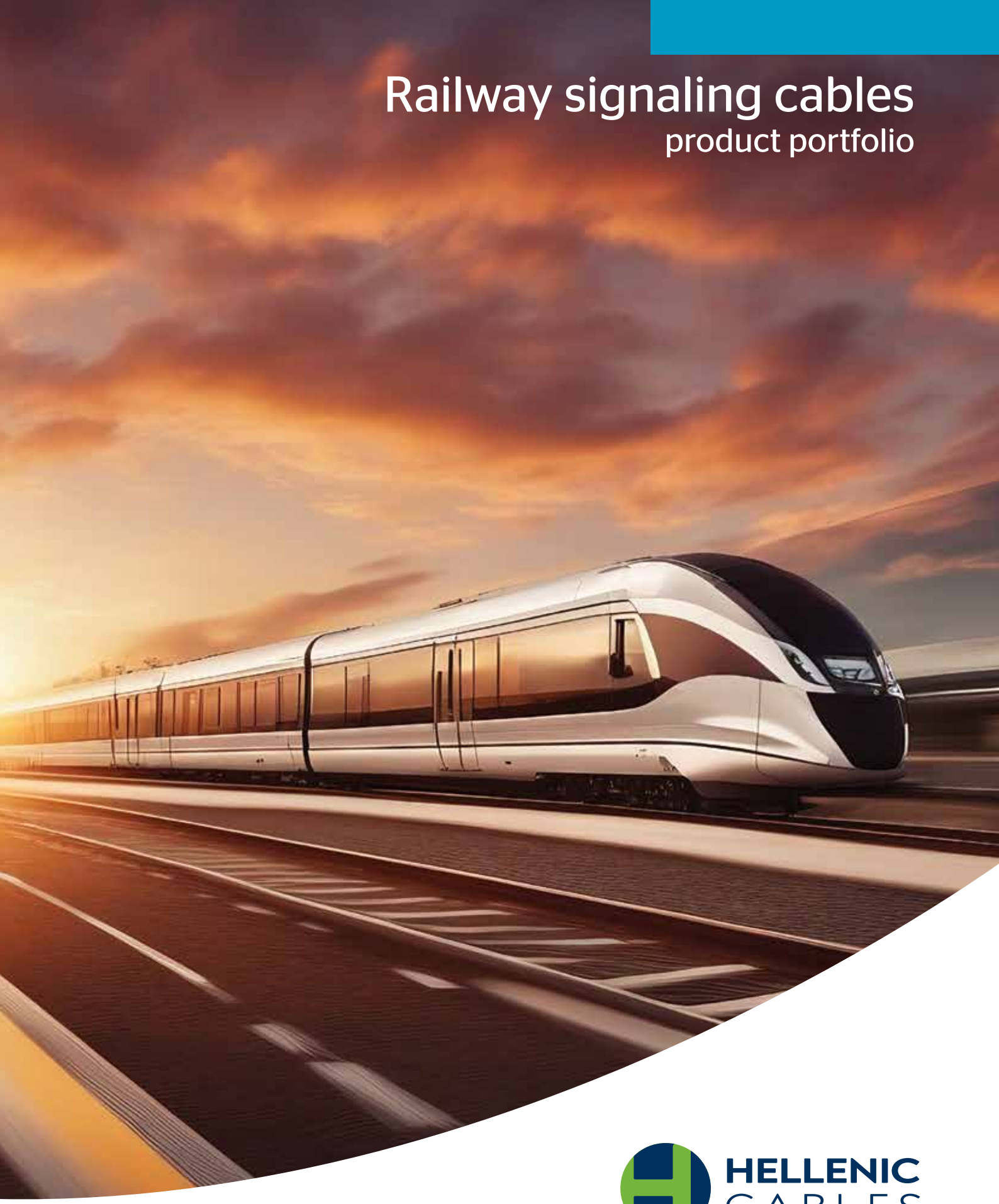
Railway signaling cables
product portfolio



HELLENIC CABLES

Member of CENERGY HOLDINGS

www.hellenic-cables.com

Railway signaling cables

HELLENIC CABLES

Member of CENERGY HOLDINGS

33 EUR million average annual investments (last 5 years)

Sales in more than 46 countries

Established 1950

5 manufacturing plants in 3 countries

State of the art facilities

Telecommunication & Data Cables

Bucharest, Romania

With a wide portfolio of reliable and sustainable cable solutions for international customers, **Hellenic Cables is one of the largest cable producers.**

The company is globally active in the energy transmission and distribution markets in the renewable energy sources, telecommunications and data transmission, construction and industry sectors, and is distinguished for its strong exports orientation.

Hellenic Cables represents the cable production and marketing sector of Viohalco S.A. The Company started its activities in 1950 as a Viohalco plant and in 1973 was incorporated as an independent subsidiary under the name Hellenic Cables, expanding its production and trade operations. Today, Hellenic Cables consists of Hellenic Cables S.A. which operates two plants in, Greece that produce cables, and plastic and elastomer compounds; the Fulgor S.A. plant in Corinth, Greece, which manufactures power cables, power and fibre optic submarine cables and copper wires; Icme Ecab S.A., a power and telecommunication cable manufacturer in Bucharest, Romania and Lesco Ltd Blagoevgrad, Bulgaria which manufactures wooden reels and pallets.
With a strong focus on development of value added products, such as high and extra-high voltage cables and submarine cables, the company implements significant investments towards enriching its product portfolio and enhancing its sustainability profile. The company has implemented a EUR 280 million approximately investment plan since 2011 for the production of high and extra-high voltage submarine and underground cables.

The company's wide product range extends to PVC, EPR and XLPE insulated power cables (rated up to 500kV), marine and low smoke halogen free cables, fire resistant cables, telecommunication, signal and data cables with copper conductors or optical fibres, as well as fire retardant halogen free plastic and elastomer compounds. Cables are supplied to a variety of international standards, such as VOE, CEI, ICEA, NF, SEN, BS, UL, NEMA, JIS, ASTM, DIN, IEC, ITU and ELDT. Many of the Company's products are certified by BASEC, VOE, IMQ, NF-USE, NETWORK RAIL, KEMA, DNV and UL.

Technical know-how is combined with continual investment in state-of-the-art machinery, to ensure levels of efficiency and quality which meet the strictest standards. The company's Quality Management System is certified to ISO 9001:2015, its Environmental Management System to ISO 14001:2015 and its Occupational Health and Safety to ISO 45001:2018. Hellenic Cables has the necessary expertise to develop and offer turnkey solutions that meet specific demands of its customers.

Commitment to quality and sustainable development has been a key factor in enabling Hellenic Cables to establish a strong market position internationally. The company's highly experienced technical and managerial staff have a strong commitment to innovation, technological excellence and outstanding quality, which ensures that users of Hellenic Cables' products have made a reliable and sustainable choice.

Hellenic Cables aims to constantly improve its offering and respond swiftly to changes in customer requirements around the world with reliable and safe products, based on environmentally friendly technologies. At the same time, the company places strong emphasis on the development of its people and the creation of value for its shareholders, partners and the communities in which it operates. Looking ahead, the company plans additional investments in technology and innovative cable solutions, as a way of contributing to the creation of a sustainable future for its stakeholders.

