatic additional bullets appear on mouse clicks
- Slide contains linked file showing doc/field controlled devices

INSTRUCTOR COMMENT:

- Entergy’s power system are divided into distribution and transmission systems which includes the lines and substation equipment associated with transmission and distribution.
- The power system is further divided up by state and operating company.
- Each of these areas are assigned a controlling authority that manages the switching, tagging and clearance operations in their assigned area.
- The controlling authorities and their areas of control are:

SLIDE CONTENT:

TOC:

All transmission lines and facilities if the substation

DOC:

All distribution substation facilities including the 3ϕ feeder/trunk up to first protective device on the line providing there are no other sources of 3ϕ feed downstream.

Field:

Distribution line facilities beginning at and including the first protective device in series with the feeder/trunk except when feeder/trunk loops back or has another source of feed. (Details on DOC Field drawing hyperlink)

TEMPORARY CONTROLLING AUTHORITIES

Circuit Boss:

During storms with approval from Jurisdictional Director or VP of operations controlling authority for a specific de-energized feeder trunk and associated taps may be transferred to a circuit boss.

Substation Boss:

During storms responsible for isolating de-energized transmission and distribution substation equipment

SLIDE 6: Entergy's 5 Controlling Authorities

Temporary Controlling Authorities

4. Circuit Boss: During storms with approval from Jurisdictional Director or VP of operations controlling authority for a specific de-energized feeder trunk and associated taps may be transferred to a circuit boss.
5. Substation Boss: During storms responsible for isolating de-energized transmission and distribution substation equipment

You Are Required To Work With One Or More Of These Groups When Performing Switching or Clearances Activities!

Instructor Notes:

- Slide discusses the 5 controlling authorities and the area of the power system they control
- Slide is animated first bullet is automatic additional bullets appear on mouse clicks
- Slide contains linked file showing doc/field controlled devices

INSTRUCTOR COMMENT:

- Entergy's power system are divided into distribution and transmission systems which includes the lines and substation equipment associated with the transmission and distribution.

- The power system is further divided up by state and operating company.
- Each of these areas are assigned a controlling authority that manages the switching, tagging and clearance operations in their assigned area.
- The controlling authorities and their areas of control are:

SLIDE CONTENT:

- TOC:

All transmission lines and facilities if the substation

- DOC:

All distribution substation facilities including the 3ϕ feeder/trunk up to first protective device on the line providing there are no other sources of 3ϕ feed downstream.

- Field:

Distribution line facilities beginning at and including the first protective device in series with the feeder/trunk except when feeder/trunk loops back or has another source of feed. (Details on DOC Field drawing hyperlink)

Temporary Controlling Authorities

- Circuit Boss:

During storms with approval from Jurisdictional Director or VP of operations controlling authority for a specific de-energized feeder trunk and associated taps may be transferred to a circuit boss.

- Substation Boss:

During storms responsible for isolating de-energized transmission and distribution substation equipment

SLIDE 7: Definitions and Safety Rules Switching, Tagging and Clearances

Slide Content

Switchman- An Entergy employee or an employee of a company hired by Entergy that is certified by training and experienced for switching the physical configuration of the electrical system and/or its associated control schemes.

Switchman List (Data Base)- A list of individuals who have been trained and certified in Distribution switching or Transmission switching.

Switching Order- A sequential set of instructions directed by the Operator and performed by the switchman for the purpose of altering the physical configuration of the electrical system and/or its associated control schemes.

Instructor Notes:

None

SLIDE 8: Definitions and Safety Rules Switching, Tagging and Clearances

Slide Content

Clearance Order - A documentation process identified by a unique number and issued by the DOC/TOC Operator, which is given to ensure personnel that a piece of equipment or line has been de-energized, that at least one secured visible air gap on each side of the cleared section has been established with all potential sources into the clearance area opened and all Hold Tags are attached as part of the switching procedures.

Clearance Order Requirement - A Clearance Order and all appropriate installed grounds shall be required for work to be performed on any de-energized distribution or transmission line. A Clearance Order and all appropriate installed grounds shall also be required for work to be performed on any substation equipment, including buses, if the work being performed on the equipment places employee(s) in danger of contacting a normally energized component of the substation.

Instructor Notes:

None

SLIDE 9: Three-Part Communication

Three-Part Communication – a directives issued by the Issuer, which is repeated by the Recipient, and confirmed as accurate by the Issuer.

- *In a three-part communication,* directives are issued by the Issuer, and shall be repeated by the Recipient and confirmed as accurate by the Issuer.
- Three-part communication is used in switching and clearance to assure the information being transmitted between the dispatcher and the field personnel are being communicated accurately.
- Three-part communication promotes a safe work environment and efficient work practices.

How then does the three-part communication apply to switching, tagging and clearance?

Instructor Notes:

Instructor Comment:

- **Answer:** Provide students with an example of the three-part communication method being used in the

SLIDE 10: Field Switching Training and Requirements

Slide Content

- It is the responsibility of local management to train and qualify employees for switching or holding clearances on field controlled devices.
- Switching and holding clearances on field controlled devices requires the switchman or clearance holder to follow the applicable safety rules and procedures established by:
  - Entergy Safety Manual
  - D&T Switching, Tagging and Clearance Procedures

Instructor Notes:

- Slide discusses specifics of training for field switching and what safety and STC procedures apply.
- Slide is animated first bullet appears automatically additional information appears on mouse clicks.
- This slide contains links to examples switching and clearance orders click on the pictures of each to open the example.

Instructor Comment:

Let’s take a look at Field Switching requirements, responsibilities and some examples of switching and clearance orders.

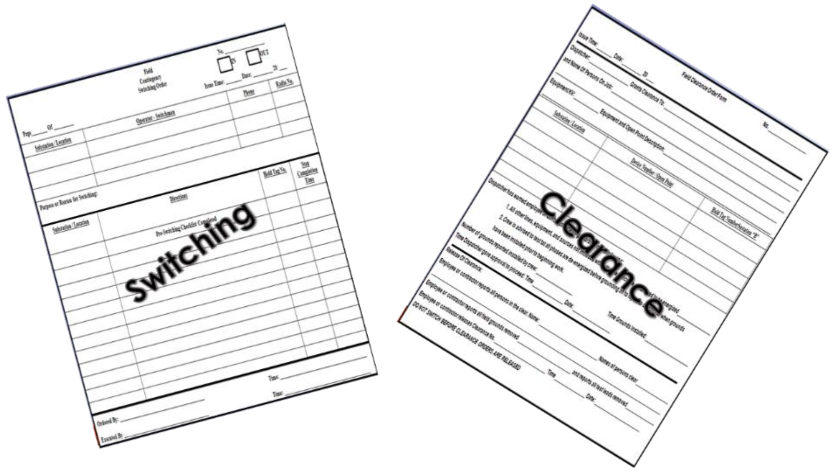
Slide Content:

- It is the responsibility of local management to train and qualify employees for switching or holding clearances on field controlled devices.
- Switching and holding clearances on field controlled devices requires the switchman or clearance holder to follow the applicable safety rules and procedures established by:
  - Entergy Safety Manual
  - D&T Switching, Tagging and Clearance Procedures

Examples of switching and clearance order forms you are required to use

SLIDE 11: Examples of Forms Used for Switching

SLIDE CONTENT



Instructor Notes:

- Slide discusses specifics of training for field switching and what safety and STC procedures apply.
- Slide is animated first bullet appears automatically additional information appears on mouse clicks.
- This slide contains links to examples switching and clearance orders click on the pictures of each to open the example.

Instructor Comment:

Let's take a look at field switching requirements, responsibilities and some examples of switching and clearance orders.

Slide Content:

- It is the responsibility of local management to train and qualify employees for switching or holding clearances on field controlled devices.
- Switching and holding clearances on field controlled devices requires the switchman or clearance holder to follow the applicable safety rules and procedures established by:
    - Entergy Safety Manual
    - D&T Switching, Tagging and Clearance Procedures

Examples of switching and clearance order forms you are required to use

SLIDE 12: Why Are Danger Hold Tags Important?

SLIDE CONTENT

This statement says it all!

Danger Hold Tags are a tool that keeps you safe by informing others a switch or device is open for a reason and is not to be operated without proper authorization

Caution:

Hold Tags are not a clearance and do not take the place of a clearance under any conditions

Instructor Notes:

- Slide discusses the importance of danger hold tags by using student inter action question.
- Slide is animated question appears automatically and the answer appears on next mouse click.

Slide Content

Question for class participation

- Why Are Danger Hold Tags Important?

Answer

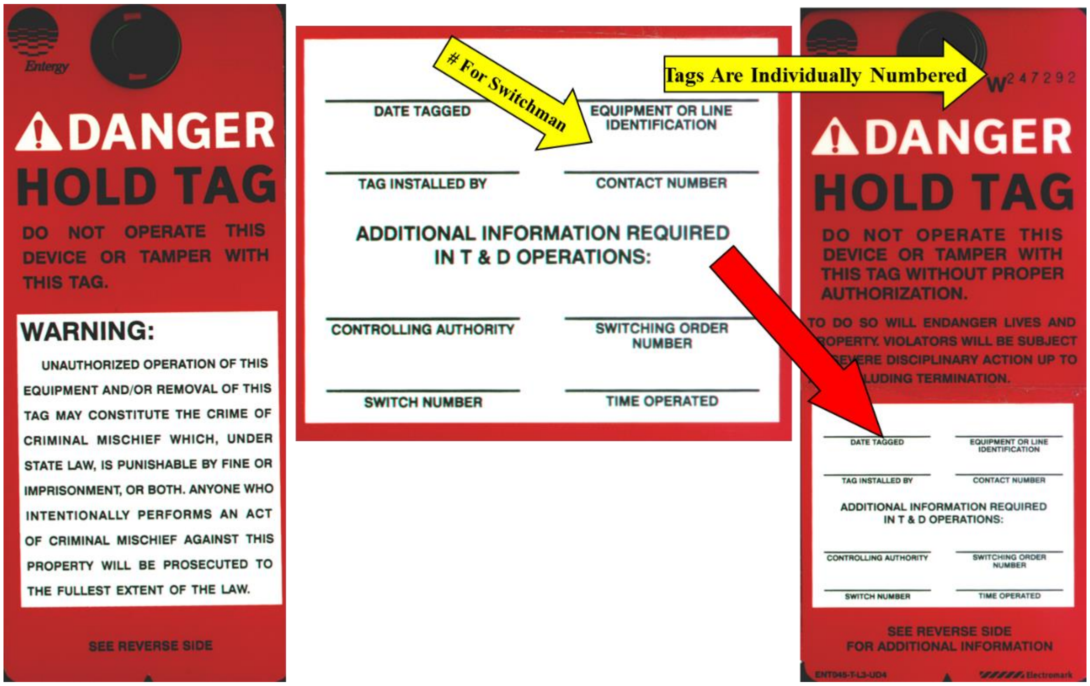
- This statement says it all! Danger Hold Tag Do Not Operate This Device or Tamper With This Tag

Danger Hold Tags are a tool that keeps you safe by informing others a switch or device open for a reason and is not to be operated without proper authorization

Caution: Hold Tags are not a clearance and do not take the place of a clearance under any conditions.

SLIDE 13: Danger Hold Tag Content

Slide Content



Instructor Notes:

- Slide displays a danger hold tad and the information that should be on every tag.
- Slide is animated first bullet is automatic additional information appears on mouse clicks.

Instructor comment:

- This is an example of a properly filled out danger hold tag.
- A properly filled out tag provides the switchman and controlling authority all of the information they need.
- The numbers on each hold tag serves as a valuable tool for confirming you are at the correct location and/or device or on the correct step of a switching or your clearance has isolated the correct line or substation equipment.

Slide Content:

(On mouse click) Walk student through and explain the danger hold tag content

SLIDE 14: Key Points to Remember

Slide Content

- Switching, tagging and clearance processes and procedures are considered critical tasks because of the risks involved and are Fatal 5 Rules
- Certifications are required to perform switching, tagging and clearance operations:

  - In substations
  - On transmission lines
  - On sections of feeders controlled by the DOC
- Local management is responsible for training and qualifying employees to switch or hold clearances on field controlled devices

Instructor Notes:

- Slide presents some key points to remember
- Slide is animated first bullet appears automatically additional bullets appear on mouse clicks

Instructor comment:

- Here are some key points to remember

Slide Content:

- Switching, tagging and clearance processes and procedures are considered critical tasks because of the risks involved and are Fatal 5 Rules
- Certifications are required to perform switching, tagging and clearance operations:
  - In substations
  - On transmission lines
  - On sections of feeders controlled by the DOC
  - Local management is responsible for training and qualifying employees to switch or hold clearances on field controlled devices.
- Switching, tagging and clearance operations on sections of feeders controlled by the field are still subject to all the processed and procedures set forth in the:
  - Safety Manual
  - D&T Switching Tagging and Clearances Procedures

Your safety, coworkers safety and jobs depend on following the rules

SLIDE 15: Key Points to Remember

Slide Content

- Switching, tagging and clearance operations on sections of feeders controlled by the field are still subject to all the processes and procedures set forth in the:
  - Safety Manual
  - D&T Switching Tagging and Clearances Procedures
- During OJT the trainee may perform certain switching activities when supervised by a qualified switchman
- Your safety, coworkers safety and jobs depend on following the rules

Instructor Notes:

- Slide presents some key points to remember

- Slide is animated first bullet appears automatically additional bullets appear on mouse clicks

Instructor comment:

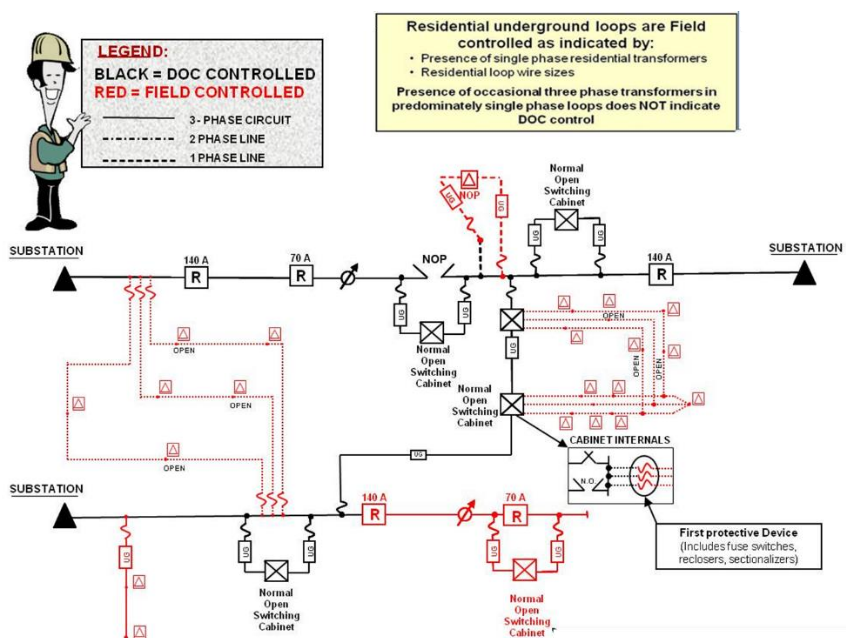
- Here are some key points to remember

Slide Content:

- Switching, tagging and clearance processes and procedures are considered critical tasks because of the risks involved and are Fatal 5 Rules
- Certifications are required to perform switching, tagging and clearance operations:
    - In substations
    - On transmission lines
    - On sections of feeders controlled by the DOC
    - Local management is responsible for training and qualifying employees to switch or hold clearances on field controlled devices.
- Switching, tagging and clearance operations on sections of feeders controlled by the field are still subject to all the processed and procedures set forth in the:
    - Safety Manual
    - D&T Switching Tagging and Clearances Procedures

Your safety, coworkers safety and jobs depend on following the rules

SLIDE 16: No Title



Slide Content

Instructor Notes:

Slide gives the details for area of control boundaries between DOC and distribution field / network controlled underground equipment and lines

Handout 1: This slide is a student teaching aid handout labeled “Handout 1” (see media locations section of your instructor manual) Print discuss in color and handout before discussing slide.

Additional Slide Comment:

This diagram gives the details for who (DOC or Field) underground lines and equipment

The legend in the upper left hand corner indicates black is DOC controlled and red is Field controlled and also shows the coding for three phase, two phase and single phase circuits

Instructor Notes:

Walk class through discussing who controls what lines and equipment and how this is effected by the various switching cabinets and how they are switched.

SLIDE 17: Next Steps

The following steps are required to receive credit for this Module

Locate and take the exam on web

Print the exam results and provide to your instructor

Complete the hands-on competency test administer by the instructor

Check with your instructor if you have any questions

Instructor Notes:

You have completed this portion of your training

The following steps are required to receive credit for this training

Locate and take the exam on the web

Print the exam results and give them to your instructor

Complete the hands on competency test administer by the instructor

CF50849/OJT - 400 Level - Lineman/CF50849/PDF

PLACEHOLDER FOR CERTIFICATION

CF51849/Direct Burial of RD Cable

Video: Underground Cable Installation- Segment 1- Direct Burial of URD Cable

OBJECTIVE:

Describe three methods used for the direct burial of URD cable.

T&D EXCERPT

When underground cable is properly installed, it may operate trouble-free for many years. However, cable that is damaged by improper installation commonly causes customer outages and system downtime. This training program describes techniques and equipment that can be used to install cable in underground residential distribution (URD) systems, where direct burial is often used, and in underground systems, where the cables are usually pulled through conduit.

Trenching, plowing, and shooting (burrowing) are three methods that can be used for the direct burial of URD cable. When trenching is used, a trench is dug, the cable is placed in the trench, and then the trench is backfilled. Plowing involves the use of a machine called a cable plow that digs a trench, installs cable, and backfills, all at the same time. Shooting, or burrowing, requires the use of a boring tool to create a hole through which cable can be inserted.

FIGURE 0-1: TRENCH FOR URD CABLE

TRENCHING

The first order of business in any job requiring digging to place cable underground, is to determine where existing underground utilities may be placed, so as to avoid damage and injuries by accidentally digging in the wrong location. See page 80 for the Uniform Color Codes

used in marking underground utilities.

One of the most common ways to begin a URD cable installation job is to dig a trench for the direct burial of URD cable using a machine called a trencher (Figure 0-2). Although specific trencher designs vary, trenchers generally use a digging wheel or a digging chain mounted on a tractor. The trencher shown in Figure 0-2 uses a mechanically powered digging chain that is mounted on a hydraulically operated boom.

FIGURE 0-2: TRENCHER

The digging performed by a trencher is done by buckets or teeth located on the digging chain. The digging chain on the trencher shown in Figure 0-2 has carbide-steel-tipped teeth (Figure 0-3) for use in rocky soil. The width of the spacing of the teeth and the length of the digging chain determine the width and depth of the trench that can be dug. The digging chain is removable. It can be replaced with chains that dig deeper or wider trenches.

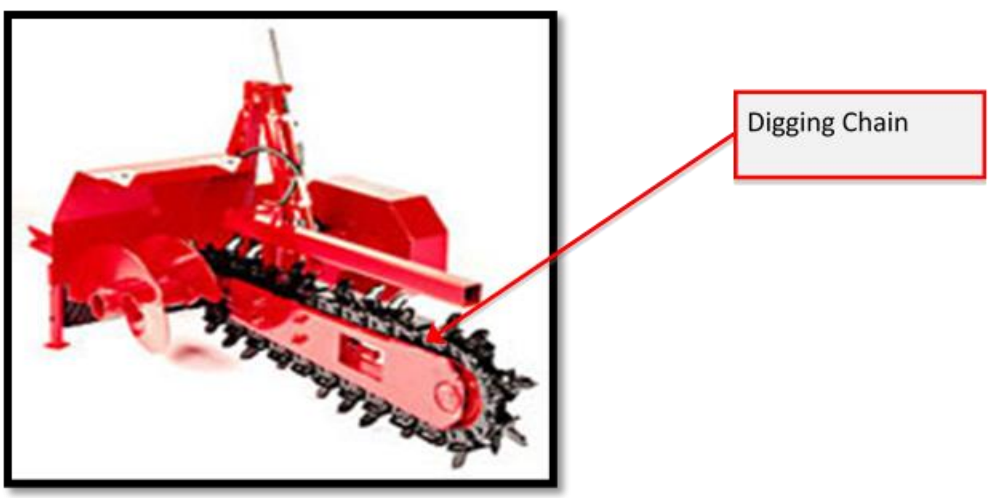


FIGURE 0-3: DIGGING TEETH

A trencher's digging boom often has a curved piece at the end called a crumber (Figure 0-4).

When the digging chain is operated, the boom is lowered into the ground. As digging is accomplished, the hydraulically operated crumber keeps the trench bottom smooth and free of obstructions. The crumber performs its function by forcing loose material against the digging chain as the unit moves.

FIGURE 0-4: CRUMBER

In areas that are free of major obstructions, trenchers are able to dig a trench in a short time. For example, the trencher shown in Figure 0-2 can dig at a rate of approximately 8 feet per minute.

When large obstructions are present, or if a trench must be dug near existing utilities, a trencher can be dangerous to use. The digging chain can snag on large obstacles, and it can easily cut through utility lines.

Trenchers are most efficient when they are used on level ground. Changes in ground level can cause the depth of a trench to vary, so care should be taken to ensure that trench depth (Figure 0-5) conforms to company requirements.

FIGURE 0-5: MONITORING THE DEPTH OF A TRENCH

OSHA Regulations Snap-Shot

1926.956
c) Trenching and excavating.
(1) During excavation or trenching, in order to prevent the exposure of employees to the hazards created by damage to dangerous underground facilities, efforts shall be made to determine the location of such facilities and work conducted in a manner designed to avoid damage.

After a trencher is used to dig a trench, cable can be installed. The trench can then be backfilled (Figure 0-6).

FIGURE 0-6: TRENCH READY FOR BACKFILLING

OSHA Regulations Snap-Shot

1926.652
Protection of employees in excavations.
(1) Each employee in an excavation shall be protected from cave-ins by an adequate protective system designed in accordance with paragraph (b) or (c) of this section except when:
(i) Excavations are made entirely in stable rock; or
(ii) Excavations are less that 5 feet (1.52m) in depth and examination of the ground by a competent person

provides no indication of a potential cave-in.
(2) Protective systems shall have the capacity to resist without failure all loads that are intended or could reasonably be expected to be applied or transmitted to the system.

Another machine that is commonly used for digging trenches is a backhoe. A backhoe (Figure 0-7) is a tractor-mounted, hydraulically operated, jointed boom and shovel. In general, backhoes dig wider trenches than most trenchers.

FIGURE 0-7: BACKHOE

Caution! No employee is allowed in the excavation within striking distance of the booms or bucket. No one should be permitted to place themselves under the booms or bucket or under a suspended load.

OSHA Regulations Snap-Shot

1926.550(a)(19), (19)
All employees shall be kept clear of loads about to be lifted and of suspended loads.

Using a backhoe for digging trenches has several advantages. One advantage is that the backhoe operator has a great deal of control over the digging process. An experienced operator can actually feel a change in resistance against the shovel when an underground obstacle is encountered. Proper operation of the backhoe means that people can work safely in nearby areas (Figure 0-8).

FIGURE 0-8: BACKHOE WORKING IN TIGHT RESIDENTIAL AREA

Another advantage of using a backhoe is the backhoe's ability to deal with obstacles and tight spaces difficult for a typical trencher. Even large obstacles, like rocks and tree stumps, can be excavated and moved out of the way with a backhoe. This means that it may not be necessary to detour a trench to avoid an obstacle.

The backhoe boom (Figure 0-9) is mounted so that it can swing to the left and right, enabling the backhoe to make an excavation several shovels wide without moving the tractor. For this reason, a backhoe may be preferred to dig a trench that is to be used for a multiple cable run or for the installation of more than one utility, and at angles to the worksite.

FIGURE 0-9: BACKHOE BOOM

Caution!

