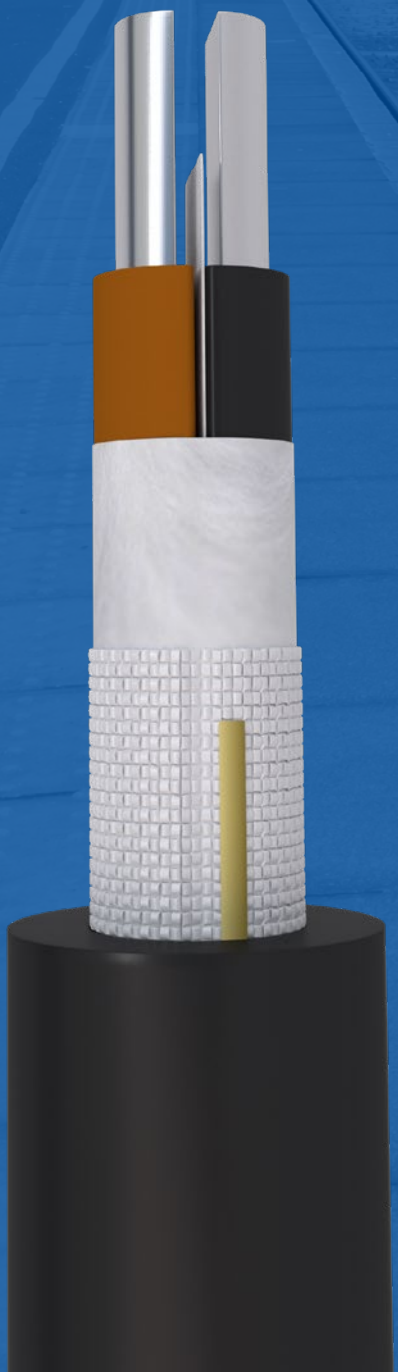
TRATOS

CABLES FOR A MOVING WORLD

TRATOS NETWORK RAIL FGT®



Crown Commercial Service *Supplier*

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

THE QUEEN'S AWARDS FOR ENTERPRISE: INNOVATION 2019

Certificate of Full Acceptance
PA05/07165

NetworkRail

March **2021**
TCn20-Rev-11

INDEX

OUR MEMBERSHIPS IN THE RAILWAYS INDUSTRY

Rail Forum MIDLANDS

As featured in the 2019 QUEEN'S AWARDS for ENTERPRISE magazine

THE QUEEN'S AWARD FOR ENTERPRISE IN INNOVATION

Tratos Ltd

Tratos Ltd is the cable industry's innovator and, because cable is fundamental to almost every innovation, it has become an enabler of emerging technology across the industries that move the world forward.

Tratos is part of an international team working on the ITER project – an exploration of controlled thermonuclear fusion as an inexhaustible supply of clean, green energy.

Tratos supplied key components of the superconductivity experiment, in particular cable-in-conduit (CIC) superconducting wire, for the construction of magnets for the ITER reactor.

R&D develops cable from concept to production to open up new possibilities for performance. Tratos conceived and produced the world's smallest microcable for faster and more easily-accessed broadband connectivity, for example.

Its latest sheathing compounds deliver reliability, performance and health and safety advances in the harshest environments, and its new breed hybrid conductors are protecting the integrity of more hard-won energy as it travels across overhead power cables.

Tratos won a Queen's Award for Innovation for its JBA cable. The JBA (Jasmine* Bragagni Albano) was named after the President of Tratos, Ing. Com. Albano Bragagni, OMRI, inventor of the LSZH (Low Smoke Zero Halogen) extra compound. Tratos' Oil & Gas JBA® is a special cable range designed and manufactured for the oil and gas market to meet necessary test requirements.

The JBA family of cables is mud and fire resistant to extreme temperatures, and capable of withstanding water and impact.

Tratos is a family-owned business professionally managed by a board drawn from senior experts with a wealth of industry experience. The Tratos board members, pictured left to right; Dr Ennio Bragagni Capaccini, Ing Albano Bragagni, Dr Elisabetta Bragagni Capaccini, Mr Germano Bragagni, Mr Neil Ancell, Mr John Light and Dr Maurizio Bragagni. Additional members of The Tratos board include; Enrico Scambia, Kevin and James Card.

Tratos has UK and Italy manufacturing and test facilities, and offices worldwide. It works with customers, creating bespoke solutions and high quality cabling to meet their needs.

The international ports industry is celebrating the 11th year of continuous running of Tratos' high-speed reeling cable.

Left and below: Tratos is the cable industry's innovator, and its range is helping to move the world forward.

Tratos works across infrastructure industries worldwide, from rail and smart highways to power, oil and gas, marine, construction, defence and communications. It is invested in the UK; not only on the millions spent on state-of-the-art production facilities, new manufacturing equipment and creating 40 new jobs, but as a stakeholder in the UK economy.

Tratos supports investment in faster, smarter routes to super-fast broadband speeds for Britain. Its White Paper examines the issues and potential solutions to UK connectivity challenges. It also champions change-for-good for the development of more efficient green energy transmission cable for safer homes and public buildings.

The company's Academy works to develop its people and encourage innovation. Says CEO and Chair Dr Maurizio Bragagni: "A true culture of innovation requires the time and space to experiment, and the understanding that it's ok to make mistakes. Finding out how not to do something is another step closer to achieving the right way to doing something. Removing the fear of blame is the first step towards discovering something new, useful and ground-breaking. In our world 'impossible' simply means not possible… yet."

**Developed for the Jasmine North Sea offshore platform.*

TRATOS LTD
Randles Road, Knowsley Business Park, Knowsley, L34 9HX • Tel: +44 151 548 3888
zilah.skerritt@tratosgroup.com
www.tratosgroup.com

TRATOS RECENTLY **INVESTED OVER £20M** IN THE UNITED KINGDOM

The successful delivery of a five-year plan for investment and expansion at Tratos' UK manufacturing facilities has seen significant growth in resource and capability – and the opening up of new market sectors for the company's advanced cable.

In addition to increasing production efficiencies, with faster machines and a purpose-built factory, the company has been careful to invest in the professional development of its people.

During those past five years Tratos has transformed itself to cope with the speed of its own cable innovation – rapidly accepted by customers – and seen turnover and market share rise significantly.

With a growing reputation for quality, service, health and safety and bespoke solutions with additional benefits for customers, the company's new corporate video sets out the new-look company and explores the changes and challenges for Tratos across domestic and global markets.

Investment:

- £20m investment at Tratos' UK base in **Knowsley, Merseyside** created 40 new jobs
- £15m of this investment pledged to facilitate new state-of-the-art machines and equipment to speed up and increase capacity
- Additional investment in equipment has seen a rise in turnover to £200m
- At its facility in Pieve, Tuscany, an additional £6m funded new machines and infrastructure, creating another 40 new jobs in Italy
- The **Tratos Academy** to share best practice and develop its best people with a focus on product knowledge and customer service that is second to none and encouraging innovative thinking.

TRATOS UK LTD WINS
NETWORK RAIL CABLES APPROVAL

Advanced technology cable maker Tratos has gained **Network Rail cables approval** for its family of enhanced unarmoured **signalling power cables**.

The independent British manufacturer won a Network Rail Certificate of Acceptance (Network Rail product approval no: PA05/07165) for cable designed for signalling power distribution systems in accordance with NR/L2/SIGELP/27408. The cables feature glass fibre weave (FGT) and water blocking (WB). The range comprises both **Copper** and **Aluminium** conductors with either PVC or LSOH sheathing. Copper conductors are stranded and can be either circular or sectoral shape dependent on cross sectional area (CSA). The formal acceptance by **Network Rail Acceptance Panel (NRAP)** authorises Tratos' Railways' product to be used on projects for which **Network Rail** is Infrastructure Manager under the ROGS (Railways & Others Guided Transport Systems) regulations.

Chris Harris, UK Sales Manager, Mass Transit, for Tratos said: *"This is a significant milestone for Tratos. Rail is a core sector for us. The Tratos sales & technical team is delighted to offer Network Rail PADS approved Enhanced Signalling Power Cable. We are focused on innovation and quality and have a particular strength, as w ell as a proven track record, in the rail sector, so this latest acceptance is very welcome."* The Network Rail product acceptance process applies to products intended for use on or about rail infrastructure and ensures they are safe, reliable, fit for purpose, compatible and do not export unacceptable risks to the infrastructure.

Tratos was one of a small number of British companies to win a **Queen's Award for Enterprise: Innovation** in 2019, taking the award for its enhanced-performance **JBA® cable compound**. The new cable technology brings big advances for Railways, Mass Transit and other industries.

Tratos CEO Dr Maurizio Bragagni said: "*The complete range of cables will be manufactured at the Tratos Knowsley Merseyside, factory. We are unusual in this industry – in what we do and in the way our company is 'built'. We are an independent British SME. I would like to commend the particularly enlightened thinking by Network Rail in opening the door to a smaller and more agile innovation-led company like ours."*

Construction or maintenance work on the UK rail infrastructure is safety-critical. **Network Rail** is dedicated to ensuring that only products that have passed its own very thorough performance and safety tests are approved for use on its sites. Network Rail and its appointed contractors can now purchase and install Tratos' enhanced signalling power cable product range (below) across all Network Rail regions.

Product Range: NR/L2/SIGELP/27408

- 2, 3 and 4 Core CU/XLPE/WB/FGT/LSOH
- 2, 3 and 4 Core CU/XLPE/WB/FGT/PVC
- 2, 3 and 4 Core FAC/XLPE/WB/FGT/LSOH
- 2, 3 and 4 Core FAC /XLPE/WB/FGT/PVC
- 2, 3 and 4 Core SAC/XLPE/WB/FGT/LSOH
- 2, 3 and 4 Core SAC /XLPE/WB/FGT/PVC

TRATOS® RAILWAYS & MASS TRANSIT

Tratos produces a varied cable range specifically for applications in the Railways and Mass Transit Markets:

- **Trackside power** cables including feeder cables
- **Trackside signalling** control and communication cables; including optical fibre communication cables and fire performance cables
- **Stations and premises** cabling including enhanced fire performance types
- **Railway rolling stock** cabling including pantograph cables
- Tratos is also a leading manufacturer of **flexible cables** for intermodal loading and unloading transfer cranes.

In the last 40 years Tratos has been key in helping to enhance and develop many of the existing **Fire Performance** standards required for cables within the Railways and Mass Transit applications, which in turn has developed new solutions for increased safety and performance.

Tratos has also produced a new generation of cables to improve **security** and to reduce the risk of **copper theft** on the railways.

Thanks to all these continued improvements Tratos is leader of the **Health** and **Safety** innovation in Railways and Mass transit applications.

OUR CUSTOMERS

Alstom, Hitachi, London Docklands Light, Railway (TfL), London Underground (TfL), Thales UK Ltd, Network Rail.

Continued investment and development has ensured Tratos can create a wide spectrum of specialised railways cable solutions: from **Medium voltage** & **High voltage** cable for connection to substations and switchgear, **Data** & **Telecommunication** Cable (copper & fibre optic), **Signalling Power** & **Control** cables, **OLE** cable, **Track Feeder** cable, Station & Premises and **Pantograph** & **Rolling Stock** cable.

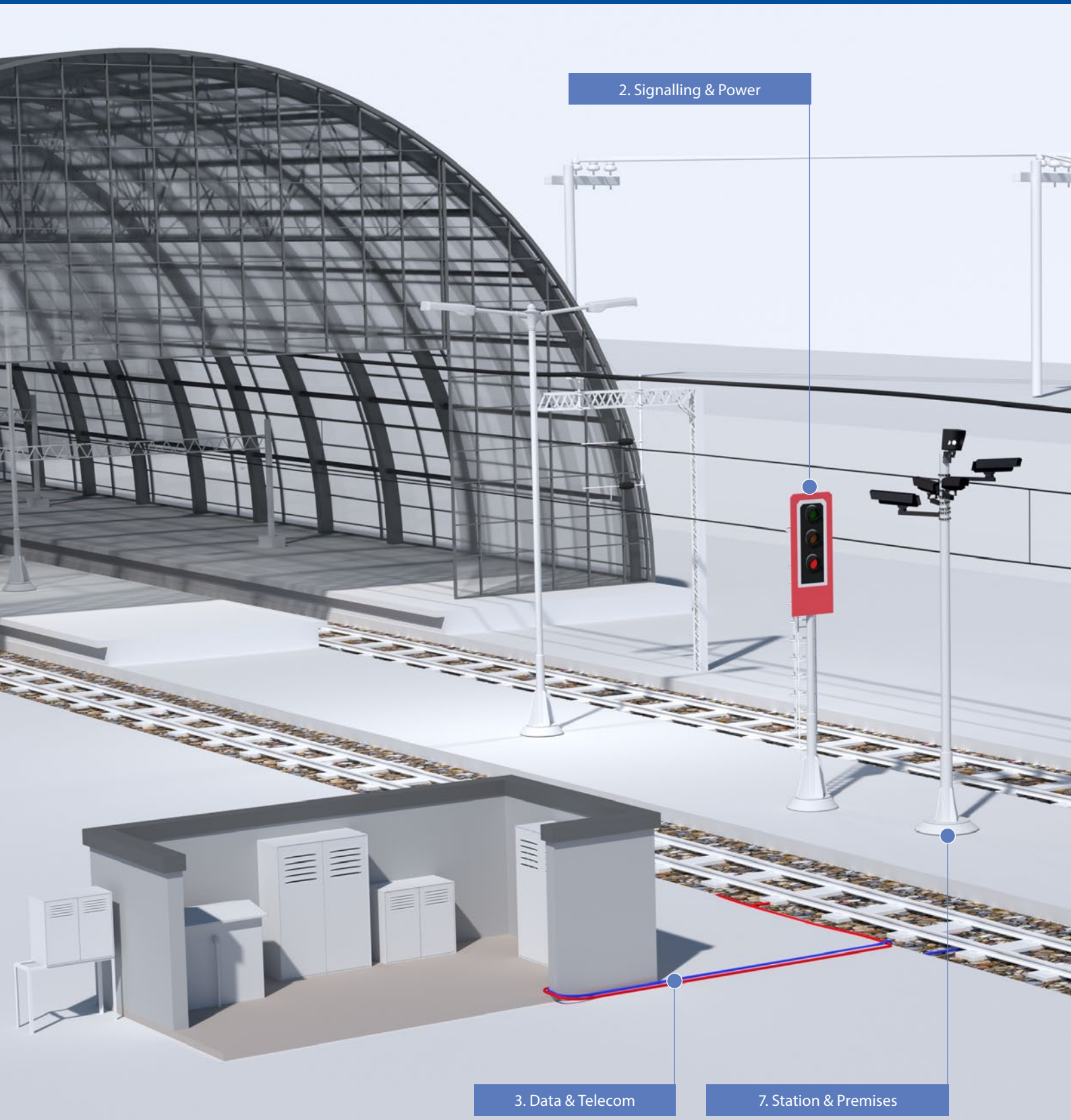
Tratos supplied **Frecciarossa**; the Italian Railways on the project "Alta Velocità", and the 'Rome-Naples' **high-speed train** was inaugurated on schedule thanks to the **fire resistant fibre optic** cable from Tratos. Years of significant investment in equipment, materials and human resources have led to the development of this cable; which has passed the testing requirements of Italferr and IMQ.