Submarine & Power Cables

Corinth, Greece

Rubber & Plastic Compounds

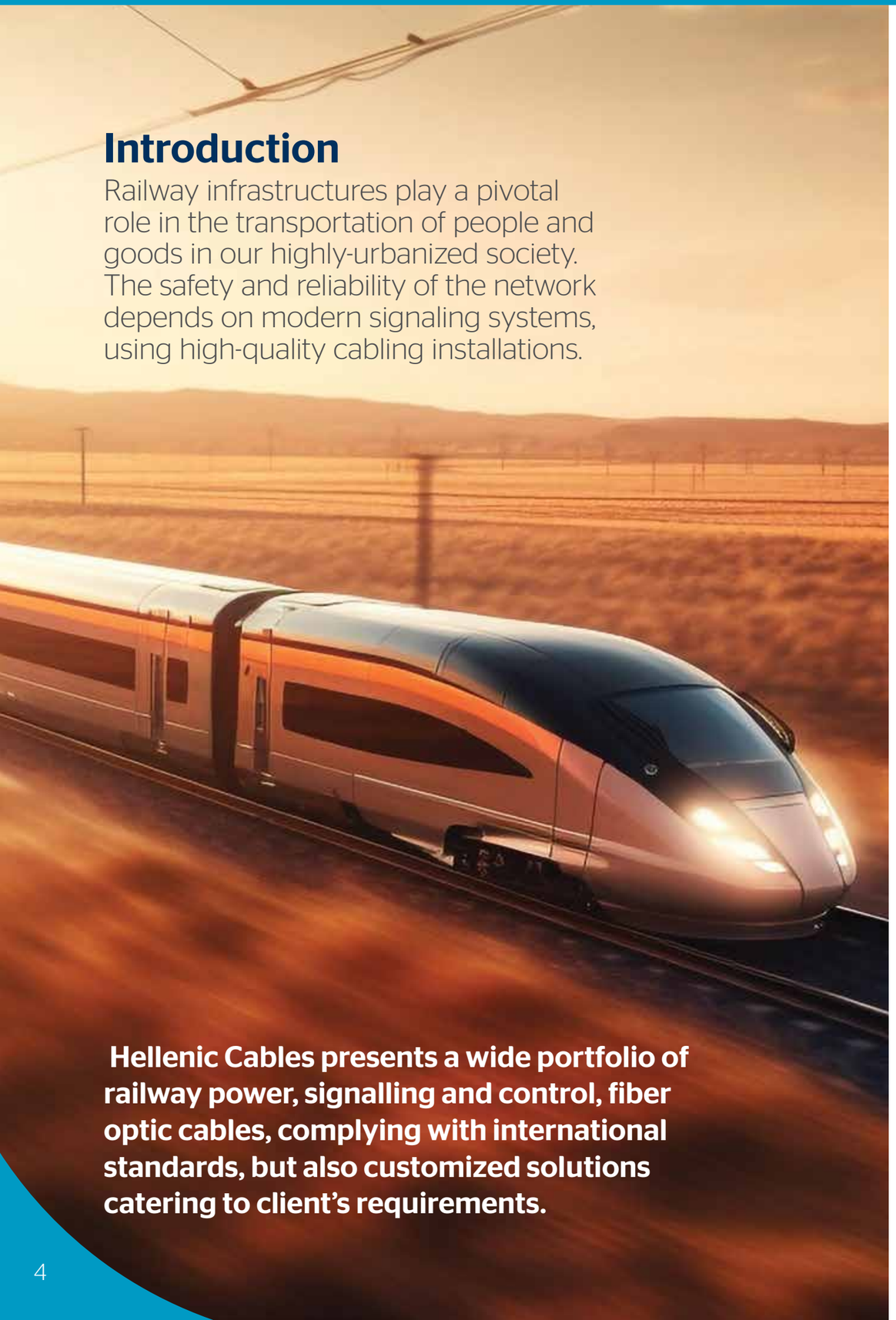
Oinofyta, Greece

Power Cables

Thiva, Greece

Power & Telecommu-nications Cables

Thiva, Greece



Introduction

Railway infrastructures play a pivotal role in the transportation of people and goods in our highly-urbanized society. The safety and reliability of the network depends on modern signaling systems, using high-quality cabling installations.

Hellenic Cables presents a wide portfolio of railway power, signalling and control, fiber optic cables, complying with international standards, but also customized solutions catering to client's requirements.

Signaling cables **construction**

The signaling and control cables cover a range of applications, such as point machines, level crossings, signal lights, axle counters etc. and are classified mainly in 3 categories:

Multicore cables	Single pair/Multipair cables	Single quad/Multiquad cables

The construction of such cables follows below:

Conductor	Solid or stranded copper of typical diameter 0.64 - 1.8mm
Insulation	Solid PVC/PE/XLPE, foam-skin PE
Cabling elements	cores/pairs/quads in concentric layers or in units
Wrapping – Filling	• Plastic tapes (dry cable core) • Jelly filling compound & pre-impregnated paper tape (jelly-filled cable core) • Swellable materials - waterblocking tapes,yarns & powder (dry-filled cable core)
Sheath (inner – outer)	PE/PVC/LSZH
Induction protection	(PE-)AL-PE tape, AL tape, aluminium wires, copper wires, copper tape
Armouring	Steel tapes, Steel Wires, Soft corrugated steel tape

Signaling cables **standards**

The most recognized European standards and specifications of signaling cables are mentioned on the table below.

Country / Application	Cable type designation	Standard / Specification
GERMANY	A-2Y2Yv, A-2Y2YB2Y, AJ-2Y2YDB2Y, A-2Y2Y(SR)2Y	DB AG 416.0113
		DB AG 416.0114
	A-2Y(L)2Yv, A-2Y(L)2YB2Y, AJ-2Y(L)2YDB2Y	DB AG 416.0115
	A-2YOF(L)2Yv, A-2YOF(L)2YB2Y, AJ-2YOF(L)2YDB2Y	DB AG 416.0113 v2.0
		DB AG 416.0114 v2.0
FRANCE	ZPAU, ZPFU (standard & -SH version)	SNCF CT 445
	K23	NF F 55-623
SPAIN	EAPSP, EATST, CCPSSP, CCTSST (underground & aerial)	ADIF E.T. 03.365.052.4
GREAT BRITAIN	TWIN DATALINK	BR 1932
	A-2YF(L)2YAWA2Y	NR PS ELP 27220
	PE/PE/SWA/PVC dry/jelly	BS 7870-8.2

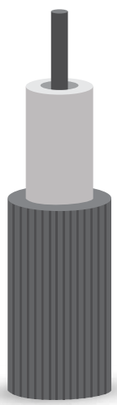
HELLENIC CABLES portfolio includes these signaling cables, along with several customized cables, produced according to European and Middle Eastern national railway standards (i.e. Romanian, Bulgarian, Israel, Hungarian, Egyptian Railways).

Apart from cables constructed based on country specifications, HELLENIC cables produces customized balise cables for ERTMS (European Rail Traffic Management System). Of special importance within ERTMS, balise cables are customized constructions with electromagnetic protection, which are used mainly for linking control centers and position tags along the railway network.

Fiber optic cables for railways

Within the railway network, the need for fast signals transmission without distance or interference constraints is always present. When this is not possible with typical signalling and control copper cables, then fiber optic cables are also incorporated in railways. Their transmission media is not metal conductors, but glass waveguides, that offer a very wide bandwidth, high transmission rate and immunity against electromagnetic interference. HELLENIC CABLES presents a portfolio of fiber optic cables suitable for underground usage along railtracks or for aerial usage along overhead lines (installation on poles).

Main element of fiber optic cables are the optical fibers, thin strands of pure silica (glass) that guide light, consisting of following:



Core
The center of the fiber where the light is transmitted.

Cladding
The outside optical layer of the fiber that traps the light in the core and guides it along.

Coating
is added to protect the core from damage and moisture

Loose tube
The primary coated fibers shall have an additional secondary protection. For this reason they are placed in silicone-free jelly-filled loose polymer tube, coloured, consisting of up to 24 fibers and with typical dimensions 2-3mm.

Optical fibers are broadly categorized in Multi-mode (MM) and Single-mode (SM) fibers, with below typical dimensions and basic characteristics:

	SM	MM
Coating Diameter	250 μm	250 μm
Cladding Diameter	125 μm	125 μm
Core Diameter	9 μm	62.5 μm 50 μm

SINGLE MODE			
Standards	**ITU-T G.652.D IEC 60793-2-50 Type B1.3 IEC 11801 / EN50173 OS2**	**ITU-T G.652.D ITU-T G.657.A1 (Bend improved) IEC 60793-2-50 Type B6_a1 IEC 11801 / EN50173 OS2**	**ITU-T G.655.D Non-Zero Dispersion-Shifted (NZDS) IEC 60793-2-50 Type B4**
Attenuation Coefficient [dB/km], max.			
at 1310nm	0.36	0.36	
at 1550nm	0.23	0.23	0.23
at 1625nm	0.25	0.25	0.25
Dispersion [ps/(nmxkm)], max.			
at 1285-1310nm	3.5	3.5	-
at 1550nm	18	18	2 - 6

