TRATOS

CABLES FOR A MOVING WORLD

TRATOS OVERHEAD®
TRATOS OPGW®

THE QUEEN'S AWARDS FOR ENTERPRISE: INNOVATION 2019

TRATOSFIBRE® - BT cables are made with award winning Tratos-JBA® compound.

Tratos UK Ltd has won a Queen's Award for Enterprise - Innovation for its technologically advanced Tratos-JBA® compound.

June **2022**
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TRATOS® OVERHEAD & OPGW

ACSR POWER CABLES

AAAC & AAC POWER CABLES

HIGH TEMPERATURE LOW SAG CABLES

OPGW CABLES

STANDARDS AND QUALITY SYSTEM

STANDARDS

Overhead cables manufactured based on:

IEC Standards

IEC 61089 . . . . . Round wire concentric lay overhead electrical stranded conductors

ITU Standards

ITU-T G.652. . . . . Characteristics of a single-mode optical fibre and cable

ITU-T G.655. . . . . Characteristics of a non-zero dispersion-shifted single-mode optical fibre and cable

BS EN Standards

BS EN 50182 . . . . . Conductors for overhead lines. Round wire concentric lay stranded conductors

BS EN 50183 . . . . . Conductors for overhead lines. Aluminium-magnesium-silicon alloy wires

BS EN 61232 . . . . . Aluminium-clad steel wires for electrical purposes

BS EN 62004 . . . . . Thermal-resistant aluminium alloy wire for overhead line conductor

American Standards

IEEE 1138 . . . . . IEEE Standard for Testing and Performance for Optical Ground Wire (OPGW) for Use on Electric Utility Power Lines

Industry Standards

TERNA LIN 00000C59

TERNA LIN 00000C60

TERNA LIN 00000C61

TERNA LIN 000C3907

RED ELECTRICA DE ESPANIA ET032

RED ELECTRICA DE ESPANIA ET033

STANDARDS AND QUALITY SYSTEM

QUALITY SYSTEM

Tratos aim to work closely with customers to find better, more environmentally friendly solutions to their challenges.
We are committed to our vision and strategy to serve all our internal and external customers by providing high quality services and products. Tratos is an established industry leader in the design, manufacture and supply of cables and products and to maintain this leading position we are committed at every level to providing our customers with quality services and products at a competitive price. As a commercial enterprise we are aware of the importance of satisfying our customers and of the financial impact of which nonconformities may have on our profitability. For these reasons we are committed to complying with all customer requirements and specifications both legal and statutory requirements. Our Quality Management System has been audited and approved by two independent, Internationally recognized and accepted authorities: BSI and AENOR-IQNET (E), in accordance to BS EN ISO 9001:2015 covering the production, purchasing of raw materials design and final test including various document types. The Tratos Quality Management system is under frequent regular surveillance by inspectors working for the Certification Autorities.

ENVIRONMENTAL SYSTEM

Our Environmental Management System has been audited and approved by two independent, Internationally recognized and accepted authorities:
BSI and AENOR-IQNET (E), in accordance to BS EN ISO 14001:2015 covering the production, purchasing of raw materials design and final test including various document types. The Tratos Quality Management system is under frequent regular surveillance by inspectors working for the Certification Autorities.

ENERGY MANAGEMENT SYSTEMS

By complying with the BS EN ISO 50001:2018 Tratos follows a systematic approach in achieving continual improvement of energy performance and the Energy Management Systems (EnMS).
The BS EN ISO 50001:2018 is a standard issued by the International Standard Organization (ISO) which outlines the requirements for establishing, implementing, maintaining and improving an energy management system (EnMS).

CIRCULAR ECONOMY

The EU Eco-Management and Audit Scheme (EMAS) is a premium management instrument developed by the European Commission for companies and other organisations to evaluate, report, and improve their environmental performance. EMAS is open to every type of organisation eager to improve its environmental performance. It spans all economic and service sectors and is applicable worldwide.

AWARDS

Tratos cables are made with award winning Tratos-JBA® compound.
Tratos UK Ltd has won a **Queen's Award for Enterprise - Innovation** for its technologically advanced Tratos-JBA® compound.

STANDARDS AND QUALITY SYSTEM

HEALTY & SAFETY SYSTEM

Oince its decision to create a board post dedicated to furthering best practice for Health and Safety, international cable manufacturer Tratos is celebrating receipt of ISO 45001.

ISO 45001 sets out the minimum requirements for occupational health and safety management best practice and helps companies achieve the maximum return for employees, operations and customers.

REACH, WEEE & ROHS

Tratos is fully compliant with the **REACH**. This is a European Union regulation concerning the **Registration, Evaluation, Authorisation and restriction of Chemicals**. It came into force on 1st June 2007 and replaced a number of European Directives and Regulations with a single system. REACH applies to substances manufactured or imported into the EU in quantities of 1 tonne or more per year. Generally, it applies to all individual chemical substances on their own, in preparations or in articles . To summarise, REACH makes the cable industry directly responsible for assessing and managing the risks posed by chemicals and providing safety information to their users.

Tratos fully subscribes to The **Waste Electrical and Electronic Equipment Directive (WEEE Directive)**, introduced into UK law in January 2007 by the Waste Electronic and Electrical Equipment Regulations 2006. The WEEE Directive aims to reduce the amount of electrical and electronic equipment being produced and to encourage everyone to reuse, recycle and recover it. The WEEE Directive also aims to improve the environmental performance of businesses that manufacture, supply, use, recycle and recover electrical and electronic equipment. TRATOS has enlisted the services of the UK's leading producer compliance scheme, Valpak, whom manage our recycling obligations and also ensure our compliance to the WEEE Regulations and the Waste Batteries and Accumulators Regulations.

Tratos is fully compliant with the **Restriction of Hazardous Substances (RoHS) Regulations**. These Regulations implement EU Directive 2011/65/EU which bans the placing on the EU market of new electrical and electronic equipment containing more than agreed levels of lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyl (PBB) and polybrominated diphenyl ether (PBDE) flame retardants. Tratos fully understands the requirements of the RoHS Directive and ensures that our products, and their components, comply.

CORPORATE SOCIAL RESPONSABILITY

Tratos adoptes a Code of Ethics which adheres to the United Nations Global Compact on human rights, labour standards, protection of the environment and anti corruption measures.
Under this self regulatory code, Tratos will carry out initiatives in the environmental and social fields with special reference to environmental policies and social policies regarding child labour, compulsory labour, health and security, freedom of association and the right to collective bargaining, discrimination, disciplinary procedures, working hours and wages.

APPROVALS

Utilities and Distribution Network Operators across Europe rely upon the extensive range of overhead conductors produced by Tratos, in its manufacturing plants in both Italy and the UK.

Overhead Conductor Cables

OVERHEAD CONDUCTOR CABLES

High TEMPERATURE LOW SAG (OHC-HV) Phase conductors

Tratos manufacture a comprehensive range of High Temperature Low Sag (HTLS) overhead phase conductors made from an innovative hybrid lightweight carbon fibre/glass/aluminium sheathed central strength member with high temperature zirconium-aluminium wires (TAL) as the conducting element.

TRATOS INNOVATIVE DESIGN

Tratos has now developed, tested and successfully installed a completely new hybrid design of conductor for use in overhead lines based upon a high load carrying carbon fibre core with two compact, space saving, segmental thermal resistant aluminium alloy (AT1) wire layers, helically applied around in accordance with IEC 62004. This avoids the use of traditional conductor designs, based on existing technology, where any increase in transmitted power results directly in either an increase in size and hence the weight of the conductor, or an increase in the operating temperature above the recommended maximum operating temperature.

APPLICATIONS

These new innovative hybrid conductors are especially suitable as a fast and cost effective replacement for traditional ACSR conductors in short and medium spans in all topographical locations.

BETTER BY DESIGN – Current carrying capacity is twice that of traditional designs. Reduced weight and strain allows existing pylons and standard installation techniques to be used.
MORE STRENGTH, LESS SAG – Greater tensile strength to withstand snow, ice and wind loadings. Less sag and increased ground clearance at maximum current rating.
ECONOMIC BENEFIT – Reduced cost and easier installation alongside increased power transmission

TRATOS CONVENTIONAL DESIGNS

Based upon decades of experience of successful supply, Tratos are also still fully committed to suppling all metal designs of conventional overhead conductors - All Aluminium Alloy Conductor (AAAC), All Aluminium Conductor (AAC), and Aluminium Conductor Steel Reinforced (ACSR) for those customers who still require and use these types.

Synonymous with overhead power lines Tratos Aluminium Conductor Steel Reinforced conductors require no introduction they can be supplied in any ratio of steel to aluminium, with only the steel inner greased or with grease applied to the whole conductor. The outer layer of aluminium wires can be smooth bodied to provide a circular finish which can be treated to reduce or eliminate glare, leading to a reduction in the overall visual impact of the transmission line. Made to special order aluminium coated steel wires can be substituted for galvanised steel wires for cables to be installed where corrosion of traditional galvanised steel has been a problem in the past.

All Aluminium Alloy Conductors made from heat-treated magnesium silicon aluminium alloys have higher strength but lower conductivity than pure aluminium conductors. Being lighter, alloy conductors can sometimes be used to advantage to give a higher current rating whilst reducing the load on towers but it's lower breaking load has to be considered.
For short spans in temperate regions of the world bare All Aluminium Conductors are still popular and Tratos continue to supply these for low voltage and medium voltage applications, including a complete range of covered overhead conductors (ABC).

With decades of experience Tratos manufacture the most popular sizes and types of conductor but as part of its tailor made programme, other types and sizes to suit customer particular application can also be supplied on request.

OPGW Cables

OPGW CABLES

Tratos also produce a wide range of OPGW conductors in both conventional and innovative hybrid designs.

Tratos optical fibre composite overhead ground wire (OPGW) Cables are designed to run between the top of high voltage electricity pylons to provide the grounding and lightening protection required by overhead transmission lines combined with high speed optical transmission path, along new or existing low and medium tension network lines. (OPGW cables are also known as shield wire, static wire, earth wire and skywire)
Since the telecommunication market has been opened up to new operators, data transmission and video service providers, there is now the opportunity to install OPGW cable in a wide variety of transmission line installations.

TRATOS INNOVATIVE OPGW DESIGNS

In their latest range of OPGW conductors Tratos combine their experience and expertise in the supply of innovative hybrid designs of HTLS conductors and optical fibre transmission systems. The intrinsic three layer protection afforded by the central tubular design of Tratos HTLS conductors simplifies the inclusion of optic fibres into the cable and provides enhanced mechanical protection to these fibres. The use of a carbon composite strength member in place of traditional steel centres allows a greater volume of aluminium to be included without any weight penalty, this can be further increased by the used of shaped trapezoid aluminium or aluminium alloy wires. Encasing the stranded carbon composite strength member in a jelly filled, seamless aluminium sheath allows for the inclusion the optical fibres in an enclosed, fully filled, protected environment.

Tratos OPGW conductors offer the operator:
- The ability to include multiple optical fibres
- Greater tensile strength to resist snow, ice and wind loadings
- Lightest weight for a given fault current
- Smallest dimensions for a given fault current
- Lowest sag in both normal and fault conditions
- Existing pylons and installation techniques can be used
- Tratos can tailor the design of these cables to meet the specific characteristics of the overhead transmission lines with which they are used.