No employee should enter the swing radius of the backhoe while in operation. Should the employee need to enter the swing radius the operator and the employee should make visual contact with each other.

FIGURE 0-10: CABLE PULLED FROM CABLE REEL

After the trench has been dug, cable can be installed. One of the major causes of cable failure is damage to the cable's insulation during installation. To avoid this damage, care must be taken to install the cable properly. Several methods can be used. For example, cable can be pulled from a truck-mounted cable reel and then rolled into the trench by a workman walking behind the truck (Figure 0-10). This technique avoids putting excessive strain on the cable. It is commonly used to install cable next to a road or in an area that is free of major obstructions such as trees.

Another method is often used when cable must be pulled around obstacles near the trench. As the cable is pulled off the truck, it is supported by two or more crew members (Figure 0-11). One crewman pulls the cable out to a specified distance, and then another crewman continues the pull. The first crewman provides support for his section while the next length of cable is pulled off the reel.

FIGURE 0-11: CABLE PULLED AND GUIDED BY CREWMAN

When the cable has been pulled out to its full length on the ground, it can be rolled into the trench (Figure 0-12).

FIGURE 0-12: ROLLING CABLE INTO TRENCH

PLOWING

Cables may also be direct-buried using a cable plow. A cable plow (Figure 0-13) digs a trench, installs a run of cable, and backfills, all at the same time.

FIGURE 0-13: CABLE PLOW

The cable plow has a reel of cable mounted on a special hydraulic bracket at the front end of a tractor. From the reel, cable runs along several guides back to the plowing device at the rear of the tractor. The cable then enters a channel in the top of the plow blade (Figure 0-14), runs through the plow blade, and exits from the bottom rear.

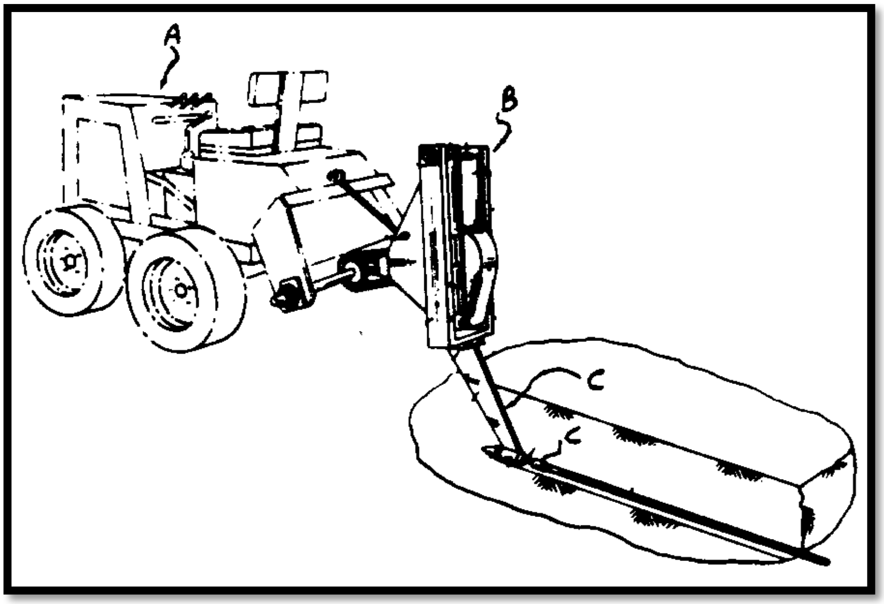


FIGURE 0-14: CABLE PLOW BLADE AND GUIDE

As the cable plow operates, the tractor moves along, pulling the plow blade through the earth. The plow blade vibrates, which allows it to move through the earth more easily. The vibrations also pulverize the dirt in an area several inches around the cable. This provides a tube of backfill that encircles the cable.

Cable plows work best in open, obstruction-free, rural areas, or in new development sites where underground utility installation has not already been done. The blade of a cable plow can be deflected around some obstructions, but the plow may have to be detoured from the cable path to avoid large obstacles.

SHOOTING (BURROWING)

In areas where excavation may not be desirable, a hole can be bored through the earth, and then a cable can be installed in the hole. This is often referred to as shooting, or burrowing. It may be used, for example, when cable is to be installed under an existing roadway or a parking lot, where excavation may be too expensive, time-consuming, or inconvenient.

One method of boring a hole through the earth is to use an auger, which is shaped like a large drill bit, and often called a mole (Figure 0-15). A mole uses a rotary action to bore a hole through the earth. Cable can then be fed through the hole.

FIGURE 0-15: MOLE

OSHA Regulations Snap-Shot

1910.138
Hand protection.

(a) ***General requirements. Employers shall select and require employees to use appropriate hand protection when employees' hands are exposed to hazards such as those from skin absorption of harmful substances; severe cuts or lacerations; severe abrasions; punctures; chemical burns; thermal burns; and harmful temperature extremes.***

(b) ***Selection. Employers shall base the selection of the appropriate hand protection on an evaluation of the performance characteristics of the hand protection relative to the task(s) to be performed, conditions present, duration of use, and the hazards and potential hazards identified.***

Another device that can be used to bore a hole through the earth is called a bullet (Figure 0-16). A bullet is pneumatically operated, and its operation is similar to that of a jackhammer. The nose of the bullet has a series of concentric rings that grip the sides of the hole being formed. The bullet is held in place and guided by channel irons or other means until it is far enough into the earth to grip the sides of the hole being bored and feed itself through. The bullet forces itself into the ground by compressing dirt in an outward direction, forming a tube-shaped hole into which cable can be fed.

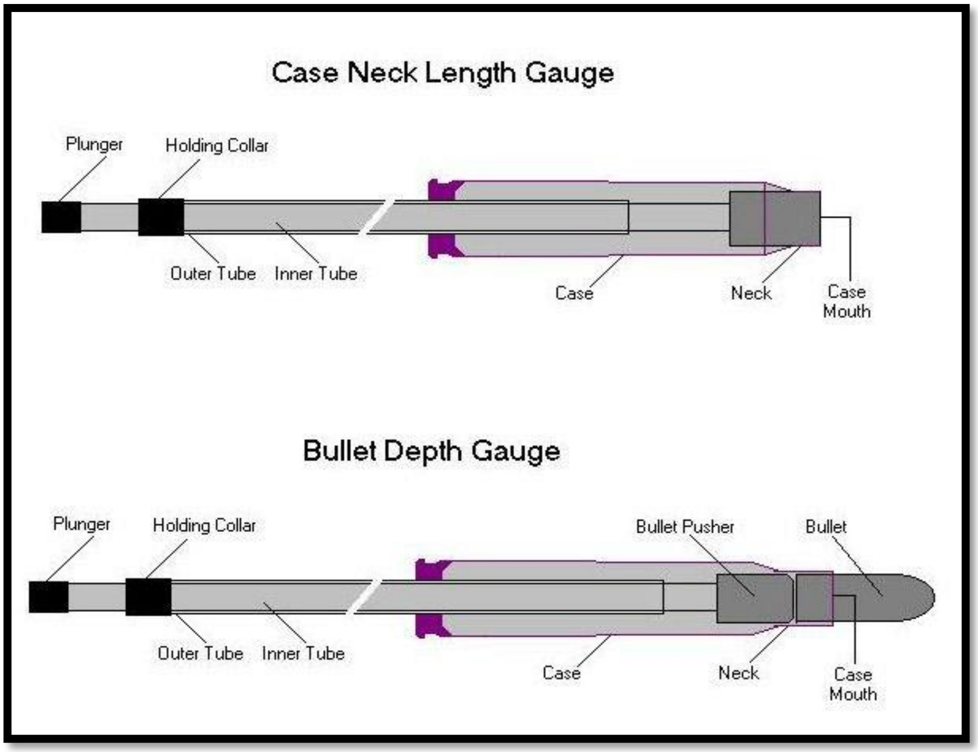


FIGURE 0-16: BULLET

Another alternative is to use a boring rod pushed through the earth by hydraulic or pneumatic power, creating a hole through which cable can be inserted. This method is shown in Figure 0-17. The hydraulic cylinder in the unit pictured is anchored by a metal plate placed crosswise in the trench. The cylinder pulls against the plate as it forces the rod through the earth.

FIGURE 0-17: PUSHING A ROD USING HYDRAULIC POWER

Other types of boring tools may also be used for burrowing, depending on company equipment and procedures.

OSHA Regulations Snap-Shot

1910.136
Foot protection
(a) General requirements. The employer shall ensure that each affected employee uses protective footwear when working in areas where there is a danger of foot injuries due to falling or rolling objects, or objects piercing the sole, and where such employee's feet are exposed to electrical hazards.

CF51850/URD Cable in Conduit

VIDEO: UNDERGROUND CABLE INSTALLATION – SEGMENT 2 – URD CABLE IN CONDUIT

OBJECTIVES

List and describe the tools needed to pull URD cable in conduit.

Describe or demonstrate pulling URD cable in conduit.

T&D Excerpt

As an alternative to direct burial, URD cables may be installed in PVC or fiberglass tubes called conduit. This is often done to protect cables from the pressure caused by traffic and the damage caused by corrosives, and to make cable replacement easier in URD systems.

In both direct-buried and cable-in-conduit (CIC) systems, empty conduit, called spare conduit, is often used. In a direct-buried system, spare conduit may be installed when the original excavation and cable installation are done. In a system where all of the cable is installed in conduit, spare conduit is typically installed along with conduit that is being used. Having spare conduit available means that future cable installations can be done without extensive excavation.

FIGURE 0-18: CONDUIT

The example that follows describes one way of installing a section of cable in existing underground conduit beneath a roadway. Figure 0-19 is a simplified illustration of the job site. It shows a section of roadway under which a length of conduit is buried. When the conduit was installed, it was capped to prevent dirt and other foreign matter from getting into it. For the purposes of this example, the ends of the conduit have been exposed by excavating a trench on each side of the road.

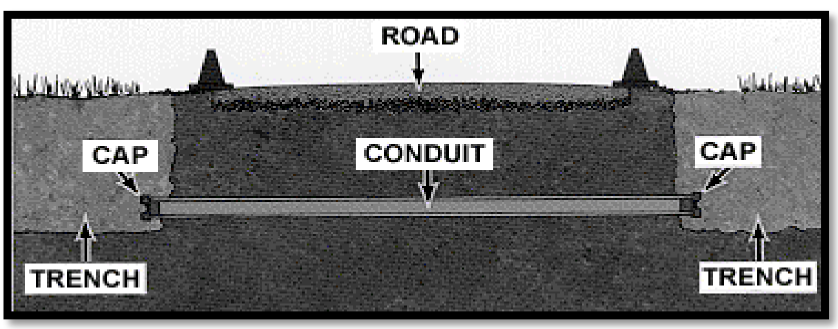


FIGURE 0-19: SIMPLIFIED ILLUSTRATION OF CONDUIT UNDER ROADWAY

The basic cable installation job can be broken into four steps: excavation, line blowing, conduit cleaning, and cable pulling.

EXCAVATION

As illustrated in Figure 0-19, a trench was dug on each side of the road. In the video presentation, the conduit was exposed by crewmen digging by hand to avoid damaging the conduit.

The cable was then pulled into the trench up to the point where it would cross under the road. The cable pulled was long enough to reach through the conduit and up to its next connecting point, which was a pad-mounted transformer. Excess cable was coiled on the ground.

Line Blowing

With the trenches and the cable ready, the next step is to blow a light synthetic line, called a jet line, through the conduit. (Later, cleaning tools and then a cable pulling rope will be attached to the jet line.) The jet line is usually blown through the conduit using compressed air.

Figure 0-20: Jet Line Gun

In the video presentation, the device used to blow the jet line was a jet gun. Although jet line guns vary, most operate in the same basic way. The jet gun shown in Figure 0-20 consists of a wooden cylinder and several fittings. The cylinder is tapered so that it can fit into and seal conduit of various diameters.

One fitting on the jet line gun is a pipe that can be connected to an air compressor or other source of compressed air. A valve on the pipe is used to control the flow of air. The jet line gun cylinder also has a channel drilled through it. The jet line passes through the channel.

In the video demonstration, the conduit ends were uncapped, and then a hollow ‘cone’, often called a shuttlecock (Figure 0-21), was connected to the jet line.

FIGURE 0-21: CONE

The cone was inserted into one end of the conduit (Figure 0-22A), and the jet line gun was used to seal the conduit end (Figure 0-22B).

A. Cone Inserted into Conduit

FIGURE 0-22: CONE AND JET LINE GUN IN PLACE

When the jet line gun's air flow valve was opened, compressed air pushed the cone and the jet line through the conduit. In the video demonstration, there were no major obstructions in the conduit, so the cone and the jet line emerged on the other side of the road.

CONDUIT CLEANING

After the jet line is blown through the conduit, the conduit is cleaned to remove solid particles and debris. In the video demonstration, this was done using a wire brush (Figure 0-23) with a diameter slightly larger than the diameter of the conduit. After the cone was removed from the jet line, one end of the brush was attached to the jet line, and the other end was attached to a half-inch pulling rope. The brush was then moved back and forth through the conduit until the conduit was clean. When the brush was removed, the pulling rope was left threaded through the conduit so that it could be used to pull the cable.

FIGURE 0-23: KELLEM GRIP (BASKET)

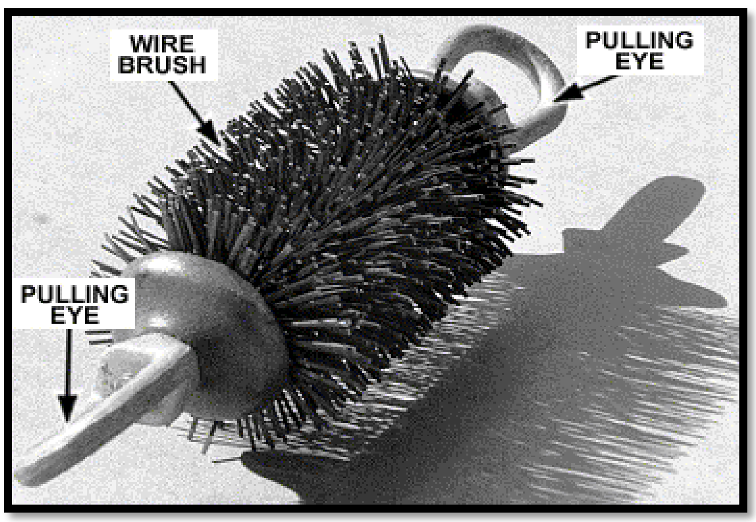


FIGURE 0-24: WIRE BRUSH

CABLE PULLING

Pulling the cable is the last of the four basic steps of cable installation. In the video example, the pulling distance was only about 50 feet and the cable was fairly light, so the cable pull was done by hand. One end of the pulling rope was attached to the cable with a Kellem grip, or basket (Figure 0-24). The basket's wires contract and hold fast to the cable sheath when tension is applied.

After the pulling rope was attached to the cable, the cable pull began. The pulling rope was pulled from one end of the conduit, while the cable was fed into the conduit from the other end (Figure 0-25).

FIGURE 0-25: FEEDING THE CABLE

OSHA Regulations Snap-Shot

- ***1910.134***
- ***Training.***
  -The employer shall provide training to each employee who is required by this section to use PPE. Each such employee shall be trained to know at least the following:
- ***When PPE is necessary;***
- ***What PPE is necessary;***
- ***How to properly don, doff, adjust, and wear PPE;***
- ***The limitations of the PPE; and,***
- ***The proper care, maintenance, useful life and disposal of the PPE.***

Care was taken to prevent kinks from forming in the cable, and the cable was visually inspected during the pull (Figure 0-26) to make sure that it was not damaged.

FIGURE 0-26: PULLING AND INSPECTING THE CABLE

After the cable was pulled through the conduit and placed in the trench, the two trenches were backfilled and compacted according to company procedures.

CF51851/Underground Cable Systems

Video: Underground Cable Systems: Segment 3: Underground Cable Installation

T&D EXCERPT

Underground Cable Systems

In addition to URD systems, cable may also be installed in other underground systems. Underground cable installation can often involve handling cables that can weigh ten tons or more. Moving and installing these cables requires special equipment and rigging techniques that reduce the chances of damaging the cable and help to ensure a safe installation.

OBJECTIVES:

- Identify the steps involved in installing cable in conduit between two manholes.
- Describe the rigging and equipment necessary to install cable in conduit between two manholes.

The techniques and equipment for installing underground cable vary from job to job. The example in this section shows one method of installing cable in conduit between two manholes. The techniques and equipment that are used are representative of what is used in the field.

The job of installing cable between two manholes can be broken down into five basic steps: advance planning; conduit preparation; positioning above-ground equipment; rigging the manholes; and pulling the cable. (It should be noted that these steps do not necessarily happen in the order listed, and two or more steps may be done at the same time.)

Advance Planning

The advance planning step is typically completed before a crew is sent to a job site to install underground cable. Planning a job ahead of time can help ensure that the job is completed successfully. During the planning step, consideration should be given to the length of cable needed, the direction of the cable pull, and the equipment and personnel required for the job.

OSHA Regulations Snap-Shot

1910.269 (c)

Job briefing.

The employer shall ensure that the employee in charge conducts a job briefing with the employees involved before they start each job. The briefing shall cover at least the following subjects: hazards associated with the job, work procedures involved, special precautions, energy source controls, and personal protective equipment requirements.

Cable length is an important consideration, because some types of cable are ordered directly from the manufacturer in the specific length required for a particular location. The direction of the cable pull is also important. When cable is installed between two manholes, one manhole is generally rigged for feeding the cable into the conduit. This manhole is referred to as the feed hole. The other manhole is generally rigged for pulling the cable through the conduit. This manhole is referred to as the pulling hole. In general, the cable pulling direction should be the one that will produce the least amount of tension on the cable and provide the easiest cable pull.

In some cases, it makes no difference which manhole is used for pulling and which is used for feeding. For example, Figure 0-1 represents a side cutaway view of a straight run of conduit between two manholes. Since there are no changes of direction in the conduit run, the tension on the cable will probably be the same, regardless of the direction of the pull. Either manhole can be designated as the pulling hole.

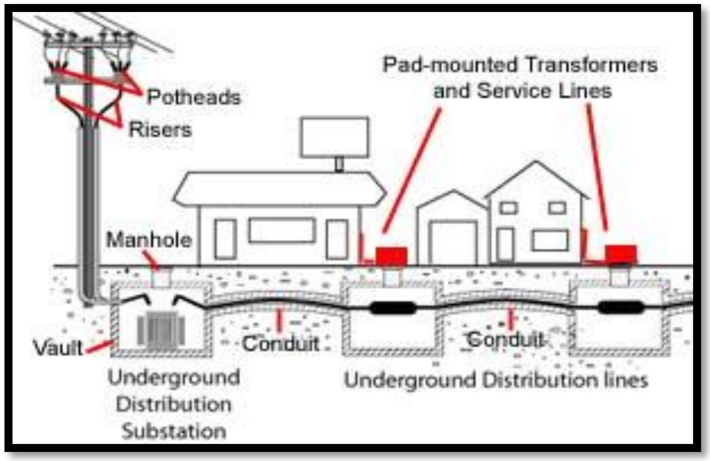


FIGURE 0-1: STRAIGHT CONDUIT RUN

The conduit run illustrated in Figure 0-2 has a bend in it. The bend creates a change in direction that allows the conduit to go around an obstacle. The bend will also increase the tension on the cable during the cable pull. In this example, the manhole labeled "A" is a more desirable feed hole, and the manhole labeled "B" is a more desirable pulling hole. This arrangement allows the cable to be pulled through the bend almost immediately after it is fed into the feed hole. This means that less cable is being pulled when the bend is encountered, so there is less tension on the cable, and the cable pull is easier.

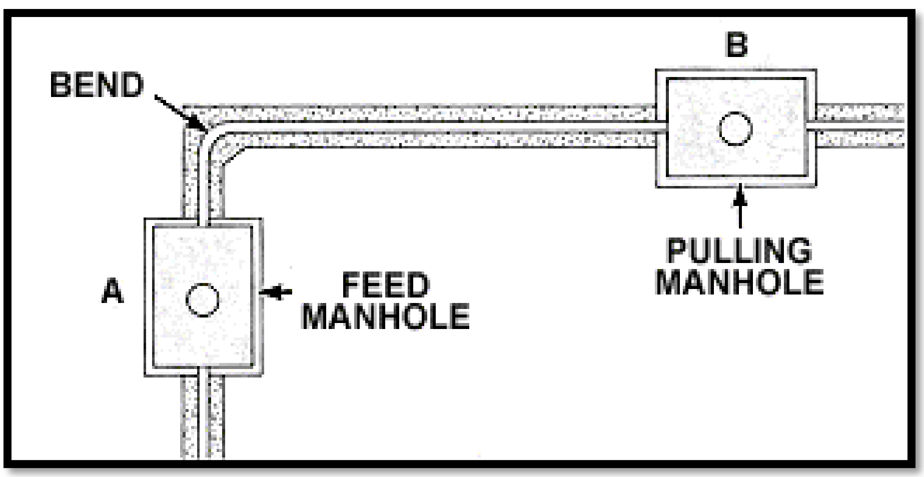


FIGURE 0-2: BEND IN CONDUIT RUN

Another consideration is whether or not the conduit run is level, as illustrated in Figure 0-3. With a level run, there is no advantage in using one manhole or the other as the pulling hole.

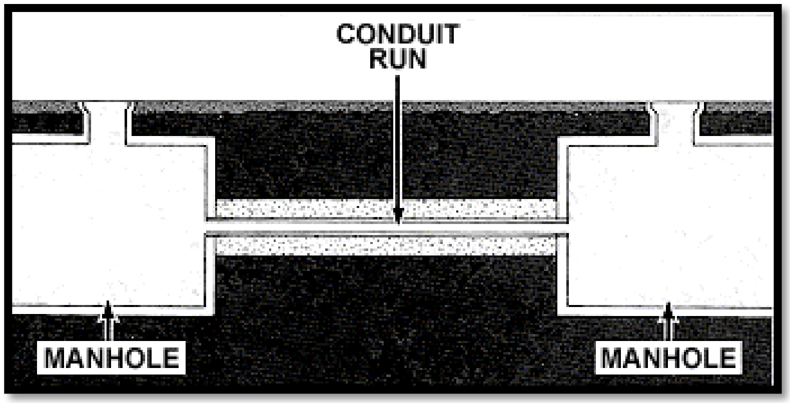


FIGURE 0-3: LEVEL CONDUIT RUN

Figure 0-4 illustrates a conduit run on a slope. In this case, the pulling hole would probably be the one at the lower grade, because it is easier to pull cable downhill.

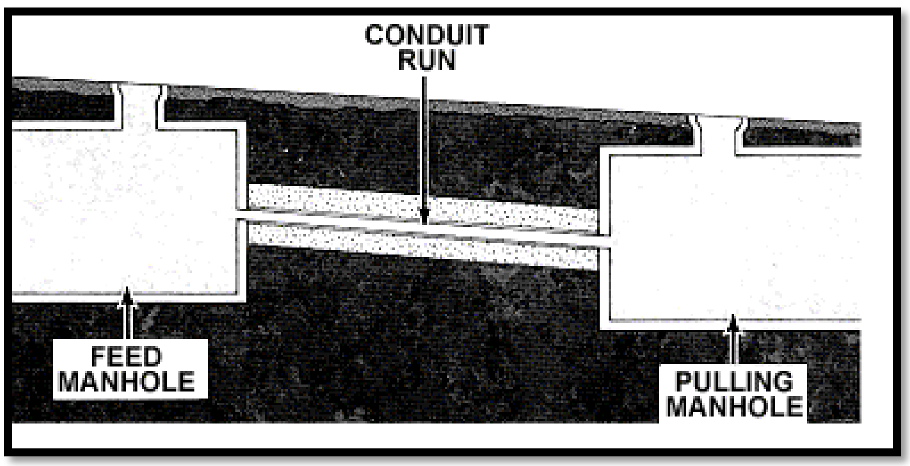


FIGURE 0-4: CONDUIT RUN ON A SLOPE

For a conduit run along a steep grade (Figure 0-5), the pulling hole is generally the one at the higher grade. When a steep grade is involved, even though it might be easier to pull the cable downhill, it might not be safe, because the cable and the cable reel may be more difficult to control. Pulling the cable uphill can allow for greater control over the cable and the cable reel.

