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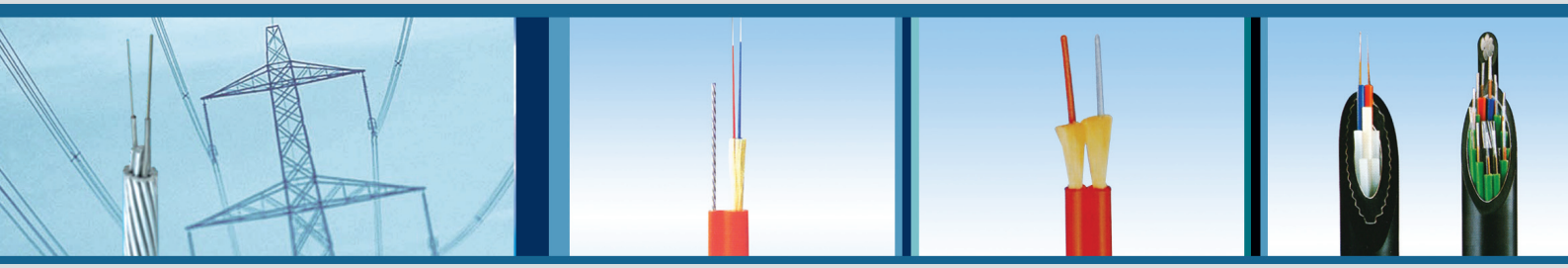
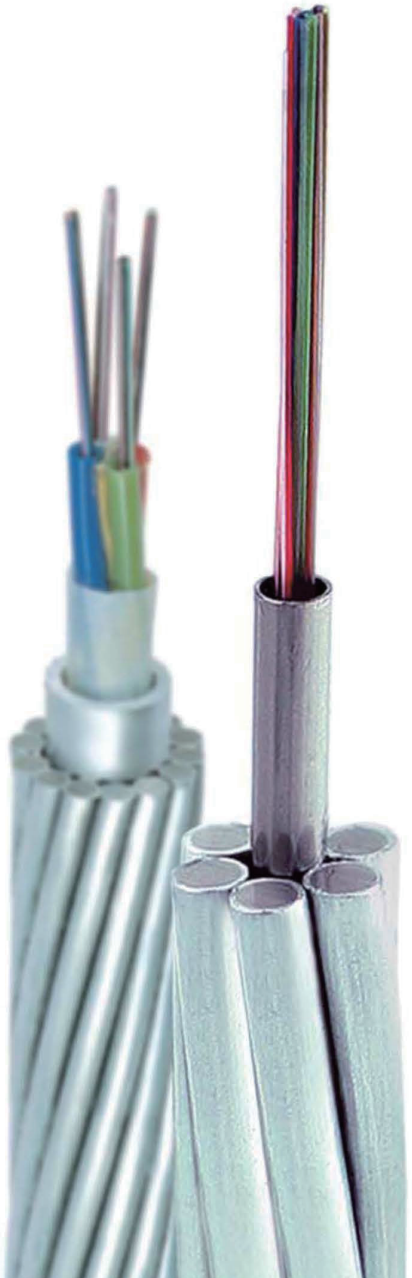
A Guide of ITECO Cable