TRATOS CONVENTIONAL OPGW DESIGNS

Based upon decades of experience of successful supply, Tratos are also still fully committed to suppling all metal designs of conventional OPGW conductors with constructions based upon an aluminium or stainless steel jelly filled metallic tube containing the optical fibres surrounded by All Aluminium (AAAC), All Aluminium Conductor (AAC), and Aluminium Conductor Steel Reinforced (ACSR) as ordered for those customers who still require and use these types of cable. Complete conducts are normally supplied grease filled but can also be supplied dry on request.

CORRECT DESIGN

All types of overhead cables produced by Tratos provide the optimum balance between strength and conductivity, the lay lengths are carefully chosen to ensure that the conductor is neutral along its central axis giving excellent handling characteristics without any tendency to corkscrew or retract when being taken from the delivery drum during installation.

OPPC DESIGNS

Tratos also manufacture and supply a range of Optical Phase Conductors (OPPC) where the optical fibres are enclosed in a stainless steel tube with replaces one of the steel strength members.

ALL DIELECTRIC SELF-SUPPORTING OVERHEAD FIBRE CABLE

Tratos can also supply a separate All Dielectric Self Supporting fibre cable with no conductive elements for stringing from transmission towers where just a high speed data transmission path is required

FIBRE TYPES

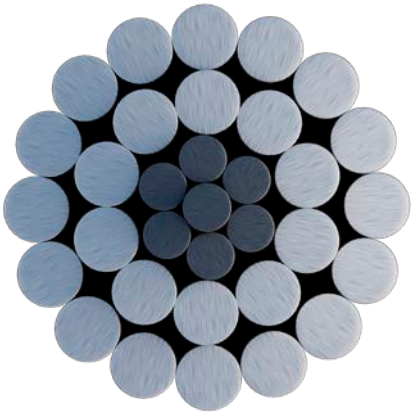
Tratos OPGW cables typically contain between 8 to 148 single-mode optical fibre (ITU-T G652/D) or non-zero dispersion-shifted single-mode optical fibre (ITU-T G655) with low transmission loss, allowing long distance transmission at high speeds however multimode fibres can be provided if required.
Note: This is an indicative range of Standards to which Tratos manufacture cables. Cables manufactured in accordance with other Standards are available on request.

OVERHEAD CABLES BASED ON BS EN 50182

TRATOS® OHC 193051
ACSR Power Cable

Conventional ACSR phase conductor, ungreased seven wire galvanised steel (ST1A) central reinforcement, two layers of hard drawn (H19) aluminium wires laid around.

FEATURES AND PERFORMANCES



CONSTRUCTION

1) Inner seven strand galvanised steel wire (1.95mm) reinforcement, overall diameter 5.85mm
2) Second layer ten hard drawn (H19) aluminium wires (2.44mm)
3) Outer layer 16 hard drawn (H19) aluminium wires (2.44mm). Overall diameter 15.60mm

INTERNATIONAL STANDARDS

- BS EN 50182
- BS EN 50189
- BS EN 60889

GENERAL CHARACTERISTICS

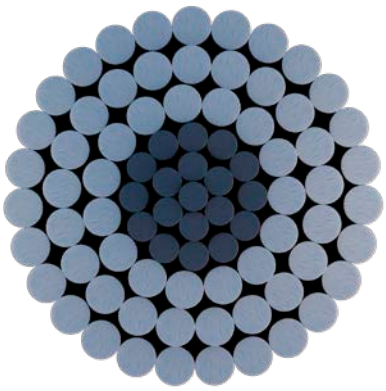
	U.M.	TYPE/NOMINAL VALUE
FORMATION		
Galvanized Steel wires ST 1A	mm	7 x ø1,95
Galvanized Steel wires ST 1A	mm	1+6
Hard drawn H19 aluminum wires	mm	26 x ø2,44
Aluminum wire formation		10+16
GENERAL DATA		
Total cross section	mm^2	142,48
Total weight	Kg/m	0,500
ELECTRICAL CHARACTERISTICS		
Electric DC resistance at 20°C	Ω/Km	0,24
MECHANICAL CHARACTERISTICS		
CTE total	$10^{-6}K^{-1}$	18,7
Elastic modulus	GPa	80
Rated tensile strength (RTS) [%]	daN/mm^2	95% UTS
Ultimate tensile strength (UTS)	daN	4570

OVERHEAD CABLES BASED ON IEC 61089

TRATOS® OHC 201177
ACSR Power Cable

Conventional ACSR phase conductor nineteen wire grease filled galvanised steel (ST1A) central reinforcement, three layers of greased filled hard drawn (H19) aluminium wires laid around..

FEATURES AND PERFORMANCES



CONSTRUCTION

1) Inner nineteen strand galvanised steel wire (2.25mm) reinforcement, overall diameter 11.25mm - greased
2) Second layer fifteen hard drawn (H19) aluminium wires (3.00mm) - greased
3) Middle layer twenty-one hard drawn (H19) aluminium wires (3.00mm) - greased
4) Outer layer twenty-seven hard drawn (H19) aluminium wires (3.00mm). Overall diameter 29.25mm - greased

INTERNATIONAL STANDARDS

- IEC 61089

GENERAL CHARACTERISTICS

	U.M.	TYPE/NOMINAL VALUE
FORMATION		
Galvanized Steel wires S1A IEC 61089, greased	mm	19 x ø2,25
Hard drawn aluminum wires H19 IEC 61089, greased	mm	63 x ø3,00
Galvanized Steel formation		1+6+12
Aluminum formation		15+21+27
Final external diameter	mm	29,25
External lay direction		Right
GENERAL DATA		
Galvanized steel wires cross section	mm^2	75,45
Aluminum wires cross section	mm^2	445,32
Total cross section	mm^2	520,60
Galvanized steel wires weight	Kg/m	0,593
Aluminum wires weight	Kg/m	1,224
Grease (typical)	Kg/m	0,073
Total weight	Kg/m	1,890
ELECTRICAL CHARACTERISTICS		
Electric DC resistance at 20°C	Ω/Km	0,064
MECHANICAL CHARACTERISTICS		
Coefficient of linear expansion (Galvanized steel core)	$10^{-6}K^{-1}$	11,5
Coefficient of linear expansion (Conductor)	$10^{-6}K^{-1}$	18,95
Final elastic modulus (Galvanized steel core)	daN/mm^2	20700
Final elastic modulus (Conductor)	daN/mm^2	8100
Load at break	daN	15840

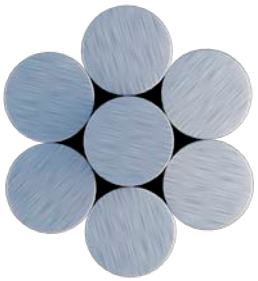
OVERHEAD CABLES BASED ON BS EN 50183

TRATOS® OHC 204934

AAAC Power Cable

Conventional All Aluminium Alloy Conductor (AAAC) phase conductor, Code name OAK.

FEATURES AND PERFORMANCES



CONSTRUCTION

1) Seven strand aluminium alloy magnesium-silicon AL3 left bare – 13.95mm overall diameter

STANDARDS

- BS EN 50183

GENERAL CHARACTERISTICS

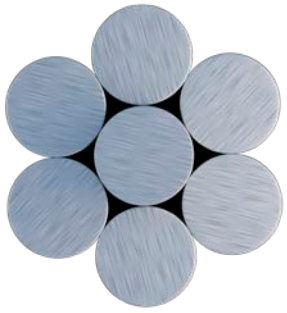
	U.M.	TYPE/NOMINAL VALUE
FORMATION		
Aluminum alloy magnesium-silicon AL3 - EN 50183	mm	7 x ø4,65
Aluminum alloy formation		1+6
Final external diameter	mm	13,95
GENERAL DATA		
Total cross section	mm^2	118,90
Total weight	Kg/m	1,890
ELECTRICAL CHARACTERISTICS		
Electric DC resistance at 20°C	Ω/Km	0,324
MECHANICAL CHARACTERISTICS		
Load at break	daN	3507

OVERHEAD CABLES BASED ON BS EN 60889

TRATOS® OHC 204941
AAC Power Cable

Conventional All Aluminium Conductor (AAC) phase conductor, Code name WASP.

FEATURES AND PERFORMANCES



CONSTRUCTION
1) Seven strand hard drawn aluminium AL1 left bare – 13.17mm overall diameter

STANDARDS
- BS EN 60889

GENERAL CHARACTERISTICS

	U.M.	TYPE/NOMINAL VALUE
FORMATION		
Hard drawn aluminum AL1 - EN 60889	mm	7 x ø4,39
Hard drawn aluminum AL1 formation		1+6
Final external diameter	mm	13,17
GENERAL DATA		
Total cross section	mm^2	106,0
Total weight	Kg/m	0,2896
ELECTRICAL CHARACTERISTICS		
Electric DC resistance at 20°C	Ω/Km	0,2697
MECHANICAL CHARACTERISTICS		
Load at break	daN	1695

OVERHEAD CABLES BASED ON BS EN 50183

TRATOS® OHC 204938

AAAC Power Cable

Conventional All Aluminium Alloy Conductor (AAAC) phase conductor, Code name OAK with Black PVC covering.

FEATURES AND PERFORMANCES

CONSTRUCTION

1) Seven strand aluminium alloy magnesium-silicon AL3 left bare – 13.95mm overall diameter
2) PVC Black extruded covering to 16.35mm overall diameter

STANDARDS

- BS EN 50183

GENERAL CHARACTERISTICS

	U.M.	TYPE/NOMINAL VALUE
FORMATION		
Aluminum alloy magnesium-silicon AL3 - EN 50183	mm	7 x ø4,65
Aluminum alloy formation		1+6
Final conductor diameter	mm	13,95
Final external diameter	mm	16,35
GENERAL DATA		
AL3 total cross section	mm^2	118,90
PVC Black (minimum thickness)	mm	1,1
Total weight	Kg/m	0,410
ELECTRICAL CHARACTERISTICS		
Electric DC resistance at 20°C	Ω/Km	0,2767
MECHANICAL CHARACTERISTICS		
Load at break	daN	3507

OVERHEAD CABLES BASED ON BS EN 60889

TRATOS® OHC 204942
AAC Power Cable

Conventional All Aluminium Conductor (AAC) phase conductor, Code name WASP with Black PVC covering.

