

OVERHEAD LINE SOLUTIONS



OVERHEAD LINE SOLUTIONS BY GENERAL CABLE EUROPE & MED

General Cable is a world leader in cable manufacturing, with 57 modern production facilities in 26 countries, employing more than 13,000 people worldwide. In Europe, General Cable covers all markets for overhead lines, from bare overhead transmission lines to optical cable solutions, and the corresponding accessories. The main production centers for overhead line solutions of General Cable Europe & Med are located at ECN in Vitoria, Spain and at Norddeutsche Seekabelwerke GmbH (NSW), Nordenham, Germany.

Founded in 1959 after the strategic merger between Echevarría Hermanos and Cablerías del Norte (Cablenor), ECN has been part of General Cable since 2006.

Provided with continuous-casting furnaces, it is one of Europe's largest manufacturers of medium, high and extra high-voltage bare conductors and optical ground wires (OPGWs). ECN is a pioneer in the introduction of ACSS (Aluminum Conductor Steel Supported) high-ampacity conductors in Europe and a promoter of the new European standard (EN 50540) for those, complementing its offer with fittings, accessories and training for installers. ECN is certified by bodies such as AENOR, LCIE, IMQ and LAPEM.

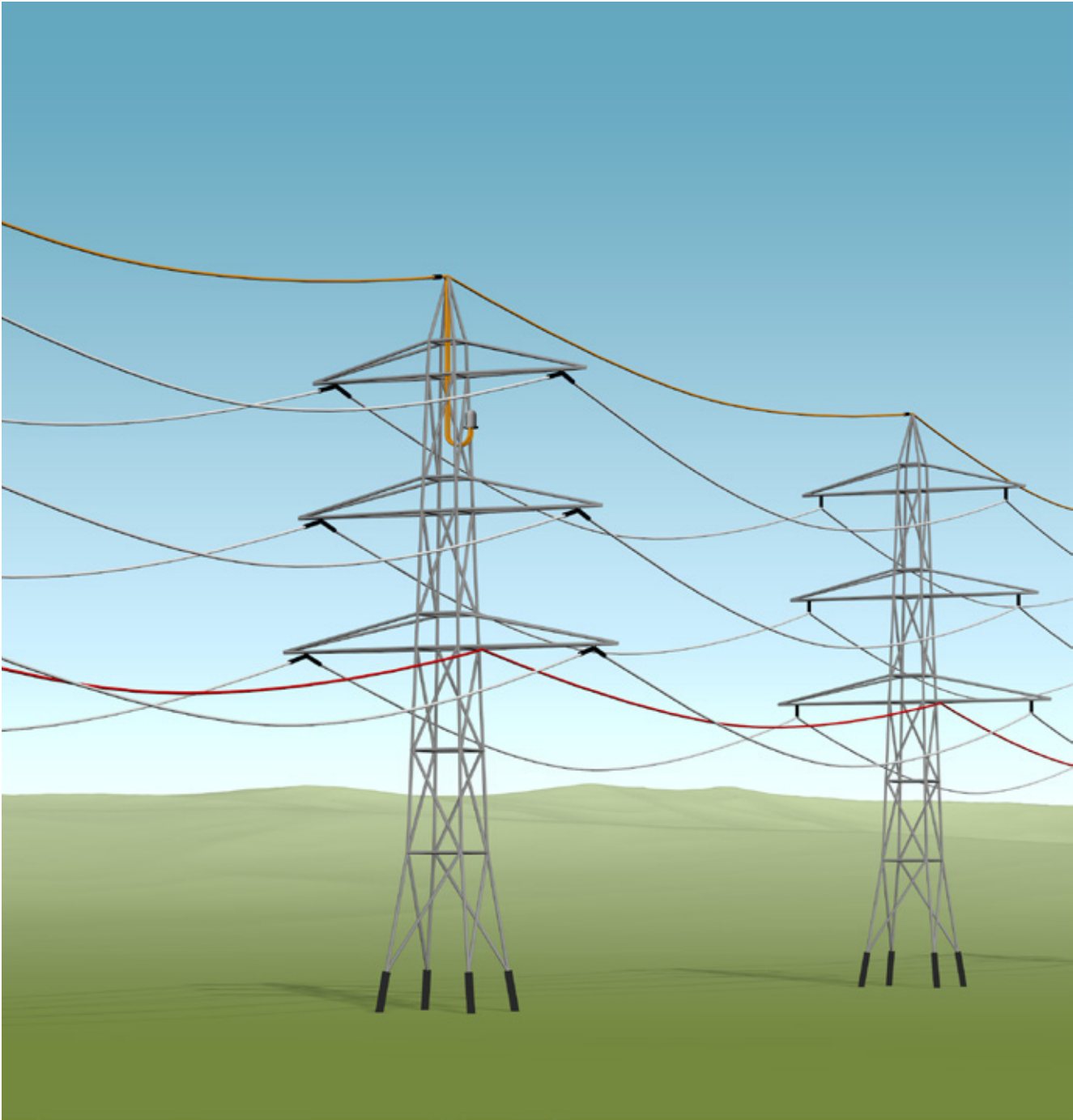
Norddeutsche Seekabelwerke GmbH, a wholly-owned subsidiary of General Cable since 2007, has been one of the world's leading companies in the field of