OPGW System

Compact High-Corrosion
Resistant Optical Ground Wire

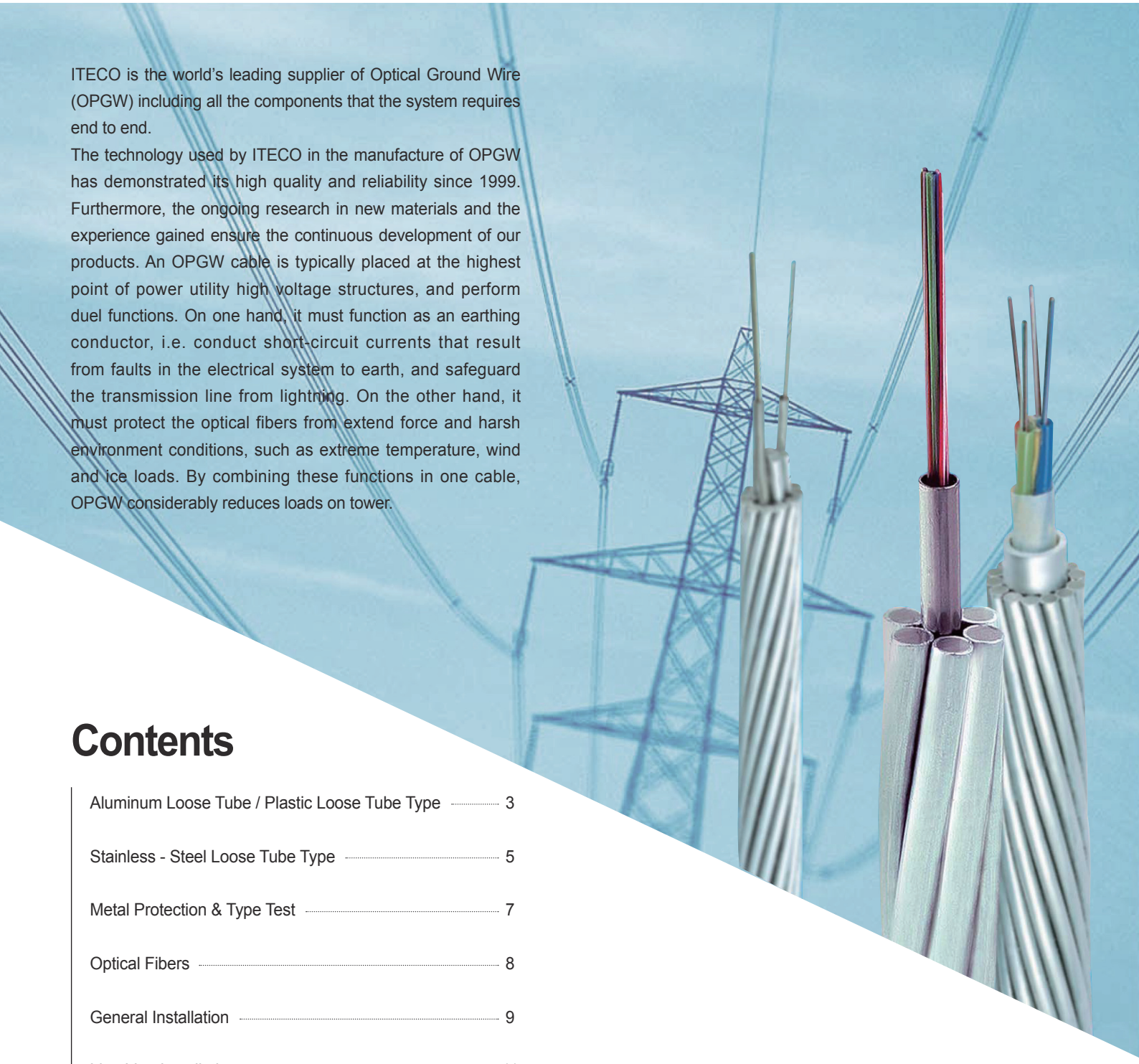
ITECO LTD

ITECO OPGW System

Compact High-Corrosion Resistant Optical Ground Wire

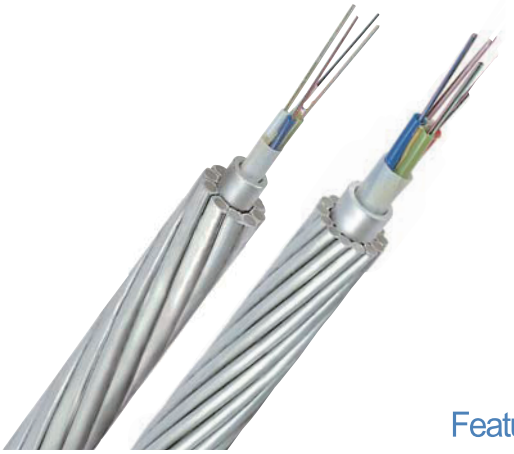
ITECO is the world's leading supplier of Optical Ground Wire (OPGW) including all the components that the system requires end to end.