FEATURES AND PERFORMANCES

CONSTRUCTION

1) Seven strand hard drawn aluminium AL1 left bare – 13.17mm overall diameter
2) PVC Black extruded covering to 15.57mm overall diameter

STANDARDS

- BS EN 60889

GENERAL CHARACTERISTICS

	U.M.	TYPE/NOMINAL VALUE
FORMATION		
Hard drawn aluminum AL1 - EN 60889	mm	7 x ø4,65
Hard drawn aluminum AL1 formation		1+6
Final conductor diameter	mm	13,17
Final external diameter	mm	15,57
GENERAL DATA		
AL1 total cross section	mm^2	106,0
PVC Black (minimum thickness)	mm	1,1
Total weight	Kg/m	0,370
ELECTRICAL CHARACTERISTICS		
Electric DC resistance at 20°C	Ω/Km	0,2697
MECHANICAL CHARACTERISTICS		
Load at break	daN	1695

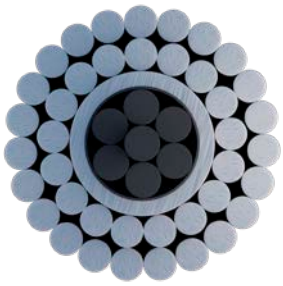
OVERHEAD CABLES BASED ON INNOVATIVE TRATOS DESIGN

TRATOS® OHC 144861

High Temperature Low Sag

A High Temperature Low Sag (HTLS) phase conductor made from an innovative hybrid, central strength member comprising 7x3,30mm lightweight carbon fibreglass yarns, tape wrapped then covered with a seamless aluminium sheath, with two layers of high temperature circular TAL wires (17+23) (AT1 according to IEC 62004); to an outer diameter of 24,80 mm

FEATURES AND PERFORMANCES



CONSTRUCTION

1) Outer layer - circular TAL wires
2) Inner layer - circular TAL wires
3) Aluminium sheath
4) Wrapping
5) Filling material
6) Carbon and glass composite wire ø3,30 mm

STANDARDS

- IEC 62004

GENERAL CHARACTERISTICS

	U.M.	TYPE/NOMINAL VALUE
FORMATION		
Hybrid composite wires: n. 7 x ø 3,30 wrapped	mm	ø 9.90
Aluminium sheath	mm	ø 10.15
1st layer of TAL 17 circular wires	mm	ø 19.10
2nd layer of TAL 23 circular wires	mm	ø 24,80
Outer diameter	mm	ø 24,80
GENERAL DATA		
Theoretical cross-section		
Conductor Carbon fibre + glass yarns (hybrid)	mm^2	59,87
Aluminium sheath Half-hard aluminium E = 5000 daN/mm^2	mm^2	60,91
17+23 TAL circular wires Aluminium – zirconium alloy	mm^2	255,18
Conductor total cross section	mm^2	316,69
Total mechanical cross section	mm^2	375,96
Theoretic weigth		
Conductor CF + glass yarns (Hybrid)	Kg/m	0,10672
Half-hard aluminium sheath	Kg/m	0,16445
2 layers TAL (16+22)	Kg/m	0,71334
Total	Kg/m	1,00747
ELECTRICAL CHARACTERISTICS		
Theoretical electric DC resistance at 20°C	Ω/Km	0,09316
MECHANICAL CHARACTERISTICS		
Ultimate tensile strength (UTS)	daN	10500
Ultimate modulus of elasticity (E)		
Whole conductor	daN/mm^2	11000
Core hybrid wires + aluminium sheath	daN/mm^2	6350
Conductor CF	daN/mm^2	8300
Thermal expansion coefficient (α)		
Whole conductor	(1/°C)	$17{,}0 \times 10^{-6}$
Core hybrid wires + aluminium sheath	(1/°C)	$8{,}4 \times 10^{-6}$
Conductor CF	(1/°C)	$1{,}034 \times 10^{-6}$

OVERHEAD CABLES BASED ON INNOVATIVE TRATOS DESIGN

TRATOS® OHC 145738

High Temperature Low Sag

A High Temperature Low Sag (HTLS) phase conductor made from an innovative hybrid, central strength member comprising 7x4,70mm lightweight carbon fibre – glass yarns, tape wrapped then covered with a seamless aluminium sheath, with two layers of high temperature trapezoid TAL wires (14+20) (AT1 according to IEC 62004); to an outer diameter of 33,30 mm

FEATURES AND PERFORMANCES

CONSTRUCTION

1) Outer layer - trapezoidal wires
2) Inner layer - trapezoidal wires
3) Aluminium sheath
4) Wrapping
5) Filling material
6) Carbon and glass composite wire ø4,70 mm

STANDARDS

- IEC 62004

GENERAL CHARACTERISTICS

	U.M.	TYPE/NOMINAL VALUE
FORMATION		
Hybrid composite wires: n. 7 x ø4,70 wrapped	mm	ø14.30
Aluminium sheath	mm	ø17.90
1 layer of TAL 14 trapezoidal wires	mm	ø25.50
1 layer of TAL 20 trapezoidal wires	mm	ø33.30
Outer diameter	mm	ø33,30
GENERAL DATA		
Theoretical cross-section		
Conductor Carbon fibre + glass yarns (hybrid)	mm^2	121,45
Aluminium sheath Half-hard aluminium E = 5000 daN/mm^2	mm^2	91,04
16+24 TAL trapezoidal wires Aluminium – zirconium alloy	mm^2	597,62
Conductor total cross section	mm^2	688,66
Total mechanical cross section	mm^2	819,11
Theoretic weigth		
Conductor CF + glass yarns (Hybrid)	Kg/m	0,216573
Half-hard aluminium sheath	Kg/m	0,245176
TAL trapezoidal wires	Kg/m	1,668766
Total	Kg/m	2,171945
ELECTRICAL CHARACTERISTICS		
Theoretical electric DC resistance at 20°C	Ω/Km	0,042267
MECHANICAL CHARACTERISTICS		
Ultimate tensile strength (UTS)	daN	24000
Ultimate modulus of elasticity (E)		
Whole conductor	daN/mm^2	6325
Core hybrid wires + aluminium sheath	daN/mm^2	8645
Conductor CF	daN/mm^2	11500
Thermal expansion coefficient (α)		
Whole conductor	(1/°C)	17,3 E-6
Core hybrid wires + aluminium sheath	(1/°C)	7,02 E-6
Conductor CF	(1/°C)	1,034 E-6

OVERHEAD CABLES BASED ON INNOVATIVE TRATOS DESIGN

TRATOS® OHC 161560

High Temperature Low Sag

A High Temperature Low Sag (HTLS) phase conductor made from an innovative hybrid, central strength member comprising 7x4,00mm lightweight carbon fibre – glass yarns, tape wrapped then covered with a seamless aluminium sheath, with two layers of high temperature trapezoid TAL wires (16+22) (AT1 according to IEC 62004); to an outer diameter of 32,00 mm

FEATURES AND PERFORMANCES

CONSTRUCTION

1) Outer layer - trapezoidal wires
2) Inner layer - trapezoidal wires
3) Aluminium sheath
4) Wrapping
5) Filling material
6) Carbon and glass composite wire ø4,00 mm

STANDARDS

- IEC 62004

GENERAL CHARACTERISTICS

	U.M.	TYPE/NOMINAL VALUE
FORMATION		
Hybrid composite wires: n. 7 x ø4,00 wrapped	mm	ø12,00
Aluminium sheath	mm	ø15,40
1 layer of TAL 16 trapezoidal wires	mm	ø23,60
1 layer of TAL 22 trapezoidal wires	mm	ø32,00
Outer diameter	mm	ø32,00
GENERAL DATA		
Theoretical cross-section		
Conductor Carbon fibre + glass yarns (hybrid)	mm^2	87,97
Aluminium sheath Half-hard aluminium E = 5000 daN/mm^2	mm^2	67,44
16+22 TAL trapezoidal wires Aluminium – zirconium alloy	mm^2	599,27
Conductor total cross section	mm^2	666,71
Total mechanical cross section	mm^2	754,68
Theoretic weigth		
Conductor CF + glass yarns (Hybrid)	Kg/m	0,156818
Half-hard aluminium sheath	Kg/m	0,182094
2 layers TAL (16+22)	Kg/m	1,666946
Total	Kg/m	2,037247
ELECTRICAL CHARACTERISTICS		
Theoretical electric DC resistance at 20°C	Ω/Km	0,0430
MECHANICAL CHARACTERISTICS		
Ultimate tensile strength (UTS)	daN	19000
Ultimate modulus of elasticity (E)		
Whole conductor	daN/mm^2	5800
Core hybrid wires + aluminium sheath	daN/mm^2	8680
Conductor CF	daN/mm^2	11500
Thermal expansion coefficient (α)		
Whole conductor	(1/°C)	$17,46x10^{-6}$
Core hybrid wires + aluminium sheath	(1/°C)	$6,53x10^{-6}$
Conductor CF	(1/°C)	$1,034x10^{-6}$

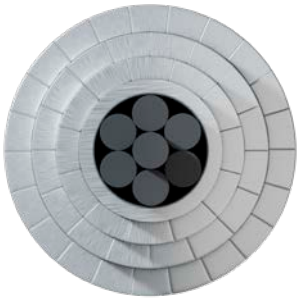
OVERHEAD CABLES BASED ON INNOVATIVE TRATOS DESIGN

TRATOS® OHC 161186

High Temperature Low Sag

A High Temperature Low Sag (HTLS) phase conductor made from an innovative hybrid, central strength member comprising 7x4,70mm lightweight carbon fibre – glass yarns, tape wrapped then covered with a seamless aluminium sheath, with three layers of high temperature trapezoid TAL wires (12+16+22) (AT1 according to IEC 62004); to an outer diameter of 37,00 mm.

FEATURES AND PERFORMANCES



CONSTRUCTION

1) Outer layer - trapezoidal wires
2) Middle layer – trapezoidal wires
3) Inner layer - trapezoidal wires
4) Aluminium sheath
5) Wrapping
6) Filling material
7) Carbon and glass composite wire ø4,70 mm

STANDARDS

- IEC 62004

GENERAL CHARACTERISTICS

	U.M.	TYPE/NOMINAL VALUE
FORMATION		
Hybrid composite wires: n. 7 x ø4,70	mm	ø14,30
Aluminium sheath	mm	ø17,90
1 layer of TAL 12 trapezoidal wires	mm	ø23,90
1 layer of TAL 16 trapezoidal wires	mm	ø30,30
1 layer of TAL 20 trapezoidal wires	mm	ø37,00
Outer diameter	mm	ø37,00
GENERAL DATA		
Theoretical cross-section		
Conductor Carbon fibre + glass yarns (hybrid)	mm^2	121,45
Aluminium sheath Half-hard aluminium E = 5000 daN/mm^2	mm^2	91,04
12+16+20 TAL wires Aluminium – zirconium alloy	mm^2	795,23
Conductor total cross section	mm^2	886,27
Total mechanical cross section	mm^2	1007,72
Theoretic weigth		
Conductor CF + glass yarns (Hybrid)	Kg/m	0,216573
Half-hard aluminium sheath	Kg/m	0,245818
3 layers TAL (12+16+22)	Kg/m	2,264914
Total	Kg/m	2,768740
ELECTRICAL CHARACTERISTICS		
Theoretical electric DC resistance at 20°C	Ω/Km	0,03340
MECHANICAL CHARACTERISTICS		
Ultimate tensile strength (UTS)	daN	23000
Ultimate modulus of elasticity (E)		
Whole conductor	daN/mm^2	6350
Core hybrid wires + aluminium sheath	daN/mm^2	8700
Conductor CF	daN/mm^2	11000
Thermal expansion coefficient (α)		
Whole conductor	(1/°C)	$17{,}8 \times 10^{-6}$
Core hybrid wires + aluminium sheath	(1/°C)	$6{,}60 \times 10^{-6}$
Conductor CF	(1/°C)	$1{,}034 \times 10^{-6}$

OVERHEAD CABLES BASED ON INNOVATIVE TRATOS DESIGN

TRATOS® OHC 161261
High Temperature Low Sag

A High Temperature Low Sag (HTLS) phase conductor made from an innovative hybrid, central strength member comprising 7x3,60mm lightweight carbon fibre – glass yarns, tape wrapped then covered with a seamless aluminium sheath, with two layers of high temperature trapezoid TAL wires (16+24) (AT1 according to IEC 62004); to an outer diameter of 32,00 mm.