MULTIMODE					
	G62.5/125 OM1	**G50/125 OM2**	**G50/125 OM3**	**G50/125 OM4**	**G50/125 OM5**
Standards	**IEC 11801 / EN 50173 OM1 ITU-T G.651.1 IEC 60793-2-10 Type A1b**	**IEC 11801 / EN 50173 OM2 ITU-T G.651.1 IEC 60793-2 Type A1a.1b**	**IEC 11801 / EN 50173 OM3 ITU-T G.651.1 IEC 60793-2 Type A1a.2b**	**IEC 11801 / EN 50173 OM4 ITU-T G.651.1 IEC 60793-2 Type A1a.3b**	**IEC 11801 / EN 50173 OM5 ITU-T G.651.1 IEC 60793-2 Type A1a.4**
Attenuation Coefficient [dB/km], max.					
at 850nm	3.0	2.8	2.5	2.5	2.5
at 953nm					1.8
at 1300nm	1.0	0.7	0.6	0.6	0.6
Bandwidth [MHz x km]					
at 850nm	200	500	1500	3500	3500
at 953nm					1850
at 1300nm	500	500	500	500	500
Core Diameter [μm]	62.5 ± 2.5	50 ± 2.5	50 ± 2.5	50 ± 2.5	50 ± 2.5

Cables properties symbols

Laying in ducts
Water resistant
Flame retardant IEC 60332-1
Aerial application
Direct burial
Moisture barrier
Fire retardant IEC 60332-3
B2ca
Anti-induction
Dielectric, no metal
Rodent protection

VDE designation codes for cables

Cable **type**

A-	Outdoor cable
AJ-	Outdoor cable with protection against inductive interference
A/I-	Universal Cable
ADSS	All-dielectric self-supporting cable

Cable **design**

2Y	Polyethylene (PE) insulation material
02Y	Cellular polyethylene (PE) insulation material
02YS	Foam-skin polyethylene (PE) insulation material
F	Petroleum jelly filling compound
OF	Low permittivity jelly filling compound
TF	Filling with water swellable yarns and tapes
(L)2Y	Moisture barrier sheath (laminated AL-foil bonded to PE sheath)
(ST)	Copper tape screen (CTS)
D	Concentrically positioned copper wires screen (CWS)
(SR)	Longitudinally applied corrugated steel tape armour (CSTA)
B	Helically applied steel tape armouring (STA)
Y	Polyvinyl chloride (PVC) sheathing material
2Y	Polyethylene (PE) sheathing material
H	Halogen free, flame retardant sheathing material
V	Reinforced sheathing
LS	Low smoke
ZH	Zero halogen
FR	Flame/Fire retardant
SWA	Steel wires armouring
AWA	Aluminium wires armouring
DQ	Loose tube – dry core
ZN	Reinforcement of non-metallic yarns (aramid or glass yarns)

Fire properties of signaling cables

Most railway infrastructure operators specify cables with a black polyethylene (PE) outer sheath for outdoor usage. PE is extremely robust and has very good UV resistance and it's also halogen-free, so it's ideal for outdoor installations.

The situation is, however, quite different in cable installations in tunnels. On such cases, cables are required to have flame-retardant properties so as not to promote the propagation of the fire. These cables have FR-LSZH sheaths and typically comply with the following standards:

Description	IEC / ISO standard
Halogen content of smoke gases	IEC 60754-1
pH-value & conductivity of smoke gases	IEC 60754-2
Smoke density	IEC 61034
Flame retardance (Single cable test)	IEC 60332-1-2
Fire retardance (Bunched cable test)	IEC 60332-3

The single cable test, according to IEC 60332-1-2, is lighter compared to the bunched cable test, specified by IEC 60332-3-24. The exact test descriptions follow below:

IEC 60332-1	IEC 60332-3
Tests on electric and optical fibre cables under fire conditions: test for vertical flame propagation for single insulated wire or cable. The flame propagation is tested according to IEC 60332-1 on a single cable. A vertical sample of cable about 600 mm in length is exposed to a flame for 60 s and/or 120 s in an area 100 mm above the lower end with a 1 kW Bunsen burner. After removing the burner, the flame must self-extinguish. The zones of the cable damaged by the flame should not reach to the upper end of the cable. The flaming time is dependant on the diameter of the cable.	*Tests on electric and optical fibre cables under fire conditions: test for vertical flame spread of vertically mounted bunched wires or cables.* The test for the spread of the flame with an array of several cables is normally carried out according to IEC 60332-3 (test method A, B, C or D, which differ on the volume of non-metallic materials). The test specimens, mounted in a vertical frame, are exposed to a flame over a length of 3600 mm starting in the lower section using a special burner with a high output. During and/or after exposure to the intensive flame for 20 and/or 40 minutes, the cables may not continue to burn to their upper end.

CPR - Construction Products Regulation

Since July 2017, the "Construction Product Regulation" (CPR) applies to any cable incorporated in construction works (permanent installation on buildings). Cable for use in the EU have to fulfil certain requirements in terms of behaviour in the case of fire and also carry the CE mark in relation to their fire performance. The definition of these safety requirements remains the responsibility of the national authorities.

The cable's fire characteristics shall be marked with a combination of different classes as below:

Table 1 - Classes of reaction to fire performance for electric cables

Class	Test method(s)	Classification criteria	Additional classification
A_{ca}	EN ISO 1716	PCS ≤ 2,0 MJ/kg [1]	
$B1_{ca}$	EN 50399 (30kW flame source)	FS ≤ 1,75 m; and THR_{1200s} ≤ 10 MJ; and Peak HRR ≤ 30 kW; and FIGRA ≤ 150 Ws^{-1}	Smoke production [2,5] and Flaming droplets/particles [3] and Acidity [4]
	EN 60332-1-2	H ≤ 425 mm	
$B2_{ca}$	EN 50399 (20,5kW flame source)	FS ≤ 1,5 m; and THR_{1200s} ≤ 15 MJ; and Peak HRR ≤ 30 kW; and FIGRA ≤ 150 Ws^{-1}	Smoke production [2,6] and Flaming droplets/particles [3] and Acidity [4]
	EN 60332-1-2	H ≤ 425 mm	
C_{ca}	EN 50399 (20,5kW flame source)	FS ≤ 12,0 m; and THR_{1200s} ≤ 30 MJ; and Peak HRR ≤ 60 kW; and FIGRA ≤ 300 Ws^{-1}	Smoke production [2,6] and Flaming droplets/particles [3] and Acidity [4]
	EN 60332-1-2	H ≤ 425 mm	
D_{ca}	EN 50399 (20,5kW flame source)	THR_{1200s} ≤ 70 MJ; and Peak HRR ≤ 400 kW; and FIGRA ≤ 1 300 Ws^{-1}	Smoke production [2,6] and Flaming droplets/particles [3] and Acidity [4]
	EN 60332-1-2	H ≤ 425 mm	
E_{ca}	EN 60332-1-2	H ≤ 425 mm	
F_{ca}	No performance determined		

Smoke classes: s1, s1a, s1b, s2, s3 (EN 50399/EN 61034-2)
Acidity classes: a1, a2, a3 (EN 60754-2)
Flaming droplets classes: d0, d1, d2 (EN 50399)

The CPR has no class or guideline for railway cables laid in exposed outdoor areas. These cables may continue to be designed, produced and installed as previously. For railway cables in tunnels or train stations, the relevant cable manufacturers associations recommend a classification according to the EU regulation (1303/2014), clause 4.2.2.4: "In case of fire, exposed cables shall have the characteristics of low flammability, low fire spread, low toxicity and low smoke density. These requirements are fulfilled when the cables fulfil as a minimum the requirements of classification B2ca, s1a, a1, as per Commission Decision 2006/751/EC."
HELLENIC CABLES signalling portfolio already includes several B2ca cables, while new B2ca cables types still continue to be added, based on customer's needs.

Protection from water penetration

Cables laid underground are sensitive to water penetration. The simplest cable protection from crosstudinal water penetration is the usage of aluminium foil, bonded with a PE sheath, creating a moisture barrier which doesn't allow water to enter inside cable core. However, this moisture barrier doesn't obstruct longitudinal water penetration.

To protect the cable core from water penetration along the cable length, two main cables types are used: Jelly filled and dry filled cables.

Jelly filling compound is the most typical method used for protection against water penetration and has been used on cables for several years. While most typical, it also has certain drawbacks as below:
- Increased cable weight
- Time-consuming cleaning during installation
- Negative influence on cable's fire behavior

Jelly filling with very low permittivity can also be used instead of normal jelly. For cables of same electrical characteristics, they are lighter and also easier to clean during installation.

Over the last years, there has been a move inside cable industry towards dry filled cables. **Dry filling** is composed of swellable waterblocking tapes, waterblocking yarns and waterblocking powder and has several advantages, as below:
- Light-weight cable construction
- Easier installation

HELLENIC CABLES produces both jelly-filled and dry-filled cable types, catering to all customers' needs.