The dynamism and multi-functional capabilities of the fibre optic department, in collaboration with in-house special-compound manufacturer Tramet; have produced a **low smoke, zero halogen optical cable of exceptionally high performance.**

All Tratos cables are manufactured to correspond to industry specifications and quality standards with bespoke solutions to customers' specific application and approval requirements.

With five manufacturing facilities in Italy and the UK and worldwide sales offices, Tratos is a leading manufacturer of a new generation of **Enhanced Fire Performance** cables for high-speed rail applications. In 1981 Tratos was established in the UK with Tratos Ltd, and in recent years has been investing significantly in new and improved manufacturing and distribution at its facility in North-West England.

Tratos manufactures high performance firesafe cables for high speed railways



TRATOS RAILWAY & MASS TRANSIT CABLES


1. MV & HV
4. Pantograph
5. Overhead
8. Rolling Stock
6. Trackfeeder

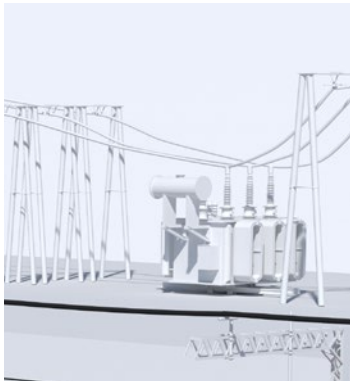
TRATOS® NETWORK RAIL FGT

1. MV AND HV CABLE

BENEFITS
Tratos specialises in the Design, Development and Production of MV and HV cables up to 245 kV and has a great many years of experience supplying cables with proven reliability to Power Utility Companies worldwide. Tratos MV and HV cables are distinguished by the use of advanced technology to manufacture cables with increased pliability, decreased weight and increased strength. Tratos MV and HV cables are approved by BASEC.

APPLICATIONS
Tratos MV and HV cables are used to connect railway substations to the Distribution Network Operator (DNO).

APPLICABLE STANDARDS
IEC 60502, IEC 60840, BS 6622, NR/PS/ELP/0008, TfL/LU S1931



2. SIGNALLING POWER & CONTROL CABLE

BENEFITS
Tratos are an Internationally recognised supplier of LV Power and Control cables for the European Rail Industry, as the manufacturer Tratos has the capability to both produce and control the conformity and quality of the cable to the applicable standard.

APPLICATION
Tratos LV Power and Control cables form the vital link between the trackside power and signalling equipment to the signalling control centre of both high-speed Railway and Mass Transit systems. They are designed to guarantee the maximum level of reliability and security of power supply and signal transmission. Typical applications include FGT Class ll power cable, points heating cables, axle counter cables, data link cables in both Elastomeric (rubber) and Polymeric materials.

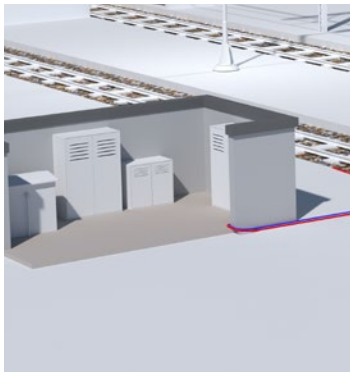
APPLICABLE STANDARDS
BR1932, NR/L2/SIG/30060, NR/PS/SIG/00005, NR/SP/ELP/40045, NR/L2/ELP/27408, TfL/LU G7250, TfL/LU SE1093, TfL/LU SE330, SE0875

3. DATA & TELECOMMUNICATION CABLE

BENEFITS
Tratos manufactures an extensive range of both copper and fibre communication & data cables which provide secure, reliable communication and data transfer. Designs are available to suit the most arduous and harshest environments encountered. As the manufacturer Tratos is ideally placed to advise on the benefits of each type to suit a particular application.

APPLICATION
Tratos Data Communication & Telecommunication Cables are used to link signalling and control centres to the railway communications network.

APPLICABLE STANDARDS
TfL/LU G7622, TfL/LU G7623, TfL/LU ST0014-A2, NR/PS/TEL/00014, NR/PS/TEL/00015



4. PANTOGRAPH POWER CABLE

BENEFITS
The standard range of pantograph cables manufactured by Tratos are rated at 26 kV and 45 kV. The multi-stranded flexible conductors and elastomeric compounds used in the manufacture of these cables ensure that the cables are pliable to ease installation in the reduced spaces commonly found on locomotives and power cars.

APPLICATION
Tratos pantograph cables form part of the essential high voltage connection between the pantograph and transformer on board electric railway locomotives and power cars, designed to have low bending radii, easy to handle, with resistance to UV and Ozone Tratos pantograph cables withstand the environmental conditions encountered in today's modern rolling stock.

5. OVERHEAD LINE EQUIPMENT CABLE

BENEFITS
In addition to conventional aluminium and copper conductor cables, Tratos in collaboration with European railway operators, has developed a range of cables for critical installations that make them less attractive to the would-be-thief. An example being steel reinforced thermal aluminium (TACSR) conductors in place of all aluminium or copper conductors, the cost and difficulty of seperating the steel from the aluminium dramatically reduces the scrap value. Tratos provides a range of options to make cable theft less profitable for the thief and traceability of the stolen cable easier for the police, with the added bonus of deterring metal merchants from receiving what are effectively stolen goods.

APPLICATION
Overhead line equipment cables are a vitally important component in earth bonding systems, they act as the return screening conductor to protect communication and data cables from electrical interference.

APPLICABLE STANDARDS
NR/PS/TEL/31102, RFI TE086A, RFI TE087A, TfL/LU SE955

6. TRACK FEEDER CABLE

BENEFITS
Tratos has many years of experience supplying flexible cables to withstand the most physically demanding of environments. The range of rubber compounds developed by Tratos resist physical abuse, attacks by fluids and the weather. Tough yet flexible, Tratos has used this knowledge and experience in the design and manufacture of its track feeder cables.

APPLICATION
'Tratos' track feeder cable forms' part of the essential link between traction substations and the third rail as well as being used to provide an effective earth path for the return current.

APPLICABLE STANDARDS
NR/PS/ELP/21101, TfL/LU S1108

7. STATION & PREMISES CABLE

BENEFITS
Tratos is able to supply a complete range of Fire Performance cables to meet the most stringent requirements for buildings and underground installations. From armoured power cables through to fibre optic Tratos has a cable to meet all applications. Manufactured using state of the art technology and materials Tratos Firesafe cables are designed for installations where a fire situation may pose a hazard.

APPLICATION
Tratos Firesafe cables are designed to be used for supplying critical power and signals to emergency evacuation systems, public address systems, CCTV security and customer information systems.

APPLICABLE STANDARDS
BS7211, BS7629, BS7846, BS6724 and when required TfL/LU 1-085

8. ROLLING STOCK CABLES

BENEFITS
Manufactured by Tratos to be fully compliant with the CENELEC European Standards for railway rolling stock cables, the complete range of cables is manufactured ensuring a "one stop" shop for both builders and operators alike.

APPLICATION
Tratos Rolling stock cables are used extensively to wire Power, Control and Communication circuits and systems in both railway and mass transit rolling stock. Locomotive, power car or passenger carriage in high speed intercity trains, commuter trains, diesel or electric motive power there is a Tratos Rolling Stock cable to suit every application.

APPLICABLE STANDARDS Tested and compliant to EN 45545-2
EN 50264 (all parts), EN 50343, EN 50382, TfL/LU T0451 S1180

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

Network Rail Certificate of Full Acceptance PA05/07165

CONSTRUCTION PRODUCTS REGULATION

The CPR is a system and framework of consistent rules for managing the marketing of construction products; a consistent technical language allows a construction product's performance to be measured and compared throughout the EU.

CPR allows for clear interpretation of the regulation by each member state.

Under CPR all reaction to fire cables supplying electricity, used for control and communication purposes and installed permanently in a construction works must meet European Standard EN 50575. This standard specifies the expected performance requirements of the cable, as well as the test and assessment methods to be used.

A cable's resistance to fire is not included.

As of 1st July 2017, only products which have a European Classification under EN 50575 are acceptable for sale in the EU or UK. **Cables which do not have this classification cannot be legally sold**.

A cable's `reaction to fire' performance is defined using a common seven-tier European Classification (Euro Classes) system from the highest performance (effectively non-flammable) to the lowest (easily flammable).

There are three further classification methods which deal with the amount of smoke produced when a cable burns (s1, s1a, s1b, s2, s3), the level of acidity of the smoke (a1, a2, a3) and flaming droplets (d0, d1, d2).

Some cables will deliver the best results in terms of their release of smoke, acid gasses and flaming droplets. Where there is a specific sector safety requirement – for instance in the rail sector - there will be a clear cable specification, from the customer or regulator, to meet the appropriate classification for the particular application.

An example of this is that in 2020 the European Union Agency for Railways (ERA) published the revised Guide for the application of the Technical Specification for Interoperability on Safety in Railway Tunnels (TSI SRT) reconfirming that exposed cables:

- shall fulfil the Construction Products Regulation (CPR) characteristics of "low flammability, low fire spread, low toxicity and low smoke density" ; and
- classified as at least B2ca,s1a,a1 are considered to fulfil these requirements.

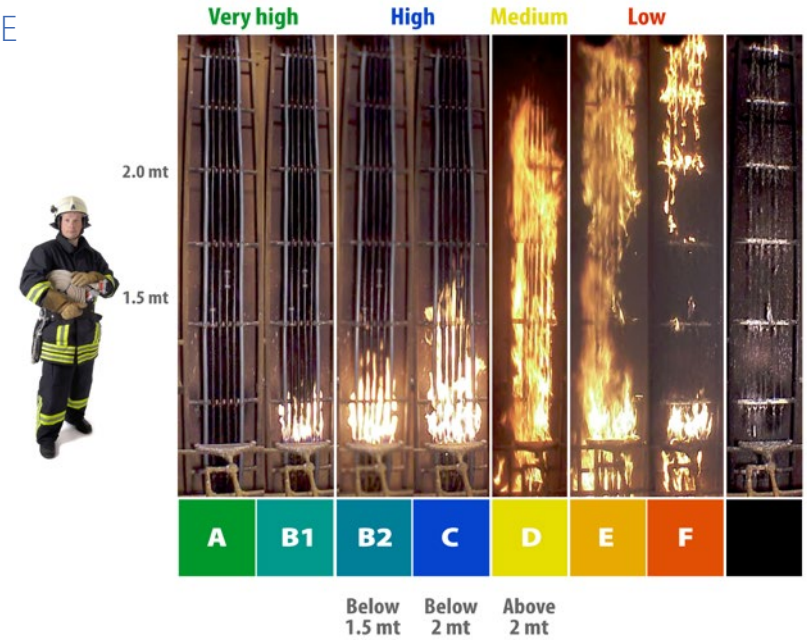
Tratos FGT railway cables are designed and manufactured to meet these requirements.

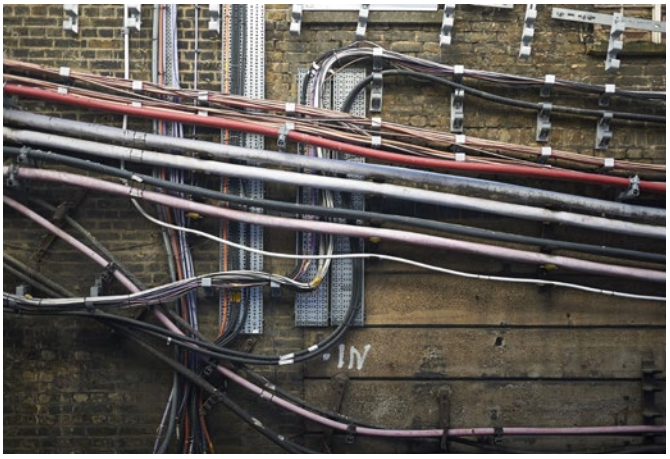
We're here to help

Tratos will of course keep its customers advised of any changes or developments and will be pleased to offer technical advice and assistance on any of its products with regards to the CPR.

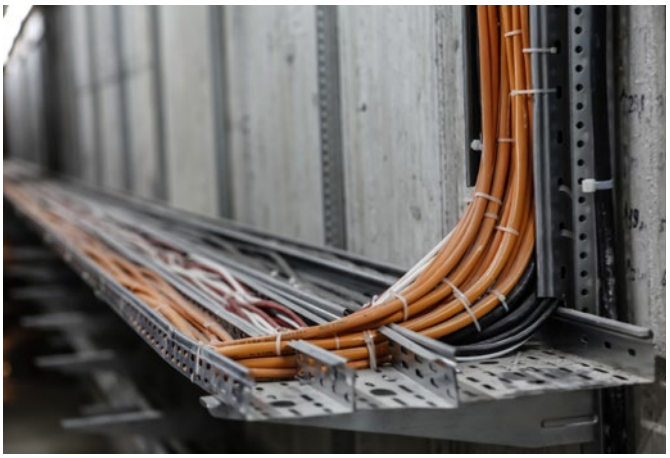
For further information about Tratos visit: ***tratosgroup.com/quality/cpr/***

CLASSIFICATION OF FIRE RESISTANCE IN CABLES






KEEP
CROSSING
CLEAR



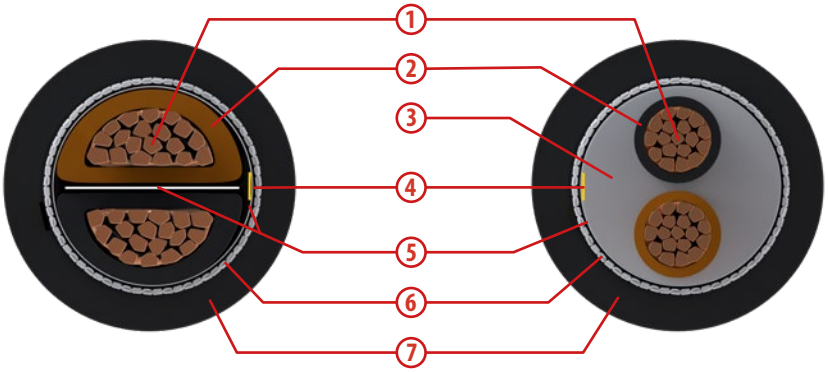
TRATOS® NETWORK RAIL FGT

ENHANCED UNARMOURED CABLE

TRATOS-RAILWAYS® TWO CORE – CU/XLPE/WB/FGT/PVC 600/1000 V

NETWORK RAIL NR/L2/SIGELP/27408

IMAGE - GENERAL CONSTRUCTION



1) Conductor
2) Insulation
3) Extruded fillers/water blocking yarns
4) Identification tape
5) Water blocking tape
6) Rodent protection
7) Outer sheath