FEATURES AND PERFORMANCES

CONSTRUCTION

1) Outer layer - trapezoidal wires
2) Inner layer - trapezoidal wires
3) Aluminium sheath
4) Wrapping
5) Filling material
6) Carbon and glass composite wire ø3,60 mm

STANDARDS

- IEC 62004

GENERAL CHARACTERISTICS

	U.M.	TYPE/NOMINAL VALUE
FORMATION		
Hybrid composite wires: n. 7 x ø3,60	mm	ø10,80
Aluminium sheath	mm	ø14,00
1st layer of TAL 16 trapezoidal wires	mm	ø22,80
2nd layer of TAL 24 trapezoidal wires	mm	ø32,00
Outer diameter	mm	ø32,00
GENERAL DATA		
Theoretical cross-section		
Conductor Carbon fibre + glass yarns (hybrid)	mm^2	71,25
Aluminium sheath Half-hard aluminium E = 5000 daN/mm^2	mm^2	58,90
16+24 TAL trapezoidal wires Aluminium – zirconium alloy	mm^2	630,29
Conductor total cross section	mm^2	689,19
Total mechanical cross section	mm^2	760,44
Theoretic weigth		
Conductor CF + glass yarns (Hybrid)	Kg/m	0,127054
Half-hard aluminium sheath	Kg/m	0,159043
2 layers TAL (16+22)	Kg/m	1,752018
Total	Kg/m	2,064492
ELECTRICAL CHARACTERISTICS		
Theoretical electric DC resistance at 20°C	Ω/Km	0,0428
MECHANICAL CHARACTERISTICS		
Ultimate tensile strength (UTS)	daN	18000
Ultimate modulus of elasticity (E)		
Whole conductor	daN/mm^2	6060
Core hybrid wires + aluminium sheath	daN/mm^2	8200
Conductor CF	daN/mm^2	11500
Thermal expansion coefficient (α)		
Whole conductor	(1/°C)	$19,1x10^{-6}$
Core hybrid wires + aluminium sheath	(1/°C)	$7,30x10^{-6}$
Conductor CF	(1/°C)	$7,30x10^{-6}$

OVERHEAD CABLES BASED ON INNOVATIVE TRATOS DESIGN

TRATOS® OHC 095502

High Temperature Low Sag

A High Temperature Low Sag (HTLS) phase conductor made from an innovative hybrid, central strength member comprising 7x4,50mm lightweight carbon fibre – glass yarns, tape wrapped then covered with a seamless aluminium sheath, with two layers of high temperature trapezoid ZTAL wires (12+16) of aluminium-nickel-molybdenum (according to IEC 62004); to an outer diameter of 30,00 mm.

FEATURES AND PERFORMANCES

CONSTRUCTION

1) Outer layer - trapezoidal wires
2) Inner layer - trapezoidal wires
3) Aluminium sheath
4) Wrapping
5) Filling material
6) Carbon and glass composite wire ø4,50 mm

STANDARDS

- IEC 62004

GENERAL CHARACTERISTICS

	U.M.	TYPE/NOMINAL VALUE
FORMATION		
Hybrid composite wires: n. 7 x ø4,50	mm	ø13.50
Aluminium sheath	mm	ø16.70
1 layer of TAL wires	mm	ø23.30
1 layer of TAL wires	mm	ø30,00
Outer diameter	mm	ø30,15
GENERAL DATA		
Theoretical cross-section		
Conductor Carbon fibre + glass yarns (hybrid)	mm^2	111,33
Aluminium sheath Half-hard aluminium E = 5000 daN/mm^2	mm^2	72,63
ZTAL wires Aluminium – zirconium alloy	mm^2	471,03
Conductor total cross section	mm^2	542,76
Total mechanical cross section	mm^2	653,99
Theoretical weigths		
Conductor CF + glass yarns (Hybrid)	Kg/m	0,19859
Half-hard aluminium sheath	Kg/m	0,19339
Layer of ZTAL wires	Kg/m	1,31444
Total°	Kg/m	1,74484

* including filling material and wrapping

GENERAL CHARACTERISTICS

	U.M.	TYPE/NOMINAL VALUE
ELECTRICAL CHARACTERISTICS		
Theoretical electric DC resistance at 20°C	Ω/Km	0,054364
MECHANICAL CHARACTERISTICS		
Ultimate tensile strength (UTS)	daN	Actual 22000, declared 18000
Ultimate modulus of elasticity (E)		
Whole conductor	daN/mm²	6275
Conductor CF	daN/mm²	13000
Thermal expansion coefficient (α)		
Whole conductor	10-6/°C	15,55
Conductor CF	10-6/°C	1,034
Hybrid wires core + aluminium sheath		
Modulus E	daN/mm²	10170
Modulus E	α 1/°C	5,26

* including filling material and wrapping

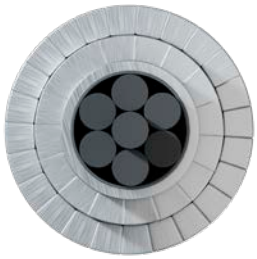
OVERHEAD CABLES BASED ON INNOVATIVE TRATOS DESIGN

TRATOS® OHC 145294

High Temperature Low Sag

A High Temperature Low Sag (HTLS) phase conductor made from an innovative hybrid, central strength member comprising 7x4,00mm lightweight carbon fibre – glass yarns, tape wrapped then covered with a seamless aluminium sheath, with two layers of high temperature trapezoid TAL wires (12+16) (AT2 according to IEC 62004); to an outer diameter of 33,30 mm. (Araucaria type with TAL trapezoidal wires)

FEATURES AND PERFORMANCES



CONSTRUCTION

1) Outer layer - trapezoidal wires
2) Inner layer - trapezoidal wires
3) Aluminium sheath
4) Wrapping
5) Filling material
6) Carbon and glass composite wire ø4,00 mm

STANDARDS

• IEC 62004

GENERAL CHARACTERISTICS

	U.M.	TYPE/NOMINAL VALUE
FORMATION		
Hybrid composite wires: n. 7 x ø4,00	mm	ø12.00
Aluminium sheath	mm	ø15.30
1 layer of TAL wires	mm	ø23.70
1 layer of TAL wires	mm	ø33.30
Outer diameter	mm	ø33,30
GENERAL DATA		
Theoretical cross-section		
Conductor Carbon fibre + glass yarns (hybrid)	mm^2	87,97
Aluminium sheath Half-hard aluminium E = 5000 daN/mm^2	mm^2	66,96
TAL trapezoidal wires (16+24) Aluminium – zirconium alloy	mm^2	666,13
Conductor total cross section	mm^2	733,09
Total mechanical cross section	mm^2	821,06
Theoretical weigths		
Conductor CF + glass yarns (Hybrid)	Kg/m	0,156842
Half-hard aluminium sheath	Kg/m	0,180779
Layer of TAL trapezoidal wires	Kg/m	1,851266
Total°	Kg/m	2,220216
ELECTRICAL CHARACTERISTICS		
Theoretical electric DC resistance at 20°C	Ω/Km	0,04018
MECHANICAL CHARACTERISTICS		
Ultimate tensile strength (UTS)	daN	23500
Ultimate modulus of elasticity (E)		
Whole conductor	daN/mm^2	6150
Conductor CF	daN/mm^2	11500
Thermal expansion coefficient (α)		
Whole conductor	18.6 E-6/°C	15,55
Conductor CF	1.034 E-6/°C	1,034
Hybrid wires core + aluminium sheath		
Modulus E	daN/mm^2	8960
Modulus E	α 1/°C	6,7 E-6

* including filling material and wrapping

OVERHEAD CABLES BASED ON INNOVATIVE TRATOS DESIGN

TRATOS® OHC 130804

High Temperature Low Sag

A High Temperature Low Sag (HTLS) phase conductor made from an innovative hybrid, central strength member comprising 7x1,80mm lightweight carbon fibre – glass yarns, tape wrapped then covered with a seamless aluminium sheath, with three layers of high tem-pera- ture trapezoid TAL wires (10+16+222) (AT1 according to IEC 62004); to an outer diameter of 28,60 mm

FEATURES AND PERFORMANCES

CONSTRUCTION

1) Outer layer - trapezoidal wires
2) Inner layer - trapezoidal wires
3) Aluminium sheath
4) Wrapping
5) Filling material
6) Carbon and glass composite wire ø1,80 mm

STANDARDS

- IEC 62004

GENERAL CHARACTERISTICS

	U.M.	TYPE/NOMINAL VALUE
FORMATION		
Hybrid composite wires: n . 7 x ø1,80 wrapped	mm	ø5.40
Aluminium sheath	mm	ø8.80
1st layer of TAL 10 trapezoidal wires	mm	ø15.40
2nd layer of TAL 16 trapezoidal wires	mm	ø22,00
3rd layer of TAL 22 trapezoidal wires	mm	ø28,80
Outer diameter	mm	ø28,80
GENERAL DATA		
Theoretical cross-section		
Conductor Carbon fibre + glass yarns (hybrid)	mm^2	17,81
Aluminium sheath Half-hard aluminium E = 5000 daN/mm^2	mm^2	37,92
10+16+24 TAL trapezoidal wires Aluminium – zirconium alloy	mm^2	579,96
Conductor total cross section	mm^2	617,88
Total mechanical cross section	mm^2	635,69
Theoretic weigth		
Conductor CF + glass yarns (Hybrid)	Kg/m	0,0317
Half-hard aluminium sheath	Kg/m	0,1032
3 layers TAL (10+16+22)	Kg/m	1,5657
Total	Kg/m	1,7189
ELECTRICAL CHARACTERISTICS		
Theoretical electric DC resistance at 20°C	Ω/Km	0,048
MECHANICAL CHARACTERISTICS		
Ultimate tensile strength (UTS)	daN	6300
Ultimate modulus of elasticity (E)		
Whole conductor	daN/mm^2	6209
Core hybrid wires + aluminium sheath	daN/mm^2	8397
Conductor CF	daN/mm^2	13500
Thermal expansion coefficient (α)		
Whole conductor	(1/°C)	$22{,}38 \times 10^{-6}$
Core hybrid wires + aluminium sheath	(1/°C)	$15{,}98 \times 10^{-6}$
Conductor CF	(1/°C)	$1{,}04 \times 10^{-6}$

OVERHEAD CABLES BASED ON INNOVATIVE TRATOS DESIGN

TRATOS® OPGW 091472

OPGW 48 4(12SMR) ø11,5 mm

An Optical Ground Wire (OPGW) comprising a centre of 4 loose tubes each containing 12 Single Mode optical fibres, surrounded by an aluminium tube and an overall conductor of 14x2.24 mm diameter Aluminium Covered Steel (ACS) wires. Nominal overall diameter 11.50mm.