The technology used by ITECO in the manufacture of OPGW has demonstrated its high quality and reliability since 1999. Furthermore, the ongoing research in new materials and the experience gained ensure the continuous development of our products. An OPGW cable is typically placed at the highest point of power utility high voltage structures, and perform duel functions. On one hand, it must function as an earthing conductor, i.e. conduct short-circuit currents that result from faults in the electrical system to earth, and safeguard the transmission line from lightning. On the other hand, it must protect the optical fibers from extend force and harsh environment conditions, such as extreme temperature, wind and ice loads. By combining these functions in one cable, OPGW considerably reduces loads on tower.



Contents

Aluminum Loose Tube / Plastic Loose Tube Type



Features & Benefits

- Our high quality standards for designing, testing and manufacturing with the highest grade materials available to ensure long-term reliability.
- Maximum fiber counts up to 72 fibers with minimized cable diameter due to variable designs.
- Superior optical performance over a broad temperature range from -40℃ to +85℃.
- Engineering support, supervising and providing its own line of accessory hardware.
- Excellent tensile performance under cable elongation and contraction due to extreme tension and variation of temperature.
- Moisture-proof jelly filled core for superior protection to the optical fibers due to hydrogen generation in metal structure.
- Continuous and seamless tube for superior protection to the optical fibers from moisture and extreme environmental conditions such as lateral force.

The Main Design Parameters

- **Mechanical**
  - Minimum Breaking Load
  - Maximum Permissible Weight & Diameter
  - Minimum Modulus of Elasticity & Maximum Coefficient of Linear Expansion
- **Electrical**
  - Minimum Short-Circuit Capacity & Lightning Resistance
  - Minimum Ohmic Resistance
- **Optical**
  - The Number &Type of Optical Fibers
  - Transmission Capacity & Distance

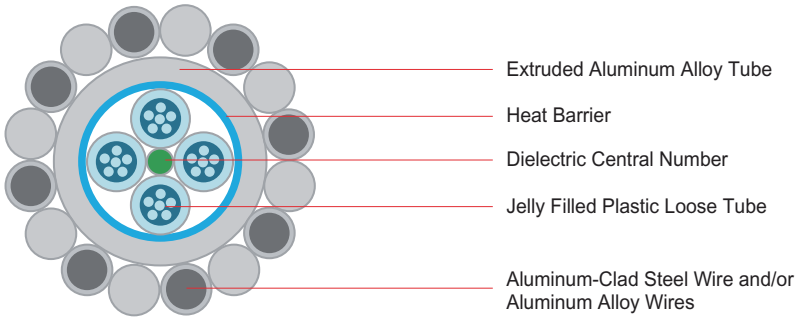
Aluminum Loose Tube / Plastic Loose Tube Type

Applicable Standards

- **Optical Fiber**
  - ITU-T G.650 / ITU-T G.652
  - ITU-T G.653 / ITU-T G.655
  - IEC 60793
- **Aluminum-Clad Steel Wire**
  - IEC 61232 / ASTM B 415
- **Aluminum Alloy Wire**
  - IEC 60104 / ASTM B 398
- **Complete OPGW**
  - IEC 61089 / IEC 60794
  - IEC 60794-4
  - ASTM B 416 / IEEE 1138

Construction

Optical core is composed of a dielectric central strength member, optical fibers are protected in a copolymer loose buffer tube jelly filling and subjection tapes. The optical unit is covered by an extruded aluminum alloy tube. And it is protected by a aluminum-clad steel wires and/or aluminum alloy wires.