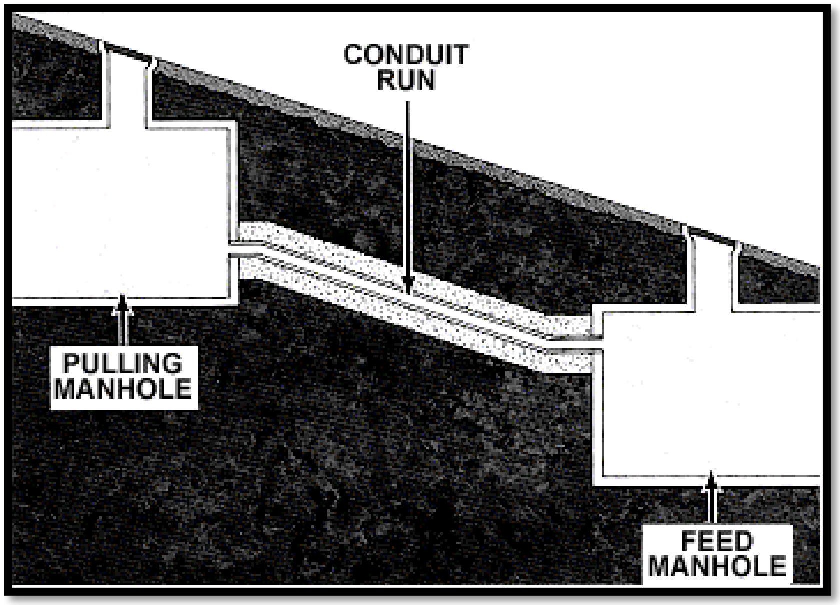


FIGURE 0-5: CONDUIT RUN ON A STEEP GRADE

In some cases, the design of a manhole may affect the direction of the cable pull. For example, the manhole illustrated in Figure 0-6 has cable entering in one corner of each end. The cable splice has been made along one side and placed on cable racks. The length of cable extending into the manhole to the left of the splice is shorter than the length of cable on the right. A rule of thumb is to pull cable into the manhole that needs the shorter end, because the rigging needed to pull cable into a manhole can restrict the length of cable that can be pulled into the manhole. At the feed hole, the cable is cut off of the cable reel, allowing any length of cable necessary for installation. Therefore, the manhole in this example would be used as the pulling hole for the cable on the left, and as the feed hole for the cable on the right.

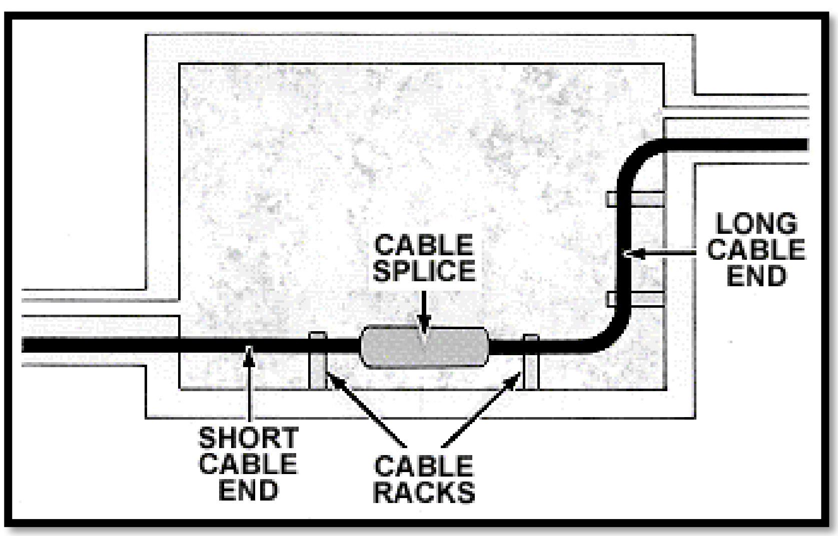


FIGURE 0-6: MANHOLE WITH CABLE AND CABLE RACKS

Another concern that must be considered as part of the advance planning for a cable installation is the equipment and personnel needed for the job. Generally, the length and weight of the cable, the direction and difficulty of the pull, and the rigging necessary for the job determine how many people are needed and what equipment is required.

Conduit Preparation

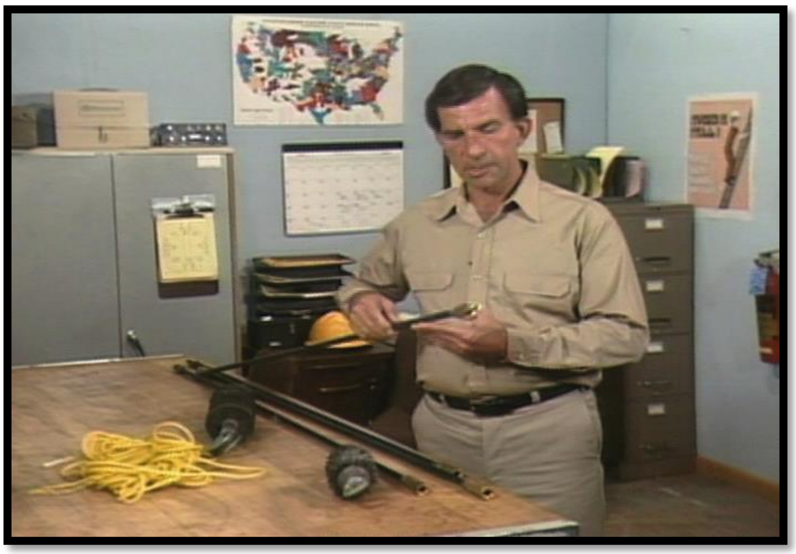


FIGURE 0-7: RODDING

One of the cable installation steps that is done at the job site is conduit preparation. For the purposes of this program, conduit preparation is accomplished in three steps: installing a jet line, cleaning the conduit, and installing the cable pulling rope.

A jet line may be installed by blowing it through the conduit, as described in Segment 2, or with the aid of rodding. Rodding is a stiff material that can be pushed through a length of conduit. In some cases, the rodding is a number of wooden or fiberglass rods (Figure 0-7). These rods are joined together to provide the length needed to reach from one manhole to the other.

In other cases, a long, flexible steel or fiberglass rod (Figure 0-8) may be used.

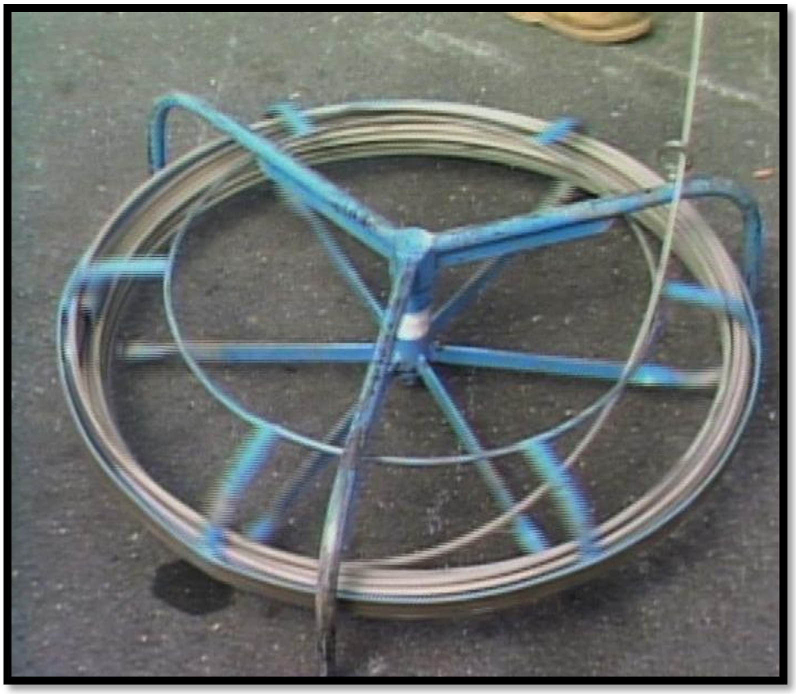


FIGURE 0-8: FLEXIBLE RODDING ON A REEL

Once the rodding is pushed through the conduit from one manhole to the other, it can be used to thread a jet line through the conduit. The jet line can then be used to pull other lines and a variety of equipment through the conduit. One type of equipment that is often pulled through is equipment used to clean the conduit. Two of the basic types of cleaning tools commonly used are a wire brush and a mandrel. The tools have an eye on each end. The line is attached to the eye on one end, and a tag line is attached to the eye on the other end. The tool can then be pulled back and forth through the conduit.

A wire brush (Figure 0-9) is commonly used to clear conduit of loose debris. The diameter of the brush is generally the same as or larger than the diameter of the conduit.

FIGURE 0-9: WIRE BRUSH

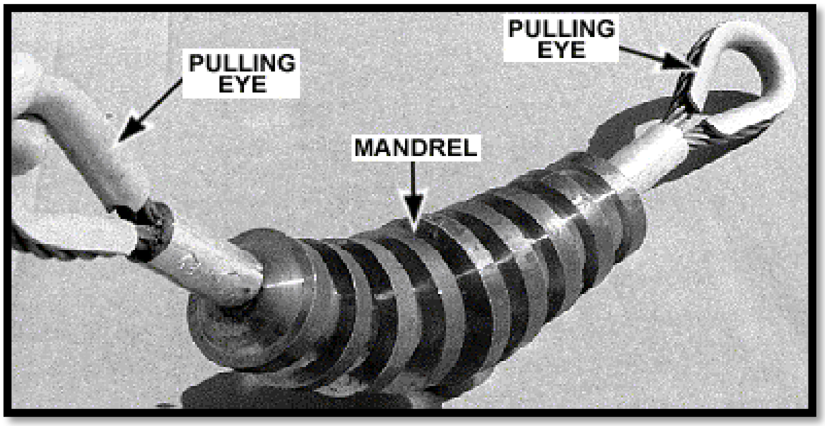


FIGURE 0-10: MANDREL

A mandrel (Figure 0-10) is a steel or wooden form that is slightly smaller than the diameter of the conduit. It may be used to remove more difficult obstructions, such as concrete that has seeped through a conduit joint. Some mandrels may also be used to check the inside dimensions of the conduit to verify that a cable can be pulled through without becoming stuck or damaged.

Positioning Above-Ground Equipment and Rigging the Manholes

Positioning the above-ground pulling equipment and rigging each manhole are two more basic cable installation steps. Figure 0-11 is a simplified illustration that can be used to show how above-ground equipment was positioned at the feed manhole in the video presentation.

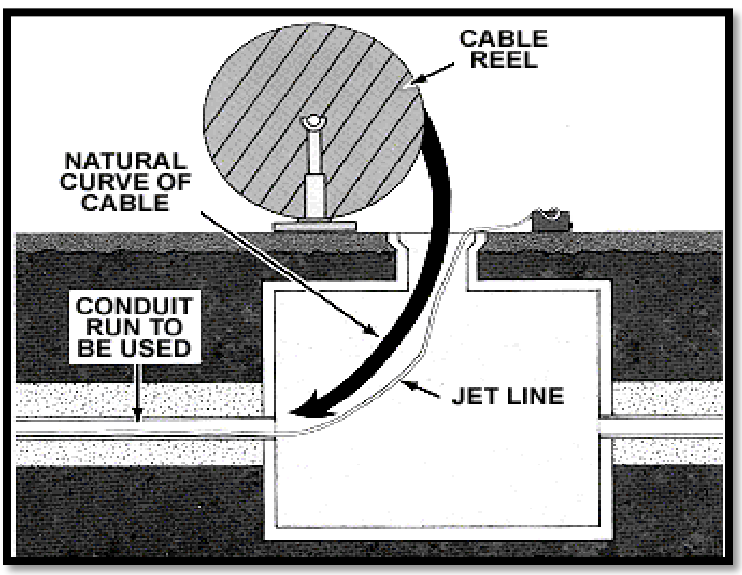


FIGURE 0-11: FEED MANHOLE

As part of the advance planning for this job, the cable reel was delivered to the feed manhole. At the manhole, the reel was positioned directly over the conduit to be used, and it was set up so that the cable could be pulled from the top of the reel. This positioning ensured that the cable would come off the reel in the direction of its natural curve.

A feed tube is used to guide the cable into the manhole and to protect it from abrasive surfaces or sharp edges. The feed tube (Figure 0-12) is a flexible, hollow, steel tube. The large end of the tube is anchored to the manhole opening. Interchangeable nozzles, designed to fit different diameters of conduit, can be attached to the other end. When the feed tube is secured on both ends, it provides a protective curve that prevents cable abrasions and kinking.

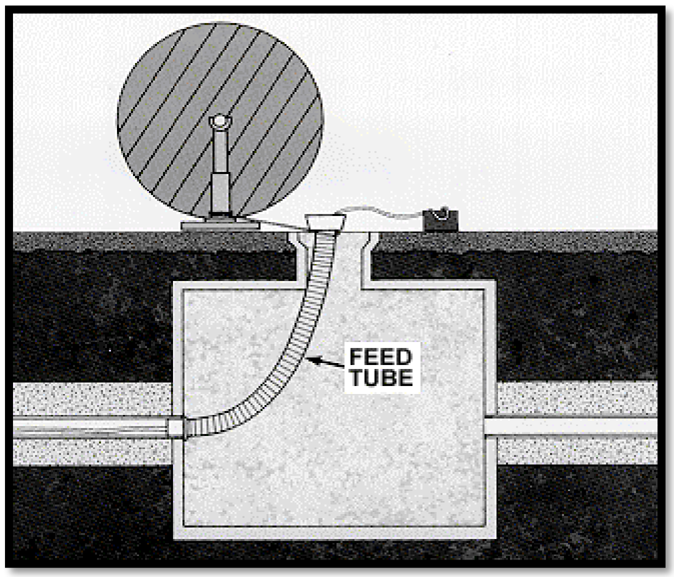


FIGURE 0-12: FEED TUBE RIGGED AT FEED MANHOLE

Figure 0-13 illustrates the rigging at the pulling hole. At the pulling hole, the ideal rigging is the simplest arrangement that allows for the desired straight pull out of the conduit. In this example, there is a pulling eye on the manhole wall opposite the conduit to be used, so a snatch block can be rigged to guide the pulling rope from the conduit and redirect it up through the manhole opening. Above the manhole, a truck with a winch is positioned to provide the power needed during the cable pull. Ideally, the truck is positioned so that the cable pulling rope can be pulled directly through the manhole opening.

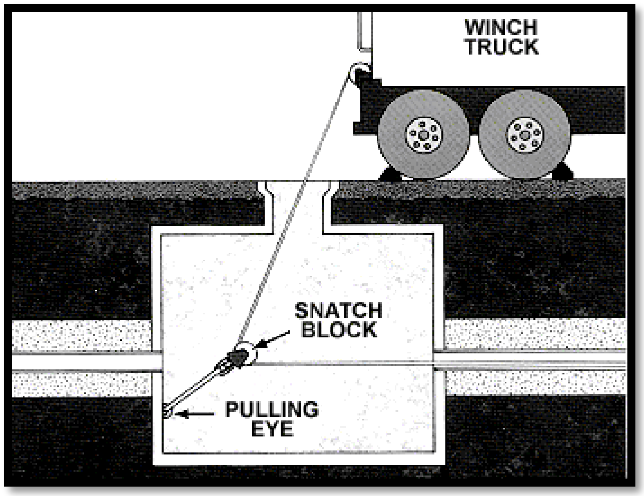


FIGURE 0-13: RIGGING ARRANGEMENT FOR PULLING HOLE

NOTE: DO NOT USE A WIRE PULLING DOLLY BLOCK FOR THIS TASK! A ROLLER BLOCK DOES NOT HAVE THE STRENGTH OF A STEEL SNATCH BLOCK.

If there is no pulling eye in the manhole, several options may be used. For example, a portable pulling eye can be bolted to the manhole wall (Figure 0-14).

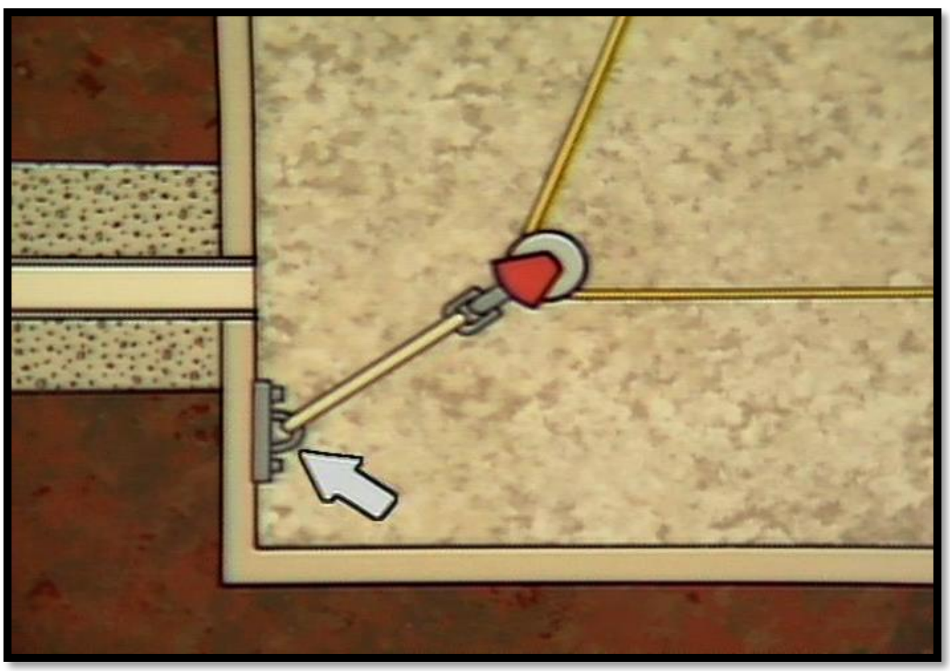


FIGURE 0-14: PORTABLE PULLING EYE ON MANHOLE WALL

OSHA Regulations Snap-Shot

1926.251

(a) General.

(1) Rigging equipment for material handling shall be inspected prior to use on each shift and as necessary during its use to ensure that it is safe. Defective rigging equipment shall be removed from service.

(2) Rigging equipment shall not be loaded in excess of its recommended safe working load, as prescribed in Tables H-1 through H-20 in this subpart, following 1926.252(e) for the specific equipment.

(3) Rigging equipment, when not in use, shall be removed from the immediate work area so as not to present a hazard to employees.

Another alternative is to rig a device called a sheave stand. A sheave stand (Figure 0-15) consists of several channel irons, or beams, that are bolted together. Between the beams is a space for a sheave. Holes in the beams allow the sheave to be placed in different positions, as needed. The sheave stand is positioned and wedged into the manhole, using material to brace it in position, so that it is stable during the cable pull.

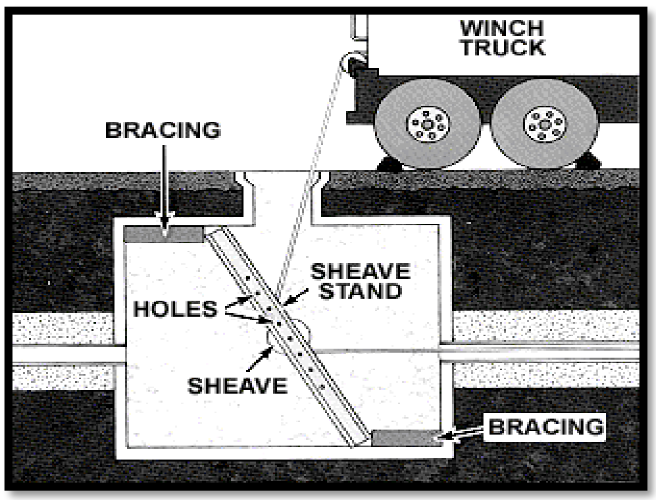


FIGURE 0-15: SHEAVE STAND RIGGED AT PULLING MANHOLE

If the winch truck at the pulling hole cannot be positioned so that the back of the truck is in a direct line with the snatch block in the manhole, a special block, called either a trap block or a corner block, can be used. The trap block can be rigged at the manhole opening so that the pulling rope can be directed through the manhole opening and up to the winch. This is illustrated in Figure 0-16.

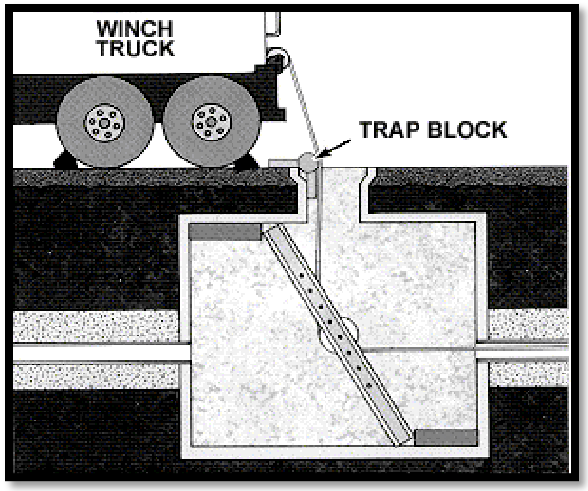


FIGURE 0-16: TRAP BLOCK RIGGED AT PULLING MANHOLE

Pulling the Cable

When the rigging is installed and the above-ground equipment is in position, the jet line is used to pull the cable-pulling rope from the pulling truck. When the pulling rope reaches the cable reel, it is threaded through the feed tube, and then attached to the cable. The cable is then pulled off of the reel, through the feed tube, and into the conduit by the winch at the pulling hole.

CF51852/Pad-Mounted Transformers

Video: Pad-Mounted Transformers and Switchgear: Segment 1: Pad-Mounted Transformers

T&D EXCERPT

Pad-Mounted Transformers

Underground residential and distribution (URD) systems that use pad-mounted transformers and switchgear provide an alternative to cluttered overhead power distribution systems. This training program focuses on the construction and operation of pad-mounted transformers and switchgear, as well as how this equipment can be used to sectionalize and route power within a URD system

FIGURE 0-1: PAD-MOUNTED TRANSFORMER WORK SITE

OBJECTIVE:

Describe the general construction and features of a pad-mounted transformer.

Pad-Mounted Transformer Characteristics

A pad-mounted transformer looks like a box (Figure 0-2). It is made of a steel alloy, and it is set on a pad that is usually made of concrete or fiberglass. Transformer characteristics such as weight, size, and operating capacity can vary, depending on the type of pad-mounted transformer and the manufacturer. Regardless of these variations, however, pad-mounted transformers generally have certain physical and operational characteristics in common.

FIGURE 0-2: TYPICAL PAD-MOUNTED TRANSFORMER

The case of a pad-mounted transformer is designed to protect the transformer's internal parts from damage. As illustrated in Figure 0-3, the case is divided into two sections: the tank and the terminations compartment. The tank, which is the rear section, provides a waterproof housing for the transformer windings and the core. The tank is usually filled with an insulating oil. This oil is used for cooling, to provide additional insulation for the transformer windings, and to keep moisture from accumulating in the tank.

