OPGW LIVE-LINE INSTALLATION METHODOLOGY

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OBJECTIVE

At the end of the session the participants should be able to identify the Special Equipment and the different methodology used in the OPGW Live-Line Installation.
COURSE OUTLINE

- Overview of OPGW Installation
- Optical Cable Type and Structure
- Advantages of Overhead Line versus Underground Cable
- Identification and Description of Special Equipment
- OPGW Live-Line Installation Methodology
OVERVIEW OF OPTICAL FIBER CABLE

INDEX TERMS

- Construction Works for Transmission Line
- Energized Line
- Ground Wires
- OPGW Cable
- OHGW Cables
- OPGW Installation in Alive-Lines
- Overhead Transmission Line
- All-Dielectric Self-Supporting (ADSS)
- Optical Phase Conductor Cables (OPCC)
OVERVIEW OF OPTICAL FIBER CABLE

INDEX TERMS

OPGW Stands For
- Optical Ground Wire
- Optical Fiber Composite Overhead Ground Wire
- Optical Power Ground Wire

OHGW Stands For
- Overhead Ground Wire for electrical applications
- Simply a Grounding Wire with no embedded fiber optic cable
OPTICAL CABLE TYPE AND STRUCTURE

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**OPGW STRUCTURE**

- A tubular structure with one or more optical fibers in it
- Surrounded by layers of steel and aluminum wire
- Fluid Filled (FF) Cable
OPTICAL CABLE TYPE AND STRUCTURE

TYPES OF OVERHEAD OPTICAL FIBER CABLES

- Self-supporting Fiber Optic Cable (ADSS)
  - a non-metallic cable which supports its own weight without the use of lashing wires or messenger
  - could be for all types of lines: electric lines, overhead distribution lines for railways, etc.
OPTICAL CABLE TYPE AND STRUCTURE

TYPES OF OVERHEAD OPTICAL FIBER CABLES

- Lashed Fiber Optic Cables
  - Optical cables lashed to the ground wire or the phase cable on the electric lines.
  - Ex. OPGW (usually installed on normal voltage and extra high voltage power lines)
OPTICAL CABLE TYPE AND STRUCTURE

TYPES OF OVERHEAD OPTICAL FIBER CABLES

- Optical Phase Conductor Cables (OPPC)
  - Composite optical phase cables used as an alternative telecommunications solution when there is no existing Optical Ground Wire in the high voltage electric lines
OPTICAL CABLE TYPE AND STRUCTURE

OVERHEAD LINE VS. UNDERGROUND CABLE

- Underground (Buried) Cable
  - The technology involves restrictions for land owners (legal disadvantage)
  - Irreversible ecological damage (ecological disadvantage)
**OPTICAL CABLE TYPE AND STRUCTURE**

**OVERHEAD LINE VS. UNDERGROUND CABLE**

- Impact of Underground (Buried) Cable
  - When burying cables, the soil must be exchanged
  - Cable routes need to be kept free from deeply rooted plants
  - Underground cables radiate heat which has an effect on soil humidity
  - The laying of underground cable also requires the construction of cable jointing structures every 500 to 700 meters
OPTICAL CABLE TYPE AND STRUCTURE

OVERHEAD LINE VS. UNDERGROUND CABLE

- Overhead Line
  - Overhead lines make up a large part of the interconnected system
  - Ensure low-loss transmission at 138 kV to 750 kV extra-high voltage thus guarantee reliable energy supply
IDENTIFICATION AND DESCRIPTION OF SPECIAL EQUIPMENT
OPGW Live-Line Installation Methodology

IDENTIFICATION AND DESCRIPTION OF SPECIAL EQUIPMENT

TRACTION MACHINE / MOBILE UNIT

This Mobile Unit is used to deliver guide rope suspended with existing Overhead Ground Wire (OHGW) by self-driven machine from one steel tower to the next steel tower/s using supporting roller system.

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This Recovery Machine used to recover the guide and pulling rope upon completion of installation of OPGW and retrieving the existing OHGW. It prevents of supporting rollers and tighten the guide rope to prevent touching with live conductor, it has a serving brake when the guide rope is being drawn back by the winch.

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This Supporting Roller is a two guide wheel block, set at 10 meters (applicable to 5/8” dia. Existing OHGW) or 15 meters (applicable to 3/8” dia. Existing OHGW) interval distance and attached to the 16mm (for 5/8” OHGW) or 12mm (for 3/8” OHGW) diameter guide rope. It is used to rotate the ground wire with new OPGW cable and can resist the influence of wind direction.
This Grounding Roller is a two guide wheel block. It is used to protect workers from induction. Install after every 150 meters interval distance supporting rollers or minimum of two (2) pcs Grounding Rollers per span whichever is applicable.
This Wire Stretching Roller is designed to smoothly guide and lessen friction during stringing works to prevent damage to the OPGW cable. This tool with 5 rollers can turn up to 90 deg and installed inside the steel tower.
This Earthing Roller is designed to protect worker from possible electric induction from the existing live high voltage cable.
IDENTIFICATION AND DESCRIPTION OF SPECIAL EQUIPMENT

SINGLE BLOCK ROLLER: 18 “ DIA.

This 18 inches single block roller is installed at corner runs of OPGQ to met the allowable bending radius of the OPGW.
GUIDE ROPE: 14MM DIA.

It is the guide rope that maintain the interval of two wheel roller by connecting to the center of the supporting roller.
PULLING ROPE: 16MM DIA.