COMPONENTS

Conductor	Annealed stranded plain copper, Class 2, BS EN 60228
Insulation	Cross-linked polyethylene (XLPE) Type GP8
Core colours	Brown, black, in accordance with Network Rail NR/L3/SIGELP/27427
Identification tape	PROPERTY OF NETWORK RAIL
Wrapping	Water-blocking (WB) tape (and water blocking (WB) yarns where applicable)
Rodent protection	One water-blocking glass-fibre weave tape, non-metallic rodent (NMR) protection
Outer Sheath	PVC, Black
Cable Sheath Marking	TRATOS + LOT + ELECTRIC CABLE 600/1000V + 2 X CSA CU PVC + YEAR + NMR + WB + NR/L2/ SIGELP/27408 + PROPERTY OF NETWORK RAIL PADS NO XXXX/XXXXX

Certificate of Full Acceptance
PA05/07165

TRATOS-RAILWAYS® TWO CORE - CU/XLPE/WB/FGT/PVC 600/1000 V

CONDUCTOR X TWO CORE									
Nominal cross section	mm²	10	16	25	35	50	70	95	120
Tratos code		144209	144210	144211	144212	144214	144223	144226	144229
PADS number		006/186019	006/186020	006/186021	006/186022	006/186023	006/186024	006/186025	006/186026
Material		Annealed stranded plain copper, Class 2							
Nominal diameter	mm	3.80	4.65	5.65	6.80	SHAPED			
Maximum resistance at 20°C	Ω/km	1.830	1.150	0.727	0.524	0.387	0.268	0.193	0.153

INSULATION		
Material		XLPE (GP8)
Nominal thickness	mm	2.0

WRAPPING / FILLERS / YARNS		
Identification tape		YES
Water-blocking tape		YES
Water-blocking yarns	YES	NO
Extruded fillers	YES	NO

RODENT PROTECTION		
Material		Water-blocking glass fibre weave tape
Nominal thickness	mm	0.6

OUTER SHEATH									
Material		PVC							
Nominal thickness	mm	2.4	2.4	2.4	2.6	2.7	2.9	3.0	3.2
Nominal outer diameter	mm	24.8	26.8	29.2	31.0	33.0	35.8	38.4	40.9

ELECTRICAL CHARACTERISTICS									
Maximum resistance at 90°C	Ω/km	2.332	1.466	0.927	0.668	0.493	0.342	0.246	0.195
Capacitance core to core	nF/km	90	100	110	110	120	120	130	130
Capacitance core to earth	nF/km	160	170	180	200	230	260	280	300
Nominal inductance	mH/km	0.334	0.312	0.293	0.280	0.271	0.258	0.249	0.242
Nominal reactance	Ω/km	0.105	0.098	0.092	0.088	0.085	0.081	0.078	0.076
Nominal impedance	Ω/km	1.834	1.155	0.733	0.532	0.397	0.280	0.209	0.171
Nominal positive/negative sequence resistance at 20°C	Ω/km	1.830	1.150	0.727	0.524	0.387	0.268	0.193	0.153
Nominal positive/negative sequence reactance	Ω/km	0.105	0.098	0.092	0.088	0.085	0.081	0.078	0.076
Nominal positive/negative sequence impedance	Ω/km	1.833	1.154	0.733	0.531	0.396	0.280	0.208	0.171
Nominal zero sequence resistance at 20°C	Ω/km	1.830	1.150	0.727	0.524	0.387	0.268	0.193	0.153
Nominal zero sequence reactance*	Ω/km	0.218	0.213	0.209	0.199	0.191	0.177	0.172	0.170
Nominal zero sequence impedance	Ω/km	1.843	1.170	0.756	0.560	0.431	0.321	0.259	0.229

* against an external metallic tube

PHYSICAL REQUIREMENTS									
Maximum pulling force	Newtons	1000	1600	2500	3500	5000	7000	9500	12000
Minimum bending radius	mm	150 (4D)	165 (6D)	180 (6D)	190 (8D)	200 (8D)	210 (8D)	235 (8D)	250 (8D)
Nominal weight	kg/km	655	825	1050	1230	1550	1990	2535	3185
Maximum drum length	metres	2000	2000	2000	2000	2000	2000	2000	2000

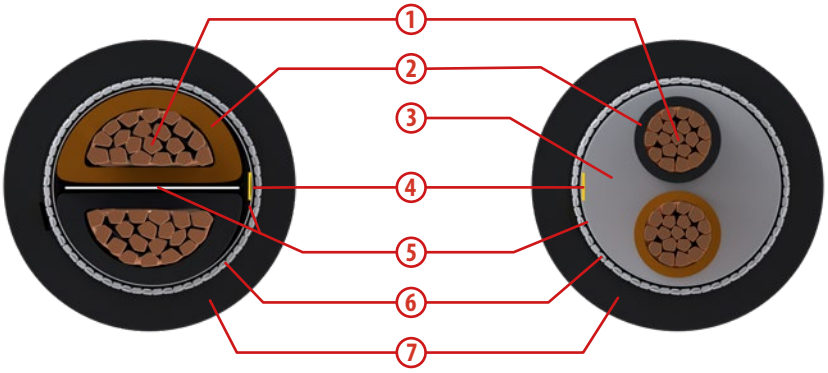
TRATOS® NETWORK RAIL FGT

ENHANCED UNARMOURED CABLE

TRATOS-RAILWAYS® TWO CORE – CU/XLPE/WB/FGT/LSOH 600/1000 V

NETWORK RAIL NR/L2/SIGELP/27408

IMAGE - GENERAL CONSTRUCTION



1) Conductor
2) Insulation
3) Extruded fillers/water blocking yarns
4) Identification tape
5) Water blocking tape
6) Rodent protection
7) Outer sheath

COMPONENTS

Conductor	Annealed stranded plain copper, Class 2, BS EN 60228
Insulation	Cross-linked polyethylene (XLPE) Type GP8
Core colours	Brown, black, in accordance with Network Rail NR/L3/SIGELP/27427
Identification tape	PROPERTY OF NETWORK RAIL
Wrapping	Water-blocking (WB) tape (and water blocking (WB) yarns where applicable)
Rodent protection	One water-blocking glass-fibre weave tape, non-metallic rodent (NMR) protection
Outer Sheath	Low-smoke zero halogen (LSOH), Black
Cable Sheath Marking	TRATOS + LOT + ELECTRIC CABLE 600/1000V + 2 X CSA CU LSOH + YEAR + NMR + WB + NR/L2/ SIGELP/27408 + PROPERTY OF NETWORK RAIL PADS NO XXXX/XXXXX

Certificate of Full Acceptance
PA05/07165

TRATOS-RAILWAYS® TWO CORE - CU/XLPE/WB/FGT/LSOH 600/1000 V

CONDUCTOR X TWO CORE									
Nominal cross section	mm²	10	16	25	35	50	70	95	120
Tratos code		144255	144256	144258	194053	163207	144261	144262	144263
PADS number		006/186027	006/186028	006/186029	006/186030	006/186031	006/186032	006/186033	006/186034
Material		Annealed stranded plain copper, Class 2							
Nominal diameter	mm	3.80	4.65	5.65	6.80	SHAPED			
Maximum resistance at 20°C	Ω/km	1.830	1.150	0.727	0.524	0.387	0.268	0.193	0.153

INSULATION		
Material		XLPE (GP8)
Nominal thickness	mm	2.0

WRAPPING / FILLERS / YARNS		
Identification tape		YES
Water-blocking tape		YES
Water-blocking yarns	YES	NO
Extruded fillers	YES	NO

RODENT PROTECTION		
Material		Water-blocking glass fibre weave tape
Nominal thickness	mm	0.6

OUTER SHEATH									
Material		LSOH							
Nominal thickness	mm	2.4	2.4	2.4	2.6	2.7	3.1	3.2	3.4
Nominal outer diameter	mm	24.8	26.8	29.2	31.0	33.0	35.8	38.4	40.9

ELECTRICAL CHARACTERISTICS									
Maximum resistance at 90°C	Ω/km	2.332	1.466	0.927	0.668	0.493	0.342	0.246	0.195
Capacitance core to core	nF/km	90	100	110	110	120	120	130	130
Capacitance core to earth	nF/km	160	170	180	200	230	260	280	300
Nominal inductance	mH/km	0.334	0.312	0.293	0.280	0.271	0.258	0.249	0.242
Nominal reactance	Ω/km	0.105	0.098	0.092	0.088	0.085	0.081	0.078	0.076
Nominal impedance	Ω/km	1.834	1.155	0.733	0.532	0.397	0.280	0.209	0.171
Nominal positive/negative sequence resistance at 20°C	Ω/km	1.830	1.150	0.727	0.524	0.387	0.268	0.193	0.153
Nominal positive/negative sequence reactance	Ω/km	0.105	0.098	0.092	0.088	0.085	0.081	0.078	0.076
Nominal positive/negative sequence impedance	Ω/km	1.833	1.154	0.733	0.531	0.396	0.280	0.208	0.171
Nominal zero sequence resistance at 20°C	Ω/km	1.830	1.150	0.727	0.524	0.387	0.268	0.193	0.153
Nominal zero sequence reactance*	Ω/km	0.218	0.213	0.209	0.199	0.191	0.177	0.172	0.170
Nominal zero sequence impedance	Ω/km	1.843	1.170	0.756	0.560	0.431	0.321	0.259	0.229

* against an external metallic tube

PHYSICAL REQUIREMENTS									
Maximum pulling force	Newtons	1000	1600	2500	3500	5000	7000	9500	12000
Minimum bending radius	mm	150 (4D)	165 (6D)	180 (6D)	190 (8D)	200 (8D)	210 (8D)	235 (8D)	250 (8D)
Nominal weight	kg/km	715	1000	1240	1255	1705	2130	2840	3185
Maximum drum length	metres	2000	2000	2000	2000	2000	2000	2000	2000

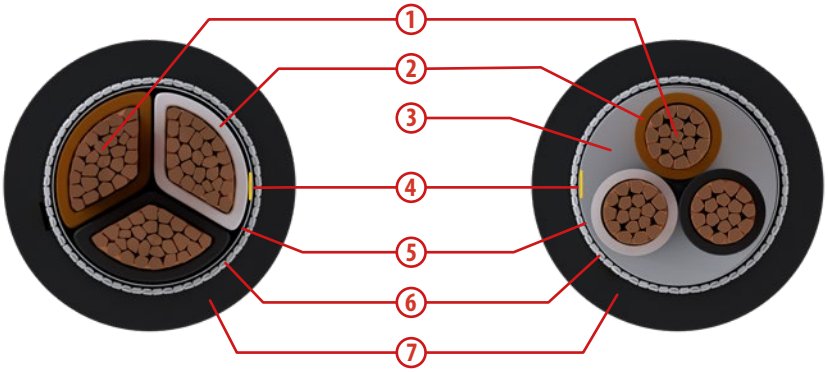
TRATOS® NETWORK RAIL FGT

ENHANCED UNARMOURED CABLE

TRATOS-RAILWAYS® THREE CORE – CU/XLPE/WB/FGT/PVC 600/1000 V

NETWORK RAIL NR/L2/SIGELP/27408

IMAGE - GENERAL CONSTRUCTION



1) Conductor
2) Insulation
3) Extruded fillers/water blocking yarns
4) Identification tape
5) Water blocking tape
6) Rodent protection
7) Outer sheath

COMPONENTS

Conductor	Annealed stranded plain copper, Class 2, BS EN 60228
Insulation	Cross-linked polyethylene (XLPE) Type GP8
Core colours	Brown, black, grey, in accordance with Network Rail NR/L3/SIGELP/27427
Identification tape	PROPERTY OF NETWORK RAIL
Wrapping	Water-blocking (WB) tape (and water blocking (WB) yarns where applicable)
Rodent protection	One water-blocking glass-fibre weave tape, non-metallic rodent (NMR) protection
Outer Sheath	PVC, Black
Cable Sheath Marking	TRATOS + LOT + ELECTRIC CABLE 600/1000V + 3 X CSA CU PVC + YEAR+ H + NMR + WB + NR/L2/ SIGELP/27408 + PROPERTY OF NETWORK RAIL PADS NO XXXX/XXXXX

Certificate of Full Acceptance
PA05/07165

TRATOS-RAILWAYS® THREE CORE - CU/XLPE/WB/FGT/PVC 600/1000 V

CONDUCTOR X THREE CORE									
Nominal cross section	mm²	10	16	25	35	50	70	95	120
Tratos code		194080	194083	194085	194087	194090	194093	194095	194097
PADS number		006/186111	006/186112	006/186113	006/186114	006/186115	006/186116	006/186117	006/186118
Material		Annealed stranded plain copper, Class 2							
Nominal diameter	mm	3.80	4.65	5.65	6.80	SHAPED			
Maximum resistance at 20°C	Ω/km	1.830	1.150	0.727	0.524	0.387	0.268	0.193	0.153

INSULATION		
Material		XLPE (GP8)
Nominal thickness	mm	2.0

WRAPPING / FILLERS / YARNS		
Identification tape	YES	
Water-blocking tape	YES	
Water-blocking yarns	YES	NO
Extruded fillers	YES	NO

RODENT PROTECTION		
Material		Water-blocking glass fibre weave tape
Nominal thickness	mm	0.6

OUTER SHEATH									
Material		PVC							
Nominal thickness	mm	2.4	2.4	2.4	2.6	2.7	3.1	3.2	3.4
Nominal outer diameter	mm	25.8	27.8	30.8	33.2	34.4	38.5	42.4	45.5

ELECTRICAL CHARACTERISTICS									
Maximum resistance at 90°C	Ω/km	2.332	1.466	0.927	0.668	0.493	0.342	0.246	0.195
Capacitance core to core	nF/km	90	100	110	110	120	120	130	130
Capacitance core to earth	nF/km	150	160	180	190	220	250	270	290
Nominal inductance	mH/km	0.334	0.312	0.293	0.280	0.271	0.258	0.249	0.242
Nominal reactance	Ω/km	0.105	0.098	0.092	0.088	0.085	0.081	0.078	0.076
Nominal impedance	Ω/km	1.834	1.155	0.733	0.532	0.397	0.280	0.209	0.171
Nominal positive/negative sequence resistance at 20°C	Ω/km	1.8301	1.1501	0.7271	0.5241	0.3871	0.2681	0.1931	0.1531
Nominal positive/negative sequence reactance	Ω/km	0.105	0.098	0.092	0.088	0.085	0.081	0.078	0.076
Nominal positive/negative sequence impedance	Ω/km	1.833	1.154	0.733	0.531	0.396	0.280	0.208	0.171
Nominal zero sequence resistance at 20°C	Ω/km	1.8300	1.1500	0.7270	0.5240	0.3870	0.2680	0.1930	0.1530
Nominal zero sequence reactance*	Ω/km	0.225	0.220	0.219	0.212	0.199	0.196	0.191	0.190
Nominal zero sequence impedance	Ω/km	1.843	1.170	0.756	0.560	0.431	0.321	0.259	0.229