- Number of Fibers : 6 to 72 Nos.
- Overall Diameter : 12 mm ~ 23.9 mm
- Standard Weight : 550 kg/km ~ 1400 kg/km
- Nominal Breaking Strength : 4,500 kgf ~ 19,530 kgf
- Short Circuit Current Capacity : 50 kA^2.sec ~ 640 kA^2.sec
- Maximum Allowable Temperature : 180℃
- The values indicated above are provided as an example. Other requirements subject to assessment.

Stainless - Steel Loose Tube Type

Features & Benefits

- Our high quality standards for designing, testing and manufacturing with the highest grade materials available to ensure long-term reliability.
- Maximum fiber counts up to 288 fibers with minimized cable diameter due to variable designs.
- Superior optical performance over a broad temperature range from -40℃ to +85℃.
- Engineering support, supervising and providing its own line of accessory hardware.
- Compact design light weight & small out diameter for low wind and ice loading, reducing the need for tower reinforcement and additional costs.
- High crush resistance due to the metallic tube design.
- Sealed tube for superior protection to the optical fibers from moisture and extreme environmental conditions such as lightning.
- Simple installation with the same method as conventional ground wire.

The Main Design Parameters

- **Mechanical**
  - Minimum Breaking Load
  - Maximum Permissible Weight & Diameter
  - Minimum Modulus of Elasticity & Maximum Coefficient of Linear Expansion
- **Electrical**
  - Minimum Short-Circuit Capacity & Lightning Resistance
  - Minimum Ohmic Resistance
- **Optical**
  - The Number & Type of Optical Fibers
  - Transmission Capacity & Distance

Stainless - Steel Loose Tube Type

Applicable Standards

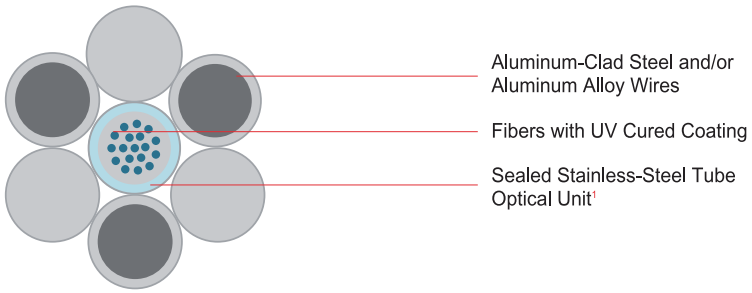
- **Optical Fiber**
  - ITU-T G.650 / ITU-T G.652
  - ITU-T G.653 / ITU-T G.655
  - IEC 60793
- **Aluminum-Clad Steel Wire**
  - IEC 61232 / ASTM B 415
- **Aluminum Alloy Wire**
  - IEC 60104 / ASTM B 398
- **Complete OPGW**
  - IEC 61089 / IEC 60794
  - IEC 60794-4
  - ASTM B 416 / IEEE 1138

Construction

The optical fibers loosely places in a hermetically sealed stainless-steel loose tube.

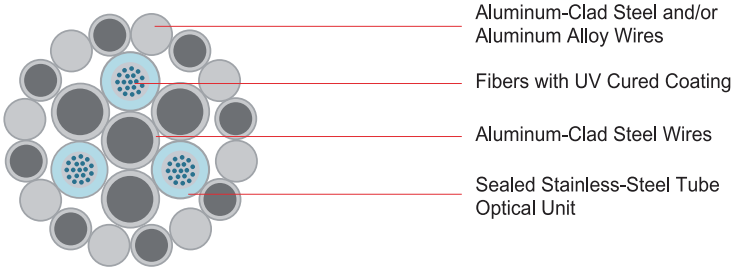
- **Central Construction Type**

  Aluminum-clad steel wires are stranded together around the central stainless-steel tube.



- **Layer Construction Type**

  One or more stainless-steel tube shall be stranded together with aluminum clad steel and/or aluminum alloy wires.