FEATURES AND PERFORMANCES

CONSTRUCTION

1) Central dielectric support (FRP)
2) Jelly filled loose tubes containing 12 FO
3) Wrapping
4) Aluminium tube
5) Aluminium covered steel (No.12) wires

STANDARDS

- TERNA
- LIN00000C59
- ITU-T G652/D

COLOUR CODING

LOOSE TUBE COLOURS	
Loose Tube	**Colour**
SMR - Pilot	Red
SMR - Directional	Green
OTHERS	White

OPTICAL FIBER COLOUR SCHEME				
	Fibre number	**Colour**	**Fibre number**	**Colour**
Red Loose Tube Pilot	1	Red	7	Pink
	2	Green	8	Orange
	3	Yellow	9	Grey
	4	Brown	10	Black
	5	Blue	11	Aqua
	6	Purple	12	White
Green Loose Tube	The same as red loose tube plus 1 black ring; fibre number 10 is substituted with transparent colour + 1 black ring			
White Loose Tube 1	The same as red loose tube plus 2 black rings; fibre number 10 is substituted with transparent colour + 2 black rings			
White Loose Tube 2	The same as red loose tube plus 3 black rings; fibre number 10 is substituted with transparent colour + 3 black rings			

TECHNICAL DATA SHEET

	U.M.	NOMINAL VALUES
OPTICAL CORE		
N° fibers		48 FO
Loose tubes		4 loose tubes with 12 G652.D fibers each
Weight per unit length	Kg/m	0,020
ALUMINIUM TUBE		
External diameter	mm	8,00
Thickness	mm	1,40
Cross section	mm^2	29,03
Weight per unit length	Kg/m	0,078
ACSNWIRES 20-SA EN 61232		
N°		14
Diameter	mm	12,48
Cross section	mm^2	55,17
Weight per unit length (all wires)	Kg/m	0.078
	U.M.	**NOMINAL VALUES**
Diameter	mm	12,48
Total Metallic cross section	mm^2	84,20
Weight per unit length	Kg/m	0,475
Electrical DC resistance at 20°C	Ω/Km	0,614
Rated Tensile Strength	daN	7,450
Elastic Modulus	daN/mm^2	12.000
CTE	$1/°Cx10^{-6}$	14,1
Short circuit	$(kA)^2s$	50

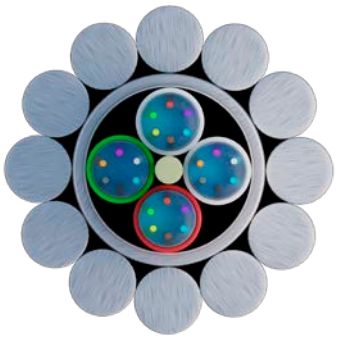
OVERHEAD CABLES BASED ON INNOVATIVE TRATOS DESIGN

TRATOS® OPGW 094491

OPGW 24 4 (6SMR)

An Optical Ground Wire (OPGW) comprising a centre of 4 loose tubes each containing 6 Single Mode optical fibres, surrounded by an aluminium tube and an overall conductor of 12x2.82 mm diameter Aluminium Covered Steel (ACS) wires. Nominal overall diameter 14.0mm.

FEATURES AND PERFORMANCES



CONSTRUCTION

1) Central dielectric support FRP
2) Jelly filled loose tube (6 FO)
3) Wrapping
4) Aluminium tube
5) ACS Wire (N° 12)

STANDARDS

- ITU-T G652/D (Characteristics of a single-mode optical fiber)
- IEEE 1138
- EN 61232

COLOUR CODING

LOOSE TUBE COLOUR	
	Colour
SMR - Pilot	Red
SMR - Directional	Green
OTHERS	White

FIBERS COLOUR				
	TUBE 1/3		TUBE 2/4	
	N° Fiber	Colour	N° Fiber	Colour
24 FO	1	Red	7	Pink
	2	Green	8	Orange
	3	Yellow	9	Grey
	4	Brown	10	Black
	5	Blue	11	Aqua
	6	Purple	12	White

MECHANICAL AND ENVIRONMENTAL CHARACTERISTICS

	U.M.	TYPE/NOMINAL VALUE
OPTICAL CORE		
N° fibers	-	24 FO SMR G652/D
Loose tubes in the cable	-	4 tubes with 6 fibers
ALUMINIUM TUBE		
Minimal outer diameter	mm	8,35
Minimal thickness	mm	1,8
ACS WIRE		
N°	-	12
Nominal wire diameter	mm	2,82
GENERAL DATA		
Aluminium tube size	mm^2	33,5
Total metallic cross section	mm^2	108,7
Nominal diameter	mm	14,0
Nominal metallic weight	Kg/Km	545
Nominal OPGW weight	Kg/Km	590
ELECTRICAL CHARACTERISTICS		
Electrical resistance at 20°C	Ω/Km	0,428
MECHANICAL CHARACTERISTICS		
Linear expansion thermal coefficient a	$1/°C x 10^{-5}$	14,8
Elastic modulus	daN/mm^2	7.980
Load at break	daN	11.390

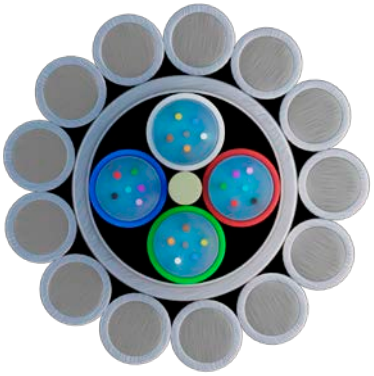
OVERHEAD CABLES BASED ON INNOVATIVE TRATOS DESIGN

TRATOS® OPGW 093395

OPGW 24 6(6SMR) ø15,8 mm

An Optical Ground Wire (OPGW) comprising a centre of 4 loose tubes each containing 6 Single Mode optical fibres, surrounded by an aluminium tube and an overall conductor of 12x3.31 mm diameter Aluminium Covered Steel (ACS No.12) wires. Nominal overall diameter 15.8mm.

FEATURES AND PERFORMANCES



CONSTRUCTION

1) The CONSTRUCTION is missing I think it should be
2) Central dielectric support (FRP)
3) Jelly filled loose tubes containing 12 FO
4) Wrapping
5) Aluminium tube
6) Aluminium covered steel (No.12) wires

INTERNATIONAL STANDARDS

- TERNA UX LC50
- ITU-T G652/D

COLOUR CODING

LOOSE TUBE COLOUR	
	Colour
SMR - Pilot	Red
SMR - Directional	Green
OTHERS	White

FIBERS COLOUR				
	TUBE 1/3		TUBE 2/4	
	N° Fiber	Colour	N° Fiber	Colour
24 FO	1	Red	7	Pink
	2	Green	8	Orange
	3	Yellow	9	Grey
	4	Brown	10	Black
	5	Blue	11	Aqua
	6	Purple	12	White

MECHANICAL AND ENVIRONMENTAL CHARACTERISTICS

	U.M.	TYPE/NOMINAL VALUE
OPTICAL CORE		
N° fibers	-	24 FO SMR G652/D
Loose tubes in the cable	-	4 tubes with 6 fibers
ALUMINIUM TUBE		
Minimal outer diameter	mm	10,34
Minimal thickness	mm	2,28
ACS WIRE		
N°	-	12
Nominal wire diameter	mm	3,31
Sezione nominale acciaio totale	mm^2	103
Sezione nominale metallica totale	mm^2	161
Diametro nominale	mm	15,8
Peso nominale	Kg/Km	808
GENERAL DATA		
Aluminium tube size	mm^2	33,5
Total metallic cross section	mm^2	108,7
Nominal diameter	mm	14,0
Nominal metallic weight	Kg/Km	545
Nominal OPGW weight	Kg/Km	590
ELECTRICAL CHARACTERISTICS		
Electrical resistance at 20°C	Ω/Km	0,28
Corrente max. di corto circuito a 0,5"	kA	≥20,0
MECHANICAL CHARACTERISTICS		
Linear expansion thermal coefficient a	$1/°C x10^{-5}$	14,41
Elastic modulus	daN/mm^2	10.400
Load at break	daN	11.500

OVERHEAD CABLES BASED ON INNOVATIVE TRATOS DESIGN

TRATOS® OPGW 161895

OPGW 12 6(12G652D) ø15,2 mm

An Optical Ground Wire (OPGW) comprising a centre of 2 loose tubes, 2 tubes containing 6 Single Mode CWDM optical fibres (G.652D) and 2 Fillers, surrounded by an aluminium tube and an overall conductor of 13x2.9 mm diameter Aluminium Covered Steel (ACS) wires. Nominal overall diameter 15.2mm.

FEATURES AND PERFORMANCES

CONSTRUCTION

1) Central dielectric support (FRP)
2) Thixotropic compound filled loose tubes containing 6 FO
3) Wrapping (Mica/Polyester)
4) Dry Aluminium tube
5) Aluminium covered steel (No.20) wires

INTERNATIONAL STANDARDS

- ITU-T G652/D
- RED ELECTRICA DE ESPANA ET 032

COLOUR CODING

LOOSE TUBE COLOUR		
	Colour	Fiber Type
1	Blue	G.652D
2	White	G.652D
FILLER	Natural/Black	-

FIBERS COLOUR					
N° Fiber	Colour	Fiber Type	N° Fiber	Colour	Fiber Type
1	Yellow	G.652D	7	Black	G.652D
2	Blue	G.652D	8	Red	G.652D
3	White	G.652D	9	Rose	G.652D
4	Grey	G.652D	10	Tourquoise	G.652D
5	Brown	G.652D	11	Green	G.652D
6	Orange	G.652D	12	Violet	G.652D

GENERAL CHARACTERISTICS

	U.M.	TYPE/NOMINAL VALUE
OPTICAL CORE		
N° fibers		12 FO
TRATOS code		161895
Fiber type		12 G.652D
Loose tubes in the cable	-	2 tubes 6 fo 2 fillers
Loose tubes filler		Water blocking synthetic thixotropic compound
Central dielectric fiberglass diameter	mm	0,8±0,1
Loose tubes external diameter	mm	1,8±0,1
Loose tubes internal diameter	mm	1,2±0,1
Optical core wrappings	-	Mica + Polyester
DRY ALUMINIUM EXTRUDED TUBE		
Outer diameter	mm	9,3±0,1
Inner diameter	mm	5,4±0,05
ACS WIRE		
Type	-	20SA-A ICAS 20,3%
N°	-	13
Diameter	mm	2,82
Aluminium cross section	mm^2	62,19±1,55
Total metallic cross section	mm^2	130,89±1,55
Metallic weight	Kg/Km	703,8±14,0
Outer diameter	mm	15,10 -0±0,15
Total weight	Kg/Km	723,8±14,0
ELECTRICAL CHARACTERISTICS		
Max Electrical resistance at 20°C	Ω/Km	0.391
Max Short circuit current	kA	17
Short circuit time	sec	0,3
MECHANICAL CHARACTERISTICS		
Linear expansion thermal coefficient a	$1/°C x10^{-5}$	1,417
Elastic modulus	MPa	123.000
UTS	daN	12.300
RTS	daN	11.600

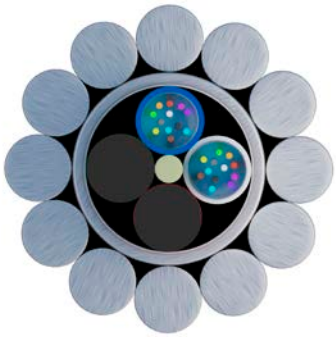
OVERHEAD CABLES BASED ON INNOVATIVE TRATOS DESIGN

TRATOS® OPGW 161785

OPGW 24 12(G652D) ø15,2 mm

An Optical Ground Wire (OPGW) comprising a centre of 2 loose tubes, 2 tubes containing 12 Single Mode CWDM optical fibres (G.652D) and 2 Fillers, surrounded by an aluminium tube and an overall conductor of 13x2.9 mm diameter Aluminium Covered Steel (ACS) wires. Nominal overall diameter 15.2mm.