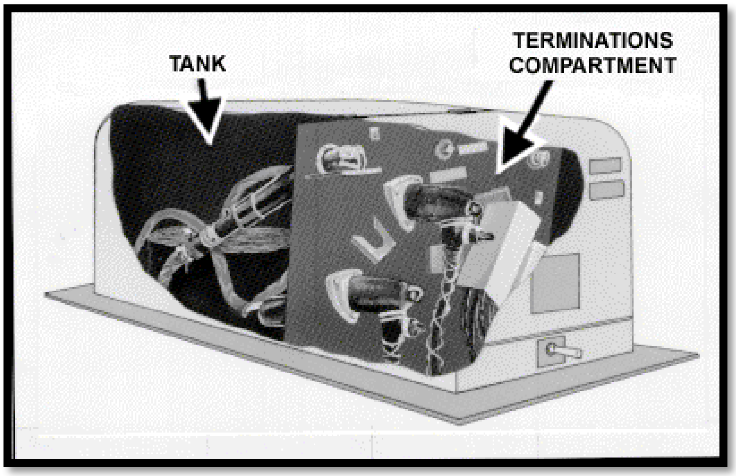


FIGURE 0-3: TRANSFORMER SECTIONS

In addition to oil cooling, many transformers have metal cooling tubes or fins (Figure 0-4). The fins or tubes help cool the transformer oil by increasing the amount of surface area that is exposed to the air. Tubes are connected at each end to the transformer tank, so that oil can flow through them. Above the oil is a drying agent, such as nitrogen gas, that fills the remainder of the tank cavity.

FIGURE 0-4: COOLING FINS

The front section of the transformer case is the terminations compartment. Primary and secondary cables enter this compartment from underground and are connected to the transformer. The compartment is usually hinged or has a door to allow access.

The wall that separates the tank from the terminations compartment usually contains the transformer connections, fuses, and other equipment. For the transformer shown in Figure 0-5, the left side contains the primary connections and the right side contains the secondary connections.

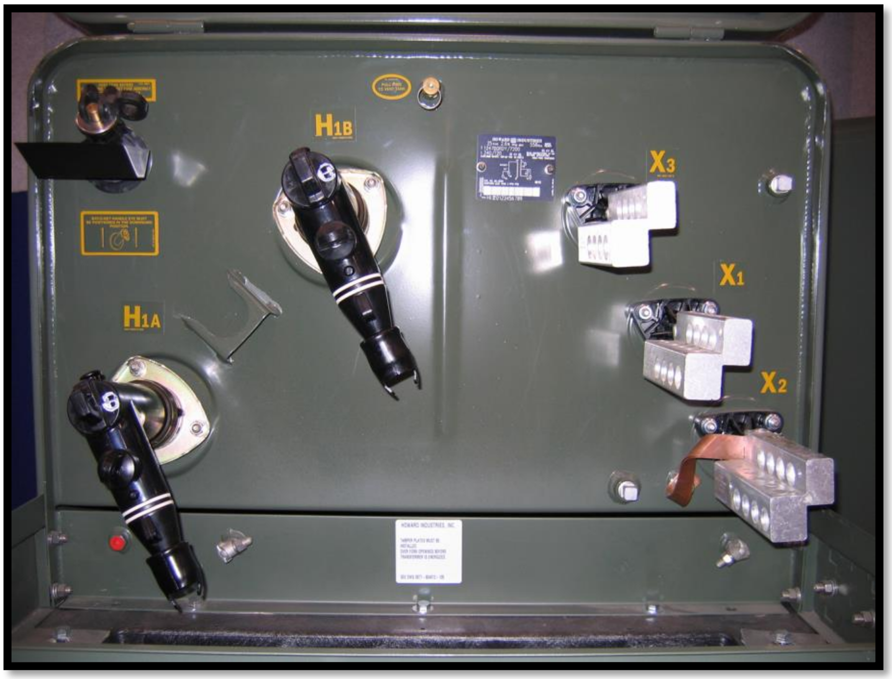


FIGURE 0-5: TRANSFORMER CONNECTIONS

On some transformers, a pressure relief valve is also located in the wall between the two transformer sections. The relief valve helps to prevent structural damage to the transformer by providing a means for relieving the pressure that builds up from heat or arcing. It also allows a workman to manually release the pressure in the tank.

Types of Pad-Mounted Transformers

Pad-mounted transformers may be classified as either live-front transformers or dead-front transformers. The classification depends on how the connections are made between the primary URD cable and the transformer's primary bushings.

On a dead-front transformer (Figure 0-6*)*, no energized primary equipment is exposed in the terminations compartment. The URD primary cables run into the terminations compartment and are connected to the primary bushings by elbows. The elbows are made of an insulating material. They fit over the primary bushings and provide covered, insulated connections between the URD cable and the transformer bushings. Some types of elbows, called load break elbows, are designed to be used as switches. With the proper safety equipment and hot sticks, a workman can move load break elbows from energized transformer bushings to non-energized stand-off, or parking, bushings.

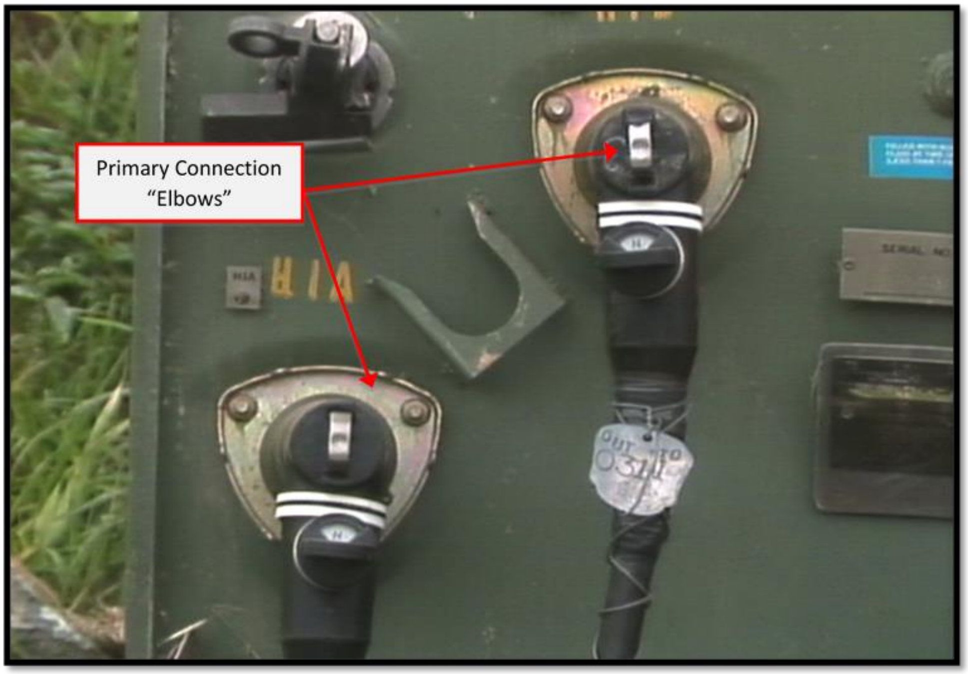


FIGURE 0-6: DEAD-FRONT TRANSFORMER PRIMARY CONNECTIONS

On live-front transformers (Figure 0-7), the primary terminations are bolted together, and they have exposed, energized metal components. The primary cables are often connected to their bushings with switches that can be used to energize or de-energize the transformer. Company policy should be checked carefully before any pad-mounted transformer switching is done.

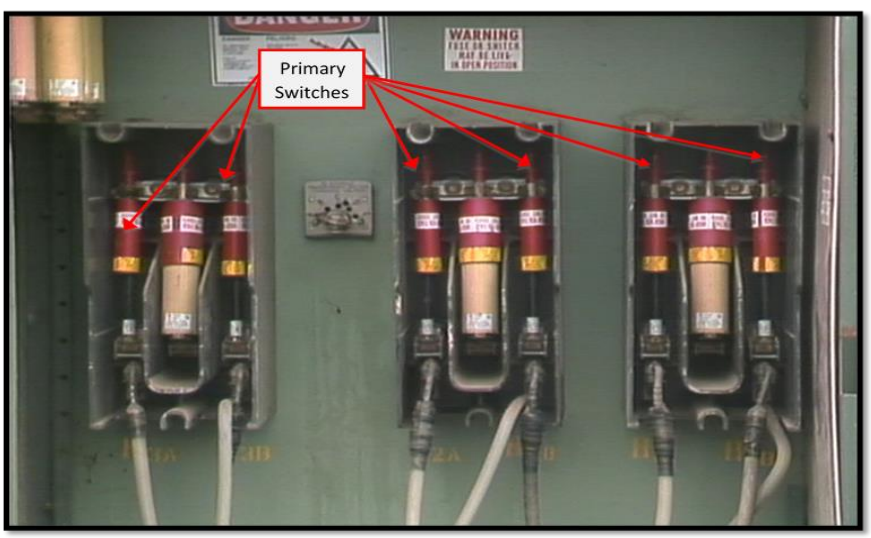


FIGURE 0-7: LIVE-FRONT TRANSFORMER PRIMARY CONNECTIONS

Transformers may also be classified as either single-phase transformers or three-phase transformers. Single-phase transformers are generally used for residential customers, while three-phase transformers are used for customers with equipment that requires three-phase power.

Pad-Mounted Transformer Components and Operation

Figure 0-8 is a simplified diagram of a single-phase transformer. Shown are the primary cables in and out of the transformer; the transformer switches and bushings; a bus bar; a fuse; the primary coil, or winding; the secondary coil, or winding; and the secondary cables.

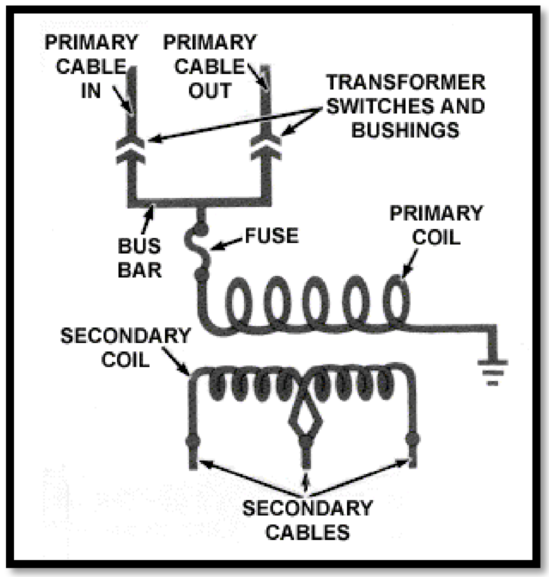


FIGURE 0-8: SINGLE PHASE TRANSFORMER DIAGRAM

During normal operation, the power path is into one primary bushing, across the bus bar, and out of a second primary bushing to other transformers in the URD system. The bus bar electrically connects the two bushings so that the transformer can be energized from either primary bushing. Some transformers may not have bushings "out" to other transformers. The fuse connects the primary winding to the bus bar. The voltage in the primary winding induces a voltage in the secondary winding. Although the primary and secondary windings are shown separately in Figure 0-8, they can be wound around the same metal core and separated by layers of insulation. The core is not shown in Figure 0-8.

The fuse in this transformer (Figure 0-9) is installed through the tank wall. It is held in place with a bayonet mount.

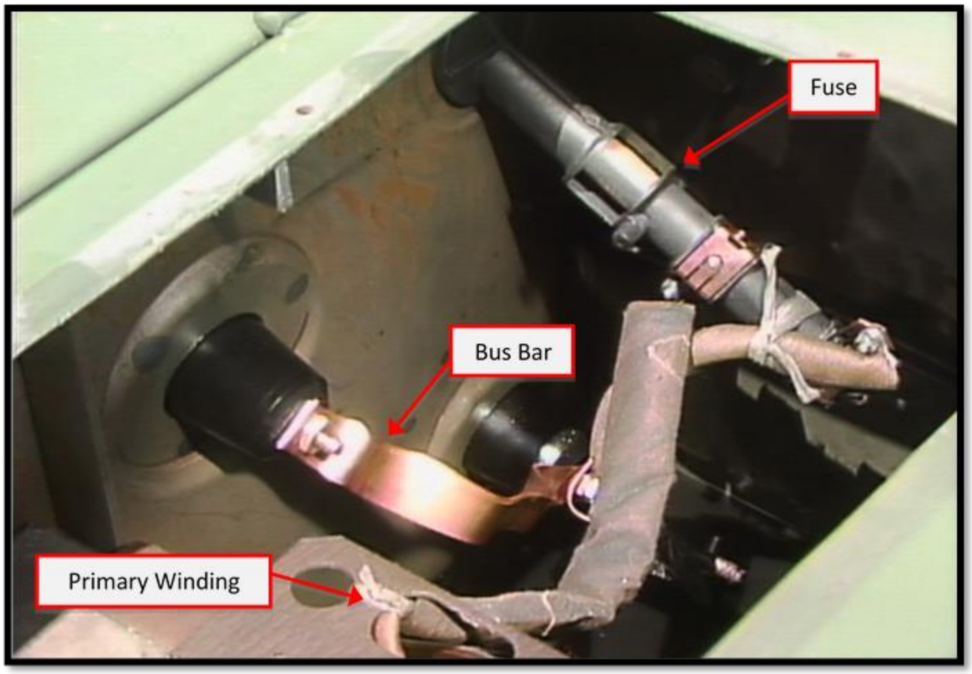


FIGURE 0-9: FUSE IN TANK

The fuse serves two purposes: it protects the URD system, and it connects the primary winding to the bus bar, allowing the primary winding to be energized.

OSHA Regulations Snap-Shot

1910.333 (c)
Working on or near exposed energized parts.
(1) Application. This paragraph applies to work performed on exposed live parts (involving either direct contact or by means of tools or materials) or near enough to them for employees to be exposed to any hazard they present.
(2) Work on energized equipment. Only qualified persons may work on electric circuit parts or equipment that have not been deenergized under the procedures of paragraph (b) of this section. Such persons shall be capable of working safely on energized circuits and shall be familiar with the proper use of special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools.

The fuse protects the URD system from faults in the secondary cable and from transformer malfunctions. For example, if a fault occurs in the secondary, the fuse blows, and the transformer is de-energized. However, power is still routed through the bus bar to equipment located beyond the faulted transformer. This situation is illustrated in Figure 0-10.

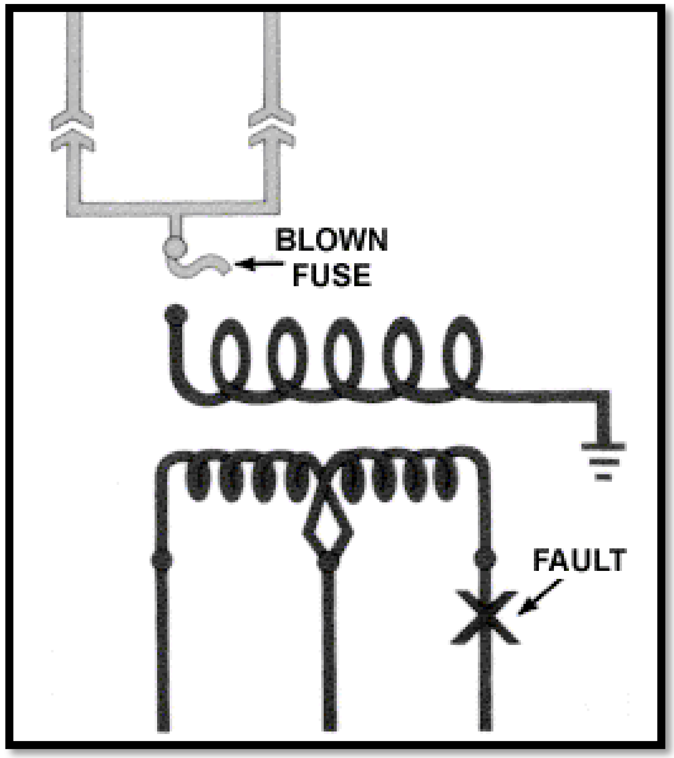


FIGURE 0-10: FAULT IN THE SECONDARY

Figure 0-11 shows the windings inside a transformer tank. The windings shown represent a three-phase transformer.

FIGURE 0-11: TRANSFORMER WINDINGS

The transformer's primary winding is used to induce a voltage in the secondary winding, which is connected to the secondary bushings. The other end of each secondary bushing is connected to a secondary URD cable in the transformer's terminations compartment (Figure 0-12). The secondary URD cable then runs to a customer.

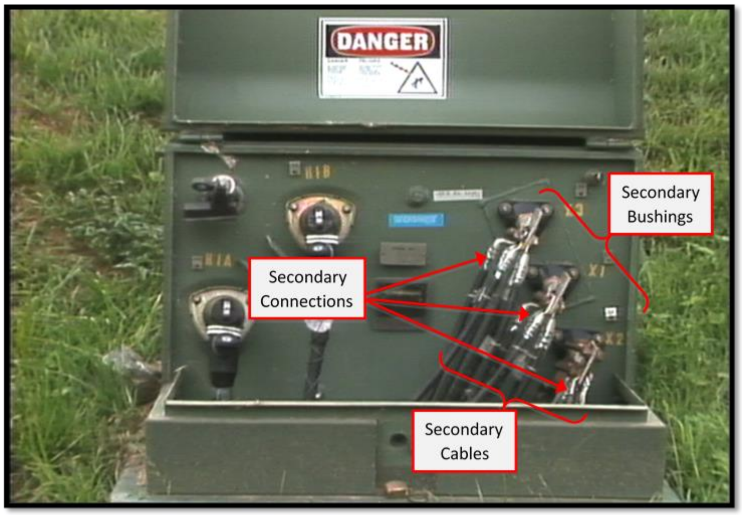


FIGURE 0-12: SECONDARY CONNECTIONS IN TERMINATIONS COMPARTMENT

Tap Adjustments

Customers in a URD system require a secondary voltage that stays within a specified range. However, primary distribution voltages may vary, so some transformers have tap adjustments, which can be used to control the level of the secondary voltage. Tap adjustments alter the number of turns on the primary winding, which affects the secondary voltage output.

The taps on a transformer look like additional connections to the primary winding. The primary winding represented in Figure 0-13 has had four taps added: "A," "B," "D," and "E." The lettered positions indicate the different voltage variations for the transformer. The "C" position indicates the nominal, or normal, voltage.

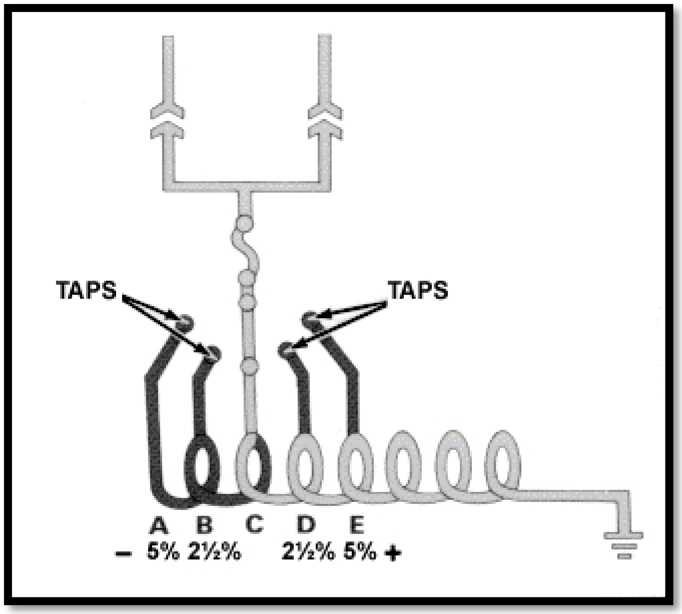


FIGURE 0-13: TAPS ON PRIMARY WINDING

For the example illustrated in Figure 0-13, moving the tap adjustment to the right decreases the number of turns on the primary winding and raises the secondary voltage. For instance, from the "C" position to the "E" position, there is a *5%* increase in voltage, in 2% increments. Moving the tap adjustment to the left, for instance, from position "C" to position "A," increases the number of turns on the primary winding and lowers the secondary voltage by *5%* in 2% increments.

An actual tap adjustment control is shown in Figure 0-14. The tap adjustment is not designed to operate under load. For safety, the tap position should never be changed while the transformer is energized.

FIGURE 0-14: TRANSFORMER TAP ADJUSTMENT

OSHA Regulations Snap-Shot

1910.269 (d) (2)
Hazardous energy control (lockout/tagout) procedures.
General.
(i) The employer shall establish a program consisting of energy control procedures, employee training, and periodic inspections to ensure that, before any employee performs any servicing or maintenance on a machine or equipment where the unexpected energizing, start up, or release of stored energy could occur and cause injury, the machine or equipment is isolated from the energy source and rendered inoperative.

CF51853/Pad-Mounted Transformers Installation

Video: Pad-Mounted Transformers and Switchgear: Segment 2: Pad-Mounted Transformers Installation

T&D EXCERPT

Pad-Mounted Transformer Installation

Pad-mounted transformers and switchgear must be properly installed in order to function properly. Since there are many ways of installing transformers and switchgear, each installation must be done in accordance with company policy and procedures.

1910.269 (d) (2)
Hazardous energy control (lockout/tagout) procedures.
General.
The employer shall establish a program consisting of energy control procedures, employee training, and periodic inspections to ensure that, before any employee performs any servicing or maintenance on a machine or equipment where the unexpected energizing, start up, or release of stored energy could occur and cause injury, the machine or equipment is isolated from the energy source and rendered inoperative.

OBJECTIVE:

Describe an installation procedure for a three-phase pad-mounted transformer that includes the following steps: site preparation, transformer installation, and testing.

The transformer installation procedure described in this section is divided into three parts: site preparation, transformer installation, and testing.

Site Preparation

Before a transformer can be installed, the installation site must be prepared. Site preparation can involve digging cable trenches, installing conduit and cable, and preparing the area where the transformer will sit.

OSHA Regulations Snap-Shot

1910.269 (c)
The employer shall ensure that the employee in charge conducts a job briefing with employees involved before they start each job. The briefing shall cover at least the following subjects: hazards associated with the job, work procedures involved, special precautions, energy source controls, and personal protective equipment requirements.
1. *Number of briefings.* If the work or operations to be performed during the work day or shift are repetitive and similar, at least one job briefing shall be conducted before the start of the first job of each day or shift.

Additional job briefings shall be held if significant changes, which might affect the safety of the employees, occur during the course of the work.

2. *Extent of briefing.* A brief discussion is satisfactory if the work involved is routine and if the employee, by virtue of training and experience, can reasonably be expected to recognize and avoid the hazards involved in the job. A more extensive discussion shall be conducted:

(i) if the work is complicated or particularly hazardous, or

(ii) if the employee cannot be expected to recognize and avoid the hazards involved in the job.

To help with the transformer pad and conduit alignment, a template (Figure 0-1) made of two-by-six boards or metal is positioned over the spot where the transformer pad will be located. The template allows the conduit to be placed so that it will fit properly into the transformer's terminations compartment. The template also helps to hold the conduit in place while the trenches are backfilled and the concrete is poured.

FIGURE 0-1: TRANSFORMER BASE AND CONDUIT

FIGURE 0-2: EXAMPLE OF INCORRECTLY STABILIZED BASE

Before the pad is installed, the pad location may have to be reinforced with dirt or a gravel and concrete mixture to form a base (Figure 0-3) to support the weight of the transformer and the pad without settling. Then, a ground rod is driven at each corner of the template, and the four ground rods are connected with bare copper wire.

FIGURE 0-3: CONCRETE BASE WITH TRANSFORMER

OSHA Regulations Snap-Shot

1910.269
Electric power generation, transmission, and distribution
(a) General.
(1) Application.
(i) This section covers the ***operation and maintenance o***f electric power generation, control, transformation, transmission, and distribution lines and equipment. These provisions apply to:
[A] Power generation, transmission, and distribution installations, including related equipment for the purpose of communication or metering, which are accessible only to qualified employees.

1926.950 subpart "V"
General requirements
(a) Application. The occupational safety and health standards contained in this Subpart V shall apply to the ***construction*** of electric transmission and distribution lines and equipment.

After the ground rods and the conduit are in place, the template is removed. The pad is then moved into place (Figure 0-4) and lowered into position. As this is done, crew members make sure that the pad is properly aligned. The pad has an opening, or slot, to allow the cables to enter the transformer from underground. The crew should check to make sure that the pad is level, and that the conduit is properly placed in the pad's slot.