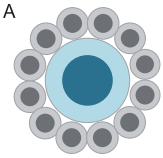
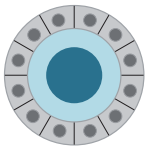
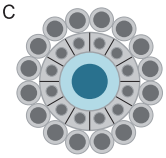
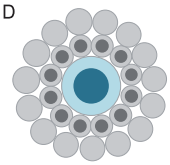


- Number of Fibers : 6 to 288 Nos.
- Overall Diameter : 9 mm ~ 20 mm
- Standard Weight : 300 kg/km ~ 1,000 kg/km
- Nominal Breaking Strength : 4,000 kgf ~ 8,550 kgf
- Short Circuit Current Capacity : 25 kA^2.sec ~ 210 kA^2.sec
- Maximum Allowable Temperature : 180℃
- The values indicated above are provided as an example. Other requirements subject to assessment.

[1] Note : Aluminum covered stainless-steel tube optical unit available to improve corrosion properties.

Metal Protection & Type Test

Metal Protection

Conductor Type	Sectional Area (mm^2)	Conductor (Individual)			Remark
		Type	Conductivity (%)	Tensile Strength (kg/mm^2)	
Type A 	50 ~ 120	Round AW and/or Al-Alloy	14 ~ 40	70 ~ 160	Standard
Type B 	50 ~ 120	Smooth Body AW	30 ~ 40	70 ~ 90	Reduced Diameter
Type C 	170 ~ 290	First Layer : Smooth Body AW Second Layer : Round AW	14 ~ 40	70 ~ 160	Reduced Diameter Large Cross-Section
Type D 	170 ~ 290	First Layer : Round AW Second Layer : Al-Alloy	AW : 14 ~ 40 Al-Alloy : 52.5	AW : 70 ~ 160 Al-Alloy : 33.15	Large Cross-Section

Type Test

The type test according to the latest IEEE 1138 and IEC 60794-4 was successfully completed.

Cable Test Type	Applicable Standard
Water Ingress Test	IEEE 1138 / IEC 60794-4
Seepage of Flooding Compound	IEEE 1138 / IEC 60794-4
Short Circuit Test	IEEE 1138 / IEC 60794-4
Aeolian Vibration Test	IEEE 1138 / IEC 60794-4
Galloping Test	IEEE 1138 / IEC 60794-4
Sheave Test	IEEE 1138 / IEC 60794-4
Crush Test	IEEE 1138 / IEC 60794-4
Impact Test	IEEE 1138 / IEC 60794-4
Creep Test	IEEE 1138 / IEC 60794-4
Fiber Strain Test	IEEE 1138 / IEC 60794-4
Strain Margin Test	IEEE 1138 / IEC 60794-4
Stress Strain Test	IEEE 1138 / IEC 60794-4
Cable Cut-Off Wavelength	IEEE 1138 / IEC 60794-4
Temperature Cycle Test	IEEE 1138 / IEC 60794-4
Cable Self Damping	EIA / TIA-455-16A / IEC 60794-4
Lightning Test	IEEE Std 4 / IEC 60794-4

Optical Fibers

The optical fibers are used primarily in telecommunication networks characterized by long distance links and high capacity. The optical fibers in cable are designed and manufactured to provide optimum transmission services.

Dual Window Single Mode Fiber (ITU-T G.652)

- **Application**
  - General application fiber suitable for most uses
- **Attenuation**
  - Attenuation Coefficient at 1310 nm : 0.35~0.40 dB/km
  - Attenuation Coefficient at 1550 nm : 0.21~0.30 dB/km
- **Dispersion**
  - Dispersion Coefficient at 1310 nm : 3.5 ps/nm.km, Maximum
  - Dispersion Coefficient at 1550 nm : 18 ps/nm.km, Maximum

Dispersion Shifted Single Mode Fiber (ITU-T G.653)