submarine telecommunication cables for over 111 years. Founded in 1899, NSW installed its first significant submarine telecommunication cable of approximately 7,993 kilometers in 1904. In the field of overhead cable solutions, NSW is one of the leading suppliers of Optical Ground Wires (OPGWs) for terrestrial backbone telecommunications lines. In addition, the company offers Optical Phase Conductors (OPPCs), Metal-Armored Self-Supporting Cable (MASS) as well as high-end accessories. NSW maintains an integrated management system following ISO 9001 and 14001 as well as OHSAS 18001.



PRODUCT OVERVIEW

General Cable offers the complete range of cables for overhead lines.



Ground Wires
Optical Ground Wires (OPGW)
Conventional Ground Wires

Conductors
Bare Conductors
Optical Phase Conductor (OPPC)

Metal-Armored Self-Supporting Cables (MASS)

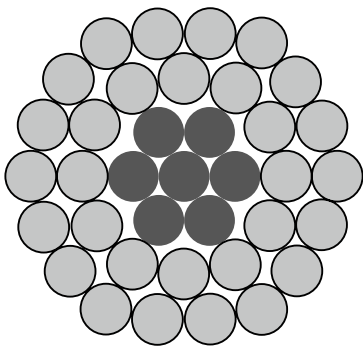
OVERHEAD LINE CONDUCTORS

ECN ACSS High Ampacity Conductors

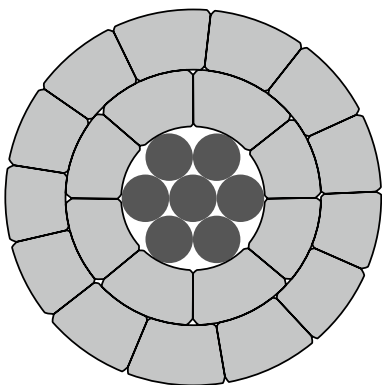
ACSS – ACSS/TW – ACSS/AW

Aluminum Conductor Steel Supported

ACSS is a HTLS (high-ampacity low sag) conductor, capable of operating continuously at 200 °C and above, without any risk for the mechanical properties.



ACSS
1.65 – 1.85 × ACSR



ACSS/TW
1.9 – 2.2 × ACSR
· Same area → 10% Reduction in diameter
· Same diameter → 20 – 25% increase Al content

Standards

EN 50540
ASTM B856 (round wires)
ASTM B857 (trapezoidal wires)

Design

- ACSSs are constructed by fully annealed aluminum wires stranded around a steel or ACS core.
- The steel wires of the core can be galvanized, 95Zn5Al composite metal or aluminum-clad steel (ACSS/AW), depending on the protective corrosion coating involved.
- Several strength grades (HS, EHS or UHS) are possible for steel wires depending on the required conductor RTS.

Characteristics

- Annealed aluminum wires have an improved conductivity of 63% IACS.
- Final sag is not affected by long-term creep.
- In final conditions, all the mechanical responsibility lies with the steel core. Thus sag is only affected by the Thermal Expansion Coefficient and Final Modulus of Elasticity of the steel core.
- Higher capacity of absorption of aeolian vibrations (improved self-damping behavior).
- ACSS/TW designs permit a reduction of the outer diameter for the same equivalent area. Forces transmitted efforts to the existing structures due to wind and/or ice loads will be correspondingly lower.