FEATURES AND PERFORMANCES



CONSTRUCTION

1) Central dielectric support (FRP)
2) Thixotropic compound filled loose tubes containing 12 FO
3) Wrapping (Mica/Polyester)
4) Dry Aluminium tube
5) Aluminium covered steel (No.20) wires

INTERNATIONAL STANDARDS

- ITU-T G652/D
- RED ELECTRICA DE ESPANA ET 032

COLOUR CODING

LOOSE TUBE COLOUR		
	Colour	Fiber Type
1	Blue	G.652D
2	White	G.652D
FILLER	Natural/Black	-

FIBERS COLOUR					
N° Fiber	Colour	Fiber Type	N° Fiber	Colour	Fiber Type
1	Yellow	G.652D	7	Black	G.652D
2	Blue	G.652D	8	Red	G.652D
3	White	G.652D	9	Rose	G.652D
4	Grey	G.652D	10	Tourquoise	G.652D
5	Brown	G.652D	11	Green	G.652D
6	Orange	G.652D	12	Violet	G.652D

GENERAL CHARACTERISTICS

	U.M.	TYPE/NOMINAL VALUE
OPTICAL CORE		
N° fibers		24 FO
TRATOS code		161785
Fiber type		24 G.652D
Loose tubes in the cable	-	2 tubes 12 fo 2 fillers
Loose tubes filler		Water blocking synthetic thixotropic compound
Central dielectric fiberglass diameter	mm	0,8±0,1
Loose tubes external diameter	mm	1,8±0,1
Loose tubes internal diameter	mm	1,2±0,1
Optical core wrappings	-	Mica + Polyester
DRY ALUMINIUM EXTRUDED TUBE		
Outer diameter	mm	9,3±0,1
Inner diameter	mm	5,4±0,05
ACS WIRE		
Type	-	20SA-A ICAS 20,3%
N°	-	13
Diameter	mm	2,82
Aluminium cross section	mm^2	62,19±1,55
Total metallic cross section	mm^2	130,89±1,55
Metallic weight	Kg/Km	703,8±14,0
Outer diameter	mm	15,10 -0±0,15
Total weight	Kg/Km	723,8±14,0
ELECTRICAL CHARACTERISTICS		
Max Electrical resistance at 20°C	Ω/Km	0.391
Max Short circuit current	kA	17
Short circuit time	sec	0,3
MECHANICAL CHARACTERISTICS		
Linear expansion thermal coefficient a	$1/°C x10^{-5}$	1,417
Elastic modulus	MPa	123.000
UTS	daN	12.300
RTS	daN	11.600

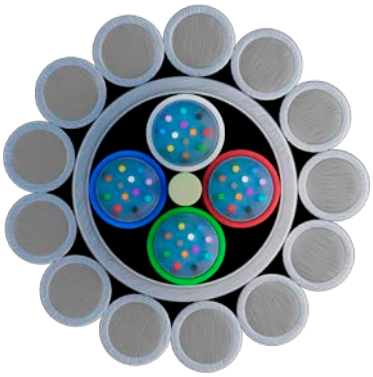
OVERHEAD CABLES BASED ON INNOVATIVE TRATOS DESIGN

TRATOS® OPGW 025271

OPGW 48 12(G652D) ø15,2 mm

An Optical Ground Wire (OPGW) comprising a centre of 4 loose tubes containing 12 Single Mode CWDM optical fibres (G.652D), surrounded by an aluminium tube and an overall conductor of 13x2.9 mm diameter Aluminium Covered Steel (ACS) wires. Nominal overall diameter 15.2mm.

FEATURES AND PERFORMANCES



CONSTRUCTION

1) Central dielectric support (FRP)
2) Thixotropic compound filled loose tubes containing 12 FO
3) Wrapping (Mica/Polyester)
4) Dry Aluminium tube
5) Aluminium covered steel (No.20) wires

INTERNATIONAL STANDARDS

- ITU-T G652/D
- RED ELECTRICA DE ESPANA ET 032

COLOUR CODING

LOOSE TUBE COLOUR		
	Colour	Fiber Type
1	Blue	G.652D
2	White	G.652D
3	Red	G .652D
4	Green	G .652D

FIBERS COLOUR					
N° Fiber	Colour	Fiber Type	N° Fiber	Colour	Fiber Type
1	Yellow	G.652D	7	Black	G.652D
2	Blue	G.652D	8	Red	G.652D
3	White	G.652D	9	Rose	G.652D
4	Grey	G.652D	10	Tourquoise	G.652D
5	Brown	G.652D	11	Green	G.652D
6	Orange	G.652D	12	Violet	G.652D

GENERAL CHARACTERISTICS

	U.M.	TYPE/NOMINAL VALUE
OPTICAL CORE		
N° fibers		48 FO
TRATOS code		025271
Fiber type		48 G.652D
Loose tubes in the cable	-	4 tubes 12 fo
Loose tubes filler		Water blocking synthetic thixotropic compound
Central dielectric fiberglass diameter	mm	0,8±0,1
Loose tubes external diameter	mm	1,8±0,1
Loose tubes internal diameter	mm	1,2±0,1
Optical core wrappings	-	Mica + Polyester
DRY ALUMINIUM EXTRUDED TUBE		
Outer diameter	mm	9,3±0,1
Inner diameter	mm	5,4±0,05
ACS WIRE		
Type	-	20SA-A ICAS 20,3%
N°	-	13
Diameter	mm	2,82
Aluminium cross section	mm^2	62,19±1,55
Total metallic cross section	mm^2	130,89±1,55
Metallic weight	Kg/Km	703,8±14,0
Outer diameter	mm	15,10 -0±0,15
Total weight	Kg/Km	723,8±14,0
ELECTRICAL CHARACTERISTICS		
Max Electrical resistance at 20°C	Ω/Km	0,391
Max Short circuit current	kA	17
Short circuit time	sec	0,3
MECHANICAL CHARACTERISTICS		
Linear expansion thermal coefficient a	$1/°C x 10^{-5}$	1,417
Elastic modulus	MPa	123.000
UTS	daN	12.300
RTS	daN	11.600

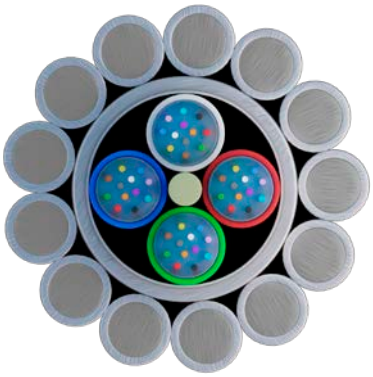
OVERHEAD CABLES BASED ON INNOVATIVE TRATOS DESIGN

TRATOS® OPGW 161783

OPGW 48 12(42G652D+6G655) ø15,2 mm

An Optical Ground Wire (OPGW) comprising a centre of 4 loose tubes, 3 tubes containing 12 Single Mode CWDM optical fibres (G.652D) and 1 tube containing 6 Single-mode CWDM optical fibres (G.652D) + 6 Single-mode DWDM optical fibres (G.655), surrounded by an aluminium tube and an overall conductor of 13x2.9 mm diameter Aluminium Covered Steel (ACS) wires. Nominal overall diameter 15.2mm.

FEATURES AND PERFORMANCES



CONSTRUCTION

1) Central dielectric support (FRP)
2) Thixotropic compound filled loose tubes containing 12 FO
3) Wrapping (Mica/Polyester)
4) Dry Aluminium tube
5) Aluminium covered steel (No.20) wires

INTERNATIONAL STANDARDS

- ITU-T G652/D
- ITU-T G655
- RED ELECTRICA DE ESPANA ET 032

COLOUR CODING

LOOSE TUBE COLOUR		
	Colour	Fiber Type
1	Blue	G.652D
2	White	G.652D
3	Red	G.652D
4	Green	G.655

FIBERS COLOUR					
N° Fiber	Colour	Fiber Type	N° Fiber	Colour	Fiber Type
1	Yellow	G.652D	7	Black	G.652D/G.655
2	Blue	G.652D	8	Red	G.652D/G.655
3	White	G.652D	9	Rose	G.652D/G.655
4	Grey	G.652D	10	Tourquoise	G.652D/G.655
5	Brown	G.652D	11	Green	G.652D/G.655
6	Orange	G.652D	12	Violet	G.652D/G.655

GENERAL CHARACTERISTICS

	U.M.	TYPE/NOMINAL VALUE
OPTICAL CORE		
N° fibers		48 FO
TRATOS code		161783
Fiber type		42 G.652D 6 G.655
Loose tubes in the cable	-	4 tubes 12 fo
Loose tubes filler		Water blocking synthetic thixotropic compound
Central dielectric fiberglass diameter	mm	0,8±0,1
Loose tubes external diameter	mm	1,8±0,1
Loose tubes internal diameter	mm	1,2±0,1
Optical core wrappings	-	Mica + Polyester
DRY ALUMINIUM EXTRUDED TUBE		
Outer diameter	mm	9,3±0,1
Inner diameter	mm	5,4±0,05
ACS WIRE		
Type	-	20SA-A ICAS 20,3%
N°	-	13
Diameter	mm	2,82
Aluminium cross section	mm^2	62,19±1,55
Total metallic cross section	mm^2	130,89±1,55
Metallic weight	Kg/Km	703,8±14,0
Outer diameter	mm	15,10 -0±0,15
Total weight	Kg/Km	723,8±14,0
ELECTRICAL CHARACTERISTICS		
Max Electrical resistance at 20°C	Ω/Km	391
Max Short circuit current	kA	17
Short circuit time	sec	0,3
MECHANICAL CHARACTERISTICS		
Linear expansion thermal coefficient a	$1/°C x10^{-5}$	1,417
Elastic modulus	MPa	123.000
UTS	daN	12.300
RTS	daN	11.600

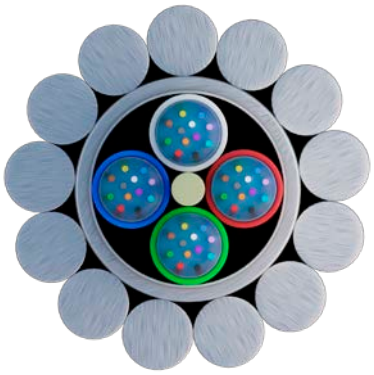
OVERHEAD CABLES BASED ON INNOVATIVE TRATOS DESIGN

TRATOS® OPGW 094462

OPGW 48 4(12SMR)

An Optical Ground Wire (OPGW) comprising a centre of 4 loose tubes containing 12 Single Mode CWDM optical fibres (G.652D), surrounded by an aluminium tube and an overall conductor of 16x2.7 mm diameter Aluminium Covered Steel (ACS) wires. Nominal overall diameter 17,0mm.