Table of **contents**

GERMANY

DB AG 416.0113 v1.1
- A-2Y2Yv nx1x0.9-1.4-1.8 (H115/H145) 14
- A-2Y2YB2Y nx1x0.9-1.4-1.8 (H115/H145) 15
- AJ-2Y2YDB2Y nx1x0.9-1.4-1.8 (H115/H145) rk600 16
- A-2YHBH nx1x0.9-1.4-1.8 B2ca 17

DB AG 416.0114 v1.1
- A-2Y2Yv nx1x1.4 (H95) 18
- A-2Y2YB2Y nx1x1.4-1.8 (H95) 19
- AJ-2Y2YDB2Y nx1x1.4 (H95) rk500 20

DB AG 416.0115 v1.1
- A-2Y(L)2Yv nx4x0.9-1.4 (H45) 21
- A-2Y(L)2YB2Y nx4x0.9-1.4 (H45) 22
- AJ-2Y(L)2YDB2Y nx4x0.9-1.4 (H45) rk600/rk500 23
- A-2Y(L)HBH nx4x0.9-1.4 B2ca 25

DB AG 416.0113 v2.0
- A-2YOF(L)2YB2Y nx1x0.9-1.4-1.8 (H115/H145) 26
- AJ-2YOF(L)2YDB2Y nx1x0.9-1.4-1.8 (H115/H145) rk600 27

DB AG 416.0114 v2.0
- AJ-2YOF(L)2YDB2Y nx1x1.4-1.8 (H95) rk500 28

FRANCE

SNCF CT 445
- ZPAU nx2x1.0-1.5mm2 30
- ZPFU nx2x1.0mm2 31

NF F 55-623
- K23 nx2x1.0-1.5mm2 32

SPAIN

ADIF 03.365.52.4
- EAPSP/EATST nx1x1.4mm 34
- EAPSP/EATST nx4x0.9-1.4mm 35
- EAPSSP/EATSST nx1x1.4mm 36
- EAPSSP/EATSST nx4x0.9-1.4mm 37
- EAPSSP-8 nx1x1.4mm 38
- EAPSSP-8 nx4x0.9-1.4mm 39
- CCPSSP/CCTSST nx1x1.4mm 40
- CCPSSP/CCTSST nx4x0.9-1.4mm 41

GREAT BRITAIN

BR 1932
- TWIN DATALINK (PE/LSZH) 44

NR PS ELP 27220
- A-2YF(L)2YAWA2Y/A-2YF(L)HAWAH nx2x0.9 45

BS 7870-8.2
- PE/PJF/PE/SWA/PVC nx2x0.8 (5kV < induced voltage <15kV) 46
- PE/PE/SWA/PVC nx2x0.8 (induced voltage < 5kV 47

BALISE
- A-2Y(SR)H 1x2x0.9 50
- A-2Y(L)2Y(SR)2Y 1x2x1.02 51
- A-2Y(L)2YB2Y 1x4x1.53 52
- A-2YTF2Y(L)2YBY / A-2YTF2Y(L)HBH 1x2x1.4 53
- AJ-2Y(ST)2YB2Y 1x2x1.4 54
- A-02YSTF(L)2YB2Y 1x4x0.8 55

FIBER OPTIC CABLES
- A-DQ(ZN)(SR)2Y 58
- A-DQ(ZN)2Y(SR)2Y 59
- A/I-DQ(ZN)H(SR)H CPR B2ca 60
- ADSS short span 61

- Notes 62-63

GERMANY

Datasheets of typical railway signaling cables

Cable type	Specification	Stranding elements	Insulation	Longitudinal watertightness	Moisture barrier	Inner sheath	Electrostatic shield / induction protection	Metallic armour	Outer sheath
A-2Y2Yv	DB AG 416.0113 v1.1 416.0114 v1.1	cores	Solid PE	-	-		-		PE
A-2Y2YB2Y		cores	Solid PE	-	-	PE	-	galvanized steel tapes	PE
AJ-2Y2YDB2Y		cores	Solid PE	-	-	PE	Copper wires	galvanized steel tapes	PE
A-2YHBH B2ca		cores	Solid PE	-	-	LSZH	-	galvanized steel tapes	LSZH
A-2Y(L)2Yv	DB AG 416.0115 v1.1	quads	Solid PE	-	AL-PE tape	-	-		PE
A-2Y(L)2YB2Y		quads	Solid PE	-	AL-PE tape	PE		galvanized steel tapes	PE
AJ-2Y(L)2YDB2Y		quads	Solid PE	-	AL-PE tape	PE	Copper wires	galvanized steel tapes	PE
A-2Y(L)HBH B2ca		quads	Solid PE	-	AL-PE tape	LSZH		galvanized steel tapes	LSZH
A-2YOF(L)2Yv	DB AG 416.0113 v2.0 416.0114 v2.0	cores	Solid PE	Low permittivity jelly	AL-PE tape	-	-		PE
A-2YOF(L)2YB2Y		cores	Solid PE		AL-PE tape	PE		galvanized steel tapes	PE
AJ-2YOF(L)2YDB2Y		cores	Solid PE		AL-PE tape	PE	Copper wires	galvanized steel tapes	PE

DB AG 416.0113 v1.1

A-2Y2Yv nx1x0.9-1.4-1.8 (H115/H145)

Unarmoured reinforced signal cables for signal installations along the railway tracks.

Construction

Conductor	Class 1, soft annealed, solid copper
Insulation	solid polyethylene (PE)
Color coding	In each layer, the insulation of the pilot conductor has blue colour, the rest are natural coloured
Stranding elements	cores stranded in concentric layers
Cable core wrapping	plastic tapes
Outer Sheath	black PE, reinforced

Cables with 14 conductors and more have 2 diametrically opposite copper monitoring cores of 0.5 mm with perforated grey PE insulation.

Temperature range	
Operation	-40°C to +60°C
Installation	-10°C to +60°C

Technical details (at 20°C)

Conductor diameter, nom	mm	0.9	1.4	1.8
Conductor resistance, max	Ohm/km	28.9	11.9	7.2
Insulation resistance, min	Mohm*km	10000		
Mutual capacitance (800Hz), max ***individual wires in cable core**	nF/km	115 120*	145 155*	145 155*
Dielectric strength test, 1 min **Conductor-conductor**	Volts	2500 (AC 50 Hz) 3535 (DC)		

Electrical characteristics for 0.5 mm monitoring cores are according to Table 1 of Appendix 2 of DB AG 416.0113 specification.

Cables physical characteristics

Cable size	Outer sheath thickness (nominal) (mm)	Cable outer diameter (calculated) (mm)	Cable weight (calculated) (kg/km)
4x1x0.9mm	2.0	8.1	80
7x1x0.9mm	2.0	9.0	105
10x1x0.9mm	2.0	10.4	135
14x1x0.9mm	2.0	11.0	170
20x1x0.9mm	2.0	12.1	215
4x1x1.4mm	2.0	9.6	125
7x1x1.4mm	2.0	10.9	170
10x1x1.4mm	2.0	13.0	240
14x1x1.4mm	2.0	13.8	310
20x1x1.4mm	2.0	15.4	410
4x1x1.8mm	2.0	10.6	170
7x1x1.8mm	2.0	12.6	260
10x1x1.8mm	2.0	15.2	355
20x1x1.8mm	2.0	19.2	625

Other cable sizes available upon request.

DB AG 416.0113 v1.1

A-2Y2YB2Y nx1x0.9-1.4-1.8 (H115/H145)

Armoured signal cables for signal installations along the railway tracks.

Construction

Conductor	Class 1, soft annealed, solid copper
Insulation	solid polyethylene (PE)
Color coding	In each layer, the insulation of the pilot conductor has blue colour, the rest are natural coloured
Stranding elements	cores stranded in concentric layers
Cable core wrapping	plastic tapes
Inner Sheath	black PE
Armouring	1 layer (thickness 0.2-0.3mm) or 2 layers (thickness ≥ 0.1mm) of galvanized steel tape*
Outer Sheath	black PE

Cables with 14 conductors and more have 2 diametrically opposite copper monitoring cores of 0.5 mm with perforated grey PE insulation.