* against an external metallic tube

PHYSICAL REQUIREMENTS									
Maximum pulling force	Newtons	1500	2400	3750	5250	7500	10500	14250	18000
Minimum bending radius	mm	155 (6D)	170 (6D)	185 (6D)	200 (6D)	210 (8D)	235 (8D)	255 (8D)	275 (8D)
Nominal weight	kg/km	785	1015	1340	1615	2135	2905	3685	4515
Maximum drum length	metres	2000	2000	2000	2000	2000	2000	2000	2000

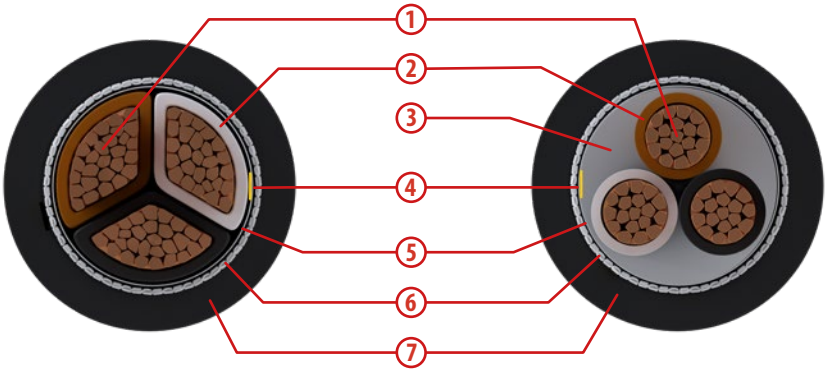
TRATOS® NETWORK RAIL FGT

ENHANCED UNARMOURED CABLE

TRATOS-RAILWAYS® THREE CORE – CU/XLPE/WB/FGT/LSOH 600/1000 V

NETWORK RAIL NR/L2/SIGELP/27408

IMAGE - GENERAL CONSTRUCTION



1) Conductor
2) Insulation
3) Extruded fillers/water blocking yarns
4) Identification tape
5) Water blocking tape
6) Rodent protection
7) Outer sheath

COMPONENTS

Conductor	Annealed stranded plain copper, Class 2, BS EN 60228
Insulation	Cross-linked polyethylene (XLPE) Type GP8
Core colours	Brown, black, grey, in accordance with Network Rail NR/L3/SIGELP/27427
Identification tape	PROPERTY OF NETWORK RAIL
Wrapping	Water-blocking (WB) tape (and water blocking (WB) yarns where applicable)
Rodent protection	One water-blocking glass-fibre weave tape, non-metallic rodent (NMR) protection
Outer Sheath	Low-smoke zero halogen (LSOH), Black
Cable Sheath Marking	TRATOS + LOT + ELECTRIC CABLE 600/1000V + 3 X CSA CU LSOH + YEAR + H + NMR + WB + NR/L2/SIGELP/27408 + PROPERTY OF NETWORK RAIL PADS NO XXXX/XXXXX

Certificate of Full Acceptance
PA05/07165

TRATOS-RAILWAYS® THREE CORE - CU/XLPE/WB/FGT/LSOH 600/1000 V

CONDUCTOR X THREE CORE									
Nominal cross section	mm²	10	16	25	35	50	70	95	120
Tratos code		194081	194084	194086	194088	194091	194094	194096	194098
PADS number		006/186119	006/186120	006/186121	006/186122	006/186123	006/186124	006/186125	006/186126
Material		Annealed stranded plain copper, Class 2							
Nominal diameter	mm	3.80	4.65	5.65	6.80	SHAPED			
Maximum resistance at 20°C	Ω/km	1.830	1.150	0.727	0.524	0.387	0.268	0.193	0.153

INSULATION		
Material		XLPE (GP8)
Nominal thickness	mm	2.0

WRAPPING / FILLERS / YARNS		
Identification tape		YES
Water-blocking tape		YES
Water-blocking yarns	YES	NO
Extruded fillers	YES	NO

RODENT PROTECTION		
Material		Water-blocking glass fibre weave tape
Nominal thickness	mm	0.6

OUTER SHEATH									
Material		LSOH							
Nominal thickness	mm	2.4	2.4	2.4	2.6	2.7	3.1	3.2	3.4
Nominal outer diameter	mm	25.8	27.8	30.8	33.2	34.4	38.5	42.4	45.5

ELECTRICAL CHARACTERISTICS									
Maximum resistance at 90°C	Ω/km	2.332	1.466	0.927	0.668	0.493	0.342	0.246	0.195
Capacitance core to core	nF/km	90	100	110	110	120	120	130	130
Capacitance core to earth	nF/km	150	160	180	190	220	250	270	290
Nominal inductance	mH/km	0.334	0.312	0.293	0.280	0.271	0.258	0.249	0.242
Nominal reactance	Ω/km	0.105	0.098	0.092	0.088	0.085	0.081	0.078	0.076
Nominal impedance	Ω/km	1.834	1.155	0.733	0.532	0.397	0.280	0.209	0.171
Nominal positive/negative sequence resistance at 20°C	Ω/km	1.8301	1.1501	0.7271	0.5241	0.3871	0.2681	0.1931	0.1531
Nominal positive/negative sequence reactance	Ω/km	0.105	0.098	0.092	0.088	0.085	0.081	0.078	0.076
Nominal positive/negative sequence impedance	Ω/km	1.833	1.154	0.733	0.531	0.396	0.280	0.208	0.171
Nominal zero sequence resistance at 20°C	Ω/km	1.8300	1.1500	0.7270	0.5240	0.3870	0.2680	0.1930	0.1530
Nominal zero sequence reactance*	Ω/km	0.225	0.220	0.219	0.212	0.199	0.196	0.191	0.190
Nominal zero sequence impedance	Ω/km	1.843	1.170	0.756	0.560	0.431	0.321	0.259	0.229

* against an external metallic tube

PHYSICAL REQUIREMENTS									
Maximum pulling force	Newtons	1500	2400	3750	5250	7500	10500	14250	18000
Minimum bending radius	mm	155 (6D)	170 (6D)	185 (6D)	200 (6D)	210 (8D)	235 (8D)	255 (8D)	275 (8D)
Nominal weight	kg/km	810	1040	1375	1640	2160	2945	3730	4565
Maximum drum length	metres	2000	2000	2000	2000	2000	2000	2000	2000

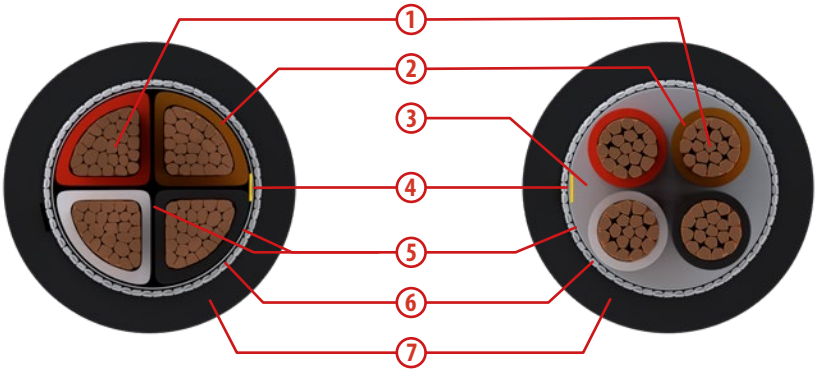
TRATOS® NETWORK RAIL FGT

ENHANCED UNARMOURED CABLE

TRATOS-RAILWAYS® FOUR CORE – CU/XLPE/WB/FGT/PVC 600/1000 V

NETWORK RAIL NR/L2/SIGELP/27408

IMAGE - GENERAL CONSTRUCTION



1) Conductor
2) Insulation
3) Extruded fillers/water blocking yarns
4) Identification tape
5) Water blocking tape
6) Rodent protection
7) Outer sheath

COMPONENTS

Conductor	Annealed stranded plain copper, Class 2, BS EN 60228
Insulation	Cross-linked polyethylene (XLPE) Type GP8
Core colours	Red, brown, black, grey, in accordance with Network Rail NR/L3/SIGELP/27427
Identification tape	PROPERTY OF NETWORK RAIL
Wrapping	Water-blocking (WB) tape (and water blocking (WB) yarns where applicable)
Rodent protection	One water-blocking glass-fibre weave tape, non-metallic rodent (NMR) protection
Outer Sheath	PVC, Black
Cable Sheath Marking	TRATOS + LOT + ELECTRIC CABLE 600/1000V + 4 X CSA CU PVC + YEAR + NMR + WB + NR/L2/ SIGELP/27408 + PROPERTY OF NETWORK RAIL PADS No XXXX/XXXXX

Certificate of Full Acceptance
PA05/07165

TRATOS-RAILWAYS® FOUR CORE - CU/XLPE/WB/FGT/PVC 600/1000 V

CONDUCTOR X FOUR CORE									
Nominal cross section	mm²	10	16	25	35	50	70	95	120
Tratos code		194124	194126	194128	194130	194132	194134	194136	194139
PADS number		006/186147	006/186148	006/186149	006/186150	006/186151	006/186152	006/186153	006/186154
Material		Annealed stranded plain copper, Class 2							
Nominal diameter	mm	3.80	4.65	5.65	6.80	SHAPED			
Maximum resistance at 20°C	Ω/km	1.830	1.150	0.727	0.524	0.387	0.268	0.193	0.153

INSULATION		
Material		XLPE (GP8)
Nominal thickness	mm	2.0

WRAPPING / FILLERS / YARNS		
Identification tape		YES
Water-blocking tape		YES
Water-blocking yarns	YES	NO
Extruded fillers	YES	NO

RODENT PROTECTION		
Material		Water-blocking glass fibre weave tape
Nominal thickness	mm	0.6

OUTER SHEATH									
Material		PVC							
Nominal thickness	mm	2.4	2.4	2.4	2.6	2.7	3.2	3.3	3.5
Nominal outer diameter	mm	28.2	30.6	33.5	36.2	37.4	41.0	45.0	47.0

ELECTRICAL CHARACTERISTICS									
Maximum resistance at 90°C	Ω/km	2.332	1.466	0.927	0.668	0.493	0.342	0.246	0.195
Capacitance core to core	nF/km	90	100	110	110	120	120	130	130
Capacitance core to earth	nF/km	150	150	170	180	210	240	260	280
Nominal inductance	mH/km	0.369	0.350	0.331	0.318	0.306	0.296	0.287	0.280
Nominal reactance	Ω/km	0.116	0.110	0.104	0.100	0.096	0.093	0.090	0.088
Nominal impedance	Ω/km	1.834	1.156	0.735	0.534	0.399	0.284	0.213	0.177
Nominal positive/negative sequence resistance at 20°C	Ω/km	1.830	1.150	0.727	0.524	0.387	0.268	0.193	0.153
Nominal positive/negative sequence reactance	Ω/km	0.116	0.110	0.092	0.104	0.100	0.096	0.090	0.088
Nominal positive/negative sequence impedance	Ω/km	1.834	1.155	0.734	0.533	0.399	0.284	0.213	0.177
Nominal zero sequence resistance at 20°C	Ω/km	1.830	1.150	0.727	0.524	0.387	0.268	0.193	0.153
Nominal zero sequence reactance*	Ω/km	0.242	0.238	0.235	0.228	0.214	0.208	0.202	0.196
Nominal zero sequence impedance	Ω/km	1.846	1.174	0.764	0.571	0.442	0.339	0.279	0.249

* against an external metallic tube

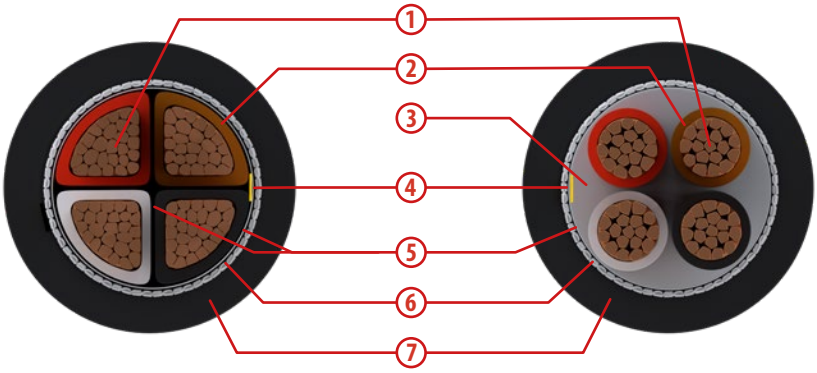
PHYSICAL REQUIREMENTS									
Maximum pulling force	Newtons	2000	3200	5000	7000	10000	14000	19000	24000
Minimum bending radius	mm	170 (6D)	185 (6D)	205 (6D)	220 (6D)	225 (8D)	250 (8D)	270 (8D)	285 (8D)
Nominal weight	kg/km	925	970	1625	2050	2715	3730	4715	5845
Maximum drum length	metres	2000	2000	2000	2000	2000	2000	2000	2000

ENHANCED UNARMOURED CABLE

TRATOS-RAILWAYS® FOUR CORE – CU/XLPE/WB/FGT/LSOH 600/1000 V

NETWORK RAIL NR/L2/SIGELP/27408

IMAGE - GENERAL CONSTRUCTION



1) Conductor
2) Insulation
3) Extruded fillers/water blocking yarns
4) Identification tape
5) Water blocking tape
6) Rodent protection
7) Outer sheath

COMPONENTS

Conductor	Annealed stranded plain copper, Class 2, BS EN 60228
Insulation	Cross-linked polyethylene (XLPE) Type GP8
Core colours	Red, brown, black, grey, in accordance with Network Rail NR/L3/SIGELP/27427
Identification tape	PROPERTY OF NETWORK RAIL
Wrapping	Water-blocking (WB) tape (and water blocking (WB) yarns where applicable)
Rodent protection	One water-blocking glass-fibre weave tape, non-metallic rodent (NMR) protection
Outer Sheath	Low-smoke zero halogen (LSOH), Black
Cable Sheath Marking	TRATOS + LOT + ELECTRIC CABLE 600/1000V + 4 X CSA CU LSOH + YEAR + NMR + WB + NR/L2/ SIGELP/27408 + PROPERTY OF NETWORK RAIL PADS NO XXXX/XXXXX

Certificate of Full Acceptance
PA05/07165

TRATOS-RAILWAYS® FOUR CORE - CU/XLPE/WB/FGT/LSOH 600/1000 V

CONDUCTOR X FOUR CORE									
Nominal cross section	mm²	10	16	25	35	50	70	95	120
Tratos code		194125	194127	194129	194131	194133	194135	194138	194140
PADS number		006/186155	006/186156	006/186157	006/186158	006/186159	006/186160	006/186161	006/186162
Material		Annealed stranded plain copper, Class 2							
Nominal diameter	mm	3.80	4.65	5.65	6.80	SHAPED			
Maximum resistance at 20°C	Ω/km	1.830	1.150	0.727	0.524	0.387	0.268	0.193	0.153

INSULATION		
Material		XLPE (GP8)
Nominal thickness	mm	2.0

WRAPPING / FILLERS / YARNS		
Identification tape		YES
Water-blocking tape		YES
Water-blocking yarns	YES	NO
Extruded fillers	YES	NO