FEATURES AND PERFORMANCES



CONSTRUCTION

1) Central dielectric support FRP
2) Jelly filled loose tube (12 FO)
3) Wrapping
4) Aluminium tube
5) ACS Wire (n° 16)

INTERNATIONAL STANDARDS

- ITU-T G652/D

COLOUR CODING

LOOSE TUBE COLOUR	
	COLOUR
SMR - Pilot	Red
SMR - Directional	Green
OTHERS	White

FIBERS COLOUR				
	TUBE 1 - 2 - 3 - 4			
	N° Fiber	Colour	N° Fiber	Colour
48 FO	1	Red	7	Pink
	2	Green	8	Orange
	3	Yellow	9	Grey
	4	Brown	10	Black
	5	Blue	11	Aqua
	6	Purple	12	White

GENERAL CHARACTERISTICS

	U.M.	TYPE/NOMINAL VALUE
OPTICAL CORE		
N° fibers		48 FO SMR G652/D
Loose tubes in the cable	-	4 tubes with 12 fibers
ALUMINIUM TUBE		
Nominal outer diameter	mm	11,6
Minimum thickness	mm	1,8
ACS WIRE		
N°	-	16
Nominal wire diameter	mm	2,7
GENERAL DATA		
Aluminium tube size	mm^2	55,0
Total metallic cross section	mm^2	147,3
Nominal diameter	mm	17,0
Nominal metallic weight	Kg/Km	770
Nominal OPGW weight	Kg/Km	786
ELECTRICAL CHARACTERISTICS		
Electrical resistance at 20°C	Ω/Km	0,332
MECHANICAL CHARACTERISTICS		
Linear expansion thermal coefficient a	$1/°C x10^{-5}$	14,1
Elastic modulus	daN/mm^2	11.300
Load at break	daN	12.370

OVERHEAD CABLES BASED ON INNOVATIVE TRATOS DESIGN

TRATOS® OPGW 161942

OPGW 12 6(12G652D) ø17,2 mm

An Optical Ground Wire (OPGW) comprising a centre of 2 loose tubes, 2 tubes containing 6 Single Mode CWDM optical fibres (G.652D) and 2 Fillers, surrounded by an aluminium tube and an overall conductor of 14x3.05 mm diameter Aluminium Covered Steel (ACS) wires. Nominal overall diameter 17.2mm.

FEATURES AND PERFORMANCES

CONSTRUCTION

1) Central dielectric support (FRP)
2) Thixotropic compound filled loose tubes containing 6 FO
3) Wrapping (Mica/Polyester)
4) Dry Aluminium tube
5) Aluminium covered steel (No.20) wires

STANDARDS

- ITU-T G652/D
- RED ELECTRICA DE ESPANA ET 033

COLOUR CODE

LOOSE TUBE COLOUR		
	COLOUR	FIBER TYPE
1	Blue	G.652D
2	White	G.652D
FILLER	Natural / Black	-

FIBERS COLOUR					
N° Fiber	Colour	Fiber Type	N° Fiber	Colour	Fiber Type
1	Yellow	G .652D	7	Black	G .652D
2	Blue	G .652D	8	Red	G .652D
3	White	G .652D	9	Rose	G .652D
4	Grey	G .652D	10	Tourquoise	G .652D
5	Brown	G .652D	11	Green	G .652D
6	Orange	G .652D	12	Violet	G .652D

GENERAL CHARACTERISTICS

	U.M.	TYPE/NOMINAL VALUE
OPTICAL CORE		
N° fibers	-	12 FO
TRATOS code		161942
Fiber type		12 G.652D
Loose tubes in the cable	-	2 tubes 6 fo 2 fillers
Loose tubes filler		Water blocking synthetic thixotropic compound
Central dielectric fiberglass diameter	mm	1,0±0,1
Loose tubes external diameter	mm	2,2±0,1
Loose tubes internal diameter	mm	1,4±0,1
Optical core wrapping	-	Mica + Polyester
DRY ALUMINIUM EXTRUDED TUBE		
Outer diameter	mm	11,1±0,11
Inner diameter	mm	6,5±0,65
ACS WIRE		
Type	-	20SA-A ICAS 20,3%
N°	-	14
Diameter	mm	3,05
GENERAL DATA		
Total Aluminium cross section	mm^2	89,16
Total metallic cross section	mm^2	165,87±4,10
Metallic weight	Kg/Km	854±20
Outer diameter	mm	17,2 -0,1 +0,4
Total weight	Kg/Km	880±20
ELECTRICAL CHARACTERISTICS		
Max Electrical resistance at 20°C	Ω/Km	0,295
Max Short circuit current	kA	25
Short circuit time	sec	0,3
MECHANICAL CHARACTERISTICS		
Linear expansion thermal coefficient	$1/°C x10^{-5}$	1,444
Elastic modulus	daN/mm^2	119.000
UTS	daN	14.700
RTS	daN	13.900

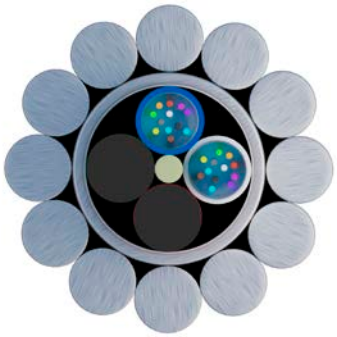
OVERHEAD CABLES BASED ON INNOVATIVE TRATOS DESIGN

TRATOS® OPGW 161945

OPGW 24 12(G652D) ø17,2 mm

An Optical Ground Wire (OPGW) comprising a centre of 2 loose tubes, 2 tubes containing 12 Single Mode CWDM optical fibres (G.652D) and 2 Fillers, surrounded by an aluminium tube and an overall conductor of 14x3.05 mm diameter Aluminium Covered Steel (ACS) wires. Nominal overall diameter 17.2mm.

FEATURES AND PERFORMANCES



CONSTRUCTION

1) Central dielectric support (FRP)
2) Thixotropic compound filled loose tubes containing 12 FO
3) Wrapping (Mica/Polyester)
4) Dry Aluminium tube
5) Aluminium covered steel (No.20) wires

STANDARDS

- ITU-T G652/D
- RED ELECTRICA DE ESPANA ET 033

COLOUR CODE

LOOSE TUBE COLOUR		
	COLOUR	FIBER TYPE
1	Blue	G.652D
2	White	G.652D
FILLER	Natural / Black	-

FIBERS COLOUR					
N° Fiber	Colour	Fiber Type	N° Fiber	Colour	Fiber Type
1	Yellow	G.652D	7	Black	G.652D
2	Blue	G.652D	8	Red	G.652D
3	White	G.652D	9	Rose	G.652D
4	Grey	G.652D	10	Tourquoise	G.652D
5	Brown	G.652D	11	Green	G.652D
6	Orange	G.652D	12	Violet	G.652D

GENERAL CHARACTERISTICS

	U.M.	TYPE/NOMINAL VALUE
OPTICAL CORE		
N° fibers	-	24 FO
TRATOS code		161945
Fiber type		24 G.652D
Loose tubes in the cable	-	2 tubes 12 fo 2 fillers
Loose tubes filler		Water blocking synthetic thixotropic compound
Central dielectric fiberglass diameter	mm	1,0±0,1
Loose tubes external diameter	mm	2,2±0,1
Loose tubes internal diameter	mm	1,4±0,1
Optical core wrapping	-	Mica + Polyester
DRY ALUMINIUM EXTRUDED TUBE		
Outer diameter	mm	11,1±0,11
Inner diameter	mm	6,5±0,065
ACS WIRE		
Type	-	20SA-A ICAS 20,3%
N°	-	14
Diameter	mm	3,05
GENERAL DATA		
Total Aluminium cross section	mm^2	89,16
Total metallic cross section	mm^2	165,87±4,10
Metallic weight	Kg/Km	854,8±20,0
Outer diameter	mm	17,20 -01±0,4
Total weight	Kg/Km	880±20,0
ELECTRICAL CHARACTERISTICS		
Max Electrical resistance at 20°C	Ω/Km	0,295
Max Short circuit current	kA	25
Short circuit time	sec	0,3
MECHANICAL CHARACTERISTICS		
Linear expansion thermal coefficient	$1/°C x10^{-5}$	1,444
Elastic modulus	daN/mm^2	119.000
UTS	daN	14.700
RTS	daN	13.900

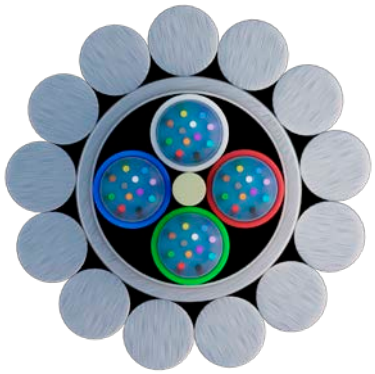
OVERHEAD CABLES BASED ON INNOVATIVE TRATOS DESIGN

TRATOS® OPGW 161946

OPGW 48 12(G652D) ø17,2 mm

An Optical Ground Wire (OPGW) comprising a centre of 4 loose tubes containing 12 Single Mode CWDM optical fibres (G.652D), surrounded by an aluminium tube and an overall conductor of 14x3.05mm diameter Aluminium Covered Steel (ACS) wires. Nominal overall diameter 17.2mm.

FEATURES AND PERFORMANCES



CONSTRUCTION

1) Central dielectric support (FRP)
2) Thixotropic compound filled loose tubes containing 12 FO
3) Wrapping (Mica/Polyester)
4) Dry Aluminium tube
5) Aluminium covered steel (No.20) wires

STANDARDS

- ITU-T G652/D
- RED ELECTRICA DE ESPANA ET 033

COLOUR CODE

LOOSE TUBE COLOUR		
	COLOUR	FIBER TYPE
1	Blue	G.652D
2	White	G.652D
3	Red	G.652D
4	Green	G.652D

FIBERS COLOUR					
N° Fiber	Colour	Fiber Type	N° Fiber	Colour	Fiber Type
1	Yellow	G.652D	7	Black	G.652D
2	Blue	G.652D	8	Red	G.652D
3	White	G.652D	9	Rose	G.652D
4	Grey	G.652D	10	Tourquoise	G.652D
5	Brown	G.652D	11	Green	G.652D
6	Orange	G.652D	12	Violet	G.652D

GENERAL CHARACTERISTICS

	U.M.	TYPE/NOMINAL VALUE
OPTICAL CORE		
N° fibers	-	48 FO
TRATOS code		161946
Fiber type		12 G.652D
Loose tubes in the cable	-	4 tubes 12 fo
Loose tubes filler		Water blocking synthetic thixotropic compound
Central dielectric fiberglass diameter	mm	1,0±0,1
Loose tubes external diameter	mm	2,2±0,1
Loose tubes internal diameter	mm	1,4±0,14
Optical core wrapping	-	Mica + Polyester
DRY ALUMINIUM EXTRUDED TUBE		
Outer diameter	mm	11,1±0,11
Inner diameter	mm	6,5±0,65
ACS WIRE		
Type	-	20SA-A ICAS 20,3%
N°	-	14
Diameter	mm	3,05
GENERAL DATA		
Total Aluminium cross section	mm^2	89,16
Total metallic cross section	mm^2	165,87±4,10
Metallic weight	Kg/Km	854±20
Outer diameter	mm	17,2 -0,1 +0,4
Total weight	Kg/Km	880±20
ELECTRICAL CHARACTERISTICS		
Max Electrical resistance at 20°C	Ω/Km	0,295
Max Short circuit current	kA	25
Short circuit time	sec	0,3
MECHANICAL CHARACTERISTICS		
Linear expansion thermal coefficient	$1/°C x10^{-5}$	1,444
Elastic modulus	daN/mm^2	119.000
UTS	daN	14.700
RTS	daN	13.900

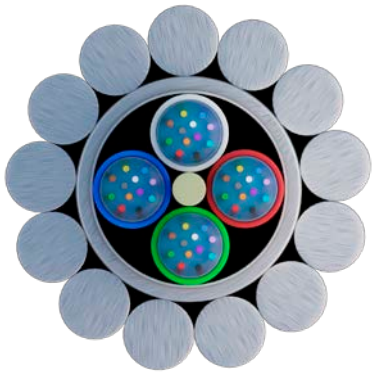
OVERHEAD CABLES BASED ON INNOVATIVE TRATOS DESIGN

TRATOS® OPGW 161947

OPGW 48 12(42G652D+6G655) ø17,2 mm

An Optical Ground Wire (OPGW) comprising a centre of 4 loose tubes, 3 tubes containing 12 Single Mode CWDM optical fibres (G.652D) and 1 tube containing 6 Single-mode CWDM optical fibres (G.652D) + 6 Single-mode DWDM optical fibres (G.655), surrounded by an aluminium tube and an overall conductor of 14x3.05 mm diameter Aluminium Covered Steel (ACS) wires. Nominal overall diameter 17.2mm.