**Upon request, armouring of galvanized steel tapes can be replaced with corrugated soft steel tape – cable type A-2Y2Y(SR)2Y.*

Temperature range	
Operation	-40°C to +60°C
Installation	-10°C to +60°C

Technical details (at 20°C)

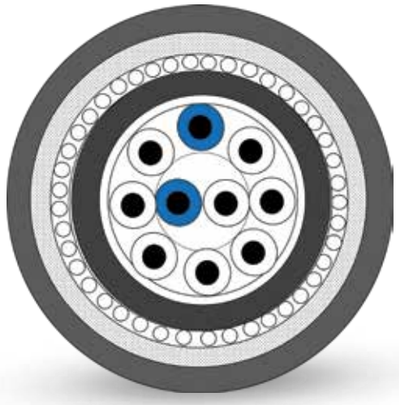
Conductor diameter, nom	mm	0.9	1.4	1.8
Conductor resistance, max	Ohm/km	28.9	11.9	7.2
Insulation resistance, min	Mohm*km	10000		
Mutual capacitance (800Hz), max ***individual wires in cable core**	nF/km	115 120*	145 155*	145 155*
Dielectric strength test, 1 min **Conductor-conductor**	Volts	2500 (AC 50 Hz) 3535 (DC)		

Electrical characteristics for 0.5 mm monitoring cores are according to Table 1 of Appendix 2 of DB AG 416.0113 specification.

Cables physical characteristics

Cable size	Inner sheath thickness (nominal) (mm)	Outer sheath thickness (nominal) (mm)	Cable outer diameter (calculated) (mm)	Cable weight (calculated) (kg/km)
4x1x0.9mm	1.3	1.2	9.8	125
7x1x0.9mm	1.3	1.2	10.9	160
10x1x0.9mm	1.3	1.2	12.3	195
14x1x0.9mm	1.3	1.2	13.0	230
20x1x0.9mm	1.3	1.2	14.0	285
4x1x1.4mm	1.3	1.2	11.9	185
10x1x1.4mm	1.3	1.2	14.9	315
14x1x1.4mm	1.3	1.2	16.0	395
20x1x1.4mm	1.3	1.2	17.8	505
4x1x1.8mm	1.3	1.2	13.3	245
7x1x1.8mm	1.3	1.2	14.9	340
10x1x1.8mm	1.3	1.2	17.6	450
14x1x1.8mm	1.3	1.2	18.8	590
20x1x1.8mm	1.3	1.2	21.1	780

Other cable sizes available upon request.



DB AG 416.0113 v1.1

AJ-2Y2YDB2Y nx1x0.9-1.4-1.8 (H115/H145) rk600

Armoured and screened signal cables for signal installations along the railway tracks with reduction factor requirements.

Temperature range	
Operation	-40°C to +60°C
Installation	-10°C to +60°C

Construction

Conductor	Class 1, soft annealed, solid copper
Insulation	solid polyethylene (PE)
Color coding	In each layer, the insulation of the pilot conductor has blue colour, the rest are natural coloured
Stranding elements	cores stranded in concentric layers
Cable core wrapping	plastic tapes
Inner Sheath	black PE
Screening	Copper wires
Armouring	2 layers of galvanized steel tape of 0.5mm thickness
Outer Sheath	black PE

Cables with 14 conductors and more have 2 diametrically opposite copper monitoring cores of 0.5 mm with perforated grey PE insulation.

Technical details (at 20°C)

Conductor diameter, nom	mm	0.9	1.4	1.8
Conductor resistance, max	Ohm/km	28.9	11.9	7.2
Insulation resistance, min	Mohm*km	10000		
Mutual capacitance (800Hz), max ***individual wires in cable core**	nF/km	115 120*	145 155*	145 155*
Dielectric strength test, 1 min **Conductor-conductor**	Volts	2500 (AC 50 Hz) 3535 (DC)		
Reduction factor		rk 600		

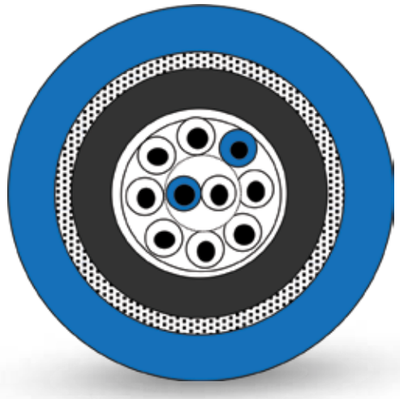
Electrical characteristics for 0.5 mm monitoring cores are according to Table 1 of Appendix 2 of DB AG 416.0113 specification.

Cables physical characteristics

Cable size	Inner sheath thickness (nominal) (mm)	Copper wires screen (No x diameter)*	Outer sheath thickness (nominal) (mm)	Cable outer diameter (calculated) (mm)	Cable weight (calculated) (kg/km)
4x1x0.9mm	1.3	9x0.9	1.2	13.9	380
7x1x0.9mm	1.3	11x0.9	1.2	15.4	455
10x1x0.9mm	1.3	14x0.9	1.2	16.1	495
12x1x0.9mm	1.3	14x0.9	1.2	16.4	535
20x1x0.9mm	1.3	15x0.9	1.2	17.6	620
4x1x1.4mm	1.3	11x0.9	1.2	15.9	455
7x1x1.4mm	1.3	13x0.9	1.2	17.0	560
10x1x1.4mm	1.3	16x0.9	1.2	18.7	675
14x1x1.4mm	1.3	18x0.9	1.2	20.3	795
20x1x1.4mm	1.3	19x0.9	1.2	21.2	915
4x1x1.8mm	1.3	10x0.9	1.2	17.0	540
7x1x1.8mm	1.3	16x0.9	1.2	18.5	690
10x1x1.8mm	1.3	18x0.9	1.2	21.2	855
20x1x1.8mm	1.3	21x0.9	1.2	26.0	1290

** The number and diameter of the copper wires may change but the value of reduction factor shall always be achieved.*

Other cable sizes available upon request.
Cables with different reduction factor index (rk500, rk400) can also be offered upon request.



DB AG 416.0113 v1.1

A-2YHBH nx1x0.9-1.4-1.8 B2ca

Highly flame-retardant railway signaling cables, suitable for installation on areas with high fire safety requirements. Cables are fire retardant.

Construction

Conductor	Class 1, soft annealed, solid copper
Insulation	solid polyethylene (PE)
Color coding	In each layer, the insulation of the pilot conductor has blue colour, the rest are natural coloured
Stranding elements	cores stranded in concentric layers
Bedding	flame retardant material
Inner Sheath	LSZH sheath
Armouring	2 layers of helically applied galvanized steel tape
Outer sheath	LSZH sheath
CPR classification	B2ca s1a d1 a1

Cables with 14 conductors and more have 2 diametrically opposite copper monitoring cores of 0.5 mm with perforated grey PE insulation

Technical details (at 20°C)

Conductor diameter, nom	mm	0.9	1.4	1.8
Conductor resistance, max	Ohm/km	28.9	11.9	7.2
Insulation resistance, min	Mohm*km	10000		
Mutual capacitance (800Hz), max ***individual wires in cable core**	nF/km	115 120*	145 155*	145 155*
Dielectric strength test, 1 min **Conductor-conductor**	Volts	2500 (AC 50 Hz) 3535 (DC)		

Electrical characteristics for 0.5 mm monitoring cores are according to Table 1 of Appendix 2 of DB AG 416.0115 specification

Cables physical characteristics

Cable size	Cable outer diameter (calculated) (mm)	Cable weight (calculated) (kg/km)
4x1x0.9	14.5	335
10x1x1.4	19.7	630
20x1x1.4	22.6	910
10x1x1.8	22.8	865
20x1x1.8	26.6	1270
40x1x1.8	30.6	1855
60x1x1.8	36.4	2595

Other cable sizes available upon request.

DB AG 416.0114 v1.1

A-2Y2Yv nx1x1.4 (H95)

Unarmoured reinforced signal cables for signal installations along the railway tracks.

Construction

Conductor	Class 1, soft annealed, solid copper
Insulation	solid polyethylene (PE)
Color coding	In each layer, the insulation of the pilot conductor has blue colour, the rest are natural coloured
Stranding elements	cores stranded in concentric layers
Cable core wrapping	plastic tapes
Outer Sheath	black PE, reinforced

Cables with 14 conductors and more have 2 diametrically opposite copper monitoring cores of 0.5 mm with perforated grey PE insulation.