RODENT PROTECTION		
Material		Water-blocking glass fibre weave tape
Nominal thickness	mm	0.6

OUTER SHEATH									
Material		LSOH							
Nominal thickness	mm	2.4	2.4	2.4	2.6	2.7	3.2	3.3	3.5
Nominal outer diameter	mm	28.2	30.6	33.5	36.2	37.4	41.0	45.0	47.0

ELECTRICAL CHARACTERISTICS									
Maximum resistance at 90°C	Ω/km	2.332	1.466	0.927	0.668	0.493	0.342	0.246	0.195
Capacitance core to core	nF/km	90	100	110	110	120	120	130	130
Capacitance core to earth	nF/km	150	150	170	180	210	240	260	280
Nominal inductance	mH/km	0.369	0.350	0.331	0.318	0.306	0.296	0.287	0.280
Nominal reactance	Ω/km	0.116	0.110	0.104	0.100	0.096	0.093	0.090	0.088
Nominal impedance	Ω/km	1.834	1.156	0.735	0.534	0.399	0.284	0.213	0.177
Nominal positive/negative sequence resistance at 20°C	Ω/km	1.830	1.150	0.727	0.524	0.387	0.268	0.193	0.153
Nominal positive/negative sequence reactance	Ω/km	0.116	0.110	0.092	0.104	0.100	0.096	0.090	0.088
Nominal positive/negative sequence impedance	Ω/km	1.834	1.155	0.734	0.533	0.399	0.284	0.213	0.177
Nominal zero sequence resistance at 20°C	Ω/km	1.830	1.150	0.727	0.524	0.387	0.268	0.193	0.153
Nominal zero sequence reactance*	Ω/km	0.242	0.238	0.235	0.228	0.214	0.208	0.202	0.196
Nominal zero sequence impedance	Ω/km	1.846	1.174	0.764	0.571	0.442	0.339	0.279	0.249

* against an external metallic tube

PHYSICAL REQUIREMENTS									
Maximum pulling force	Newtons	2000	3200	5000	7000	10000	14000	19000	24000
Minimum bending radius	mm	170 (6D)	185 (6D)	205 (6D)	220 (6D)	225 (8D)	250 (8D)	270 (8D)	285 (8D)
Nominal weight	kg/km	950	995	1655	2080	2745	3775	4760	5900
Maximum drum length	metres	2000	2000	2000	2000	2000	2000	2000	2000

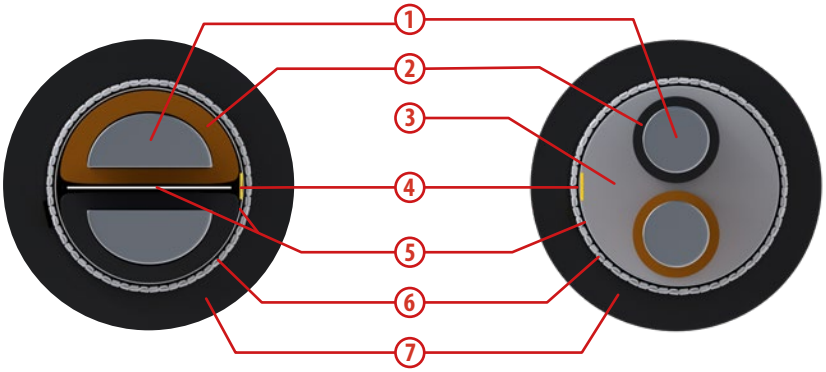
TRATOS® NETWORK RAIL FGT

ENHANCED UNARMOURED CABLE

TRATOS-RAILWAYS® TWO CORE – SAC/XLPE/WB/FGT/PVC 600/1000 V

NETWORK RAIL NR/L2/SIGELP/27408

IMAGE - GENERAL CONSTRUCTION



1) Conductor
2) Insulation
3) Extruded fillers/water blocking yarns
4) Identification tape
5) Water blocking tape
6) Rodent protection
7) Outer sheath

COMPONENTS

Conductor	Solid aluminium, Class 1, BS EN 60228
Insulation	Cross-linked polyethylene (XLPE) Type GP8
Core colours	Brown, black, in accordance with Network Rail NR/L3/SIGELP/27427
Identification tape	PROPERTY OF NETWORK RAIL
Wrapping	Water-blocking (WB) tape (and water blocking (WB) yarns where applicable)
Rodent protection	One water-blocking glass-fibre weave tape, non-metallic rodent (NMR) protection
Outer Sheath	PVC, Black
Cable Sheath Marking	TRATOS + LOT + ELECTRIC CABLE 600/1000V + 2 X CSA AL PVC + YEAR + NMR + WB + NR/L2/ SIGELP/27408 + PROPERTY OF NETWORK RAIL PADS NO XXXX/XXXXX

Certificate of Full Acceptance
PA05/07165

TRATOS-RAILWAYS® TWO CORE - SAC/XLPE/WB/FGT/PVC 600/1000 V

CONDUCTOR X TWO CORE								
Nominal cross section	mm²	16	25	35	50	70	95	120
Tratos code		194057	194061	134222	163209	194067	194068	194072
PADS number		006/186035	006/186036	006/186037	006/186038	006/186039	006/186040	006/186041
Material		Solid aluminium, Class 1						
Nominal diameter	mm	4.5	5.45†	SHAPED				
Maximum resistance at 20°C	Ω/km	1.910	1.200	0.868	0.641	0.443	0.320	0.253

† Shaped conductors available upon request

INSULATION		
Material		XLPE (GP8)
Nominal thickness	mm	2.0

WRAPPING / FILLERS / YARNS		
Identification tape		YES
Water-blocking tape		YES
Water-blocking yarns	YES	NO
Extruded fillers	YES	NO

RODENT PROTECTION		
Material		Water-blocking glass fibre weave tape
Nominal thickness	mm	0.6

OUTER SHEATH								
Material		PVC						
Nominal thickness	mm	2.4	2.4	2.6	2.7	2.9	3.0	3.2
Nominal outer diameter	mm	25.8	28.2	31.2	32.4	35.8	37.0	39.0

ELECTRICAL CHARACTERISTICS								
Maximum resistance at 90°C	Ω/km	3.950	2.450	1.540	0.822	0.568	0.410	0.324
Capacitance core to core	nF/km	100	100	110	110	120	130	130
Capacitance core to earth	nF/km	170	180	200	220	240	280	310
Nominal inductance	mH/km	0.315	0.299	0.284	0.274	0.264	0.252	0.245
Nominal reactance	Ω/km	0.099	0.094	0.089	0.086	0.083	0.079	0.077
Nominal impedance	Ω/km	1.913	1.204	0.873	0.647	0.451	0.330	0.265
Nominal positive/negative sequence resistance at 20°C	Ω/km	1.910	1.200	0.868	0.641	0.443	0.320	0.253
Nominal positive/negative sequence reactance	Ω/km	0.099	0.094	0.089	0.086	0.083	0.079	0.077
Nominal positive/negative sequence impedance	Ω/km	1.913	1.204	0.873	0.647	0.451	0.330	0.265
Nominal zero sequence resistance at 20°C	Ω/km	1.910	1.200	0.868	0.641	0.443	0.320	0.253
Nominal zero sequence reactance*	Ω/km	0.209	0.206	0.206	0.195	0.194	0.170	0.163
Nominal zero sequence impedance	Ω/km	1.921	1.218	0.892	0.670	0.484	0.362	0.301

* against an external metallic tube

PHYSICAL REQUIREMENTS								
Maximum pulling force	Newtons	960	1500	2100	3000	4200	5700	7200
Minimum bending radius	mm	206 (8D)	225 (8D)	240 (8D)	260 (8D)	286 (8D)	296 (8D)	312 (8D)
Nominal weight	kg/km	605	725	750	880	1060	1245	1470
Maximum drum length	metres	2000	2000	2000	2000	2000	2000	2000

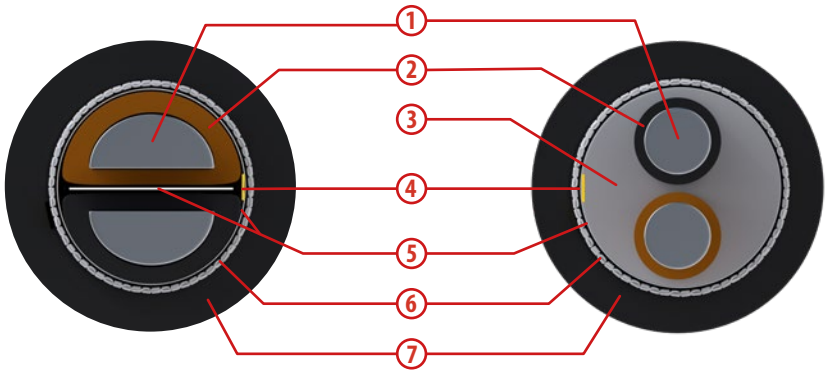
TRATOS® NETWORK RAIL FGT

ENHANCED UNARMOURED CABLE

TRATOS-RAILWAYS® TWO CORE – SAC/XLPE/WB/FGT/LSOH 600/1000 V

NETWORK RAIL NR/L2/SIGELP/27408

IMAGE - GENERAL CONSTRUCTION



1) Conductor
2) Insulation
3) Extruded fillers/water blocking yarns
4) Identification tape
5) Water blocking tape
6) Rodent protection
7) Outer sheath

COMPONENTS

Conductor	Solid aluminium, Class 1, BS EN 60228
Insulation	Cross-linked polyethylene (XLPE) Type GP8
Core colours	Brown, black, in accordance with Network Rail NR/L3/SIGELP/27427
Identification tape	PROPERTY OF NETWORK RAIL
Wrapping	Water-blocking (WB) tape (and water blocking (WB) yarns where applicable)
Rodent protection	One water-blocking glass-fibre weave tape, non-metallic rodent (NMR) protection
Outer Sheath	Low-smoke zero halogen (LSOH), Black
Cable Sheath Marking	TRATOS + LOT + ELECTRIC CABLE 600/1000V + 2 X CSA AL LSOH + YEAR + NMR + WB + NR/L2/ SIGELP/27408 + PROPERTY OF NETWORK RAIL PADS NO XXXX/XXXXX

Certificate of Full Acceptance
PA05/07165

TRATOS-RAILWAYS® TWO CORE - SAC/XLPE/WB/FGT/LSOH 600/1000 V

CONDUCTOR X TWO CORE								
Nominal cross section	mm²	16	25	35	50	70	95	120
Tratos code		194060	194062	134221	194065	194066	194069	194070
PADS number		006/186042	006/186043	006/186044	006/186045	006/186046	006/186047	006/186048
Material		Solid aluminium, Class 1						
Nominal diameter	mm	4.5	5.45†	SHAPED				
Maximum resistance at 20°C	Ω/km	1.910	1.200	0.868	0.641	0.443	0.320	0.253

† Shaped conductors available upon request

INSULATION		
Material		XLPE (GP8)
Nominal thickness	mm	2.0

WRAPPING / FILLERS / YARNS		
Identification tape		YES
Water-blocking tape		YES
Water-blocking yarns	YES	NO
Extruded fillers	YES	NO

RODENT PROTECTION		
Material		Water-blocking glass fibre weave tape
Nominal thickness	mm	0.6

OUTER SHEATH								
Material		LSOH						
Nominal thickness	mm	2.4	2.4	2.6	2.7	2.9	3.0	3.2
Nominal outer diameter	mm	25.8	28.2	31.2	32.4	35.8	37.0	39.0

ELECTRICAL CHARACTERISTICS								
Maximum resistance at 90°C	Ω/km	3.950	2.450	1.540	0.822	0.568	0.410	0.324
Capacitance core to core	nF/km	100	100	110	110	120	130	130
Capacitance core to earth	nF/km	170	180	200	220	240	280	310
Nominal inductance	mH/km	0.315	0.299	0.284	0.274	0.264	0.252	0.245
Nominal reactance	Ω/km	0.099	0.094	0.089	0.086	0.083	0.079	0.077
Nominal impedance	Ω/km	1.913	1.204	0.873	0.647	0.451	0.330	0.265
Nominal positive/negative sequence resistance at 20°C	Ω/km	1.910	1.200	0.868	0.641	0.443	0.320	0.253
Nominal positive/negative sequence reactance	Ω/km	0.099	0.094	0.089	0.086	0.083	0.079	0.077
Nominal positive/negative sequence impedance	Ω/km	1.913	1.204	0.873	0.647	0.451	0.330	0.265
Nominal zero sequence resistance at 20°C	Ω/km	1.910	1.200	0.868	0.641	0.443	0.320	0.253
Nominal zero sequence reactance*	Ω/km	0.209	0.206	0.206	0.195	0.194	0.170	0.163
Nominal zero sequence impedance	Ω/km	1.921	1.218	0.892	0.670	0.484	0.362	0.301

* against an external metallic tube

PHYSICAL REQUIREMENTS								
Maximum pulling force	Newtons	960	1500	2100	3000	4200	5700	7200
Minimum bending radius	mm	206 (8D)	225 (8D)	240 (8D)	260 (8D)	286 (8D)	296 (8D)	312 (8D)
Nominal weight	kg/km	635	755	770	880	1060	1280	1510
Maximum drum length	metres	2000	2000	2000	2000	2000	2000	2000

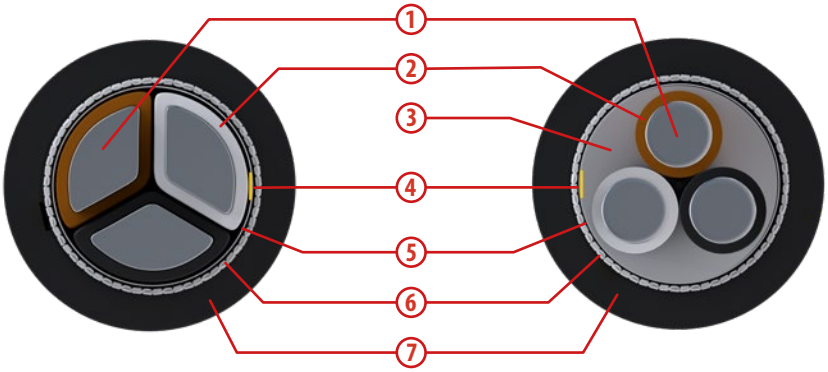
TRATOS® NETWORK RAIL FGT

ENHANCED UNARMOURED CABLE

TRATOS-RAILWAYS® THREE CORE – SAC/XLPE/WB/FGT/PVC 600/1000 V

NETWORK RAIL NR/L2/SIGELP/27408

IMAGE - GENERAL CONSTRUCTION



1) Conductor
2) Insulation
3) Extruded fillers/water blocking yarns
4) Identification tape
5) Water blocking tape
6) Rodent protection
7) Outer sheath