- **Application**
  - Fiber optimized for transmission in the third window (1550 nm wavelength), recommended in very high speed and long distance applications
- **Attenuation**
  - Attenuation Coefficient at 1550 nm : 0.23 dB/km, Maximum
- **Dispersion**
  - Dispersion Coefficient at 1550 nm : 3.5 ps/nm.km, Maximum

Non-Zero Dispersion Shifted Single Mode Fiber (ITU-T G.655)

- **Application**
  - Fiber designed for DWDM applications. It is characterized by very low dispersion at 1550 nm and a high effective area, which prevents the non-linear effects of high speed in this type of transmission, offering improved service in comparison to the previous fibers.
- **Attenuation**
  - Attenuation Coefficient at 1550 nm : 0.22~0.25 dB/km
  - Attenuation Coefficient at 1625 nm : 0.25 dB/km, Maximum
- **Dispersion**
  - Dispersion Coefficient at 1535~1565 nm : 0.1 to 6.0 ps/nm.km or 1.0 to 10.0 ps/nm.km
  - Dispersion Coefficient at 1565~1625 nm : 4.5 to 11.2 ps/nm.km
- Above values indicated are provided as an example. Other requirements subject to assessment.

General Installation

Complete Fiber Optic Solution

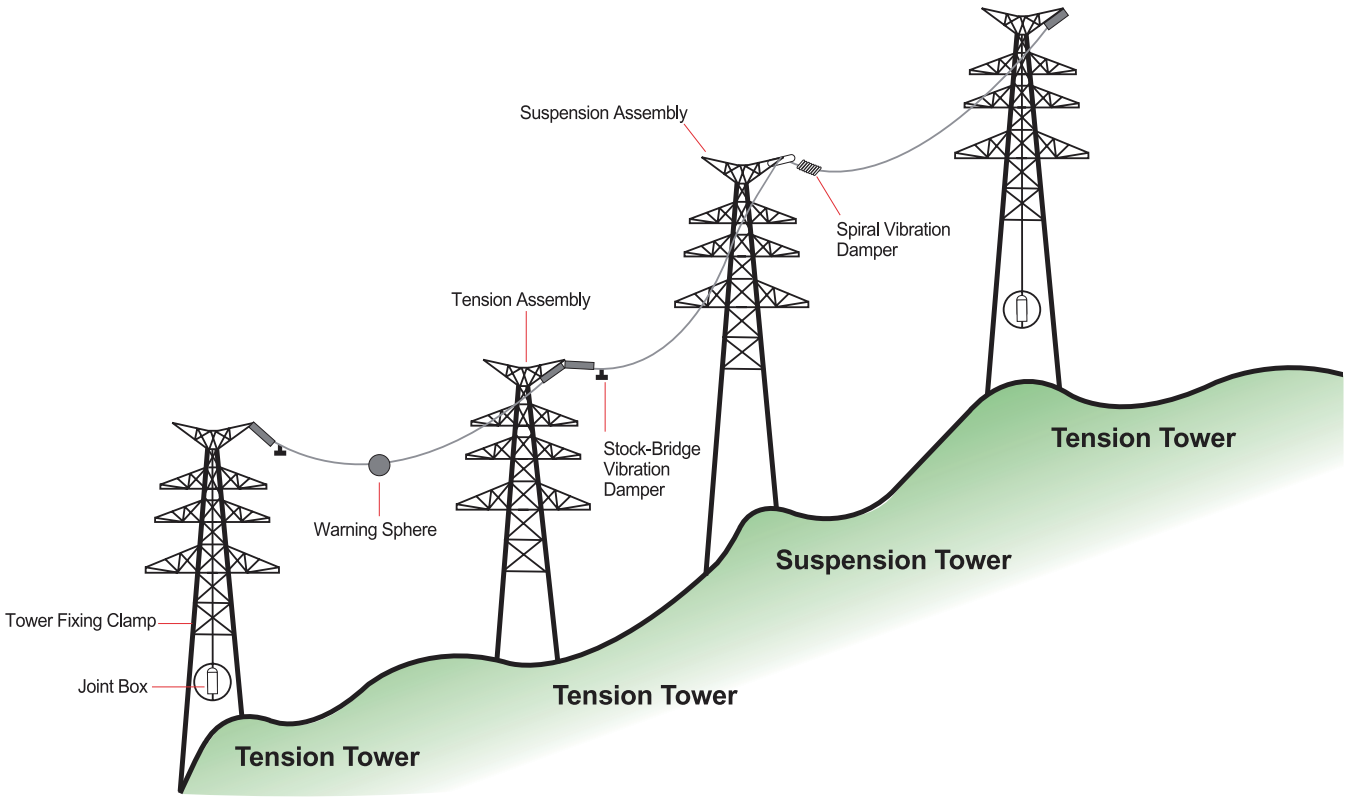
We supply a complete fiber optic solution. ITECO Cable is ready to provide whatever assistance you require to install and integrate fiber technology into your aerial cable system.