Applications

- Reconductoring/uprating applications by using existing corridors where there are difficulties in obtaining rights of way for the construction of new lines.
- Energy evacuation from wind or solar farms by using existing corridors.
- Facing temporary overloads and peaks of demand, avoiding bottlenecks and blackouts: system reliability.
- For designing of new lines saving in supports due to the lower sags and transmitted efforts.
- In interconnection priority projects where during some periods a considerable current carrying capacity is required.
- ACSSs in new lines provide reserve capability for future expected growth of the demand.

The ECN offer can include, under request:

- Conductors
- Accessories
- On-site technical assistance
- Training

References

- More than 30 years in service.
- Pioneers in installation for major TSOs in countries such as France, Greece, Germany, Italia, Romania, Poland and Spain.

ECN Conventional Bare Conductors

ECN produces a large variety of bare conductors, suited for numerous overhead applications.

Name of Conductor	Description	Standards	Application
AAC	All Aluminum Conductors 7, 19, 37, 61 and 91 wires.	EN 50182 IEC 61089 ASTM B231	HV S/S busbars LV Distribution lines
AAAC	All Aluminum Alloy Conductors 7, 19, 37, 61 and 91 wires.	EN 50182 ASTM B399 IEC 61089	OH Lines
ACSR ACSR-AW ACSR/TW	Aluminum Conductor Steel Reinforced Round or trapezoidal Al wires (TW) Core consists of galvanized steel or aluminum clad steel wires (AW) 1, 7 or 19 wires	EN 50182 IEC 61089 ASTM B232	The most popular design for OH Lines. AW core is recommended in corrosive environments or in coastal areas.
AACSR AACSR-AW	Aluminum Alloy Conductors Steel Reinforced Core consists of galvanized steel or aluminum clad steel wires (AW) 1, 7 or 19 wires	EN 50182 IEC 61089 ASTM 711	OH Lines, specially recommended in crossings or where a very high UTS is required. Also in corrosive environments or in coastal areas (AW).
ACAR	Aluminum Conductor Alloy Reinforced 7, 19, 37, 61 and 91 wires.	EN 50182 IEC 61089 ASTM B524	OH Lines, especially for high conductivity/weight ratio and corrosive environments. HV S/S busbars
ARAWELD®	Aluminum clad steel wires 7, 19 and 37 wires	EN 61232 IEC 61232 ASTM B502 ASTM B415	Special protection to core steel wires under corrosive or coastal areas. Ground wires OPGW

NSW[®] Optical Phase Conductors (OPPC)

As an alternative to optical ground wires for telecommunication applications, the optical fibers of an OPPC are incorporated in a power line's phase conductor. If the customer needs an OPPC solution, NSW can offer individualized cable designs to meet his specific requirements.

Characteristics

- Central aluminum buffer tube.
- Up to 144 optical fibers.
- Armoring: aluminum-alloy wires and aluminum clad steel wires, various layers of armoring possible.

Standards

- IEC 60794-4-1
- IEEE Std 1138
- EN 50182

GROUND WIRES AND MASS CABLES

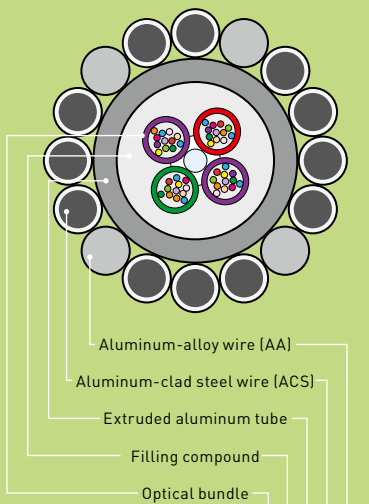
Optical Ground Wires (OPGWs)

OPGWs serve as a ground wire and a telecommunications link at the same time. The basic design of OPGWs includes optical fibers placed inside a central aluminum buffer tube, which is armored by one or more layers of wire to provide tensile strength and additional conductivity.

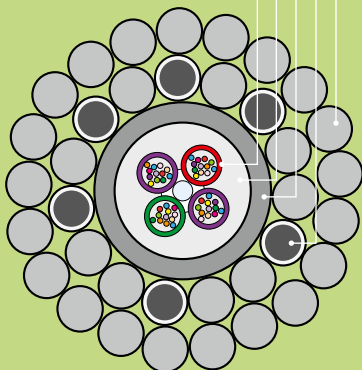
ECN Optical Ground Wires

- Containing up to 96 optical fibers
- Araweld® wires are the product of preference, based on their combined mechanical, electrical and corrosion-resistance.
- Standards: N 60794, IEEE 1138

Single Layer Design (DAB)