FIGURE 0-4: CONCRETE PAD INSTALLATION

OSHA Regulations Snap-Shot

1910.269 (a) (3)
Existing Conditions.
Existing Conditions related to the safety of the work to be performed shall be determined before work on or near electric lines or equipment is started. Such conditions include, but are not limited to, the nominal voltages of lines and equipment, the maximum switching transient voltages, the presence of hazardous induced voltages, the presence and condition of protective grounds and equipment grounding conductors, the condition of poles, environmental conditions relative to safety, and the locations of circuits and equipment, including power and communications lines and fire protective signaling circuits.

Transformer Installation

In this example, the transformer is moved into position using a derrick (Figure 0-5). As the transformer is lowered, it is checked to make sure that it is properly aligned with the pad. After the transformer is in place, the pad is checked again, to make sure that the additional weight of the transformer has not caused the pad to settle unevenly. Finally, the transformer is anchored to the pad, if necessary.

FIGURE 0-5: MOVING THE TRANSFORMER INTO POSITION

OSHA Regulations Snap-Shot

1910.136
Foot protection
(a) General requirements. The employer shall ensure that each affected employee uses protective footwear when working in areas where there is a danger of foot injuries due to falling or rolling objects, or objects piercing the sole, and where such employee's feet are exposed to electrical hazards.

When all of the equipment is in place, transformer connections are made at three locations: at the connection to the feeder circuit, at the transformer, and at the customer's connection point. In this example, the connection to the feeder circuit is made at a cable pole.

First, the transformer case and secondary ground connections are made at the transformer (Figure 0-6).

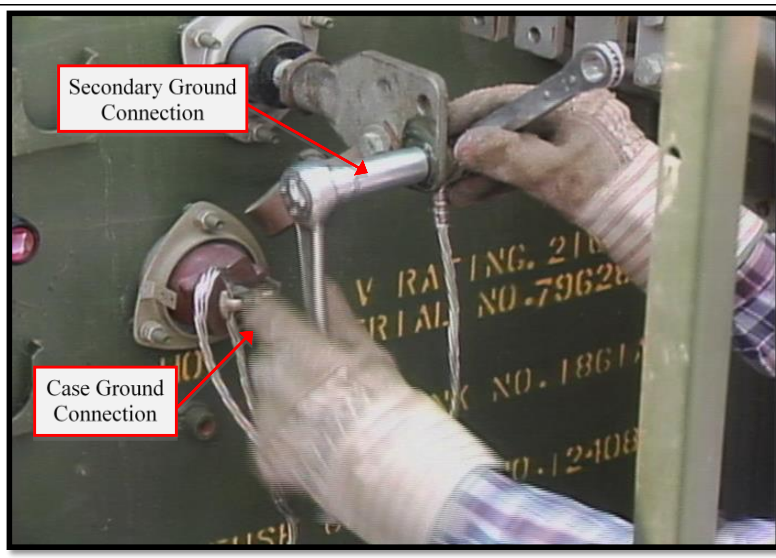


FIGURE 0-6: MAKING TRANSFORMER GROUND CONNECTIONS

OSHA Regulations Snap-Shot

1910.138
Hand protection.
(a) General requirements. Employers shall select and require employees to use appropriate hand protection when employees' hands are exposed to hazards such as those from skin absorption of harmful substances; severe cuts or lacerations; severe abrasions; punctures; chemical burns; thermal burns; and harmful temperature extremes.
(b) Selection. Employers shall base the selection of the appropriate hand protection on an evaluation of the performance characteristics of the hand protection relative to the task(s) to be performed, conditions present, duration of use, and the hazards and potential hazards identified.

The secondary connections are made next. The secondary cable is wire-brushed, to ensure good electrical contact, and then the lugs are crimped onto the conductor ends (Figure 0-7).

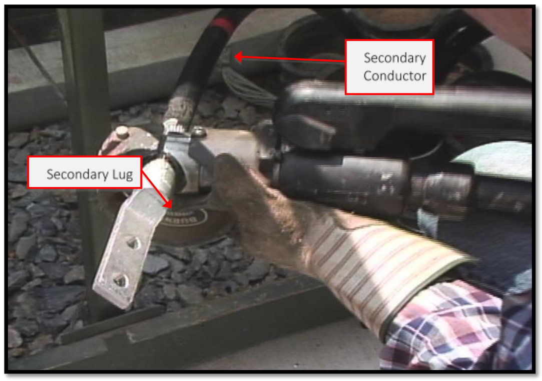


FIGURE 0-7: MAKING SECONDARY TERMINATIONS AT THE TRANSFORMER

The secondary cables are often marked to identify their phasing. Markings may be made directly on the cable jacket by the manufacturer, or the phasing may be indicated with colored tape.

After the lugs are in place, the secondary cables are tied back (Figure 0-8) and grounded to keep them out of the way while other connections are made. The secondary connections are then made at the customer's terminations panel.

FIGURE 0-8: TYING BACK SECONDARY CABLES AT THE TRANSFORMER

1910.269 (w) (7)
Backfeed.
If there is a possibility of voltage backfeed from sources of cogeneration or from the secondary system (for example, backfeed from more than one energized phase feeding a common load), the requirements of paragraph (l) of this section apply if the lines or equipment are to be worked as energized, and the requirements of paragraphs (m) and (n) of this section apply if the lines or equipment are to be worked as deenergized.

The next connections are made at the pole top. With the pole top cutout switches open, the pothead terminations are made (Figure 0-9), and the cables are then grounded at the pole ground. (Some companies may require that additional checks be made of the potheads or other equipment.)

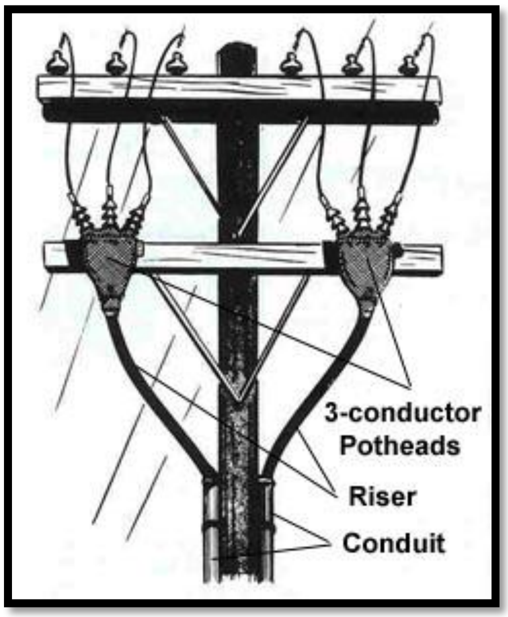


FIGURE 0-9: POLE TOP EQUIPMENT INSTALLATION

At the transformer, the primary cable terminations are made with elbows. An elbow is fitted onto each primary cable (Figure 0-10).

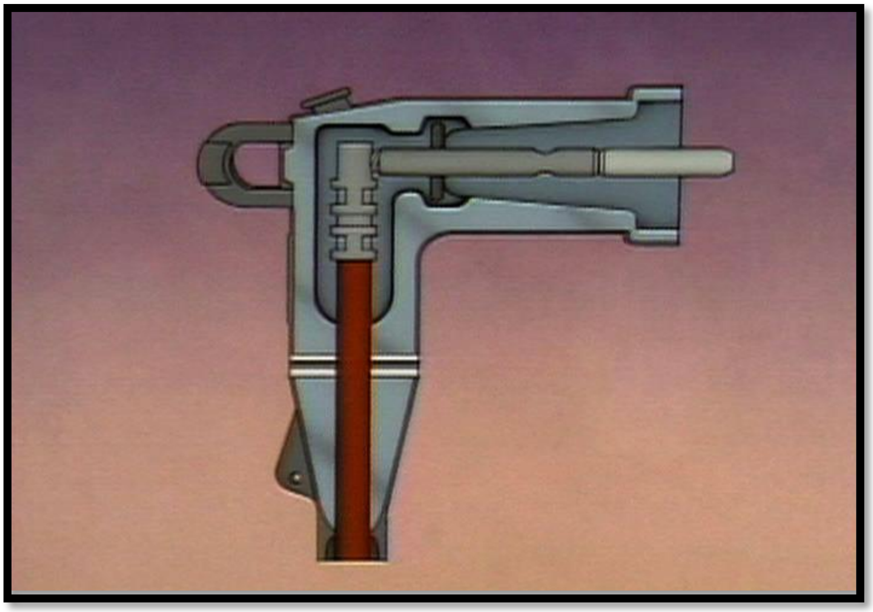


Figure 0-10: Elbow Cross Section, Primary URD Transformer Connections

In this example, the primary cable concentric neutrals are clamped to the transformer case ground. The elbows are then connected to the primary bushings (

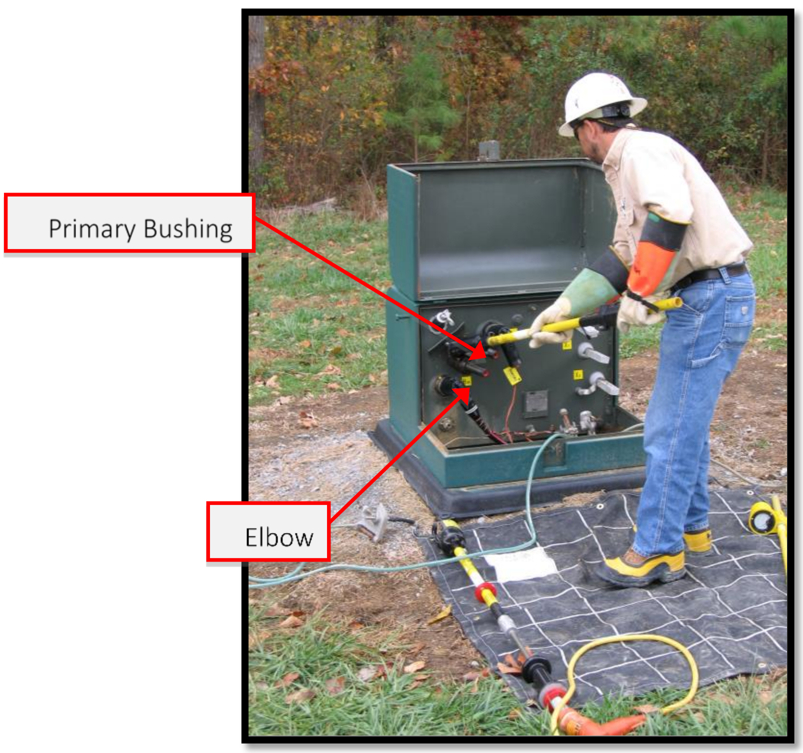


Figure 0-11).

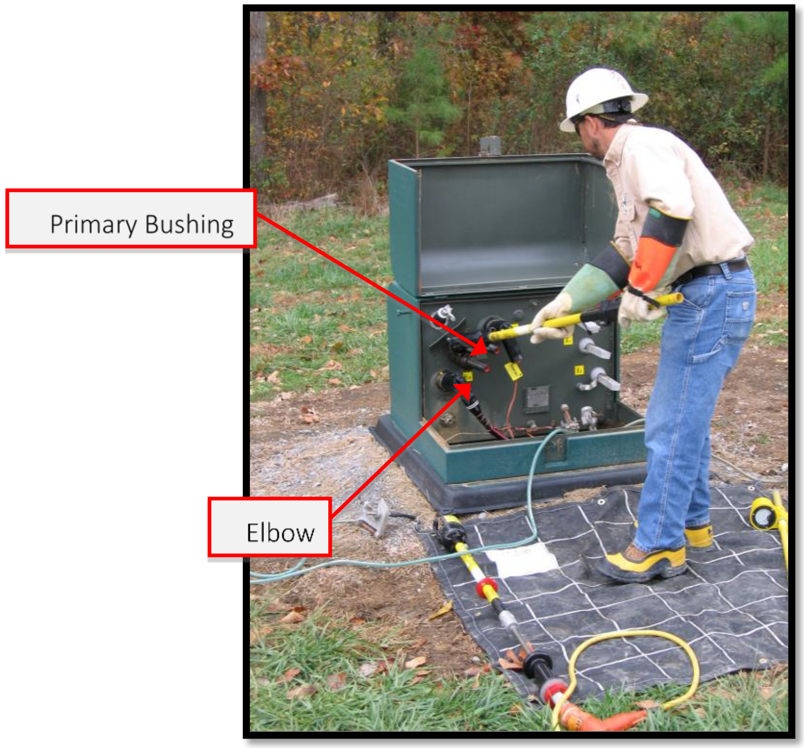


FIGURE 0-11: CONNECTING ELBOWS TO PRIMARY BUSHINGS

After these steps have been completed, the situation is as follows: The secondary cable is connected at the customer and grounded at the transformer. The primary cable is connected at the transformer and at the cable pole. The pole-top disconnect switches are open, and the primary cable is grounded at the cable pole.

OSHA Regulations Snap-Shot

1910.333 (c)
Working on or near exposed energized parts.
(1) Application. This paragraph applies to work performed on exposed live parts (involving either direct contact or by means of tools or materials) or near enough to them for employees to be exposed to any hazard they present.
(2) Work on energized equipment. Only qualified persons may work on electric circuit parts or equipment that have not been deenergized under the procedures of paragraph (b) of this section. Such persons shall be capable of working safely on energized circuits and shall be familiar with the proper use of special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools.

Transformer Testing

Transformer testing is the last part of the installation procedure. In this example, the transformer is tested to make sure that it is supplying the proper secondary voltage. The procedure described is one of several methods of conducting a transformer test.

First, at the cable pole, the temporary grounds are removed from the primary cables. The cutout switches are then closed (Figure 0-12), energizing the transformer.

FIGURE 0-12: CLOSING POLE-TOP CUTOUT SWITCHES

At the transformer, a workman uses a voltmeter to check the phase-to-ground and phase-to-phase voltages on the secondary transformer bushings (Figure 0-13).

FIGURE 0-13: CHECKING SECONDARY VOLTAGES

If the voltages are within acceptable limits, the pole-top switches are re-opened, and the primary cables are grounded again. This de-energizes the transformer so that the secondary cable connections can be made to the secondary bushings.

OSHA Regulations Snap-Shot

1910.269(I)
(6) Apparel.

(i) When work is performed within reaching distance of exposed energized parts of equipment, the employer shall ensure that each employee removes or renders nonconductive all exposed conductive articles, such as key or watch chains, rings, or wrist watches or bands, unless such articles do not increase the hazards associated with contact with the energized parts.
(ii) The employer shall train each employee who is exposed to the hazards of flames or electric arcs in the hazards involved.
(iii) The employer shall ensure that each employee who is exposed to the hazards of flames or electric arcs does not wear clothing that, when exposed to flames or electric arcs, could increase the extent of injury that would be sustained by the employee.

Finally, the transformer is energized again, and voltages are checked at the customer's breaker box (Figure 0-14) to verify that the secondary voltage to the customer is within acceptable limits. If the direction of the phase rotation is an important consideration in the system being connected, additional checks may be made with a rotation indicator.

FIGURE 0-14: CHECKING SECONDARY VOLTAGE AT THE CUSTOMER'S BREAKER BOX

Arc Flash Safety

OSHA evaluates compliance with its electrical safety regulations, OSHA 1910 Subpart S and OSHA 1926 Subpart K, using the comprehensive information in *NFPA 70E* . While OSHA tells you *what* to do to avoid electrical dangers, this vital Standard tells you *how*. Please refer to the National Fire Protection Standard: NFPA 70E for Arc Flash protection compliance.

CF51854/Troubleshooting A Three-Phase Pad-Mount Part 1

Video: Pad-Mounted Transformers And Switchgear: Segment 3: Troubleshooting A 3-Phase Pad-Mounted Transformer, Part 1

TROUBLESHOOTING A THREE-PHASE TRANSFORMER, PART 1

This section examines four different transformer electrical problems and describes how each may be detected. The problems presented are typical of those found in transmission and distribution systems, but they are not intended to represent all of the possible transformer problems. Also, no attempt is made to provide a complete picture of transformer troubleshooting. Company procedures should always be followed for any troubleshooting procedure.

OBJECTIVES:

- Define "one leg open" and describe its symptoms.
- Define "ferroresonance" and describe its symptoms.
- Define "off ratio winding" and describe its symptoms.
- Define "open neutral" and describe its symptoms.

OSHA Regulations Snap-Shot

1910.269p (a) (2)
Training.
(i) Employees shall be trained in and familiar with the safety-related work practices, safety procedures, and other safety requirements in this section that pertain to their respective job assignments. Employees shall also be trained in and familiar with any other safety practices, including applicable emergency procedures (such as pole top and manhole rescue), that are not specifically addressed by this section but that are related to their work and are necessary for their safety.
(ii) Qualified employees shall also be trained and competent in:
(A) The skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment,
(B) The skills and techniques necessary to determine the nominal voltage of exposed live parts,
(C) The minimum approach distances specified in this section corresponding to the voltages to which the qualified employee will be exposed, and
(D) The proper use of special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools for working on or near exposed energized parts of electric equipment. Note: For the purposes of this section, a person must have this training in order to be considered a qualified person.

Troubleshooting Considerations

When a three-phase transformer malfunctions, the problem may be difficult to diagnose. Different transformer problems may have similar symptoms. The difficulty of troubleshooting a three-phase, pad-mounted transformer can also be complicated by the transformer's design. For example, the transformer's core construction can affect the symptoms. Some three-phase transformers have three separate cores, one for each phase. Each phase is physically separated from the others. This type of construction is illustrated in Figure 0-1.

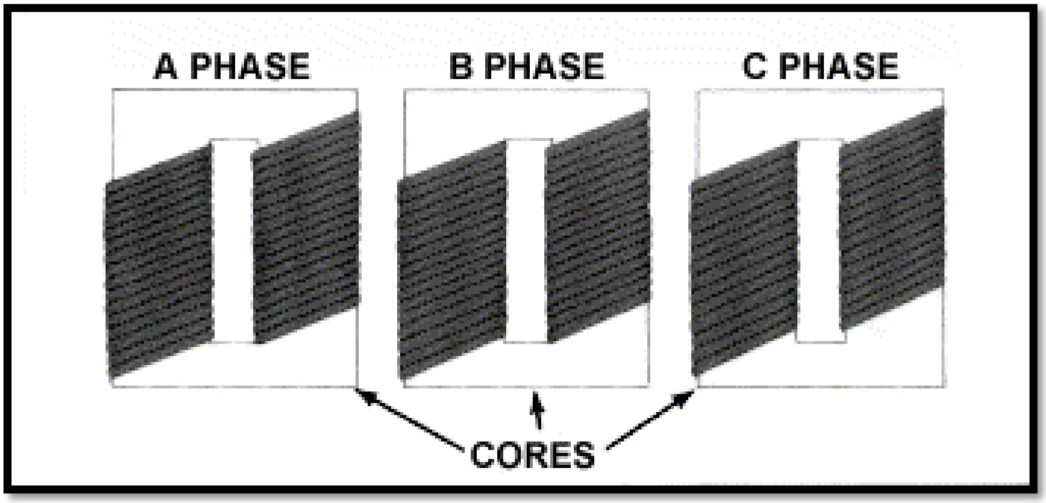


FIGURE 0-1: SEPARATE CORE CONSTRUCTION

Other transformers have a common core construction. As illustrated in Figure 0-2, each phase is wrapped around a different leg of a common core. With this construction, induction between the primary windings can affect the symptoms of a transformer problem.

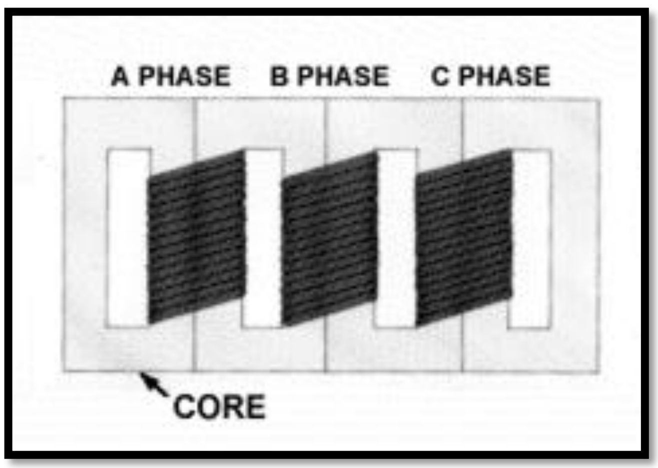


FIGURE 0-2: COMMON CORE CONSTRUCTION

A transformer's core construction is not usually indicated on its nameplate. However, a worker who is troubleshooting a transformer should be familiar with the core design, because it can affect voltage readings under certain conditions.

The illustration in Figure 0-3 can be used to demonstrate the effects of four different problems on a three-phase, pad-mounted transformer. The illustration is a simplified diagram of a 13.2 KY, wye-wye connected, three-phase transformer. The three phases are indicated by the letters "A," "B," and "C." Each phase has switches, a bus bar, a fuse, and windings. Each of the voltage problems discussed in this section affects the phase labeled "C" in the diagram.

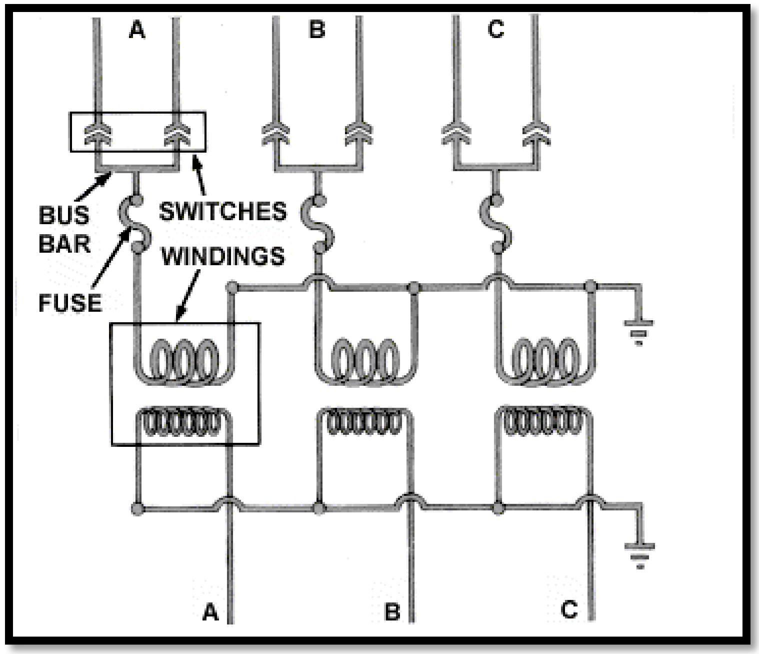


FIGURE 0-3: THREE-PHASE, 13.2 KV, WYE-WYE CONNECTED TRANSFORMER

To identify any voltage problem, it is important to take a complete set of secondary phase-to-phase and phase-to-ground readings. Depending on the problem's symptoms, other voltage and amperage, or load, readings may have to be taken as well.

The readings normally expected for the transformer in this example are shown in Figure 0-4. The normal expected secondary voltage phase-to-ground reading is 120 volts. The normal expected phase-to-phase voltage reading is 208 volts. In reality, however, normal voltages can vary within a specified range.