Engineering & Installation Service

- Pre-Installation Planning
- Complete Turn-Key Installation
- Training / Commissioning
- Sag and Tension Calculations

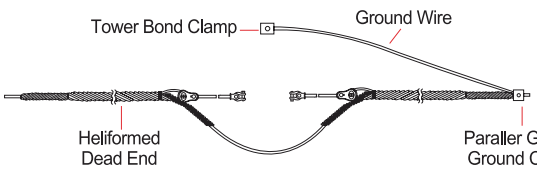
Hardware & Accessories

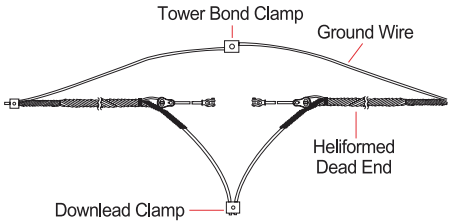
All Hardware & Accessories necessary for installation.



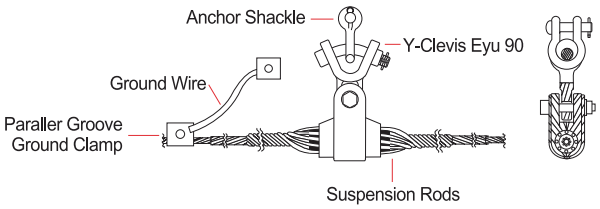
General Installation

Tension Assembly Set



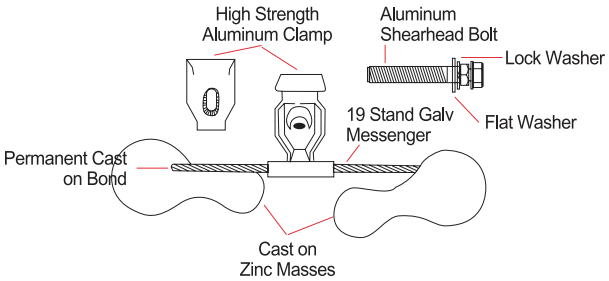


Suspension Assembly Set