Rope used to string OPGW & to remove existing Overhead Ground wire.
This Mid-Span and Dead End Stocking are used to strongly grasp and temporarily connecting OPGW to Pulling Rope and OPGW to OPGW to avoid damaged to the cable. Gripping power is increased as much as the tension applied is increased. It has 3,000.00 kgs. Working load.
This Swivel prevents the OPGW from loosing and twisting. Hence, it prevents the OPGW and pulling rope from being tangled. It has 3,000.00 kgs working load and weighs 1.50 kgs.
TENSIONER

IDENTIFICATION AND DESCRIPTION OF SPECIAL EQUIPMENT

This Tensioner.

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PULLER

This Puller

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LIVE-LINE STRINGING METHODOLOGY

This technology enhances the Installation of OPGW cable on existing Transmission Line while maintaining power supply on the existing transmission line or what we call “OPGW LIVE-LINE INSTALLATION”.

This method requires Special Equipment and proper safety measures.
LIVE-LINE INSTALLATION METHODOLOGY

THE GENERAL METHOD OF INSTALLATION

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LIVE-LINE INSTALLATION METHODOLOGY

WHY LIVE-LINE INSTALLATION?

Advantages:

- No Outage Required - 100% Full Live Line, Both Circuit Live
- Live Line Work Capability - 66KV - 500 KV
- Excellent Work Performance - 1 Drum (3-5 km) / 2 Days
- Protection of OPGW - Low Tension (70-100kgf) No twisting
- Safety Procedure - Low Tension (70-100 kgf)
- Easy Access - No Big machine Required

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LIVE-LINE INSTALLATION METHODOLOGY

Cradle Block Method

Courtesy From TE

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**Cradle Block Method**

- Limited to stringing a single span at a time
  - 250-500m
- Requires multiple stages to complete one section of stringing
  - Extra labour
  - More time (slow turn around)
- Extra equipment required
  - Pulling rope
  - Guide rope
  - Cradle blocks (15-25 blocks per span)

Courtesy From TE

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- Use old earthwire as pulling cable
- Set up stringing blocks
- Attach OPGW to earthwire at tensioner end
- Pull new OPGW through stringing blocks with P40-1H/1V Puller

Courtesy From TE

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LIVE-LINE INSTALLATION METHODOLOGY

Advantages

- Use earthwire as pulling line
- Pull 10x greater distance in a single pull
  - 5000m versus 500m
- Eliminate the need for the pulling line
- Reduced set-up time and pull time
- Faster project turnaround
LIVE-LINE INSTALLATION METHODOLOGY

- Tension stringing method

- The installation of OPGW using tension stringing method on live power transmission lines is about unrolling the OPGW wire using puller and tensioner (see Figure 1).

- These devices shall have possibility to regulate tension on the wire and pulling speed during wire installation. Furthermore these devices shall have hydraulic brake, which automatically stops the puller and tensioner when tension set point is exceeded or when the wire is broken. Controlling the tension on the wire and pulling speed, it is possible to keep the stringing force at the same level and to keep safe electrical distance between ground wires and phase wires.

- During OPGW wires installation on live power transmission lines, an isolating rope are used because of their light weight. On each tower of the tension section the pulley blocks are mounted, on which ground wire is lied. The ground wire, which is being replaced is used as messenger line for the OPGW wire. In this case it
Note 1: It should be verified or checked if the existing line ground wire is in good condition, if there are no damages to the wire and that this wire will endure stringing force applied during replacement execution.

Isolating rope is pulled out from the last tower on the tension section to the puller and lied onto the pulley block at the tower where it is jointed to the existing ground wire with cable stocking. From the other side of the tension section OPGW wire is clamped to the existing ground wire with anti-twisting device and lied onto the pulley block.

This makes possible simultaneously remove existing ground wire and install OPGW. Once the OPGW is on place, there is sagging procedure performed on the whole tension section. Next step is to clamp the OPGW wire at the tower using special equipment made for this purpose. To ensure high level of safety during project installation, especially in sections crossing important objects as routes or other power transmission lines the cradle block stringing method is used. This method is based on the installation of pulleys (cradle blocks), which are positioned on the existing ground wire every several meters. The pulleys used are usually vertical double pulleys or single pulley blocks. Vertical double pulleys are having 2 disks, each in separate chamber and sides, which may be opened. The upper disk of the double pulley is lied onto the existing ground wire, whereas lower disk is supporting pulling rope [1]. Pulleys are used for OPGW installation on the whole tension section but especially this method is used to secure important spans where above described tension stringing method is used as well as ground wire replacement in one span.
LIVE-LINE INSTALLATION METHODOLOGY

WHY LIVE-LINE INSTALLATION?

- Although the installation of OPGW (Optical Ground Wire) in existing transmission line has often been carried out by power transmission companies worldwide, power system operators has been imposing restrictions to the planned outages of the transmission lines. Because of this, the Power Transmission Companies have opted for the OPGW stringing with energized transmission lines. A quite safe and productive methodology called “Carrier” was adopted.

- The method consists in using a self-propelled carrier that slides on existing grounding wire, while pulling an aramid rope and positioning several double pulleys. The OPGW gets strung by pulleys and then replaces the existing ground wire. This paper describes the experience of several OPGW stringing, including methodology and tools used, advantages and main results achieved. Additionally, it shows how team training was conducted and security measures undertaken.
LIVE-LINE INSTALLATION METHODOLOGY

WHY LIVE-LINE INSTALLATION?

- The stringing of OPGW (Optical Ground Wire) in existing overhead transmission lines (OHTL) have been often used in many power transmission companies worldwide. In the conventional method, the replacement of an existing ground wire by OPGW required planned outage of the transmission line. However, the electric system operator imposes a series of restrictions to disconnect the transmission lines. For that reason, transmission companies have opted for OPGW installation in energized transmission lines. In order to avoid disconnecting lines while meeting the transmission companies’ needed to replace the existing ground wire by the OPGW, a very safe and productive energized line methodology called “Carrier Method” has been applying.
THANK YOU!!!