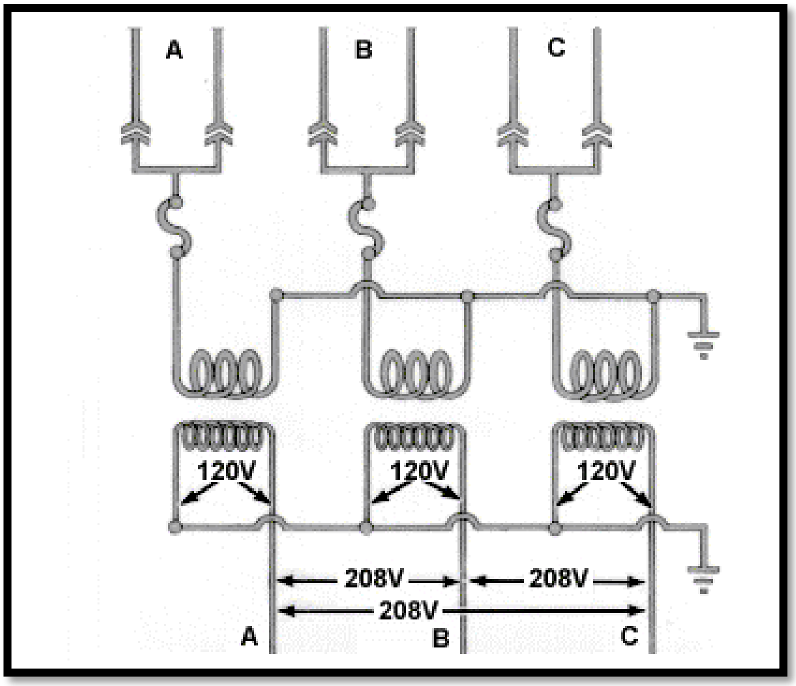


FIGURE 0-4: NORMAL EXPECTED VOLTAGE READINGS

One Leg Open

One possible transformer problem is an open leg, or phase. The diagram in Figure 0-5 shows that the fuse connected to the "C" phase has blown, causing the "C" phase primary supply to the transformer to be open. In this situation, the voltage expected on the secondary side of the open phase might be zero. However, for several reasons, the open phase can still show a voltage on the secondary. In this example, as shown in Figure 0-5, the secondary readings phase-to-ground are 120 volts, 120 volts, and 90 volts. The 90-volt reading on the open leg is due to the transformer's common core construction, which allows the leg to be energized by induction through the core.

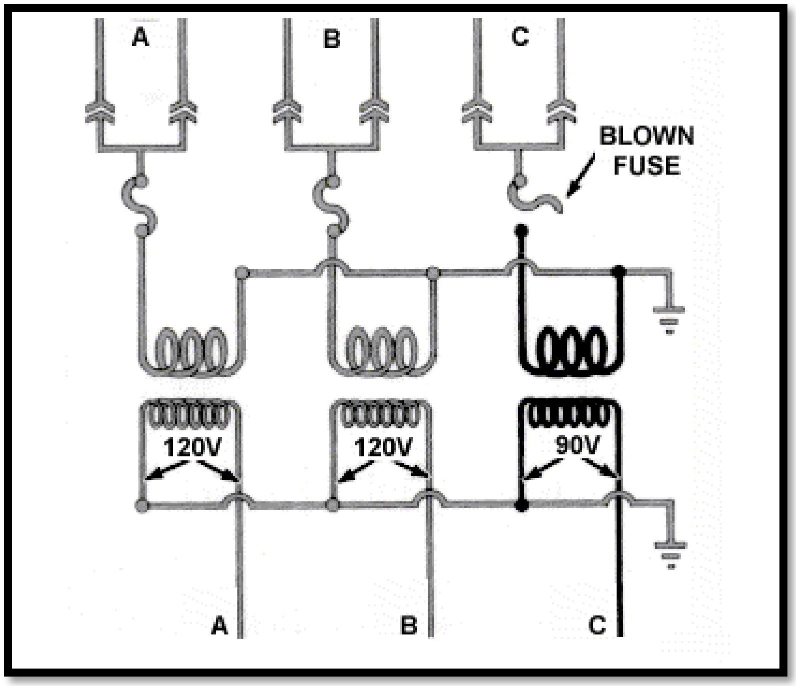


FIGURE 0-5: ONE LEG OPEN: PHASE-TO-GROUND READINGS

Phase-to-phase readings (Figure 0-6) show 208 volts from "A" to "B." From "A" to "C" and from "B" to "C," however, the voltage readings are abnormal. In this situation, voltage readings can be higher or lower than normal. In Figure 0-6, the "A" to "C" reading is 140 volts and the "B" to "C" reading is 200 volts. The 90-volt phase-to-ground reading and the low phase-to-phase readings with "C" seem to indicate an open leg.

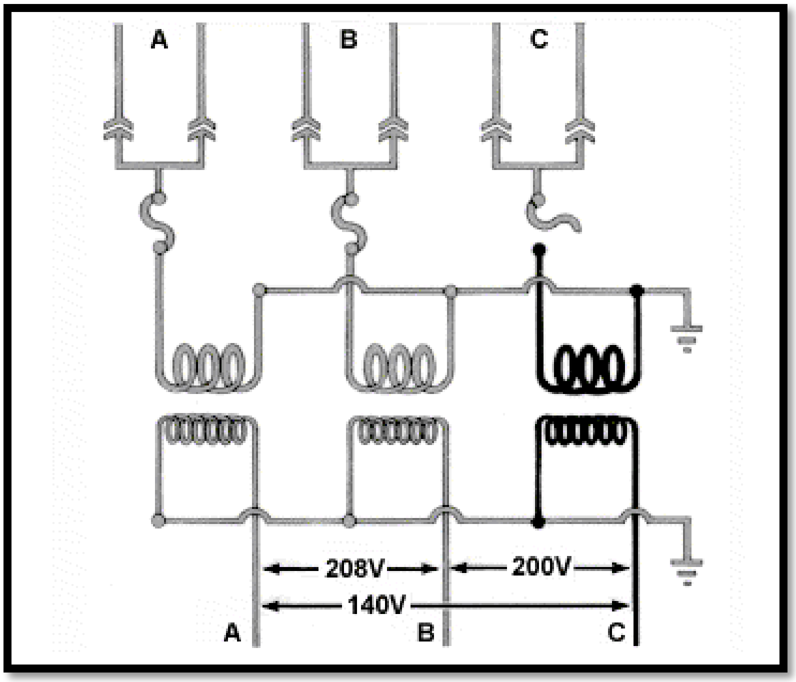


FIGURE 0-6: ONE LEG OPEN: PHASE-TO-PHASE READINGS

Load readings are taken with a clamp-on ammeter on each secondary phase to determine whether the affected leg is carrying a load. There should be a load on each normal secondary leg, but no load on the open leg. As Figure 0-7 shows, for this example, the load readings are 83 amps on the "A" phase, 67 amps on the "B" phase, and 0 amps on the "C" phase. The 0 amp reading on the "C" phase confirms the open leg.

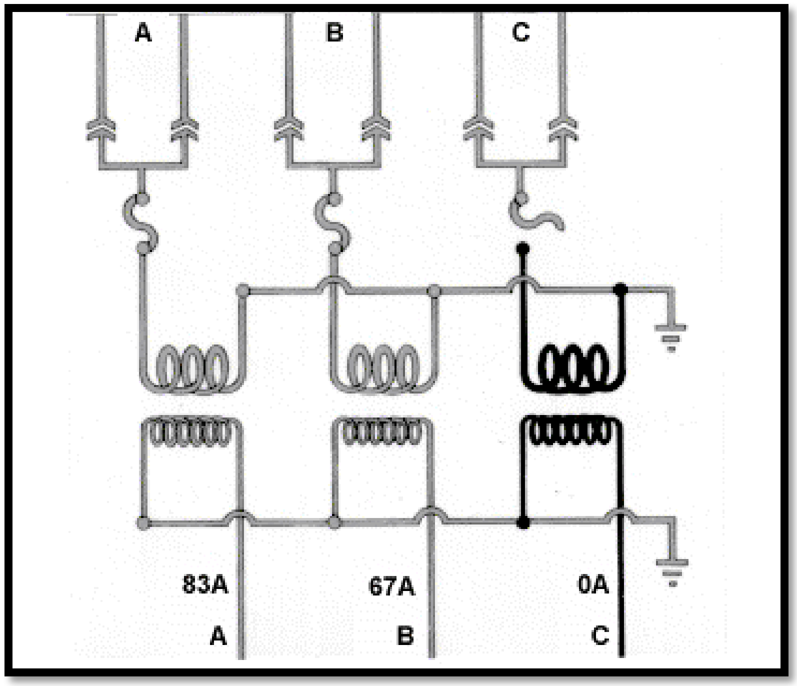


FIGURE 0-7: ONE LEG OPEN: LOAD READINGS

If the transformer in this example had individual cores for each phase, rather than a common core, voltage could still have been detected on the open phase. This could happen if the open phase were connected to another phase through customer equipment, causing electrical backfeed. Although the open phase would not be energized from its normal source, it could still be energized by the electrical backfeed. In Figure 0-8, the "B" and "C" phases are electrically connected through customer equipment. "C" phase is being backfed through that equipment. The phase-to-ground reading on each phase is 120 volts, or apparently normal.

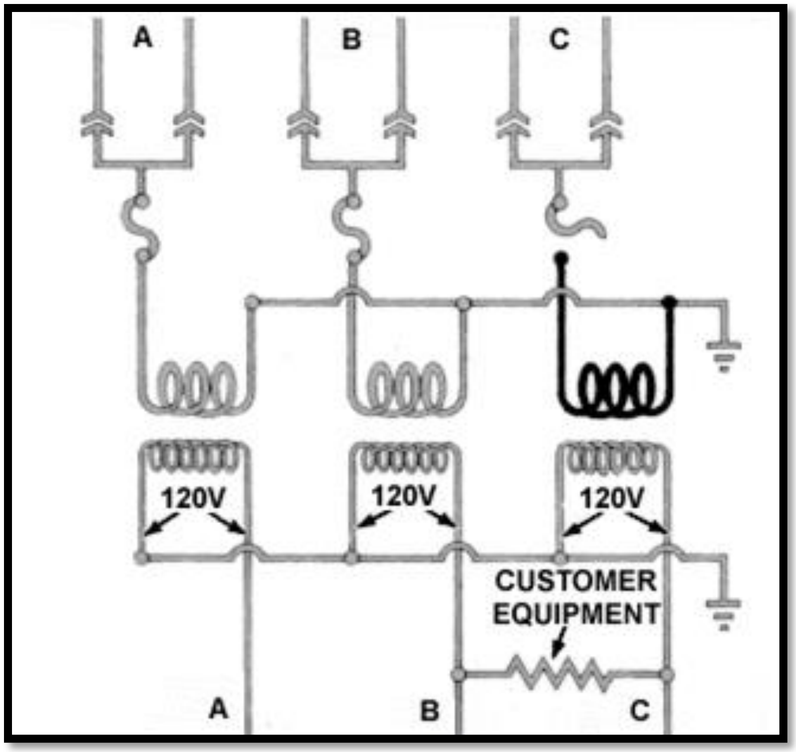


FIGURE 0-8: ONE LEG OPEN: ELECTRICAL BACKFEED (PHASE-TO-GROUND READINGS)

The phase-to-phase readings, however, include an abnormal voltage reading. Because the electrical backfeed originates from the "B" phase, the readings (Figure 0-9) are 208 volts between "A" and "B" and between "A" and "C," and 0 volts between "B" and "C." With the "C" phase open, the phase-to-phase reading between the two electrically connected phases is 0, because no potential difference exists between them.

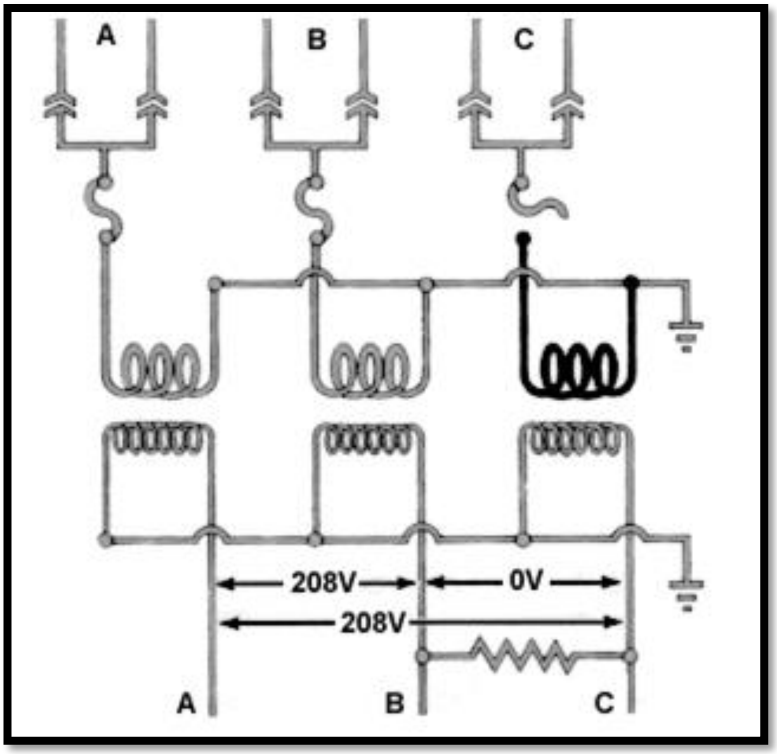


FIGURE 0-9: ONE LEG OPEN: ELECTRICAL BACKFEED (PHASE-TO-PHASE READINGS)

Load readings taken on the secondary legs should verify that the leg with the blown fuse is carrying no load. The reading for that leg should be 0 amps.

After the cause of the problem has been determined, and any faulty equipment has been replaced, a new fuse should be installed. This should energize the phase again, and normal secondary voltage should be present on all phases.

Ferroresonance

When a fuse blows outside of the transformer, at the cable pole, for example, another problem, called ferroresonance, can occur. Ferroresonance occurs when the capacitance of the URD cable between the transformer and the blown fuse closely matches the magnetic characteristics of the transformer core. Ferroresonance is only a concern in transformers with common core construction.

Ferroresonance takes the form of a resonant circuit consisting of the cable capacitance and the core induction. This current can cause a higher than normal voltage reading on the phase with the blown fuse. In some cases, the resonance can also produce higher than normal vibration and noise levels during operation. Cable overheating, arcing and blown fuses can also result.

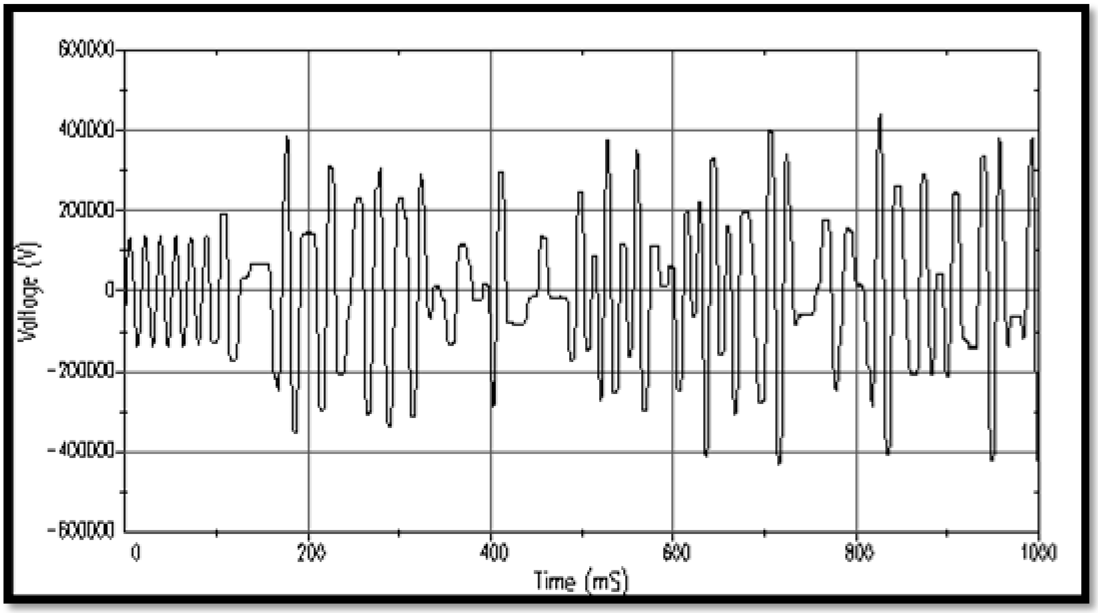


FIGURE 0-10: LOW FREQUENCY OSCILLATORY TRANSIENT CAUSED BY FERRORESONANCE OF AN UNLOADED TRANSFORMER

Figure 0-11 shows the phase-to-ground readings for one possible ferroresonant condition. The readings are 120 volts, 120 volts, and 173 volts. The voltage on two of the transformer legs is normal, but the voltage on the affected "C" phase is high.

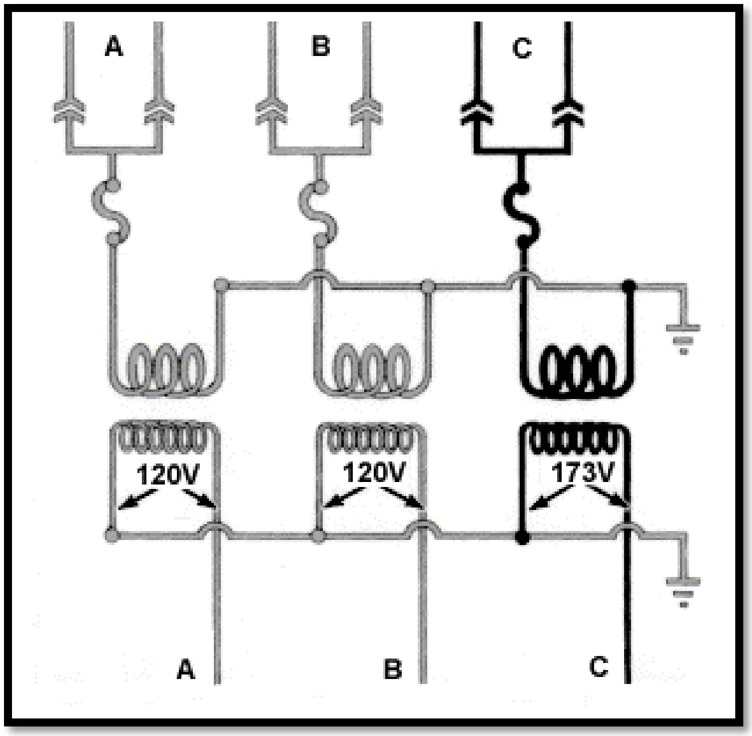


FIGURE 0-11: FERRORESONANCE: PHASE-TO-GROUND READINGS

The phase-to-phase readings for this condition are shown in Figure 0-12. Values between the ferroresonant phase and each normal phase could be almost anything. In this example, "A" to “B" reads 208 volts, "A" to "C" reads 158 volts, and "B" to "C" reads 293 volts.

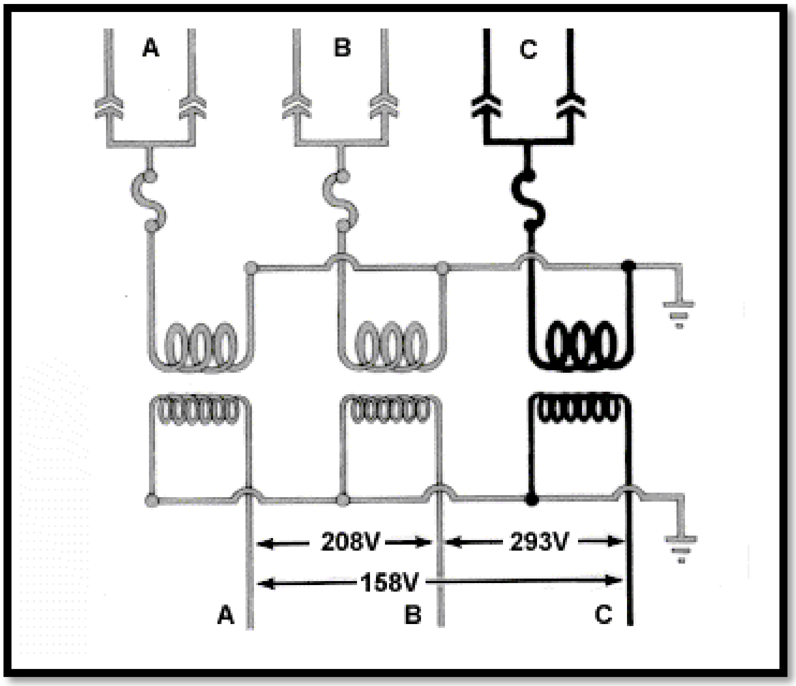


FIGURE 0-12: FERRORESONANCE: PHASE-TO-PHASE READINGS

The ferroresonant condition can be verified by using a phasing tool to take a phase-to-ground primary voltage reading on the "C" phase incoming cable through a feedthrough bushing. (Disconnecting the cable from the transformer would interrupt a ferroresonant circuit and allow a true reading of the cable.) Ferroresonance is indicated if the primary voltage reading is abnormal. In this example, since there are no other transformers on the circuit, the primary reading of the cable shows 0 volts instead of the normal 7,620 volts.

To resolve the problem in this example, the blown fuse must be located and replaced. The fuses on the primary cable feeding the affected phase are checked, beginning with the nearest fuse and working toward the cable pole until the blown fuse is found. After any necessary equipment repairs are made, replacing the blown fuse should correct the problem.

Off-Ratio Winding

The high phase-to-ground reading associated with ferroresonance could also be a symptom of another condition, called an off-ratio winding. With an off-ratio winding, a voltage surge, such as lightning, could cause several of the primary coil turns to short out, leaving fewer primary turns. Fewer primary turns raise the secondary voltage on the affected phase, resulting in a high phase-to-ground reading.

Figure 0-13 shows the phase-to-ground readings for one possible off-ratio winding condition. Two of the legs read normal phase-to-ground voltage, but the reading on the affected "C" phase is 132 volts.

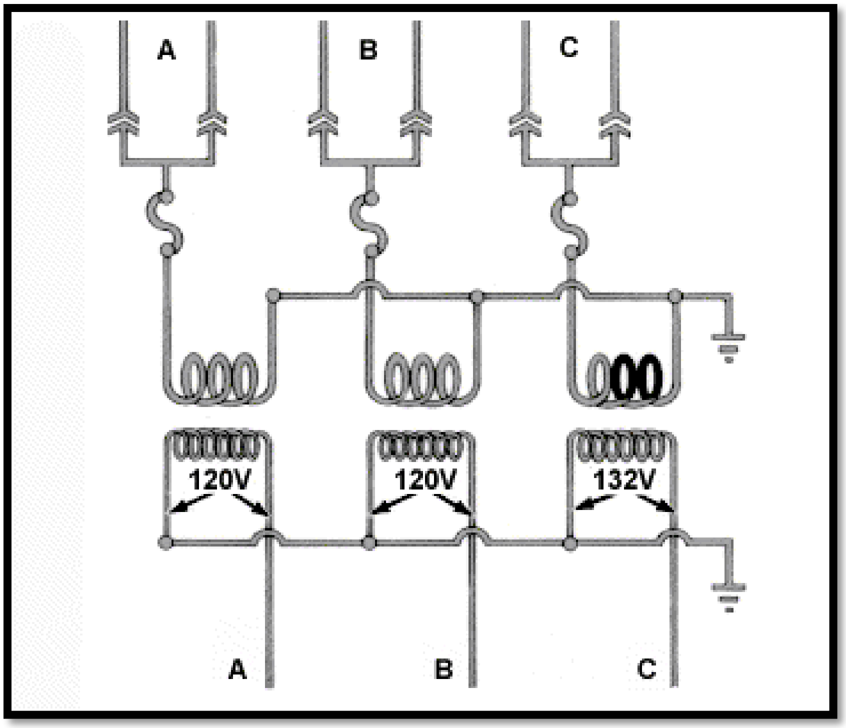


FIGURE 0-13: OFF-RATIO WINDING: PHASE-TO-GROUND READINGS

The phase-to-phase reading between the affected "C" phase and each of the other phases is higher than normal. In Figure 0-14, its value is approximately 218 volts. Between the "A" and "B" phases, however, the reading is normal. In contrast to the ferroresonant condition, for an off-ratio winding condition, the phase-to-phase readings between the affected phase and each normal phase are equal.