COMPONENTS

Conductor	Solid aluminium, Class 1, BS EN 60228
Insulation	Cross-linked polyethylene (XLPE) Type GP8
Core colours	Brown, black, grey, in accordance with Network Rail NR/L3/SIGELP/27427
Identification tape	PROPERTY OF NETWORK RAIL
Wrapping	Water-blocking (WB) tape (and water blocking (WB) yarns where applicable)
Rodent protection	One water-blocking glass-fibre weave tape, non-metallic rodent (NMR) protection
Outer Sheath	PVC, Black
Cable Sheath Marking	TRATOS + LOT + ELECTRIC CABLE 600/1000V + 3 X CSA CU PVC + YEAR + H + NMR + WB + NR/L2/ SIGELP/27408 + PROPERTY OF NETWORK RAIL PADS NO XXXX/XXXXX

Certificate of Full Acceptance
PA05/07165

TRATOS-RAILWAYS® THREE CORE - SAC/XLPE/WB/FGT/PVC 600/1000 V

CONDUCTOR X THREE CORE								
Nominal cross section	mm²	16	25	35	50	70	95	120
Tratos code		194099	194103	144113	194107	194110	194112	194115
PADS number		006/186127	006/186128	006/186129	006/186130	006/186131	006/186132	006/186133
Material		Solid aluminium, Class 1						
Nominal diameter	mm	4.5	5.45†	SHAPED				
Maximum resistance at 20°C	Ω/km	1.910	1.200	0.868	0.641	0.443	0.320	0.253

† Shaped conductors available upon request

INSULATION		
Material		XLPE (GP8)
Nominal thickness	mm	2.0

WRAPPING / FILLERS / YARNS		
Identification tape		YES
Water-blocking tape		YES
Water-blocking yarns	YES	NO
Extruded fillers	YES	NO

RODENT PROTECTION		
Material		Water-blocking glass fibre weave tape
Nominal thickness	mm	0.6

OUTER SHEATH								
Material		PVC						
Nominal thickness	mm	2.4	2.4	2.6	2.7	3.1	3.2	3.4
Nominal outer diameter	mm	27.8	29.8	33.2	34.4	37.7	41.5	43.5

ELECTRICAL CHARACTERISTICS								
Maximum resistance at 90°C	Ω/km	3.950	2.450	1.540	0.822	0.568	0.410	0.324
Capacitance core to core	nF/km	100	100	110	110	120	130	130
Capacitance core to earth	nF/km	160	170	200	220	240	270	290
Nominal inductance	mH/km	0.315	0.299	0.284	0.274	0.264	0.252	0.245
Nominal reactance	Ω/km	0.099	0.094	0.089	0.086	0.083	0.079	0.077
Nominal impedance	Ω/km	1.155	0.734	0.532	0.397	0.281	0.209	0.172
Nominal positive/negative sequence resistance at 20°C	Ω/km	1.910	1.200	0.868	0.641	0.443	0.320	0.253
Nominal positive/negative sequence reactance	Ω/km	0.099	0.094	0.089	0.086	0.083	0.079	0.077
Nominal positive/negative sequence impedance	Ω/km	1.913	1.204	0.873	0.647	0.451	0.330	0.265
Nominal zero sequence resistance at 20°C	Ω/km	1.910	1.200	0.868	0.641	0.443	0.320	0.253
Nominal zero sequence reactance*	Ω/km	0.223	0.216	0.217	0.207	0.204	0.192	0.184
Nominal zero sequence impedance	Ω/km	1.923	1.219	0.895	0.673	0.488	0.373	0.313

* against an external metallic tube

PHYSICAL REQUIREMENTS								
Maximum pulling force	Newtons	1440	2250	3150	4500	6300	8550	10800
Minimum bending radius	mm	222 (8D)	238 (8D)	254 (8D)	275 (8D)	302 (8D)	332 (8D)	348 (8D)
Nominal weight	kg/km	705	865	960	1110	1450	1770	2075
Maximum drum length	metres	2000	2000	2000	2000	2000	2000	2000

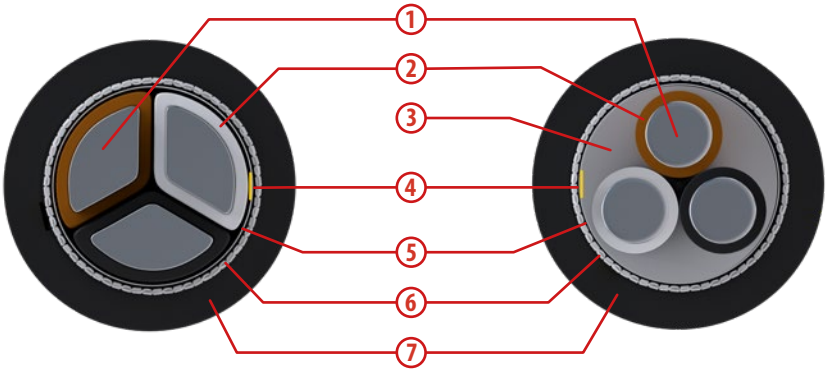
TRATOS® NETWORK RAIL FGT

ENHANCED UNARMOURED CABLE

TRATOS-RAILWAYS® THREE CORE – SAC/XLPE/WB/FGT/LSOH 600/1000 V

NETWORK RAIL NR/L2/SIGELP/27408

IMAGE - GENERAL CONSTRUCTION



1) Conductor
2) Insulation
3) Extruded fillers/water blocking yarns
4) Identification tape
5) Water blocking tape
6) Rodent protection
7) Outer sheath

COMPONENTS

Conductor	Solid aluminium, Class 1, BS EN 60228
Insulation	Cross-linked polyethylene (XLPE) Type GP8
Core colours	Brown, black, grey, in accordance with Network Rail NR/L3/SIGELP/27427
Identification tape	PROPERTY OF NETWORK RAIL
Wrapping	Water-blocking (WB) tape (and water blocking (WB) yarns where applicable)
Rodent protection	One water-blocking glass-fibre weave tape, non-metallic rodent (NMR) protection
Outer Sheath	Low-smoke zero halogen (LSOH), Black
Cable Sheath Marking	TRATOS + LOT + ELECTRIC CABLE 600/1000V + 3 X CSA CU LSOH + YEAR + H + NMR + WB + NR/L2/SIGELP/27408 + PROPERTY OF NETWORK RAIL PADS NO XXXX/XXXXX

Certificate of Full Acceptance
PA05/07165
NetworkRail

TRATOS-RAILWAYS® THREE CORE - SAC/XLPE/WB/FGT/LSOH 600/1000 V

CONDUCTOR X THREE CORE								
Nominal cross section	mm²	16	25	35	50	70	95	120
Tratos code		194101	194104	144159	194108	194111	194114	194116
PADS number		006/186134	006/186135	006/186136	006/186137	006/186138	006/186139	006/186140
Material		Solid aluminium, Class 1						
Nominal diameter	mm	4.5	5.45†	SHAPED				
Maximum resistance at 20°C	Ω/km	1.910	1.200	0.868	0.641	0.443	0.320	0.253

† Shaped conductors available upon request

INSULATION		
Material		XLPE (GP8)
Nominal thickness	mm	2.0

WRAPPING / FILLERS / YARNS		
Identification tape		YES
Water-blocking tape		YES
Water-blocking yarns	YES	NO
Extruded fillers	YES	NO

RODENT PROTECTION		
Material		Water-blocking glass fibre weave tape
Nominal thickness	mm	0.6

OUTER SHEATH								
Material		LSOH						
Nominal thickness	mm	2.4	2.4	2.6	2.7	3.1	3.2	3.4
Nominal outer diameter	mm	27.8	29.8	33.2	34.4	37.7	41.5	43.5

ELECTRICAL CHARACTERISTICS								
Maximum resistance at 90°C	Ω/km	3.950	2.450	1.540	0.822	0.568	0.410	0.324
Capacitance core to core	nF/km	100	100	110	110	120	130	130
Capacitance core to earth	nF/km	160	170	200	220	240	270	290
Nominal inductance	mH/km	0.315	0.299	0.284	0.274	0.264	0.252	0.245
Nominal reactance	Ω/km	0.099	0.094	0.089	0.086	0.083	0.079	0.077
Nominal impedance	Ω/km	1.155	0.734	0.532	0.397	0.281	0.209	0.172
Nominal positive/negative sequence resistance at 20°C	Ω/km	1.910	1.200	0.868	0.641	0.443	0.320	0.253
Nominal positive/negative sequence reactance	Ω/km	0.099	0.094	0.089	0.086	0.083	0.079	0.077
Nominal positive/negative sequence impedance	Ω/km	1.913	1.204	0.873	0.647	0.451	0.330	0.265
Nominal zero sequence resistance at 20°C	Ω/km	1.910	1.200	0.868	0.641	0.443	0.320	0.253
Nominal zero sequence reactance*	Ω/km	0.223	0.216	0.217	0.207	0.204	0.192	0.184
Nominal zero sequence impedance	Ω/km	1.923	1.219	0.895	0.673	0.488	0.373	0.313

* against an external metallic tube

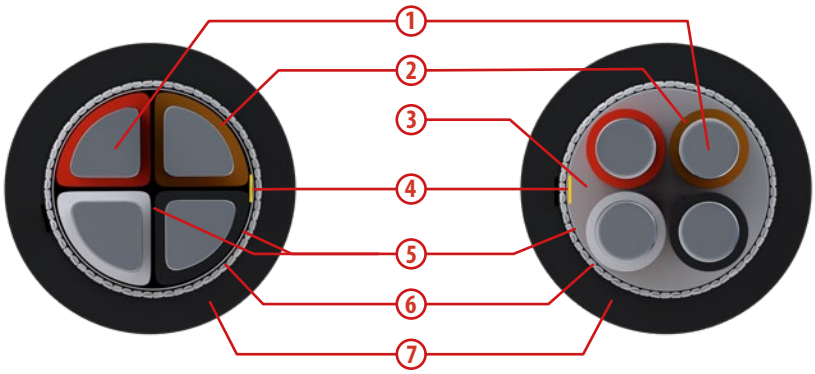
PHYSICAL REQUIREMENTS								
Maximum pulling force	Newtons	1440	2250	3150	4500	6300	8550	10800
Minimum bending radius	mm	222 (8D)	238 (8D)	254 (8D)	275 (8D)	302 (8D)	332 (8D)	348 (8D)
Nominal weight	kg/km	735	895	990	1140	1450	1815	2120
Maximum drum length	metres	2000	2000	2000	2000	2000	2000	2000

ENHANCED UNARMOURED CABLE

TRATOS-RAILWAYS® FOUR CORE – SAC/XLPE/WB/FGT/PVC 600/1000 V

NETWORK RAIL NR/L2/SIGELP/27408

IMAGE - GENERAL CONSTRUCTION



1) Conductor
2) Insulation
3) Extruded fillers/water blocking yarns
4) Identification tape
5) Water blocking tape
6) Rodent protection
7) Outer sheath

COMPONENTS

Conductor	Solid aluminium, Class 1, BS EN 60228
Insulation	Cross-linked polyethylene (XLPE) Type GP8
Core colours	Red, brown, black, grey, in accordance with Network Rail NR/L3/SIGELP/27427
Identification tape	PROPERTY OF NETWORK RAIL
Wrapping	Water-blocking (WB) tape (and water blocking (WB) yarns where applicable)
Rodent protection	One water-blocking glass-fibre weave tape, non-metallic rodent (NMR) protection
Outer Sheath	PVC, Black
Cable Sheath Marking	TRATOS + LOT + ELECTRIC CABLE 600/1000V + 4 X CSA AL PVC + YEAR + NMR + WB + NR/L2/SIGELP/27408 + PROPERTY OF NETWORK RAIL PADS NO XXXX/XXXXX

Certificate of Full Acceptance
PA05/07165

TRATOS-RAILWAYS® FOUR CORE - SAC/XLPE/WB/FGT/PVC 600/1000 V

CONDUCTOR X FOUR CORE								
Nominal cross section	mm²	16	25	35	50	70	95	120
Tratos code		194142	194144	144178	194149	194151	194153	194155
PADS number		006/186163	006/186164	006/186165	006/186166	006/186167	006/186168	006/186169
Material		Solid aluminium, Class 1						
Nominal diameter	mm	4.5	5.45†	SHAPED				
Maximum resistance at 20°C	Ω/km	1.910	1.200	0.868	0.641	0.443	0.320	0.253

† Shaped conductors available upon request

INSULATION		
Material		XLPE (GP8)
Nominal thickness	mm	2.0

WRAPPING / FILLERS / YARNS		
Identification tape		YES
Water-blocking tape		YES
Water-blocking yarns	YES	NO
Extruded fillers	YES	NO

RODENT PROTECTION		
Material		Water-blocking glass fibre weave tape
Nominal thickness	mm	0.6

OUTER SHEATH								
Material		PVC						
Nominal thickness	mm	2.4	2.4	2.6	2.7	3.2	3.3	3.5
Nominal outer diameter	mm	30.3	32.8	35.7	36.7	40.4	44.8	47.0

ELECTRICAL CHARACTERISTICS								
Maximum resistance at 90°C	Ω/km	3.950	2.450	1.540	0.822	0.568	0.410	0.324
Capacitance core to core	nF/km	100	100	110	110	120	130	130
Capacitance core to earth	nF/km	160	170	200	220	240	270	290
Nominal inductance	mH/km	0.353	0.334	0.322	0.312	0.299	0.290	0.284
Nominal reactance	Ω/km	0.111	0.105	0.101	0.098	0.094	0.091	0.089
Nominal impedance	Ω/km	1.156	0.735	0.534	0.400	0.285	0.214	0.178
Nominal positive/negative sequence resistance at 20°C	Ω/km	1,910	1,200	0,868	0,641	0,443	0,320	0,253
Nominal positive/negative sequence reactance	Ω/km	0,111	0,105	0,101	0,098	0,094	0,091	0,089
Nominal positive/negative sequence impedance	Ω/km	1,913	1,205	0,874	0,649	0,453	0,333	0,268
Nominal zero sequence resistance at 20°C	Ω/km	1,910	1,200	0,868	0,641	0,443	0,320	0,253
Nominal zero sequence reactance*	Ω/km	0,240	0,235	0,231	0,219	0,217	0,206	0,198
Nominal zero sequence impedance	Ω/km	1,925	1,223	0,898	0,677	0,493	0,381	0,322

* against an external metallic tube

PHYSICAL REQUIREMENTS								
Maximum pulling force	Newtons	1920	3000	4200	6000	8400	11400	14400
Minimum bending radius	mm	245 (8D)	262 (8D)	276 (8D)	294 (8D)	323 (8D)	358 (8D)	376 (8D)
Nominal weight	kg/km	800	980	1385	1365	1795	2175	2590
Maximum drum length	metres	2000	2000	2000	2000	2000	2000	2000