Temperature range	
Operation	-40°C to +60°C
Installation	-10°C to +60°C

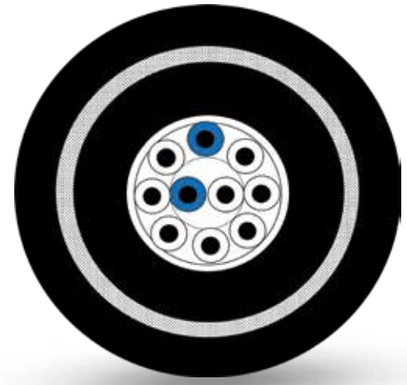
Technical details (at 20°C)

Conductor diameter, nom	mm	1.4
Conductor resistance, max	Ohm/km	11.9
Insulation resistance, min	Mohm*km	10000
Mutual capacitance (800Hz), max ***individual wires in cable core**	nF/km	95 105*
Dielectric strength test, 1 min **Conductor-conductor**	Volts	2500 (AC 50 Hz) 3535 (DC)

Electrical characteristics for 0.5 mm monitoring cores are according to Table 1 of Appendix 2 of DB AG 416.0114 specification

Cables physical characteristics			
Cable size	**Outer sheath thickness (nominal) (mm)**	**Cable outer diameter (calculated) (mm)**	**Cable weight (calculated) (kg/km)**
7x1x1.4mm	2.0	12.5	200
10x1x1.4mm	2.0	15.1	270
20x1x1.4mm	2.0	18.2	465

Other cable sizes and different conductor diameters available upon request.



DB AG 416.0114 v1.1

A-2Y2YB2Y nx1x1.4-1.8 (H95)

Armoured signal cables for signal installations along the railway tracks.

Construction

Conductor	Class 1, soft annealed, solid copper
Insulation	solid polyethylene (PE)
Color coding	In each layer, the insulation of the pilot conductor has blue colour, the rest are natural coloured
Stranding elements	cores stranded in concentric layers
Cable core wrapping	plastic tapes
Inner Sheath	black PE
Armouring	1 layer (thickness 0.2-0.3mm) or 2 layers (thickness ≥ 0.1mm) of galvanized steel tape*
Outer Sheath	black PE

Cables with 14 conductors and more have 2 diametrically opposite copper monitoring cores of 0.5 mm with perforated grey PE insulation.

**Upon request, armouring of galvanized steel tapes can be replaced with corrugated soft steel tape – cable type A-2Y2Y(SR)2Y.*

Temperature range	
Operation	-40°C to +60°C
Installation	-10°C to +60°C

Technical details (at 20°C)

Conductor diameter, nom	mm	1.4	1.8
Conductor resistance, max	Ohm/km	11.9	7.2
Insulation resistance, min	Mohm*km	10000	
Mutual capacitance (800Hz), max ***individual wires in cable core**	nF/km	95 105*	95 105*
Dielectric strength test, 1 min **Conductor-conductor**	Volts	2500 (AC 50 Hz) 3535 (DC)	

Electrical characteristics for 0.5 mm monitoring cores are according to Table 1 of Appendix 2 of DB AG 416.0114 specification.

Cables physical characteristics				
Cable size	**Inner sheath thickness (nominal) (mm)**	**Outer sheath thickness (nominal) (mm)**	**Cable outer diameter (calculated) (mm)**	**Cable weight (calculated) (kg/km)**
7x1x1.4mm	1.3	1.2	14.5	275
10x1x1.4mm	1.3	1.2	17.1	360
20x1x1.4mm	1.3	1.2	20.4	600
40x1x1.4mm	1.3	1.3	26.3	1035
10x1x1.8mm	1.3	1.2	20.0	540
30x1x1.8mm	1.3	1.3	29.3	1260

Other cable sizes and different conductor diameters available upon request.

DB AG 416.0114 v1.1

AJ-2Y2YDB2Y nx1x1.4 (H95) rk500

Armoured and screened signal cables for signal installations along the railway tracks with reduction factor rk500.

Construction

Conductor	Class 1, soft annealed, solid copper
Insulation	solid polyethylene (PE)
Color coding	In each layer, the insulation of the pilot conductor has blue colour, the rest are natural coloured
Stranding elements	cores stranded in concentric layers
Cable core wrapping	plastic tapes
Inner Sheath	black PE
Screening	Copper wires
Armouring	2 layers of galvanized steel tape of 0.5mm thickness
Outer Sheath	black PE

Cables with 14 conductors and more have 2 diametrically opposite copper monitoring cores of 0.5 mm with perforated grey PE insulation.

Temperature range	
Operation	-40°C to +60°C
Installation	-10°C to +60°C

Technical details (at 20°C)

Conductor diameter, nom	mm	1.4
Conductor resistance, max	Ohm/km	11.9
Insulation resistance, min	Mohm*km	10000
Mutual capacitance (800Hz), max ***individual wires in cable core**	nF/km	95 105*
Dielectric strength test, 1 min **Conductor-conductor**	Volts	2500 (AC 50 Hz) 3535 (DC)
Reduction factor		rk500

Electrical characteristics for 0.5 mm monitoring cores are according to Table 1 of Appendix 2 of DB AG 416.0114 specification.

Cables physical characteristics

Cable size	Inner sheath thickness (nominal) (mm)	Copper wires screen (No x diameter)*	Outer sheath thickness (nominal) (mm)	Cable outer diameter (calculated) (mm)	Cable weight (calculated) (kg/km)
7x1x1.4mm	1.3	29x0.9	1.2	17.8	680
10x1x1.4mm	1.3	36x0.9	1.2	20.5	845
14x1x1.4mm	1.3	37x0.9	1.2	21.5	955
20x1x1.4mm	1.3	41x0.9	1.2	24.5	1170
30x1x1.4mm	1.3	46x0.9	1.3	27.0	1440
50x1x1.4mm	1.3	31x1.2	1.3	33.8	2090

** The number and diameter of the copper wires may change but the value of reduction factor shall always be achieved.*

Other cable sizes available upon request.
Cables with different reduction factor index (rk500, rk400) can also be offered upon request.

DB AG 416.0115 v1.1

A-2Y(L)2Yv nx4x0.9-1.4 (H45)

Unarmoured reinforced quad signal cables for signal installations along the railway tracks.

Construction

Conductor	Class 1, soft annealed, solid copper
Insulation	solid polyethylene (PE)
Identification	Insulation of each conductor natural, ring marking according to DB AG 416.0116
Color coding	In each layer, the pilot quad is wrapped by blue wrapping tape, the rest are wrapped by natural colored tapes
Stranding elements	Quads stranded in concentric layers
Cable core wrapping	plastic tapes
Moisture barrier	AL-PE tape in contact with tinned copper drain wire 0.4mm
Outer Sheath	black PE, reinforced

Cables with 7 quads and more have 2 diametrically opposite copper monitoring cores of 0.5 mm with perforated grey PE insulation.

Temperature range	
Operation	-40°C to +60°C
Installation	-10°C to +60°C

Technical details (at 20°C)

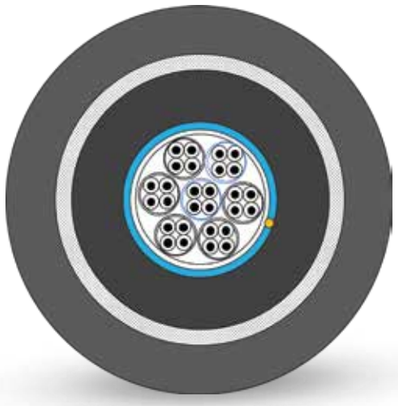
Conductor diameter, nom	mm	0.9	1.4
Conductor loop resistance, max	Ohm/km	56.6	23.4
Insulation resistance, min	Mohm*km	10000	
Mutual capacitance (800Hz), max ***individual wires in cable core**	nF/km	45 52*	
Capacitance Unbalance at 800 Hz, max. (pF/500m) **k1 - 100%/50% of all values** **k9-12 - 100%/50% of all values** **e1-2, ea1/2 - 100% of values**	pF/500m	650/150 500/150 1300	650 500 1300
Dielectric Strength at 50Hz, 1 min **Conductor - Conductor** **Conductor - shield**	Volts	2500 (AC 50 Hz) 3535 (DC)	
Attenuation at 90kHz, max	Ohm	3.3	2.6
FEXT at 90kHz, min (100%/80% of values)	dB	58/62	33

Electrical characteristics for 0.5 mm monitoring cores are according to Table 1 of Appendix 2 of DB AG 416.0115 specification.