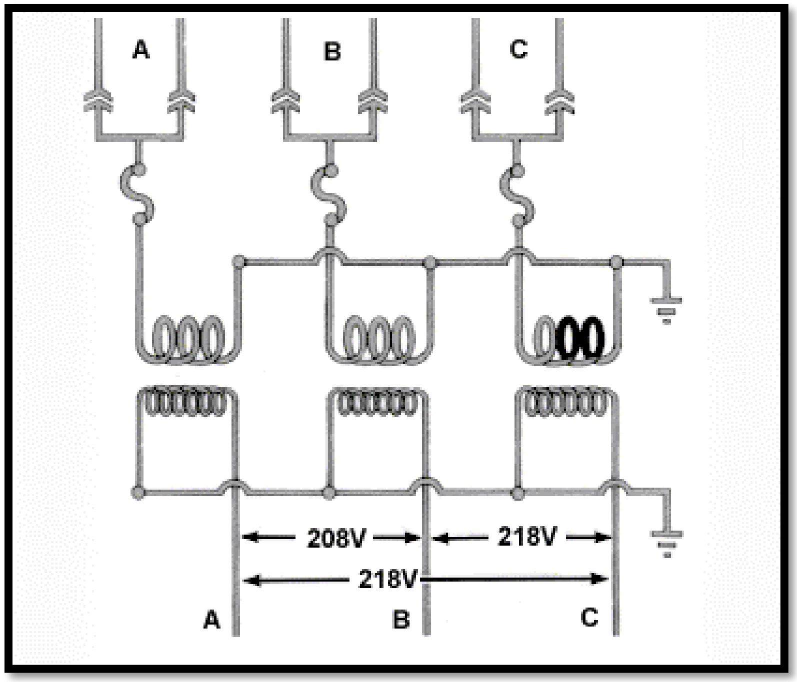


FIGURE 0-14: OFF-RATIO WINDING: PHASE-TO-PHASE READINGS

To verify the off-ratio winding condition, a phasing tool is used to read the primary phase on a feedthrough bushing. The voltage reading should be a normal 7,620 volts. With ferroresonance, the primary voltage reading is abnormal.

When an off-ratio winding condition occurs, voltage remains constant, and the problem usually affects only one phase. If the condition is confirmed, the transformer will have to be replaced.

Open Neutral

The voltage problems discussed so far affect only one phase. In some cases, the entire transformer can be affected by a voltage condition. One such condition is an open neutral. With an open neutral, the transformer's secondary neutral is not solidly connected to ground because of a burn-through, a mechanical defect, or some other reason.

The diagram in Figure 0-15 shows an open neutral condition. The open neutral is represented by the "X." Secondary voltages on a transformer with an unbalanced or open load on each phase will fluctuate. Phase-to-ground and phase-to-phase voltages may be much higher or much lower than expected, and they will change as the load changes.

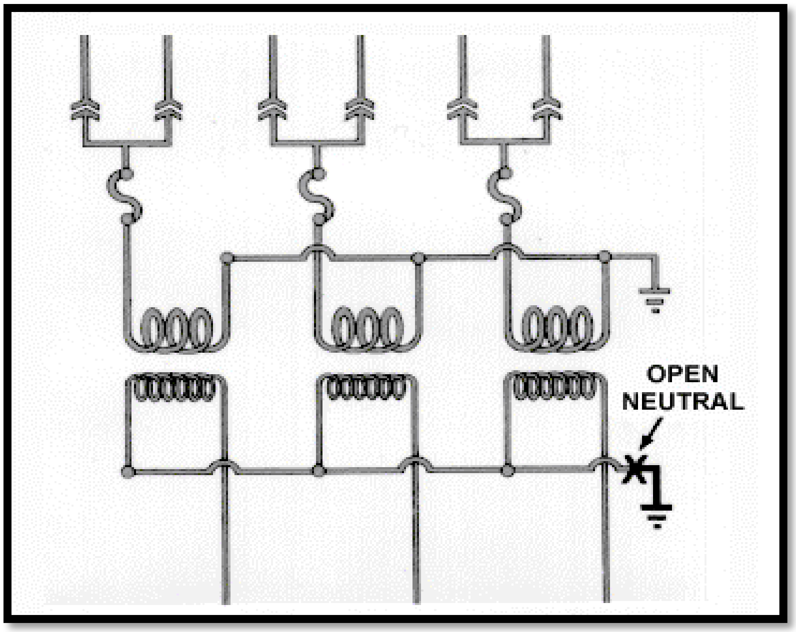


FIGURE 0-15: OPEN NEUTRAL

If voltage readings are within the normal range, or if the effects are intermittent, an open neutral could still be present. A load reading on each secondary phase and on the neutral should verify the condition. If the load is different on each phase, a load would be expected on the neutral. If there is little or no load on the neutral, then the neutral may be open. The load readings may not be conclusive, however, because with a balanced load, where the load readings on each phase are the same, no amperage should be detected on the neutral. If the voltage and load readings are inconclusive, recording voltmeters may have to be installed to record voltage fluctuations over a period of time. If an open neutral inside the transformer is confirmed, the transformer will have to be replaced.

CF51855/Troubleshooting A Three-Phase Pad-Mount Part 2

Video: Pad-Mounted Transformers And Switchgear: Segment 3: Troubleshooting A 3-Phase Pad-Mounted Transformer, Part 2

CF51857/Primary Cable Splicing

Video: Cable Splicing 2: Segment 1: Primary Cable Splicing

CF51858/Types Of Electrical URD Cable

Video: Cable Splicing 1: Segment 1: Types Of Electrical Urd Cable

CF51859/Secondary Cable Splicing

Video: Cable Splicing 2: Segment 3: Secondary Cable Splicing

CF51860/Voltage Stress and Stress Relief

Video: Cable Splicing 1: Segment 2: Voltage Stress And Stress Relief

CF51861/Cable Preparation

Video: Cable Splicing 1: Segment 3: Cable Preparation

CF51862/Splice Kits

Video: Cable Splicing 2: Segment 2: Tape Terminations

CF51863/Introduction To Termination

Video: Cable Terminations: Segment 1: Introduction To Terminations

CF51864/Elbow Terminations

Video: Cable Terminations: Segment 3: Elbow Terminations Elbow Terminations

CF51865/Rubber Cable Terminations

Video: Cable Terminations: Segment 4: Rubber Cable Terminations

CF51866/Principles Of Cable Termination

Video: High Voltage Terminations: Segment 2: Principles of Cable Termination

CF51867/Isolating URD Transformer Faults

Video: URD Troubleshooting:

CF51868/Isolating URD Cable Faults Part 1

Video: URD Troubleshooting: Segment 1: Isolating URD Transformer Faults, PART 1

CF51869/Isolating URD Cable Faults Part 2

Video: URD Troubleshooting: Segment 2: Isolating URD Transformer Faults, PART 2

CF51870/Cable Fault Location

Video: Locating Primary Faults: Segment 1: Cable Fault Location

CF51871/Capacitor Discharge Test Unit

Video: Locating Primary Faults: Segment 2: Capacitor Discharge Test Unit

CF51872/Locating A Fault in Primary URD Cable Part 1

Video: Locating Primary Faults: Segment 3: Locating a Fault In Primary URD Cable Part 1

CF51873/Location a Fault In Primary URD Cable Part 2

Video: Locating Primary Faults: Segment 4: Locating a Fault In Primary URD Cable Part 2

CF51874/Voltage Gradient Equipment

Video: Locating Secondary Faults: Segment 1: Voltage Gradient Equipment

CF51875/Locating A Fault In A Secondary URD Cable

Video: Locating Secondary Faults: Segment 2: Locating a Fault In a Secondary URD Cable

CF51903/Working On Electrical Around Gas/CF51903/Pdf-PPT/12-02-2016

OBJECTIVE:

Educate utility employees on safe work practices when working close to exposed gas lines.

CF5LT519/Install and Remove Pole in Energized Area

CF5LT519/PDF

PERFORMANCE OBJECTIVE

TASK NO.

LT-519

REV. 05/01

TASK: INSTALL AND REMOVE POLE IN ENERGIZED AREA

GIVEN: An existing energized line, wood pole and all necessary tools and material.

YOU WILL: Set the wood pole in line with the existing energized line. Upon completion of setting the pole, you will then remove pole from the energized line.

HOW WELL: The pole will be free standing and straight. The pole will be set following all the safe work practices using all necessary protective equipment needed to set the pole. The pole will be removed according to the procedures discussed in the module.

PROCEDURE: Step 1: Study Attached Sheets

Step 2: Take Written Test

Step 3: Sign up for Practice (if needed)

Step 4: Sign up for Competency Test

TOOLS

Shovel

Tamp

Pole Sling

Rubber Gloves & Sleeves

Protective equipment

Pole truck & trailer

Cant hooks or Pole tongs

RESOURCES

Attached sheets

Safety Manual

MATERIALS

1- Wood pole

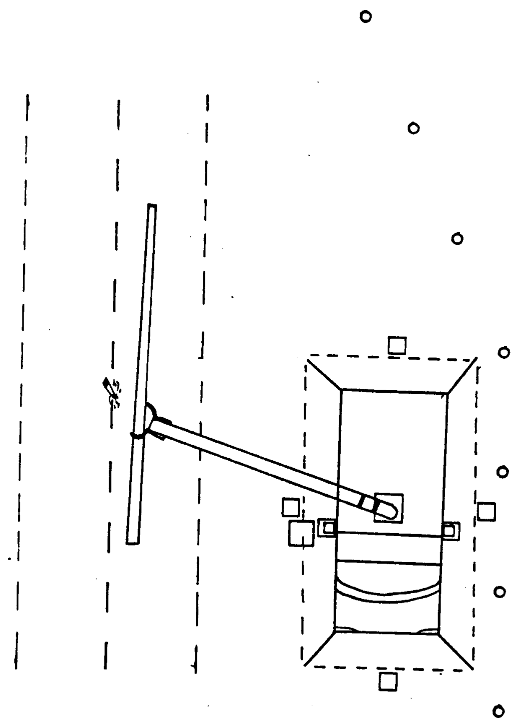
SETTING POLE IN ENERGIZED AREA

In the lineman classification when setting a pole in the energized area, the lineman's job may consist of the operations of the pole setting equipment or guiding the pole through the energized area. When performing either of the above jobs, it is essential that you understand the safe work practices for setting the pole and provide yourself and crew members with all the necessary protective equipment.

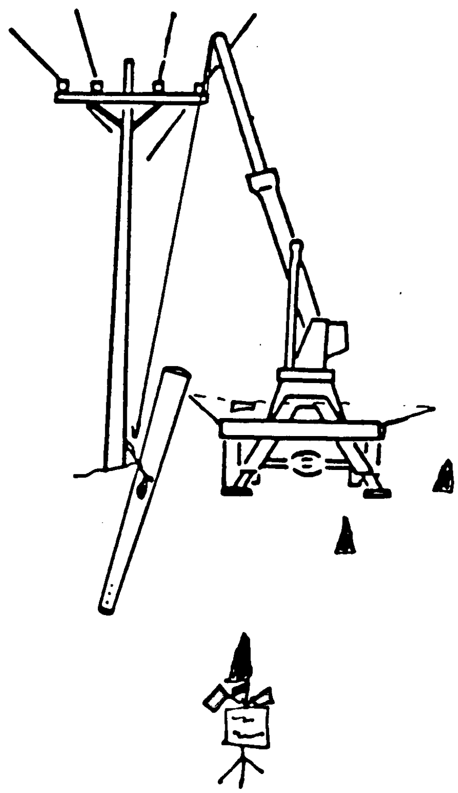
The positioning of the truck is very important. The most familiar type of line truck used on our system is the center or rear mount. To set the truck up properly, step off the distance from where the hole is to be dug to the turret (turn table), allow the auger to reach the spot of the hole with the boom extended approximately two feet.

Before rotating the derrick, the outriggers should be lowered firmly to the ground. If the truck is not on level surface, the outriggers on the low side of the truck should be lowered first to level the truck body. The outriggers on the high side of the truck are then lowered to a firm surface. If the outrigger extends into a ditch or gutter, and the fullest extension does not make firm contact, it must be built up. Cribbing the truck for this purpose is suggested.

Before digging the hole, position the pole next to the stake or setting location of the pole. When positioning the pole before setting, avoid unnecessary side strains on the winch line. Do this by positioning the boom to position the pole correctly. Whenever possible, position the pole parallel to the energized line and with balance point of the pole next to the hole.

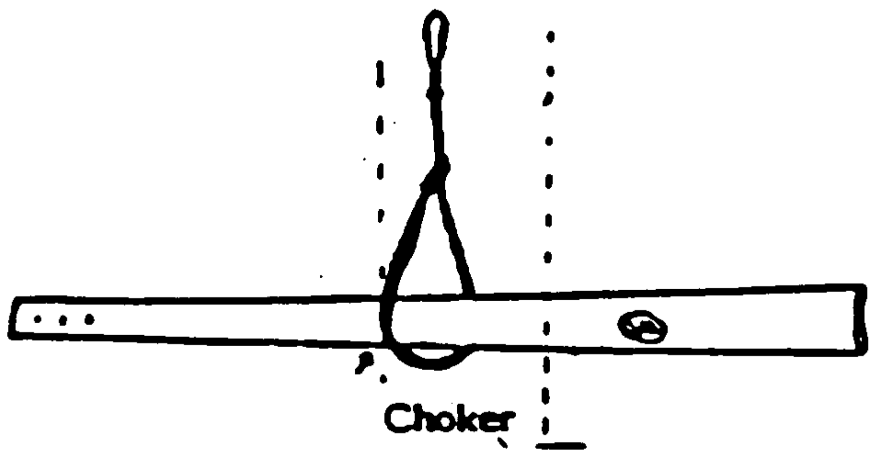


After digging the hole, position the boom over the hole. When setting a pole in existing lines, raise the boom into position so that as the pole is being raised by the winch line it can be guided into position between energized conductors. When positioning the boom, check for clearances on energized lines. Put pole guards on pole and if possible cover energized conductors with protective equipment. When making the decision for the placement of the boom, confer with the crew leader and plan the total operation of the job being performed. Make sure the boom is positioned over the hole so that there is enough winch line to lift the pole off the ground. It may be necessary to position the boom over the secondary conductors to allow enough winch line to lift the pole. After the boom is safely positioned, lower winch line to pole sling.

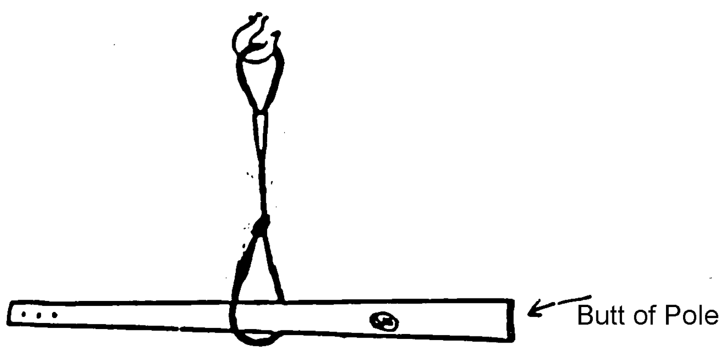


As the lineman working on the ground, it is your job when setting a pole in the energized area, to hook the winch line to the sling and guide the pole through the energized conductors, and into the hole. To accomplish this job, there are a few safety facts that must be discussed before starting the job. The first thing you must do is obtain your rubber sleeves and gloves. If they have not been field inspected, then inspect the rubber gloves and sleeves before using. If your rubber gloves and sleeves are stored on the equipment being used to set the pole, you shall remove your rubber gloves and sleeves from the truck before the equipment is positioned in the energized area. Also remove all equipment (shovel, tamp, sling) needed to set the pole, before positioning in the energized area. Remember when the pole or equipment is in the energized area, <u>no</u> crew member shall come in contact with the equipment and material without proper protective equipment.

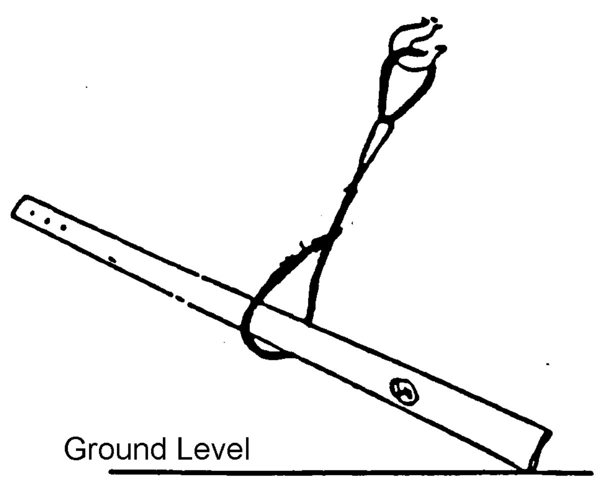
With your rubber gloves and sleeves, install sling around pole. Do this by slipping cable under the pole. Place the ball of one end of the sling through the eye of the other end of the sling.



Place the hook of cable into the open eye of the sling.



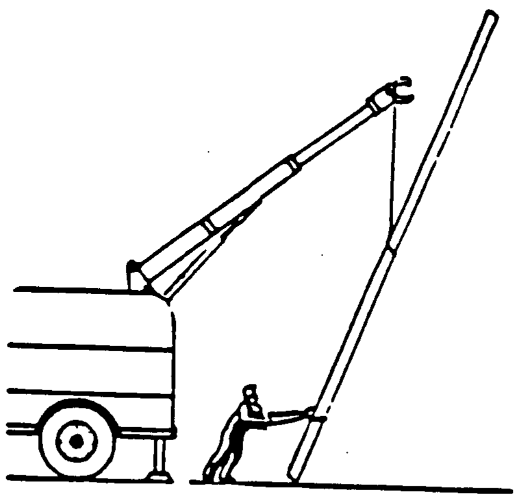
Lift the pole about two feet off the ground and check to see if the pole is butt heavy. If the pole is not butt heavy, reposition the sling by sliding toward the top of the pole. When positioning of the pole sling is complete, install pole hat and install pole plastics (required number will be according to the configuration of the existing construction).

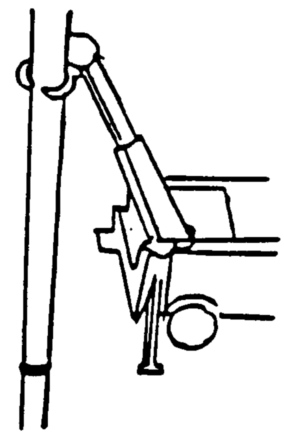


With your hard hat and glasses on, you are ready to begin setting the pole. As the winch line is lifted, insulate yourself from the pole using rubber gloves and/or non-conducting tool (see Safety Manual 9.45) while guiding the top of the pole between the conductors.

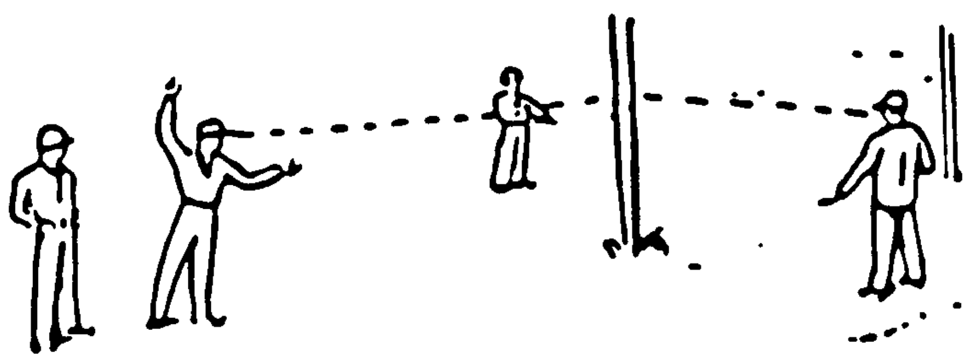
Caution: The wood handle of a cant hook is not an insulated tool. You will keep any part of your body away and off the pole when pole is near energized line.

Keep the butt of the pole, and any part of the truck (outrigger) from contacting the body. When the pole is perpendicular with the ground, guide the pole into the pole grabbers. Watch the conductors as the top of the pole is lifted through them. Push butt of pole over hole and guide the butt of pole into the hole. Be careful not to step in pole hole.





Visually align pole so the pole is straight in all directions. The lineman on the ground shall give directions for plumbing pole. Feathering controls for stinger and boom movement allows the pole to be aligned perfectly. When the pole is properly plumbed, hold it in position with the boom and winch line.



When the pole is straight, shovel dirt into the hole and use tamp to pack dirt around the pole. Before tamping pole, make sure the pole is free from touching energized conductor.

When you are through filling the hole and tamping the dirt, remove pole sling and return all tools to the truck.

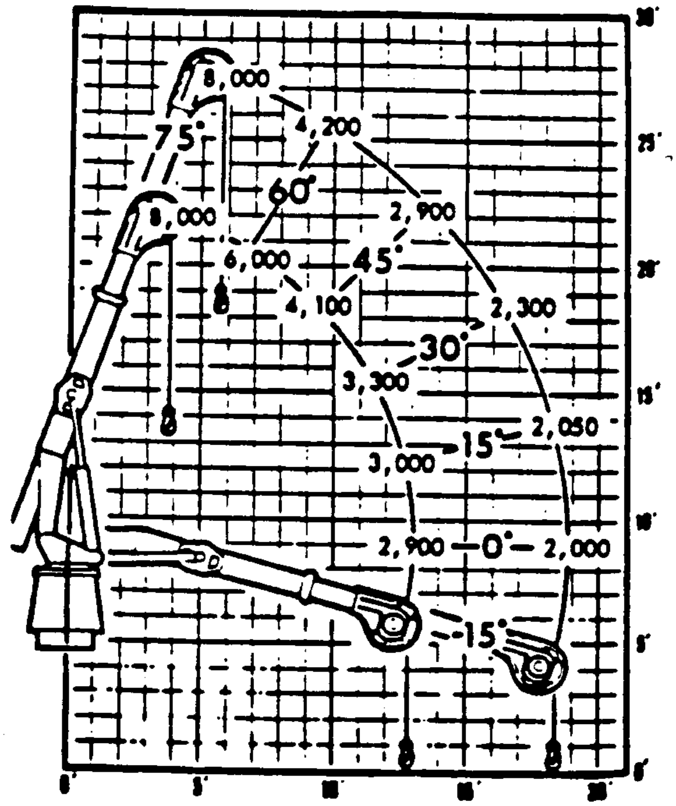
Remove Pole From Energized Area

You have just read the procedures for setting a pole in the energized area. The removal of a pole in the energized area is basically the reverse of the setting of the pole. The positioning of the line truck is the same; it may be necessary to position the truck closer to the pole. After the truck is in position, lower outriggers following the same procedures as in setting the pole.

After the truck is set up in the correct position, remove your rubber gloves, sleeves, and equipment from the line truck. The lineman will then cover the pole and all energized conductors necessary to remove the pole safely. Depending on the construction, it may be necessary to tag out the primary conductor to allow enough room to remove the pole. Tagging out conductors can be accomplished in many different ways. If it is necessary to tag out the conductors, you will be given instructions from the crew leader or lineman on the procedures to do this.

There are two recommended ways to remove a pole. The operator of the line truck should test the loads with the lift cylinders to determine if the load is within the capability of the truck. If the load can be lifted hydraulically within the stability rating of the truck, it can be safely handled.