FEATURES AND PERFORMANCES



CONSTRUCTION

1) Central dielectric support (FRP)
2) Thixotropic compound filled loose tubes containing 12 FO
3) Wrapping (Mica/Polyester)
4) Dry Aluminium tube
5) Aluminium covered steel (No.20) wires

STANDARDS

- ITU-T G652/D
- ITU-T G655
- RED ELECTRICA DE ESPANA ET 033

COLOUR CODE

LOOSE TUBE COLOUR		
	COLOUR	FIBER TYPE
1	Blue	G.652D
2	White	G.652D
3	Red	G.652D
4	Green	G.652D/G.655

FIBERS COLOUR					
N° Fiber	Colour	Fiber Type	N° Fiber	Colour	Fiber Type
1	Yellow	G.652D	7	Black	G.652D/G.655
2	Blue	G.652D	8	Red	G.652D/G.655
3	White	G.652D	9	Rose	G.652D/G.655
4	Grey	G.652D	10	Tourquoise	G.652D/G.655
5	Brown	G.652D	11	Green	G.652D/G.655
6	Orange	G.652D	12	Violet	G.652D/G.655

GENERAL CHARACTERISTICS

	U.M.	TYPE/NOMINAL VALUE
OPTICAL CORE		
N° fibers	-	48 FO
TRATOS code		161947
Fiber type		42 G .652D 6 G655
Loose tubes in the cable	-	4 tubes 12 fo
Loose tubes filler		Water blocking synthetic thixotropic compound
Central dielectric fiberglass diameter	mm	1,0±0,1
Loose tubes external diameter	mm	2,2±0,1
Loose tubes internal diameter	mm	1,4±0,14
Optical core wrapping	-	Mica + Polyester
DRY ALUMINIUM EXTRUDED TUBE		
Outer diameter	mm	11,1±0,11
Inner diameter	mm	6,5±0,65
ACS WIRE		
Type	-	20SA-A ICAS 20,3%
N°	-	14
Diameter	mm	3,05
GENERAL DATA		
Total Aluminium cross section	mm^2	89,16
Total metallic cross section	mm^2	165,87±4,10
Metallic weight	Kg/Km	854±20,0
Outer diameter	mm	17,20 -01±0,4
Total weight	Kg/Km	880±20,0
ELECTRICAL CHARACTERISTICS		
Max Electrical resistance at 20°C	Ω/Km	0,295
Max Short circuit current	kA	25
Short circuit time	sec	0,3
MECHANICAL CHARACTERISTICS		
Linear expansion thermal coefficient	$1/°C x10^{-5}$	1,444
Elastic modulus	daN/mm^2	119.000
UTS	daN	14.700
RTS	daN	13.900

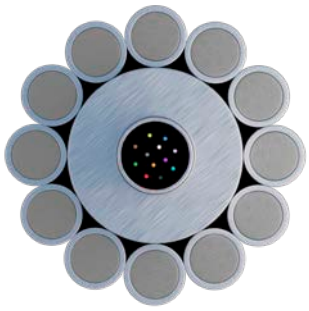
OVERHEAD CABLES BASED ON INNOVATIVE TRATOS DESIGN

TRATOS® OPGW 194046

OPGW TOL 1 48 1(48 652D) ø16,42 mm

An Optical Ground Wire (OPGW) comprising a central stainless steel loose tube containing 48 Single Mode optical fibres (G652D), surrounded by an aluminium tube and an overall conductor of 12x2.55 mm diameter Aluminium Covered Steel (ACS No .27SA) wires. Nominal overall diameter 16.42 mm. Code: SP-48F3(S77)OFS(48x1x4,2)TUAF(12x3.31) Ø16.42.

FEATURES AND PERFORMANCES



CONSTRUCTION

1) Jelly filled stainless steel loose tube containing 48 FO
2) Aluminium tube
3) Aluminium covered steel (No .27SA) wires

STANDARDS

- ITU-T G652D
- TERNA LIN_00000C60
- TERNA LIN_000C3907

COLOUR CODE

LOOSE TUBE COLOUR	
	COLOUR
Centre	Silver

FIBERS COLOUR			
N° Fiber	Colour	N° Fiber	Colour
1	Red	7	Pink
2	Green	8	Orange
3	Yellow	9	Grey
4	Brown	10	Black**
5	Blue	11	Aqua
6	Purple	12	White

* Basic colours + 1, 2, 3 black rings to identify the other fibres.
** The black fibre n ° 10 is replaced by a natural colour fibre plus 1, 2 or 3 black rings.

GENERAL CHARACTERISTICS

	U.M.	TYPE/NOMINAL VALUE
OPTICAL CORE		
N° fibers	-	48 FO SMR G652/D
TRATOS code		194046
Thixotropic water-blocking filling		-
Stainless steel loose tubes in the cable	-	1 Stainless steel tube with 48 fibers
Outer diameter	mm	4.2
Thickness of tube	mm	0,2
ALUMINIUM TUBE		
Minimal outer diameter	mm	8,00
Nominal wall thickness	mm	1.65
ACS WIRE		
N° 27SA	-	12
Nominal wire diameter	-	3,31
Length of Lay	mm	253 - 297
GENERAL DATA		
Aluminium cross section	mm^2	96
Total metallic cross section	mm^2	163
Nominal diameter	mm	16.42
Nominal metallic weight	Kg/Km	798
Nominal OPGW weight	Kg/Km	800
ELECTRICAL CHARACTERISTICS		
Max Electrical Resistance at 20°C	Ω/Km	0,28
Max Short Circuit Current	kA	20,0
Short Circuit Time	sec	0,5
MECHANICAL CHARACTERISTICS		
Linear expansion thermal coefficient	$1/°C x10^{-5}$	1,444
Elastic modulus	daN/mm^2	119.000
Load at break	daN	14.700

OVERHEAD CABLES BASED ON INNOVATIVE TRATOS DESIGN

TRATOS® OPGW 194023

OPGW TOL 1 48 1(48 652D) ø12,48 mm

An Optical Ground Wire (OPGW) comprising a central stainless steel loose tube containing 48 Single Mode optical fibres (G652D), surrounded by an aluminium tube and an overall conductor of 14x2.24 mm diameter Aluminium Covered Steel (ACS No .12) wires. Nominal overall diameter 12,48mm. Code: SP-48F3(S77)OFS(48x1x4,2)TUAF(14x2.24) Ø12.48

FEATURES AND PERFORMANCES

CONSTRUCTION

1) Jelly filled stainless steel loose tube containing 48 FO
2) Aluminium tube
3) Aluminium covered steel (No .12) wires

STANDARDS

- ITU-T G652D
- TERNA LIN_00000C60
- TERNA LIN_000C3907

COLOUR CODE

LOOSE TUBE COLOUR	
	COLOUR
Centre	Silver

FIBERS COLOUR			
N° Fiber	Colour	N° Fiber	Colour
1	Red	7	Pink
2	Green	8	Orange
3	Yellow	9	Grey
4	Brown	10	Black**
5	Blue	11	Aqua
6	Purple	12	White

* Basic colours + 1, 2, 3 black rings to identify the other fibres.
** The black fibre n ° 10 is replaced by a natural colour fibre plus 1, 2 or 3 black rings.

GENERAL CHARACTERISTICS

	U.M.	TYPE/NOMINAL VALUE
OPTICAL CORE		
N° fibers	-	48 FO SMR G652/D
TRATOS code		194023
Thixotropic water-blocking filling		
Stainless steel loose tubes in the cable	-	1 stainless steel tube with 48 fibres
Outer diameter	mm	4.2
Thickness of tube	mm	0,2
ALUMINIUM TUBE		
Minimal outer diameter	mm	8,00
Nominal wall thickness	mm	1.65
ACS WIRE		
N° 27SA	-	14
Nominal wire diameter	-	2,24
Length of Lay	mm	203 - 237
GENERAL DATA		
Aluminium cross section	mm^2	47
Total metallic cross section	mm^2	90
Nominal diameter	mm	12.48
Nominal metallic weight	Kg/Km	476
Nominal OPGW weight	Kg/Km	488
ELECTRICAL CHARACTERISTICS		
Max Electrical Resistance at 20°C	Ω/Km	0,57
Max Short Circuit Current	kA	10,0
Short Circuit Time	sec	0,5
MECHANICAL CHARACTERISTICS		
Linear expansion thermal coefficient	$1/°C x10^{-5}$	14,9
Elastic modulus	daN/mm^2	125.000
Load at break	daN	7.795

OVERHEAD CABLES BASED ON INNOVATIVE TRATOS DESIGN

TRATOS® OPGW 194269

OPGW TOL 1 48 1(48 652D) ø10,8 mm

An Optical Ground Wire (OPGW) comprising a central stainless steel loose tube containing 48 Single Mode optical fibres (G652D), surrounded by an overall conductor of 6x3.60 mm diameter Aluminium Covered Steel (ACS No .27SA) wires . Nominal overall diameter 10.80mm Code: SP-48F3(S77)OFS(48x1x3,6)TU316LF(6x3,6)Ø10.8

FEATURES AND PERFORMANCES

CONSTRUCTION

1) Jelly filled stainless steel loose tube containing 48 FO
2) Aluminium covered steel (No .27SA) wires

STANDARDS

- ITU-T G652D
- TERNA LIN_00000C61
- TERNA LIN_000C3907

COLOUR CODE

LOOSE TUBE COLOUR	
	COLOUR
Centre	Silver

FIBERS COLOUR			
N° Fiber	Colour	N° Fiber	Colour
1	Red	7	Pink
2	Green	8	Orange
3	Yellow	9	Grey
4	Brown	10	Black**
5	Blue	11	Aqua
6	Purple	12	White

* Basic colours + 1, 2, 3 black rings to identify the other fibres.
** The black fibre n ° 10 is replaced by a natural colour fibre plus 1, 2 or 3 black rings.

GENERAL CHARACTERISTICS

	U.M.	TYPE/NOMINAL VALUE
OPTICAL CORE		
N° fibres	-	48 FO
TRATOS code		194269
Type of fibres		48 FO SMR G652/D
Thixotropic water-blocking filling		
Stainless steel loose tubes in the cable	-	1 Stainless steel tube with 48 fibers
Outer diameter	mm	3.6
Thickness of tube	mm	0,2
ACS WIRE		
N° 27SA	-	6
Nominal wire diameter	-	3,60
Length of Lay	mm	175 - 205
GENERAL DATA		
Total metallic cross section	mm^2	63,2
Nominal diameter	mm	10.80
Nominal OPGW weight	Kg/Km	387
ELECTRICAL CHARACTERISTICS		
Max Electrical Resistance at 20°C	Ω/Km	1,09
Max Short Circuit Current	kA	7,0
Short Circuit Time	sec	0,5
MECHANICAL CHARACTERISTICS		
Linear expansion thermal coefficient	$1/°C x10^{-5}$	13,5
Elastic modulus	daN/mm^2	140000
Load at break	daN	6650

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