Cables physical characteristics

Cable size	AL-PE tape thickness (mm)	Outer sheath thickness (nominal) (mm)	Cable outer diameter (calculated) (mm)	Cable weight (calculated) (kg/km)
1x4x0.9mm	0.15+0.05	2.0	9.8	105
3x4x0.9mm	0.15+0.05	2.0	13.6	195
5x4x0.9mm	0.15+0.05	2.0	16.0	270
7x4x0.9mm	0.15+0.05	2.0	18.3	350
10x4x0.9mm	0.15+0.05	2.0	22.3	470
14x4x0.9mm	0.15+0.05	2.0	24.1	600
20x4x0.9mm	0.15+0.05	2.0	27.3	800
1x4x1.4mm	0.15+0.05	2.0	11.6	155
2x4x1.4mm	0.15+0.05	2.0	15.8	255
3x4x1.4mm	0.15+0.05	2.0	18.2	340
5x4x1.4mm	0.15+0.05	2.0	22.1	505
7x4x1.4mm	0.15+0.05	2.0	23.9	660
10x4x1.4mm	0.15+0.05	2.0	29.1	900
14x4x1.4mm	0.15+0.05	2.2	31.9	1205
20x4x1.4mm	0.15+0.05	2.2	37.3	1655

Other cable sizes and different conductor diameters available upon request.



DB AG 416.0115 v1.1

A-2Y(L)2YB2Y nx4x0.9-1.4 (H45)

Armoured quad signal cables for signal installations along the railway tracks.

Construction

Conductor	Class 1, soft annealed, solid copper
Insulation	solid polyethylene (PE)
Identification	Insulation of each conductor natural, ring marking according to DB AG 416.0116
Color coding	In each layer, the pilot quad is wrapped by blue wrapping tape, the rest are wrapped by natural colored tapes
Stranding elements	Quads stranded in concentric layers
Cable core wrapping	plastic tapes
Moisture barrier	AL-PE tape in contact with tinned copper drain wire 0.4mm
Inner Sheath	black PE
Armouring	1 layer (thickness 0.2-0.3mm) or 2 layers (thickness ≥ 0.1mm) of galvanized steel tape*
Outer Sheath	black PE

Cables with 7 quads and more have 2 diametrically opposite copper monitoring cores of 0.5 mm with perforated grey PE insulation.

**Upon request, armouring of galvanized steel tapes can be replaced with corrugated soft steel tape – cable type A-2Y2Y(SR)2Y.*

Temperature range	
Operation	-40°C to +60°C
Installation	-10°C to +60°C

Technical details (at 20°C)

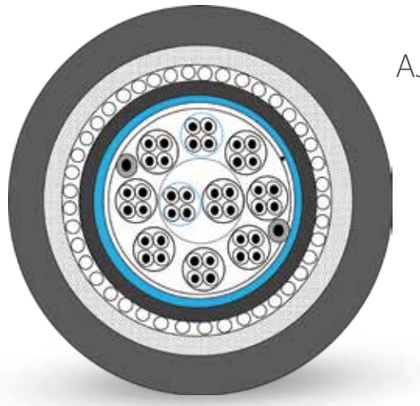
Conductor diameter, nom	mm	0.9	1.4
Conductor resistance, max	Ohm/km	56.6	23.4
Insulation resistance, min	Mohm*km	10000	
Mutual capacitance (800Hz), max ***individual wires in cable core**	nF/km	45 52*	
Capacitance Unbalance at 800 Hz, max. (pF/500m) **k1 – 100%/50% of all values** **k9-12 – 100%/50% of all values** **e1-2, ea1/2 – 100% of values**	pF/500m	650/150 500/150 1300	650 500 1300
Dielectric Strength at 50Hz, 1 min **Conductor – Conductor** **Conductor - shield**	Volts	2500 (AC 50 Hz) 3535 (DC)	
Attenuation at 90kHz, max	Ohm	3.3	2.6
FEXT at 90kHz, min (100%/80% of values)	dB	58/62	33

Electrical characteristics for 0.5 mm monitoring cores are according to Table 1 of Appendix 2 of DB AG 416.0115 specification.

Cables physical characteristics

Cable size	AL-PE tape thickness (mm)	Inner sheath thickness (nominal) (mm)	Outer sheath thickness (nominal) (mm)	Cable outer diameter (calculated) (mm)	Cable weight (calculated) (kg/km)
1x4x0.9mm	0.15+0.05	1.3	1.2	11.9	165
3x4x0.9mm	0.15+0.05	1.3	1.2	16.7	290
5x4x0.9mm	0.15+0.05	1.3	1.2	19.1	415
7x4x0.9mm	0.15+0.05	1.3	1.2	20.6	495
10x4x0.9mm	0.15+0.05	1.3	1.2	24.8	650
20x4x0.9mm	0.15+0.05	1.3	1.2	29.7	1020
1x4x1.4mm	0.15+0.05	1.3	1.2	13.5	230
2x4x1.4mm	0.15+0.05	1.3	1.2	19.5	405
3x4x1.4mm	0.15+0.05	1.3	1.2	20.4	485
5x4x1.4mm	0.15+0.05	1.3	1.2	23.8	685
7x4x1.4mm	0.15+0.05	1.3	1.2	25.8	850
10x4x1.4mm	0.15+0.05	1.3	1.2	31.9	1170
20x4x1.4mm	0.15+0.05	1.3	1.2	38.8	1955

Other cable sizes and different conductor diameters available upon request.



DB AG 416.0115 v1.1

AJ-2Y(L)2YDB2Y nx4x0.9-1.4 (H45) rk600/rk500

Screened and armoured quad signal cables for signal installations along the railway tracks.

Construction

Conductor	Class 1, soft annealed, solid copper
Insulation	solid polyethylene (PE)
Identification	Insulation of each conductor natural, ring marking according to DB AG 416.0116
Color coding	In each layer, the pilot quad is wrapped by blue wrapping tape, the rest are wrapped by natural colored tapes
Stranding elements	Quads stranded in concentric layers
Cable core filling	plastic tapes
Moisture barrier	AL-PE tape in contact with tinned copper drain wire 0.4mm
Inner Sheath	black PE
Screening	Copper wires
Armouring	2 layers of galvanized steel tape of 0.5mm thickness
Outer Sheath	black PE

Cables with 7 quads and more have 2 diametrically opposite copper monitoring cores of 0.5 mm with perforated grey PE insulation.

Temperature range	
Operation	-40°C to +60°C
Installation	-10°C to +60°C

Technical details (at 20°C)

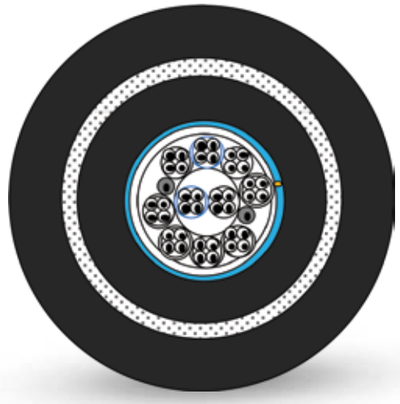
Conductor diameter, nom	mm	0.9	1.4
Conductor resistance, max	Ohm/km	56.6	23.4
Insulation resistance, min	Mohm*km	10000	
Mutual capacitance (800Hz), max ***individual wires in cable core**	nF/km	45 52*	
Capacitance Unbalance at 800 Hz, max. (pF/500m) **k1 – 100%/50% of all values** **k9-12 – 100%/50% of all values** **e1-2, ea1/2 – 100% of values**	pF/500m	650/150 500/150 1300	650 500 1300
Dielectric Strength at 50Hz, 1 min **Conductor – Conductor** **Conductor - shield**	Volts	2500 (AC 50 Hz) 3535 (DC)	
Attenuation at 90kHz, max	Ohm	3.3	2.6
FEXT at 90kHz, min (100%/80% of values)	dB	58/62	33
Reduction factor		rk 600 or rk 500	

Electrical characteristics for 0.5 mm monitoring cores are according to Table 1 of Appendix 2 of DB AG 416.0115 specification.