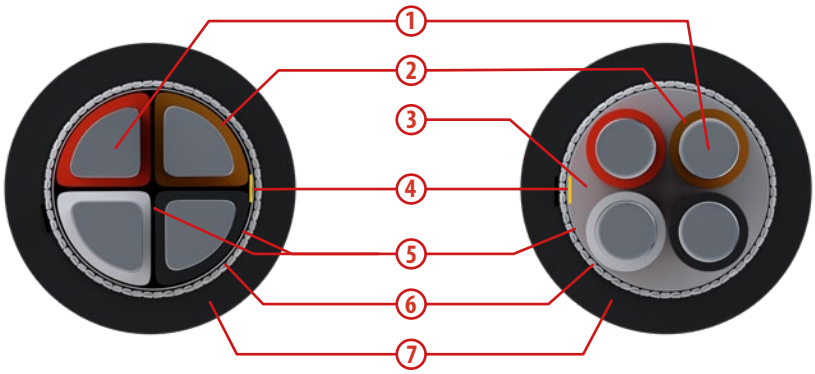
TRATOS® NETWORK RAIL FGT

ENHANCED UNARMOURED CABLE

TRATOS-RAILWAYS® FOUR CORE – SAC/XLPE/WB/FGT/LSOH 600/1000 V

NETWORK RAIL NR/L2/SIGELP/27408

IMAGE - GENERAL CONSTRUCTION



1) Conductor
2) Insulation
3) Extruded fillers/water blocking yarns
4) Identification tape
5) Water blocking tape
6) Rodent protection
7) Outer sheath

COMPONENTS

Conductor	Solid aluminium, Class 1, BS EN 60228
Insulation	Cross-linked polyethylene (XLPE) Type GP8
Core colours	Red, brown, black, grey, in accordance with Network Rail NR/L3/SIGELP/27427
Identification tape	PROPERTY OF NETWORK RAIL
Wrapping	Water-blocking (WB) tape (and water blocking (WB) yarns where applicable)
Rodent protection	One water-blocking glass-fibre weave tape, non-metallic rodent (NMR) protection
Outer Sheath	Low-smoke zero halogen (LSOH), Black
Cable Sheath Marking	TRATOS + LOT + ELECTRIC CABLE 600/1000V + 4 X CSA AL LSOH + YEAR + NMR + WB + NR/L2/ SIGELP/27408 + PROPERTY OF NETWORK RAIL PADS NO XXXX/XXXXX

Certificate of Full Acceptance
PA05/07165

TRATOS-RAILWAYS® FOUR CORE - SAC/XLPE/WB/FGT/LSOH 600/1000 V

CONDUCTOR X FOUR CORE								
Nominal cross section	mm²	16	25	35	50	70	95	120
Tratos code		194143	194145	144114	194150	194152	194154	194156
PADS number		006/186170	006/186171	006/186172	006/186173	006/186174	006/186175	006/186176
Material		Solid aluminium, Class 1						
Nominal diameter	mm	4.5	5.45†	SHAPED				
Maximum resistance at 20°C	Ω/km	1.910	1.200	0.868	0.641	0.443	0.320	0.253

† Shaped conductors available upon request

INSULATION		
Material		XLPE (GP8)
Nominal thickness	mm	2.0

WRAPPING / FILLERS / YARNS		
Identification tape		YES
Water-blocking tape		YES
Water-blocking yarns	YES	NO
Extruded fillers	YES	NO

RODENT PROTECTION		
Material		Water-blocking glass fibre weave tape
Nominal thickness	mm	0.6

OUTER SHEATH								
Material		LSOH						
Nominal thickness	mm	2.4	2.4	2.6	2.7	3.2	3.3	3.5
Nominal outer diameter	mm	30.3	32.8	35.7	36.7	40.4	44.8	47.0

ELECTRICAL CHARACTERISTICS								
Maximum resistance at 90°C	Ω/km	3.950	2.450	1.540	0.822	0.568	0.410	0.324
Capacitance core to core	nF/km	100	100	110	110	120	130	130
Capacitance core to earth	nF/km	160	170	200	220	240	270	290
Nominal inductance	mH/km	0.353	0.334	0.322	0.312	0.299	0.290	0.284
Nominal reactance	Ω/km	0.111	0.105	0.101	0.098	0.094	0.091	0.089
Nominal impedance	Ω/km	1.156	0.735	0.534	0.400	0.285	0.214	0.178
Nominal positive/negative sequence resistance at 20°C	Ω/km	1,910	1,200	0,868	0,641	0,443	0,320	0,253
Nominal positive/negative sequence reactance	Ω/km	0,111	0,105	0,101	0,098	0,094	0,091	0,089
Nominal positive/negative sequence impedance	Ω/km	1,913	1,205	0,874	0,649	0,453	0,333	0,268
Nominal zero sequence resistance at 20°C	Ω/km	1,910	1,200	0,868	0,641	0,443	0,320	0,253
Nominal zero sequence reactance*	Ω/km	0,240	0,235	0,231	0,219	0,217	0,206	0,198
Nominal zero sequence impedance	Ω/km	1,925	1,223	0,898	0,677	0,493	0,381	0,322

* against an external metallic tube

PHYSICAL REQUIREMENTS								
Maximum pulling force	Newtons	1920	3000	4200	6000	8400	11400	14400
Minimum bending radius	mm	245 (8D)	262 (8D)	276 (8D)	294 (8D)	323 (8D)	358 (8D)	376 (8D)
Nominal weight	kg/km	825	1010	1415	1395	1840	2225	2645
Maximum drum length	metres	2000	2000	2000	2000	2000	2000	2000

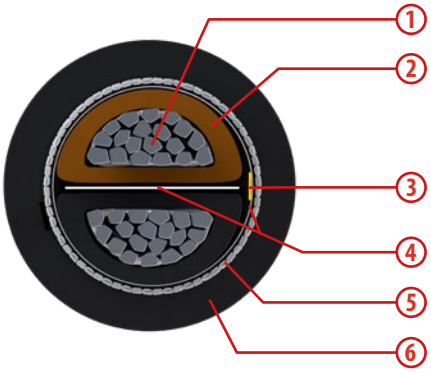
TRATOS® NETWORK RAIL FGT

ENHANCED UNARMOURED CABLE

TRATOS-RAILWAYS® TWO CORE – FAC/XLPE/WB/FGT/PVC 600/1000 V

NETWORK RAIL NR/L2/SIGELP/27408

IMAGE - GENERAL CONSTRUCTION



1) Conductor
2) Insulation
3) Identification tape
4) Water blocking tape
5) Rodent protection
6) Outer sheath

COMPONENTS

Conductor	Stranded aluminium, Class 2, BS EN 60228
Insulation	Cross-linked polyethylene (XLPE) Type GP8
Core colours	Brown, black, in accordance with Network Rail NR/L3/SIGELP/27427
Identification tape	PROPERTY OF NETWORK RAIL
Wrapping	Water-blocking (WB) tape (and water blocking (WB) yarns where applicable)
Rodent protection	One water-blocking glass-fibre weave tape, non-metallic rodent (NMR) protection
Outer Sheath	PVC, Black
Cable Sheath Marking	TRATOS + LOT + ELECTRIC CABLE 600/1000V + 2 X CSA AL PVC + YEAR + NMR + WB + NR/L2/ SIGELP/27408 + PROPERTY OF NETWORK RAIL PADS NO XXXX/XXXXX

Certificate of Full Acceptance
PA05/07165

TRATOS-RAILWAYS® TWO CORE – FAC/XLPE/WB/FGT/PVC 600/1000 V

CONDUCTOR X TWO CORE				
Nominal cross section	mm²	120	150	185
Tratos code		194156	194686	194687
PADS number		006/186013	006/186014	006/186015
Material		Stranded aluminium, Class 2		
Nominal diameter	mm	SHAPED		
Maximum resistance at 20°C	Ω/km	0.253	0.206	0.164

INSULATION		
Material	XLPE (GP8)	
Nominal thickness	mm	2.0

WRAPPING / FILLERS / YARNS	
Identification tape	YES
Water-blocking tape	YES
Water-blocking yarns	NO
Extruded fillers	NO

RODENT PROTECTION		
Material	Water-blocking glass fibre weave tape	
Nominal thickness	mm	0.6

OUTER SHEATH				
Material	PVC			
Nominal thickness	mm	3.2	3.3	3.4
Nominal outer diameter	mm	47.6	50.0	53.6

ELECTRICAL CHARACTERISTICS				
Maximum resistance at 90°C	Ω/km	0.324	0.264	0.211
Capacitance core to core	nF/km	140	140	140
Capacitance core to earth	nF/km	360	390	430
Nominal inductance	mH/km	0.236	0.233	0.226
Nominal reactance	Ω/km	0.074	0.073	0.071
Nominal impedance	Ω/km	0.264	0.219	0.179
Nominal positive/negative sequence resistance at 20°C	Ω/km	0.2531	0.2061	0.1641
Nominal positive/negative sequence reactance	Ω/km	0.074	0.073	0.071
Nominal positive/negative sequence impedance	Ω/km	0.264	0.219	0.179
Nominal zero sequence resistance at 20°C	Ω/km	0.253	0.206	0.164
Nominal zero sequence reactance*	Ω/km	0.173	0.165	0.158
Nominal zero sequence impedance	Ω/km	0.307	0.264	0.228

* against an external metallic tube

PHYSICAL REQUIREMENTS				
Maximum pulling force	Newtons	7200	9000	11100
Minimum bending radius	mm	320 (8D)	335 (8D)	360 (8D)
Nominal weight	kg/km	1495	1800	2085
Maximum drum length	metres	2000	2000	2000

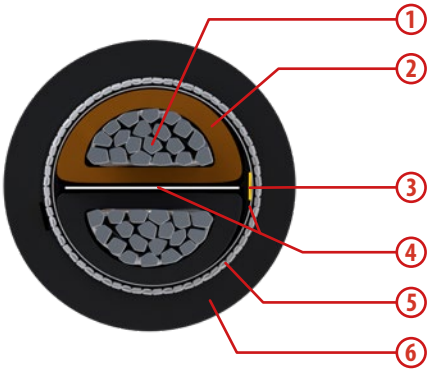
TRATOS® NETWORK RAIL FGT

ENHANCED UNARMOURED CABLE

TRATOS-RAILWAYS® TWO CORE – FAC/XLPE/WB/FGT/LSOH 600/1000 V

NETWORK RAIL NR/L2/SIGELP/27408

IMAGE - GENERAL CONSTRUCTION



1) Conductor
2) Insulation
3) Identification tape
4) Water blocking tape
5) Rodent protection
6) Outer sheath

COMPONENTS

Conductor	Stranded aluminium, Class 2, BS EN 60228
Insulation	Cross-linked polyethylene (XLPE) Type GP8
Core colours	Brown, black, in accordance with Network Rail NR/L3/SIGELP/27427
Identification tape	PROPERTY OF NETWORK RAIL
Wrapping	Water-blocking (WB) tape (and water blocking (WB) yarns where applicable)
Rodent protection	One water-blocking glass-fibre weave tape, non-metallic rodent (NMR) protection
Outer Sheath	Low-smoke zero halogen (LSOH), Black
Cable Sheath Marking	TRATOS + LOT + ELECTRIC CABLE 600/1000V + 2 X CSA AL LSOH + YEAR + NMR + WB + NR/L2/ SIGELP/27408 + PROPERTY OF NETWORK RAIL PADS NO XXXX/XXXXX

Certificate of Full Acceptance
PA05/07165

TRATOS-RAILWAYS® TWO CORE – FAC/XLPE/WB/FGT/LSOH 600/1000 V

CONDUCTOR X TWO CORE				
Nominal cross section	mm²	120	150	185
Tratos code		144270	194675	194677
PADS number		006/186016	006/186017	006/186018
Material		Stranded aluminium, Class 2		
Nominal diameter	mm	SHAPED		
Maximum resistance at 20°C	Ω/km	0.253	0.206	0.164

INSULATION		
Material	XLPE (GP8)	
Nominal thickness	mm	2.0

WRAPPING / FILLERS / YARNS	
Identification tape	YES
Water-blocking tape	YES
Water-blocking yarns	NO
Extruded fillers	NO

RODENT PROTECTION		
Material	Water-blocking glass fibre weave tape	
Nominal thickness	mm	0.6

OUTER SHEATH				
Material	LSOH			
Nominal thickness	mm	3.2	3.3	3.4
Nominal outer diameter	mm	42.0	44.0	47.0

ELECTRICAL CHARACTERISTICS				
Maximum resistance at 90°C	Ω/km	0.324	0.264	0.211
Capacitance core to core	nF/km	140	140	140
Capacitance core to earth	nF/km	360	390	430
Nominal inductance	mH/km	0.236	0.233	0.226
Nominal reactance	Ω/km	0.074	0.073	0.071
Nominal impedance	Ω/km	0.264	0.219	0.179
Nominal positive/negative sequence resistance at 20°C	Ω/km	0.2531	0.2061	0.1641
Nominal positive/negative sequence reactance	Ω/km	0.074	0.073	0.071
Nominal positive/negative sequence impedance	Ω/km	0.264	0.219	0.179
Nominal zero sequence resistance at 20°C	Ω/km	0.253	0.206	0.164
Nominal zero sequence reactance*	Ω/km	0.169	0.164	0.161
Nominal zero sequence impedance	Ω/km	0.304	0.263	0.230

* against an external metallic tube

PHYSICAL REQUIREMENTS				
Maximum pulling force	Newtons	7200	9000	11100
Minimum bending radius	mm	330 (8D)	345 (8D)	370 (8D)
Nominal weight	kg/km	1595	1900	2185
Maximum drum length	metres	2000	2000	2000

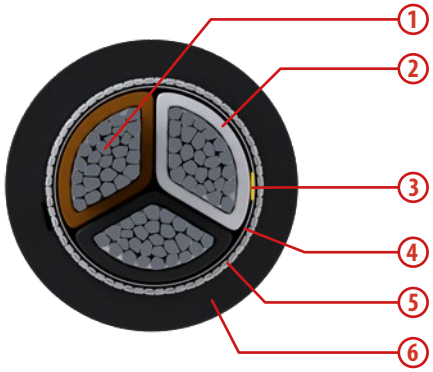
TRATOS® NETWORK RAIL FGT

ENHANCED UNARMOURED CABLE

TRATOS-RAILWAYS® THREE CORE – FAC/XLPE/WB/FGT/PVC 600/1000 V

NETWORK RAIL NR/L2/SIGELP/27408

IMAGE - GENERAL CONSTRUCTION



1) Conductor
2) Insulation
3) Identification tape
4) Water blocking tape
5) Rodent protection
6) Outer sheath

COMPONENTS

Conductor	Stranded aluminium, Class 2, BS EN 60228
Insulation	Cross-linked polyethylene (XLPE) Type GP8
Core colours	Brown, black, grey, in accordance with Network Rail NR/L3/SIGELP/27427
Identification tape	PROPERTY OF NETWORK RAIL
Wrapping	Water-blocking (WB) tape (and water blocking (WB) yarns where applicable)
Rodent protection	One water-blocking glass-fibre weave tape, non-metallic rodent (NMR) protection
Outer Sheath	PVC, Black
Cable Sheath Marking	TRATOS + LOT + ELECTRIC CABLE 600/1000V + 3 X CSA CU PVC + YEAR + H + NMR + WB + NR/L2/SIGELP/27408 + PROPERTY OF NETWORK RAIL PADS NO XXXX/XXXXX