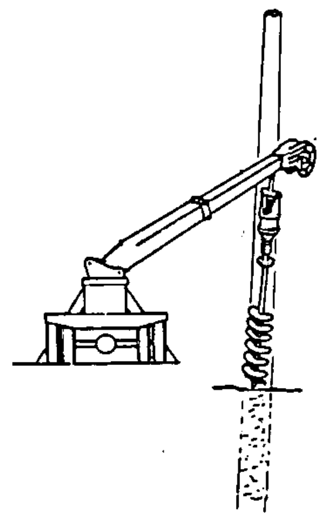
When consulting your derrick rating chart, you will notice that the derrick capacity increases at higher elevations and at shorter distances from the center line of rotations. If the lift cylinder will not lift the load, you know is it too heavy. **Do not attempt to lift load with the winch line**. Reposition the truck to attain a higher lifting elevation or shorter operating radius. So, if lift cylinders will lift load, winch cable can be used to raise the load out of the ground.



The second recommended way to remove a pole is to dig beside the pole to loosen dirt. Un-rack auger and position auger next to the pole to be removed.

Dig a hole deep enough to reach the bottom of the pole to be removed. After you have dug the hole, do not lift dirt from the hole; simply unscrew the auger in the manner that leaves the dirt in the hole.

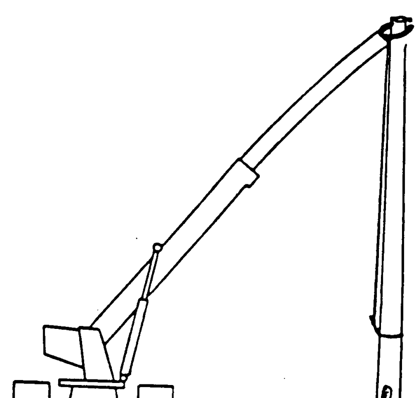
This operation will loosen the dirt enough to allow you to lift the pole with the cylinders. Once the pole can be lifted with the boom or lift cylinders, it is then permissible to use the winch cable to remove the pole. After dirt is loosened, rack auger.



DIG BESIDE OLD POLE

Now that you have prepared the pole to be removed, position the boom of the line truck above balance point. To obtain the proper height of the boom, it may be necessary to use the stinger of the truck. When using the stinger, try to keep stinger extended as short as possible as this will increase the lifting capacity of the truck.

Once the boom is in position, lower the winch cable. Close the pole grabbers around the old pole.



As a lineman assisting the operator in removing the pole, the placing of the sling around the pole is one of the most important parts of removing the pole. The placing of the sling will be determined by the size of the pole (length) and the location of the birth mark. The sling is placed around the pole and the ball of one end placed through the eye of the other end. Obtain the hook of the winch and hook the eye of the sling to the winch cable. With a switch stick or shovel, slide the sling the proper distance above the birth mark. To slide the sling, place the switch stick or shovel opposite the load line and push the sling upward.

As you push the sling up, the operator should pick up on the winch cable slowly, until the proper height is obtained. When the proper height is reached, hold down on the sling with the switch stick or shovel and the sling will tighten up around the pole.

The proper height is obtained when the sling is at the distance where the pole is out of the ground, the pole is hooked above balance, and the pole is known to be butt heavy. This allows the pole to hang from the winch cable. So the pole is hooked above the balance point in the same manner as when you are setting a pole. On the different size poles, the sling is hooked in the following way:

30' Wood pole approximately 2 feet above birth mark

35' Wood pole approximately 4 to 5 feet above birth mark

40' Wood pole approximately 6 to 7 feet above birth mark

45' Wood pole approximately 7 to 9 feet above birth mark

After the sling is properly placed around the pole, the lineman assisting will then put on his rubber gloves and sleeves. Using the lift cylinders to lift the pole, not the winch, the operator will start lifting the pole out of the ground. If you cannot dig around the pole due to underground utilities or obstructions, then a pole jack must be used. If the cylinder will not lift the pole, loosen the pole by digging more around the pole. Once the pole is lifted with the cylinders, the winch cable is then used. When the pole is almost out of the ground, the apprentice will grab the butt of the pole, being careful not to contact the pole with his body and also not get trapped between pole and another object.

After the pole is out of the ground, the lineman, with the pole still in the truck grabbers, will test the pole to see if it is butt heavy. This can be accomplished by pushing the butt in a fashion where the top of the pole will not be resting on the front of the grabbers. If this can be done with ease, the pole should be hooked above balance. Before telling the operator to open the grabbers, you need to know which way you want to guide the pole. To direct the pole, you must have good communications with the operator of the truck. Upon request of the man guiding the pole, the operator will open the pole grabbers. As the grabbers are opened, watch the pole and help the pole roll in the direction desired. Keep the pole from contacting body and do not come in contact with the truck. Guide the pole so the pole does not touch the primary conductors and guide the pole to the ground. As the pole gets closer to the ground, pull the butt of the pole in the direction needed to help the pole come down where the load line is kept in line with the sling. Once the pole has cleared the energized conductor, the operator can rotate the boom to help keep the winch cable in line with the pole being lowered.

After the pole is lowered to the ground, remove the sling from the pole. Backfill the hole, leaving a mound of dirt over the hole to allow for dirt settling. Clean the work area and load tools on the trucks, placing the tools in the proper locations.

CF5LT525/Covering Primary from Bucket Truck/CF5LT525/PDF

PERFORMANCE OBJECTIVE

TASK NO. LT-525

Rev. 6/04

TASK: COVERING PRIMARY FROM BUCKET TRUCK

GIVEN: Cover a 3 phase pole in-line, primary on x-arm, neutral below primary on spool bolt.

YOU WILL: Cover 3 phase primary and neutral using bucket truck.

HOW WELL: Take the necessary steps to cover 3 phase primary and neutral on pole following safe work practices.

PROCEDURE:

Step 1: Study attached sheets

Step 2: Take written test

Step 3: Sign up for practice (if needed)

Step 4: Sign up for competency test

Tools	Resources	Materials
Bucket truck	Attached sheets	none
Rubber Goods	Safety Manual	
Hard Cover	J.S.A.	
Hand line		
PPE		

JOB BRIEFING (TAILBOARD CONFERENCE)

Before starting any job or at any change in the job, the person in charge shall be identified, and the individuals involved shall participate in a conference type discussion explaining the method of accomplishing the job to ensure a complete understanding of the work to be performed. On tasks that pose significant hazards that are performed less than once per year, employees shall be re-trained or briefed on proper procedures prior to the task being performed.

NOTE: Employees **shall** be trained in and familiar with the safety related work practices, safety procedures and other safety requirements associated with the expected tasks prior to commencing work.

The job briefing **shall** be documented and include at least the following items:

- each person's own particular job responsibilities and the work to be performed by the other members of the crew,

- the hazards that may be encountered and how to eliminate or control them, (**Note**: Whenever asbestos is suspected contact Safety Section prior to disturbing.),
- if other crews are involved, who they are and how they will be involved,
- the method of notifying all crew members of changes in the job plan,
- emergency procedures to be followed,
- time to answer any questions at the end of the conference to assure complete understanding by all crew members,
- personal protective equipment requirements (PPE)
- The employee in charge is responsible for submitting all job briefings to the supervisor or appointed designee for proper filing and recordkeeping.

NOTE: If additional workers arrive at the site after the initial job briefing, the employee in charge is required to conduct a briefing with all employees to ensure the additional workers are abreast of the work site conditions and understand their role.

Note: An employee working alone shall plan the task as if a briefing were required.

PROTECTIVE EQUIPMENT

All rubber gloves, sleeves and cover ups shall be carefully inspected as required, properly used as needed, and properly stored and cared for. Insulating equipment shall be stored in such a location and in such a manner as to protect it from light, temperature extremes, excessive humidity, ozone, and other injurious substances and conditions.

Rubber gloves shall be carefully inspected, at least once at the first of each day that they are used on energized conductors.

Protectors furnished for use with rubber gloves shall be used only with rubber gloves and at no other time.

Appropriate personal protective equipment shall be used to protect against the hazards of the work activity. Prior to beginning work the person in charge and/or the employee shall consider the nature of the work and determine the protective equipment required.

Face/eye protection shall be worn when there is a danger from flying objects, chemicals, electric flash, or other eye hazards.

Hard hats shall be worn anytime employees are exposed to overhead hazards, falling or flying objects, or electrical shock and burns.

Rubber gloves <u>shall</u> be worn:

- When operating gang-operated air break switches from the ground even though the switch handles are grounded.
- When changing or moving ground wires or neutrals on energized equipment.
- *When setting/removing meter.
- *Rubber gloves shall be worn at all times while working within four feet of primary or within reach of secondary.

- *A rubber glove zone flag shall be attached to the pole four feet from the primary or within reach of secondary. Appropriate rubber gloves shall be worn anytime an employee is above this flag.
- *Sleeves are also required while covering or uncovering multiphase circuits at 12 KV or greater from an insulating device. On structures where the distance between phase is six feet or greater, sleeves are not required.

Personal rubber protective equipment shall be worn when climbing a pole supporting energized equipment that is known or suspected to be defective and shall be continued in use until all defective equipment has been located, properly controlled, isolated or repaired.

The worker may wear rubber gloves and sleeves anytime he/she considers them necessary for his/her personal safety.

Note: Other workers shall be off the pole or structure and clear of equipment prior to the switching being done.

Nominal voltage in kilovolts phase to phase	Distance			
	Phase to ground exposure		Phase to phase exposure	
	(ft-in)	(m)	(ft-in)	(m)
0.05 to 1.0	Avoid Contact	Avoid Contact	Avoid Contact	Avoid Contact
1.1 to 15.0	2-1	0.64	2-2	0.66
15.1 to 36.0	2-4	0.72	2-7	0.77
36.1 to 46.0	2-7	0.77	2-10	0.85
46.1 to 72.5	3-0	0.90	3-6	1.05
72.6 to 121	3-2	0.95	4-3	1.29
138 to 145	3-7	1.09	4-11	1.50
161 to 169	4-0	1.22	5-8	1.71
230 to 242	5-3	1.59	7-6	2.27
345 to 362	8-6	2.59	12-6	3.80
500 to 550	11-3	3.42	18-1	5.50
765 to 800	14-11	4.53	26-0	7.91

*Table R-6.

AC LIVE-LINE WORK MINIMUM APPROACH DISTANCE

Wearing Apparel

Employee shall wear Flame Resistant (FR) or a minimum of twelve (12) oz. 100% cotton clothing when working on ungrounded transmission or distribution circuits or equipment (277/480 volts and above), and when performing switching and other activities that may expose the employee to electric arcs or flames. In addition, employees falling under this regulation shall not wear a garment made of the following fabrics, or blends of these fabrics unless treated with FR treatment: Acetate, Nylon, Rayon, and Polyester. Employees should be familiar with local rules regarding clothing requirements.

Loose or flapping clothing shall not be worn where it can contact or catch on energized conductors, moving parts, equipment or other hazards.

Employees shall remove or make non-conductive all exposed conductive articles such as key or watch chains, rings, or wrist watches or bands, when working in reaching distance of exposed energized parts of equipment, or where there is a danger of these articles catching on the equipment.

Personal Conduct

Alertness and a business-like attitude are expected of all employees in their work. Employees shall conduct themselves in such a manner that they do not endanger the health and safety of themselves, other employees, or the public.

Horseplay, practical jokes, and other similar distractions shall be strictly prohibited.

No employee shall use alcoholic beverages or illegal drugs while on duty, nor report for duty while under the influence of these substances. Supervisors and employees are responsible for reporting observations of employee's performance or behavior which indicate that the employee may not be fit for duty.

Crews or individual employees shall not attempt to perform any work where a valid question exists concerning their ability to do the job safely.

Use of Rubber Goods And Cover Up

All live parts and conductors in the immediate work area, except that part of the conductor being worked, shall be covered with insulating cover up materials.

Before working on energized conductors where feasible all grounded objects in the immediate work area shall be covered, such as system neutrals, neutral brackets, overhead guys, down guys, pole grounds, etc.

Employees <u>shall</u> remove or make nonconductive all exposed conductive articles such as key, neck, or watch chains, rings, or wrist watches or bands, or ear rings when working in reaching distance of exposed energized parts of equipment, or where there is a danger of these articles catching on the equipment. All open leads and wire shall be grounded or covered with insulating protective equipment when it is necessary to work around or climb through them. (This includes open secondaries, open communication wires, fire alarm and pilot wires, etc.)

When covering primary conductors, linemen shall be positioned on an insulated platform or in an aerial basket, unless insulated handles are used to install cover up. Cover up equipment shall be installed from a safe position and, wherever possible, from a position below the conductor or apparatus to be covered. Cover the line nearest you and work away from yourself. In removing cover up materials, start first with the piece the farthest away and work toward yourself.

Where conditions exist which make hands-on work impractical for the application and removal of protective rubber goods, the work shall be done with hot sticks or de-energized.

CARE OF RUBBER GLOVES, SLEEVES, AND RUBBER GOODS

All rubber gloves, sleeves and cover ups shall be carefully inspected as required, properly used as needed, and properly stored and cared for. Insulating equipment shall be stored in such a location and in such a manner as to protect it from light, temperature extremes, excessive humidity, ozone, and other injurious substances and conditions.

Any protective equipment depended upon for electrical insulation shall be visually inspected before each use. Rubber gloves shall be carefully inspected, at least once at the first of each day that they are used on energized conductors.

Protectors furnished for use with rubber gloves shall be used only with rubber gloves and at no other time.

WORKING ON ENERGIZED LINES AND EQUIPMENT

Employees doing energized line work should devote their undivided attention to the work at hand. Unnecessary conversation should be avoided.

The automatic reclosing feature of the first upstream circuit interrupting device <u>**shall**</u> be made inoperative when performing conductor handling, on, near, or over energize lines in excess of 600 volts, if the design of the device so permits.

When working on energized primary circuits or equipment the individual worker shall work only one phase at a time and shall keep himself isolated and insulated from other potentials.

When two or more workers are working on energized primary circuits or equipment and are in reach of one another, only one electrical potential shall be worked at a time.

Conductor insulation shall not be relied upon for protection.

Employees working on energized wires shall, whenever possible, work from below the wires.

Workers performing energized primary (hands-on) work from the pole position shall use insulated platforms (hot boards) designated for the voltage involved.

If it is physically possible to contact energized primary line or equipment with the uninsulated portion of the unit; the unit shall be grounded, barricaded, and considered energized. Aerial lift units with insulated upper and lower booms that have been tested and rated for the voltage being worked, are exempt.

Barriers shall be used when working adjacent to energized conductors or equipment that cannot be adequately insulated with cover up materials.

When barriers are erected near energized equipment or conductors they shall be constructed of non-conductive materials.

A lightning arrester shall be energized/de-energized with a hot stick and should be considered hot at all times except when the line terminal is disconnected.

All disconnect barrels or blades shall be installed, closed, opened and removed with hot line sticks unless the circuit is dead and properly grounded.

All disconnect or fuse cutout switches, etc., shall be operated with approved hotline tools unless the circuit is dead and properly grounded.

Installing Insulated Cover From A Bucket Truck

There are several factors that must be considered before the work can be done.

1. Tailboard conference
2. Traffic control (work area protection)
3. Barricading
4. Setting up the bucket truck
5. Inspecting proper insulated cover up materials
6. Choosing the proper tools for the work to be done

Have several line hoses sent to you and place a hose on the neutral on either side of the neutral support. This is done by having both hands on the top of the hose, then placing the split side of the line hose onto the conductor and with a slight down motion, push the line hose out and onto the conductor. Care should be taken not to bounce the conductor while installing the line hoses. This could cause the conductors to slap together causing a fire. Once the line hoses are in place, slide them back up to the neutral support. Place a rubber blanket around the neutral support covering it completely by wrapping it around the ends of the line hoses, then place a clothes pin around the blanket and the line hose to hold it in place. Retrieve your handline and reposition your bucket up to the primary conductor closest to you. If you are covering phases on crossarm construction start on the phase closest to you from the outside. If you are covering vertical construction, then you would start at the bottom phase and work your way up. Again, place your handline in a workable area. Have the groundman send up four line hoses and a hood or blanket. Place two line hoses on either side of the primary insulator. You will notice that each line hose has different ends. One end is a female slot and the other is a male probe. These ends are designed to be locked together when pushed together. Once there are two line hoses on both sides of the primary insulator, slide them up to the insulator. Next, place a hood or blanket over the insulator. The hood is designed to couple onto the ends of the line hose to prevent them from sliding away from the hood. Once the outside phase (closest to you) has been covered properly, reposition your bucket to the middle phase. It is recommended that you approach this phase from underneath. Again, install the line hoses and hood or blanket in the same manner, which you did on the first phase. Now, do the same procedure to the field phase (furthest from you). If the neutral conductor is attached too high on the pole to allow your bucket to pass between it and the primary conductor, you will need to lower it. Before covering the neutral, simply remove the nut and washer holding the support to the pole and remove it from the pole. Cover the neutral as already described and gently lower it to a point out of your way. The neutral will sometimes just "float" a few feet down from its contact point. If you need more clearance then push it down the pole and tie it off to the pole using a tie rope. If it happens that the neutral "floats" too far down the pole, then simply tie it off where you want it.

When working on any one of the phases, remove just enough insulated cover to perform the work at hand. When that work is complete, then re-cover. After all work is complete remove the insulated cover, starting with the phase furthest from you and work your way out. Never leave your backside uncovered. While removing the line hoses, you could place them in your bucket to the side and remove them once you're on the ground.

OVER –UP OF DISTRIBUTION CIRCUITS

Job Safety Analysis

Step 1. PREPARE

A. Identify potential hazards (electrical; equipment; conductor clearances; climb or aerial equipment)
B. Determine type of cover necessary (hard cover per 2 man rule; class of cover, quantity required)

C. Determine necessary PPE

A. Inspect PPE and cover (verify test dates, condition, etc.)

Step 2. Perform Installation of Cover

A. Determine proper approach
B. Inspect facilities for soundness
C. Determine proper position (refer to Entergy Safety Manual, use of rubber goods and cover-up)
D. Install cover in proper order on ALL potentials in work area. (i.e. bottom to top / nearest to furthest)

Step 3. Inspect and verify proper coverage

CF5LT606/Open Neutral Burden Meter/CF5LT606/PDF

Performance Objective

Rev.12/02

TASK NO.

LT-606

TASK: CHECK FOR OPEN NEUTRAL

GIVEN: Voltmeter, Single Phase Meter Installation energized

YOU WILL: Check voltage phase-to-ground, phase-to-phase and check for an open neutral.

HOW WELL: Phase-to-ground and phase-to-phase voltage will be checked to determine if neutral is open.

PROCEDURE:

Step 1: Study Attached Sheets

Step 2: Take Written Test

Step 3: Sign up for Practice (if needed)

Step 4: Sign up for Competency Test

TOOLS	RESOURCES	MATERIALS
Voltmeter	Attached sheets	1 Ø Meter
Rubber gloves	Safety Manual	
Flash glasses		
Burden Meter		

METERING

7.07 All test equipment and test leads shall be inspected before using, to be sure that they are in safe working condition.

Meter Reading, Installation And Removal Of Meters

7.08 Installation and removal of electric meters and metering devices shall be performed by trained, authorized personnel using proper personal protective equipment and test equipment.

7.09 Do not strike or pound on the glass cover when installing meter. All broken glass shall be removed from meters prior to packaging and shipping.

7.10 Employees shall install and remove energized meters with an approved device (when appropriate) and wear safety glasses and/or face shield, and rubber gloves with protectors.

7.11 All metering devices must be properly grounded.

7.12 Meters operating under load are to be bypassed, if facilities are available, or the load reduced prior to removal or installation. *Never attempt to pick up or drop any load with a 277/480 volt, self-contained meter or with the meter by-pass switch.* (**Note**: Face shields are required, in addition to other equipment, when installing or removing 277/480 volt meters in energized circuits.)

7.13 Disconnect boots shall be installed on the load side of the meter blades, however, *boots should not be installed on 277/480 volt meter sockets equipped with a bypass switch*.

7.14 Prior to meter installation (other than meter change-out) voltage readings between source, load and ground, shall be made to prevent cross-phasing, back feed or phase-to-ground fault through the meter or meter socket.

7.15 If socket is to be left energized, employee shall install a meter, or approved socket cover on all energized sockets prior to leaving the work area.

CHECK FOR OPEN NEUTRAL

In this module, you will learn the procedures to check for an open neutral at a meter base on a single phase, 3 wire service using a voltmeter or a burden meter.

Before the actual voltage check is made at the meter base, there are several things that should first be checked. Look for the obvious. Start at the meter base going towards the electrical source.

The meter itself:

1. Is there any obvious damage?
   a. broken glass
   b. tampering
   c. loop pull away from way
2. Does the meter look O.K. or is it smoky or discolored?
   a. any foreign objects or glass particles visible through glass
   b. can you smell anything (burning) near the meter, Bakelite has a pungent odor when it's hot
   c. is the meter warm to the touch
   d. is the meter spinning too fast, for a load that might be present

Electrical source:

1. Loop wires
   a. are they the proper size for the main
   b. are the service connections good, properly squeezed and taped, do they show signs of heat (bad connection)
2. Service Cable
   a. insulation in good shape or is it flacking off possibly creating a short
   b. is it running through a tree, tree limbs can rub the service wires into, especially the bare neutral
   c. connections at the secondary, are they properly made, if there is aluminum and copper conductors is the aluminum over the copper?
3. Transformer
   a. secondary connections look good
   b. he secondary bushing lugs look good
   c. are all grounding points made up

Once you have made all these checks and any other, not finding any obvious problems, it's time to take a voltage check. With all your personal protective equipment on, cut the meter seal and remove the face cover of the meter panel. When doing this be very observant to the inside of the meter base, for not only electrical problem, but for bees, wasps or other creatures. Contact the customer that their lights will be on and off during your investigation. You are probably checking for "dim or blinking lights".

VOLTMETER

There are many different types of voltmeters being used throughout Entergy. Two of the more common ones are the Westinghouse, triple range with a mirrored scale and the Voltman, with a LCD voltage display. When using the Voltman, it automatically reads the voltage from 0 to 750 volts. A.C. This is the best feature with this instrument, there are no knobs or ranges to contend with. On the other hand, a voltmeter with separate ranges has to be operated in a different manner. You must always select the highest range when the voltage is unknown or in question. With the highest range selected check the voltage.

If the voltage is lower than the next lower scale remove the test probe (clip) from the voltage point and turn the selector knob to the next lower scale. Again, if the voltage is less than the next scale down, change the selector knob. You are looking for the most accurate reading. The three ranges on this type of voltmeter are: 0- 150V, 0- 300V and 0- 600V.

Step 1

Check voltage on the line side of meter phase-to-ground and phase-to-phase. What you are looking for is a significant difference in voltage, phase-to-ground.

Step 2

Make the same voltage checks as in Step 1, but on the load side. You are looking for the same voltage, they should be the same. If they aren't, try changing out the meter and recheck, this could be a meter problem.

Step 3

If the voltage is good, hook up two voltmeters (if possible), one to each hot leg and neutral on the line side. Ask the customer to turn on more load (A/C, micro-wave, washing machine, dryer, etc...). If there is a neutral problem your voltmeters will react in opposite directions. One leg will see a voltage drop, the other will show a voltage increase.

Step 4

Turn the customer's main off and remove the meter. Carefully inspect and tighten all bolted connections in the meter base. Also check the integrity of the ground wire and ground rod clamp. Install the meter, turn main on and have the customer put load on again. If voltage is good, the connections that you tightened where probably the problem. If the problem still exists check closer the electrical source that you've already looked over. One of the largest problems found is when one-bolt clamps have been used in the connection at either the pole or loop. If there are some installed, change them out with approved connections. If no problems are found from the load side connections back to the source, then the problem will be the customers. They will need to contact an electrician to investigate inside the building.

Note: A loose or open neutral is a "hide and go seek" game. Always remember to start at one

end of the total service and troubleshoot the service system to the other end.

BURDEN METER

When a customer is not available to put load onto the service, a burden meter can be used to put phantom load onto the system for the same checks. Burden meter are different between manufactures, but they do the basic operation, they produce resistance. Basically, it puts a heating coil across the phase being tested.