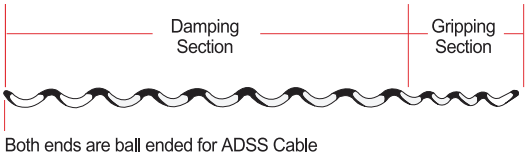


Vibration Damper

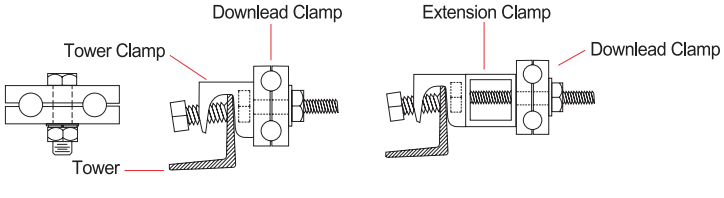
- Stock-Bridge Type



- Spiral Type



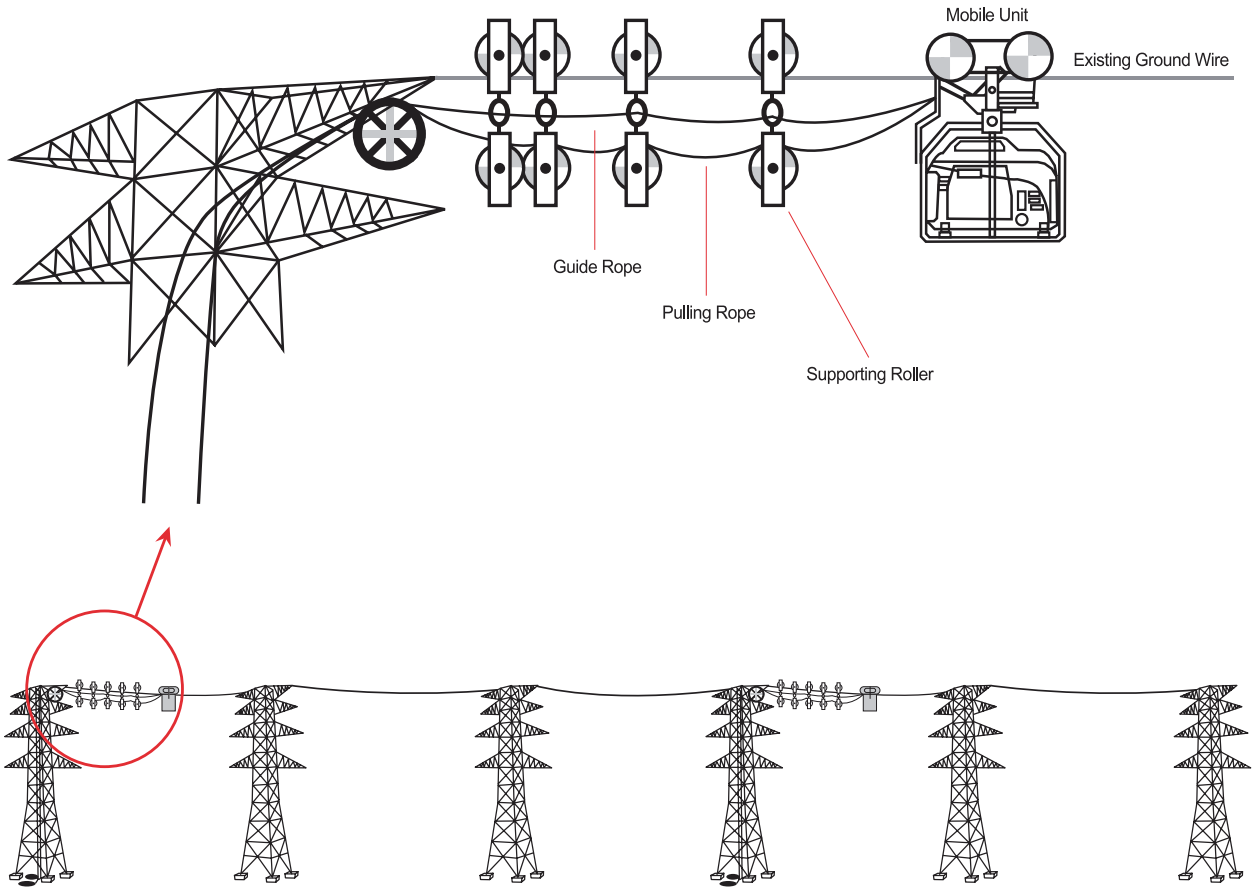
Tower Fixing & Earthing



Live-Line Installation

Features

- Preparation
- Analysis of Safety
- Attaching & Developing Supporting Roller
- Stringing & Turning-Over
- Recovering Existing Ground Wire
- Recovering & Supporting Roller & Rope
- Splicing & Testing



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