Certificate of Full Acceptance
PA05/07165

THREE CORE – FAC/XLPE/WB/FGT/PVC 600/1000 V NXSEC_rev2

CONDUCTOR X THREE CORE				
Nominal cross section	mm²	120	150	185
Tratos code		194688	194689	194690
PADS number		006/186141	006/186142	006/186143
Material		Stranded aluminium, Class 2		
Nominal diameter	mm	SHAPED		
Maximum resistance at 20°C	Ω/km	0.253	0.206	0.164

INSULATION		
Material	XLPE (GP8)	
Nominal thickness	mm	2.0

WRAPPING / FILLERS / YARNS	
Identification tape	YES
Water-blocking tape	YES
Water-blocking yarns	NO
Extruded fillers	NO

RODENT PROTECTION		
Material	Water-blocking glass fibre weave tape	
Nominal thickness	mm	0.6

OUTER SHEATH				
Material	PVC			
Nominal thickness	mm	3.4	3.5	3.6
Nominal outer diameter	mm	50.0	52.0	56.0

ELECTRICAL CHARACTERISTICS				
Maximum resistance at 90°C	Ω/km	0.324	0.264	0.211
Capacitance core to core	nF/km	140	140	140
Capacitance core to earth	nF/km	340	360	390
Nominal inductance	mH/km	0.236	0.233	0.226
Nominal reactance	Ω/km	0.074	0.073	0.071
Nominal impedance	Ω/km	0.264	0.219	0.179
Nominal positive/negative sequence resistance at 20°C	Ω/km	0.253	0.206	0.164
Nominal positive/negative sequence reactance	Ω/km	0.086	0.084	0.083
Nominal positive/negative sequence impedance	Ω/km	0.267	0.223	0.184
Nominal zero sequence resistance at 20°C	Ω/km	0.253	0.206	0.164
Nominal zero sequence reactance*	Ω/km	0.182	0.173	0.166
Nominal zero sequence impedance	Ω/km	0.312	0.269	0.233

* against an external metallic tube

PHYSICAL REQUIREMENTS				
Maximum pulling force	Newtons	10800	13500	16650
Minimum bending radius	mm	350 (8D)	380 (8D)	405 (8D)
Nominal weight	kg/km	2245	2475	2855
Maximum drum length	metres	??	??	??

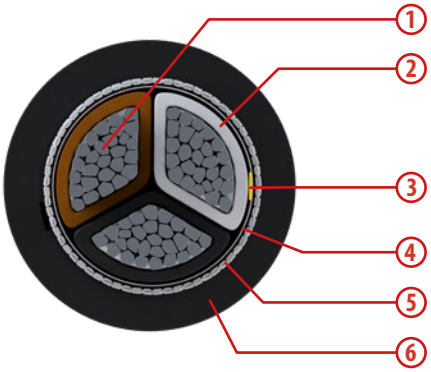
TRATOS® NETWORK RAIL FGT

ENHANCED UNARMOURED CABLE

TRATOS-RAILWAYS® THREE CORE – FAC/XLPE/WB/FGT/LSOH 600/1000 V

NETWORK RAIL NR/L2/SIGELP/27408

IMAGE - GENERAL CONSTRUCTION



1) Conductor
2) Insulation
3) Identification tape
4) Water blocking tape
5) Rodent protection
6) Outer sheath

COMPONENTS

Conductor	Stranded aluminium, Class 2, BS EN 60228
Insulation	Cross-linked polyethylene (XLPE) Type GP8
Core colours	Brown, black, grey, in accordance with Network Rail NR/L3/SIGELP/27427
Identification tape	PROPERTY OF NETWORK RAIL
Wrapping	Water-blocking (WB) tape (and water blocking (WB) yarns where applicable)
Rodent protection	One water-blocking glass-fibre weave tape, non-metallic rodent (NMR) protection
Outer Sheath	Low-smoke zero halogen (LSOH), Black
Cable Sheath Marking	TRATOS + LOT + ELECTRIC CABLE 600/1000V + 3 X CSA CU LSOH + YEAR + H + NMR + WB + NR/L2/SIGELP/27408 + PROPERTY OF NETWORK RAIL PADS NO XXXX/XXXXX

Certificate of Full Acceptance
PA05/07165

TRATOS-RAILWAYS® THREE CORE – FAC/XLPE/WB/FGT/LSOH 600/1000 V

CONDUCTOR X THREE CORE				
Nominal cross section	mm²	120	150	185
Tratos code		194678	194681	194682
PADS number		006/186144	006/186145	006/186146
Material		Stranded aluminium, Class 2		
Nominal diameter	mm	SHAPED		
Maximum resistance at 20°C	Ω/km	0.253	0.206	0.164

INSULATION		
Material	XLPE (GP8)	
Nominal thickness	mm	2.0

WRAPPING / FILLERS / YARNS	
Identification tape	YES
Water-blocking tape	YES
Water-blocking yarns	NO
Extruded fillers	NO

RODENT PROTECTION		
Material	Water-blocking glass fibre weave tape	
Nominal thickness	mm	0.6

OUTER SHEATH				
Material	LSOH			
Nominal thickness	mm	3.4	3.5	3.6
Nominal outer diameter	mm	45.0	49.0	52.0

ELECTRICAL CHARACTERISTICS				
Maximum resistance at 90°C	Ω/km	0.324	0.264	0.211
Capacitance core to core	nF/km	140	140	140
Capacitance core to earth	nF/km	340	360	390
Nominal inductance	mH/km	0.236	0.233	0.226
Nominal reactance	Ω/km	0.074	0.073	0.071
Nominal impedance	Ω/km	0.264	0.219	0.179
Nominal positive/negative sequence resistance at 20°C	Ω/km	0.253	0.206	0.164
Nominal positive/negative sequence reactance	Ω/km	0.086	0.084	0.083
Nominal positive/negative sequence impedance	Ω/km	0.267	0.223	0.184
Nominal zero sequence resistance at 20°C	Ω/km	0.253	0.206	0.164
Nominal zero sequence reactance*	Ω/km	0.187	0.185	0.184
Nominal zero sequence impedance	Ω/km	0.3515	0.277	0.246

* against an external metallic tube

PHYSICAL REQUIREMENTS				
Maximum pulling force	Newtons	10800	13500	16650
Minimum bending radius	mm	360 (8D)	395 (8D)	425 (8D)
Nominal weight	kg/km	2345	2575	2955
Maximum drum length	metres	2000	2000	2000

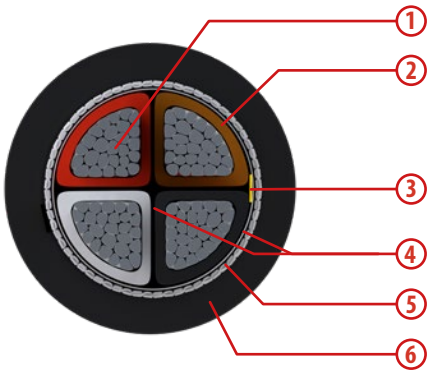
TRATOS® NETWORK RAIL FGT

ENHANCED UNARMOURED CABLE

TRATOS-RAILWAYS® FOUR CORE – FAC/XLPE/WB/FGT/PVC 600/1000 V

NETWORK RAIL NR/L2/SIGELP/27408

IMAGE - GENERAL CONSTRUCTION



1) Conductor
2) Insulation
3) Identification tape
4) Water blocking tape
5) Rodent protection
6) Outer sheath

COMPONENTS

Conductor	Stranded aluminium, Class 2, BS EN 60228
Insulation	Cross-linked polyethylene (XLPE) Type GP8
Core colours	Red, brown, black, grey, in accordance with Network Rail NR/L3/SIGELP/27427
Identification tape	PROPERTY OF NETWORK RAIL
Wrapping	Water-blocking (WB) tape (and water blocking (WB) yarns where applicable)
Rodent protection	One water-blocking glass-fibre weave tape, non-metallic rodent (NMR) protection
Outer Sheath	PVC, Black
Cable Sheath Marking	TRATOS + LOT + ELECTRIC CABLE 600/1000V + 4 X CSA AL PVC + YEAR + NMR + WB + NR/L2/ SIGELP/27408 + PROPERTY OF NETWORK RAIL PADS NO XXXX/XXXXX

Certificate of Full Acceptance
PA05/07165

TRATOS-RAILWAYS® FOUR CORE – FAC/XLPE/WB/FGT/PVC 600/1000 V

CONDUCTOR X FOUR CORE				
Nominal cross section	mm²	120	150	185
Tratos code		194691	194692	194693
PADS number		006/186177	006/186178	006/186179
Material		Stranded aluminium, Class 2		
Nominal diameter	mm	SHAPED		
Maximum resistance at 20°C	Ω/km	0.253	0.206	0.164

INSULATION		
Material	XLPE (GP8)	
Nominal thickness	mm	2.0

WRAPPING / FILLERS / YARNS	
Identification tape	YES
Water-blocking tape	YES
Water-blocking yarns	NO
Extruded fillers	NO

RODENT PROTECTION		
Material	Water-blocking glass fibre weave tape	
Nominal thickness	mm	0.6

OUTER SHEATH				
Material	PVC			
Nominal thickness	mm	3.5	3.5	3.6
Nominal outer diameter	mm	47.0	50.5	54.5

ELECTRICAL CHARACTERISTICS				
Maximum resistance at 90°C	Ω/km	0.324	0.264	0.211
Capacitance core to core	nF/km	140	140	140
Capacitance core to earth	nF/km	330	340	360
Nominal inductance	mH/km	0.274	0.268	0.264
Nominal reactance	Ω/km	0.086	0.084	0.083
Nominal impedance	Ω/km	0.268	0.223	0.184
Nominal positive/negative sequence resistance at 20°C	Ω/km	0.253	0.206	0.164
Nominal positive/negative sequence reactance	Ω/km	0.111	0.105	0.101
Nominal positive/negative sequence impedance	Ω/km	0.276	0.231	0.193
Nominal zero sequence resistance at 20°C	Ω/km	0.253	0.206	0.164
Nominal zero sequence reactance*	Ω/km	0.193	0.183	0.176
Nominal zero sequence impedance	Ω/km	0.318	0.276	0.241

* against an external metallic tube

PHYSICAL REQUIREMENTS				
Maximum pulling force	Newtons	14400	18000	20000
Minimum bending radius	mm	370 (8D)	400 (8D)	435 (8D)
Nominal weight	kg/km	2815	3065	3525
Maximum drum length	metres	2000	2000	2000

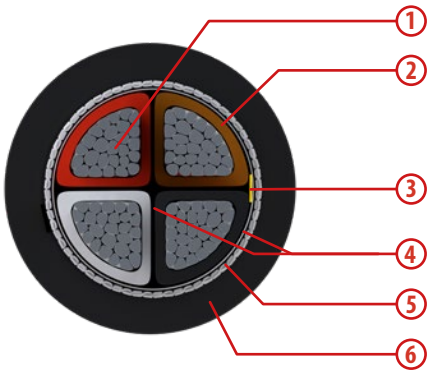
TRATOS® NETWORK RAIL FGT

ENHANCED UNARMOURED CABLE

TRATOS-RAILWAYS® FOUR CORE – FAC/XLPE/WB/FGT/LSOH 600/1000 V

NETWORK RAIL NR/L2/SIGELP/27408

IMAGE - GENERAL CONSTRUCTION



1) Conductor
2) Insulation
3) Identification tape
4) Water blocking tape
5) Rodent protection
6) Outer sheath

COMPONENTS

Conductor	Stranded aluminium, Class 2, BS EN 60228
Insulation	Cross-linked polyethylene (XLPE) Type GP8
Core colours	Red, brown, black, grey, in accordance with Network Rail NR/L3/SIGELP/27427
Identification tape	PROPERTY OF NETWORK RAIL
Wrapping	Water-blocking (WB) tape (and water blocking (WB) yarns where applicable)
Rodent protection	One water-blocking glass-fibre weave tape, non-metallic rodent (NMR) protection
Outer Sheath	Low-smoke zero halogen (LSOH), Black
Cable Sheath Marking	TRATOS + LOT + ELECTRIC CABLE 600/1000V + 4 X CSA AL LSOH + YEAR + NMR + WB + NR/L2/ SIGELP/27408 + PROPERTY OF NETWORK RAIL PADS NO XXXX/XXXXX

Certificate of Full Acceptance
PA05/07165

TRATOS-RAILWAYS® FOUR CORE – FAC/XLPE/WB/FGT/LSOH 600/1000 V

CONDUCTOR X FOUR CORE				
Nominal cross section	mm²	120	150	185
Tratos code		194683	194684	194685
PADS number		006/186180	006/186181	006/186182
Material		Stranded aluminium, Class 2		
Nominal diameter	mm	SHAPED		
Maximum resistance at 20°C	Ω/km	0.253	0.206	0.164

INSULATION		
Material	XLPE (GP8)	
Nominal thickness	mm	2.0

WRAPPING / FILLERS / YARNS	
Identification tape	YES
Water-blocking tape	YES
Water-blocking yarns	NO
Extruded fillers	NO

RODENT PROTECTION		
Material	Water-blocking glass fibre weave tape	
Nominal thickness	mm	0.6

OUTER SHEATH				
Material	LSOH			
Nominal thickness	mm	3.5	3.5	3.5
Nominal outer diameter	mm	48.0	51.5	55.5

ELECTRICAL CHARACTERISTICS				
Maximum resistance at 90°C	Ω/km	0.324	0.264	0.211
Capacitance core to core	nF/km	140	140	140
Capacitance core to earth	nF/km	330	340	360
Nominal inductance	mH/km	0.274	0.268	0.264
Nominal reactance	Ω/km	0.086	0.084	0.083
Nominal impedance	Ω/km	0.268	0.223	0.184
Nominal positive/negative sequence resistance at 20°C	Ω/km	0.253	0.206	0.164
Nominal positive/negative sequence reactance	Ω/km	0.111	0.105	0.101
Nominal positive/negative sequence impedance	Ω/km	0.276	0.231	0.193
Nominal zero sequence resistance at 20°C	Ω/km	0.253	0.206	0.164
Nominal zero sequence reactance*	Ω/km	0.199	0.198	0.196
Nominal zero sequence impedance	Ω/km	0.322	0.286	0.256

* against an external metallic tube

PHYSICAL REQUIREMENTS				
Maximum pulling force	Newtons	14400	18000	20000
Minimum bending radius	mm	385 (8D)	415 (8D)	445 (8D)
Nominal weight	kg/km	2815	3065	3525
Maximum drum length	metres	2000	2000	2000

www.tratosgroup.com

Tratos Cavi Spa - *Holding Company*
via Stadio, 2
Pieve Santo Stefano (AR)
52036 - Italy
tel: +39 0575 7941
fax: +39 0575 794246
e-mail: enquiry@tratos.eu

Tratos Ltd - *Group Commercial Department*
Baird House - 15-17 St Cross Street
Farringdon - London
EC1N 8UW - United Kingdom
sales@tratosgroup.com

March 2021