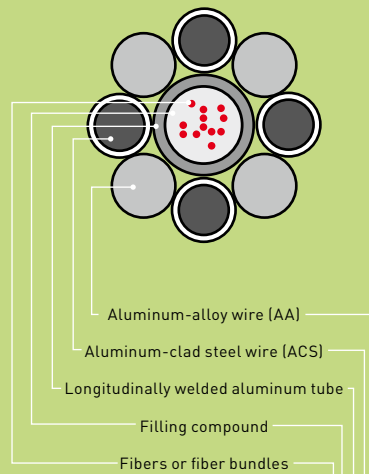
Double Layer Design (DABB)



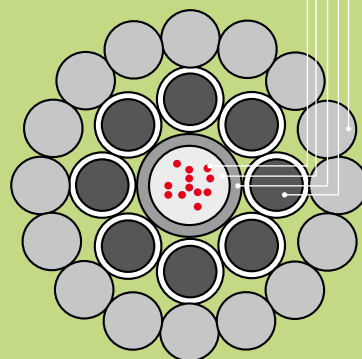
NSW® Optical Ground Wires

- Containing up to 144 optical fibers
- Central aluminum buffer tube containing various fiber types with high fiber excess lengths to guarantee optimal performance over the entire period of service.
- Standards: N 60794, IEEE 1138

Single Layer Design (DAB)



Double Layer Design (DABB)



ECN Conventional Ground Wires

Araweld® (aluminum-clad steel) overhead ground wires provide the very best means of obtaining lightning protection. They combine conductivity, corrosion-resistance and high strength – all of the properties necessary for such protection.

NSW® Metal-Armored Self-Supporting Cables (MASSs)

MASSs are similar to OPGWs, but are not designed to bear any electric load. Whenever MASSs are required, NSW can offer a central tube design cable based on OPGW technology.

PREMIUM QUALITY ACCESSORIES

Accessories/Fittings

General Cable's overhead line solutions include a wide range of accessories. In order to provide the best quality available on the market, General Cable has approved several well-known high-performance suppliers of fittings, closures and other accessories to carry out installation of its overhead cable product portfolio. These suppliers are certified on the basis of the quality requirements laid down in the ISO 9001 quality standard.

Duct Cables

With over 100 years of history in the world of telecommunications, General Cable is one of the most experienced suppliers of cost-effective solutions for the end-to-end connection. If a customer requires optical cables for direct buried installation or for placement in cable ducts, General Cable has the answer to the high-performance optical network.

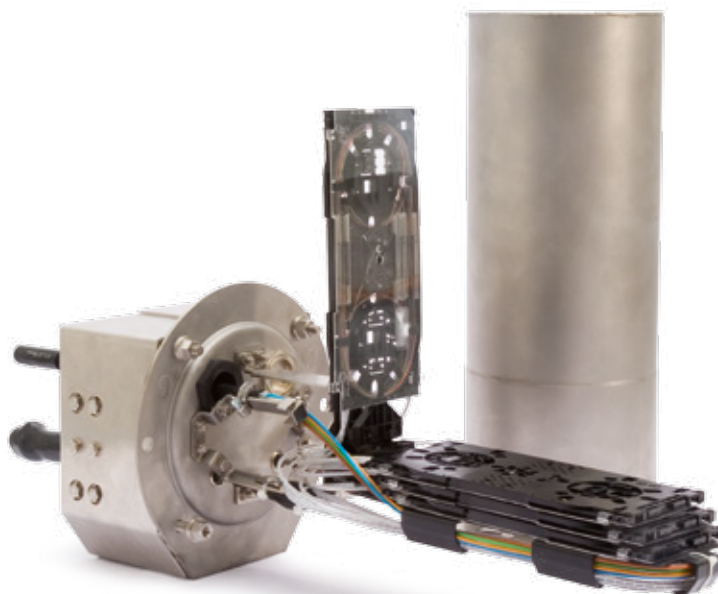
Ancillary Equipment

General Cable's various cable solutions for virtually every application are complemented by termination and distribution elements such as closures, connection systems and hardware. The distribution components are used for organizing outgoing and incoming fiber-optic cables and hardware so that subsequent reconfiguration or expansion jobs can be incorporated fast and cost-effectively.

- Closures
- Suspension assembly
- Tension assembly
- Vibration damper (damper studies)
- Tower fixing and grounding
- Warning spheres
- Splicing and measurement equipment
- Installation tools



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