Cables physical characteristics						
Cable size	**AL-PE tape thickness (nominal) (mm)**	**Inner sheath thickness (nominal) (mm)**	**Copper wires sceen (No x diameter)***	**Outer sheath thickness (nominal) (mm)**	**Cable outer diameter (calculated) (mm)**	**Cable weight (calculated) (kg/km)**
rk 600						
1x4x0.9mm	0.15+0.05	1.3	13 x 0.9	1.2	15.3	445
3x4x0.9mm	0.15+0.05	1.3	16 x 0.9	1.2	20.1	670
5x4x0.9mm	0.15+0.05	1.3	18 x 0.9	1.2	22.4	815
7x4x0.9mm	0.15+0.05	1.3	19 x 0.9	1.2	23.7	915
10x4x0.9mm	0.15+0.05	1.3	21 x 0.9	1.2	27.5	1135
1x4x1.4mm	0.15+0.05	1.3	16 x 0.9	1.2	17.1	540
3x4x1.4mm	0.15+0.05	1.3	21 x 0.9	1.2	24.1	910
5x4x1.4mm	0.15+0.05	1.3	25 x 0.9	1.2	27.2	1170
7x4x1.4mm	0.15+0.05	1.3	27 x 0.9	1.3	29.5	1380
10x4x1.4mm	0.15+0.05	1.3	35 x 0.9	1.3	35.9	1830
rk 500						
1x4x0.9mm	0.15+0.05	1.3	22 x 0.9	1.2	15.2	480
3x4x0.9mm	0.15+0.05	1.3	28 x 0.9	1.2	20.1	710
5x4x0.9mm	0.15+0.05	1.3	31 x 0.9	1.2	22.3	860
7x4x0.9mm	0.15+0.05	1.3	35 x 0.9	1.2	23.7	975
10x4x0.9mm	0.15+0.05	1.3	44 x 0.9	1.2	27.4	1225
20x4x0.9mm	0.15+0.05	1.3	54 x 0.9	1.3	33.3	1740
1x4x1.4mm	0.15+0.05	1.3	22 x 0.9	1.2	17.1	570
3x4x1.4mm	0.15+0.05	1.3	36 x 0.9	1.2	24.1	985
5x4x1.4mm	0.15+0.05	1.3	43 x 0.9	1.2	27.2	1265
7x4x1.4mm	0.15+0.05	1.3	20 x 1.4	1.3	30.5	1525
10x4x1.4mm	0.15+0.05	1.3	23 x 1.4	1.3	35.2	1920
20x4x1.4mm	0.15+0.05	1.5	40 x 1.2	1.5	44.5	3015

** The number and diameter of the copper wires may change but the value of reduction factor shall always be achieved.*

Other cable sizes and different conductor diameters available upon request.
Cables with different reduction factor index (rk400) can also be offered upon request.



DB AG 416.0115 v1.1

A-2Y(L)HBH nx4x0.9-1.4 B2ca

Railway signaling cables for transmission of low frequency signals through symmetrical circuits. Cables are fire retardant.

Construction

Conductor	Class 1, soft annealed, solid copper
Insulation	solid polyethylene (PE)
Identification	Insulation of each conductor natural, ring marking according to DB AG 416.0116
Color coding	In each layer, the pilot quad is wrapped by blue wrapping tape, the rest are wrapped by natural colored tapes
Stranding elements	Quads stranded in concentric layers
Bedding	Flame retardant material
Moisture barrier	AL-PE tape in contact with tinned copper wire 0,4mm
Inner Sheath	LSZH sheath
Armouring	2 layers of helically applied galvanized steel tape
Outer Sheath	LSZH sheath
CPR classification	B2ca s1a d1 a1

Cables with 7 quads and more have 2 diametrically opposite copper monitoring cores of 0.5 mm with perforated grey PE insulation

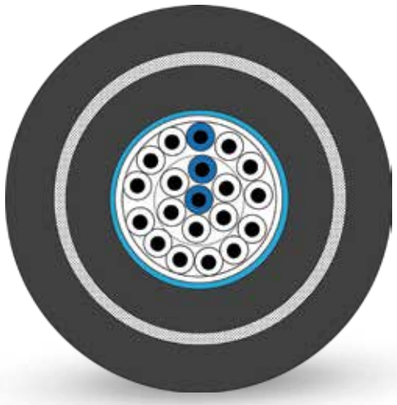
Technical details (at 20°C)

Conductor diameter, nom	mm	0.9	1.4
Conductor resistance, max	Ohm/km	56.6	23.4
Insulation resistance, min	Mohm*km	10000	
Mutual capacitance (800Hz), max ***for 1,2 and 3 quads cables and for central quads**	nF/km	45 52*	
Capacitance Unbalance at 800 Hz, max. (pF/500m) **k1** **k9-12** **e1-2, ea1/2**	pF/500m	650 500 1300	
Dielectric Strength at 50Hz, 1 min **Conductor – Conductor**	Volts	2500 (AC 50 Hz) 3535 (DC)	
Attenuation at 90kHz, max	dB/km	3.3	2.6
Far-end crosstalk (ELFEXT) at 90kHz, min	dB/km	58	33

Electrical characteristics for 0.5 mm monitoring cores are according to Table 1 of Appendix 2 of DB AG 416.0115 specification

Cables physical characteristics			
Cable size	**PE-AL-PE tape thickness (nominal) (mm)**	**Cable outer diameter (calculated) (mm)**	**Cable weight (calculated) (kg/km)**
1x4x0.9	0.15-0.04	14.2	290
1x4x1.4	0.15+0.05	16.3	380
2x4x1.4	0.15+0.05	23.4	650
3x4x1.4	0.15+0.05	24.2	735
4x4x1.4	0.15+0.05	26.4	885
5x4x1.4	0.15+0.05	28.5	1040
7x4x1.4	0.15+0.05	30.5	1220
10x4x1.4	0.15+0.05	35.5	1660
20x4x1.4	0.15+0.05	44.5	2740

Other cable sizes available upon request.



DB AG 416.0113 v2.0

A-2YOF(L)2YB2Y nx1x0.9-1.4-1.8 (H115/H145)

Armoured jelly-filled signal cables for signal installations along the railway tracks.

Construction

Conductor	Class 1, soft annealed, solid copper
Insulation	solid polyethylene (PE)
Color coding	In each layer, the insulation of the pilot conductor has blue colour, the rest are natural coloured
Stranding elements	cores stranded in concentric layers
Cable core filling	Low-permittivity jelly filling compound
Moisture barrier	PE-AL-PE tape
Inner Sheath	black PE
Armouring	1 layer (thickness 0.2-0.3mm) or 2 layers (thickness ≥ 0.1mm) of galvanized steel tape*
Outer Sheath	black PE

**Upon request, armouring of galvanized steel tapes can be replaced with corrugated soft steel tape – cable type A-2YOF(L)2Y(SR)2Y.*

Temperature range	
Operation	-40°C to +60°C
Installation	-10°C to +60°C

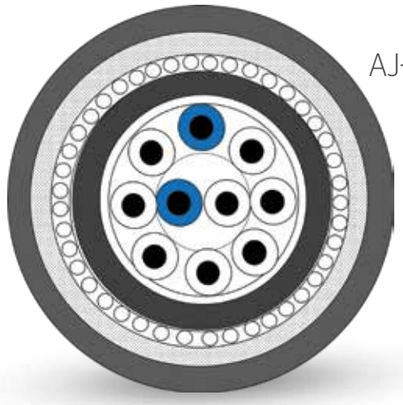
Technical details (at 20°C)

Conductor diameter, nom	mm	0.9	1.4	1.8
Conductor resistance, max	Ohm/km	28.9	11.9	7.2
Insulation resistance, min	Mohm*km	1500		
Mutual capacitance (800Hz), max ***individual wires in cable core**	nF/km	115 120*	145 155*	145 155*
Dielectric strength test, 1 min **Conductor-conductor**	Volts	2500 (AC 50 Hz) 3535 (DC)		

Cables physical characteristics

Cable size	PE-AL-PE tape thickness (nominal) (mm)	Inner sheath thickness (nominal) (mm)	Outer sheath thickness (nominal) (mm)	Cable outer diameter (calculated) (mm)	Cable weight (calculated) (kg/km)
4x1x0.9mm	0.045-0.15-0.045	1.3	1.2	12.8	185
7x1x0.9mm	0.045-0.15-0.045	1.3	1.2	13.8	230
10x1x0.9mm	0.045-0.15-0.045	1.3	1.2	15.5	285
14x1x0.9mm	0.045-0.15-0.045	1.3	1.2	16.5	305
20x1x0.9mm	0.045-0.15-0.045	1.3	1.2	17.5	385
4x1x1.4mm	0.045-0.15-0.045	1.3	1.2	14.0	240
7x1x1.4mm	0.045-0.15-0.045	1.3	1.2	15.6	325
10x1x1.4mm	0.045-0.15-0.045	1.3	1.2	17.9	420
14x1x1.4mm	0.045-0.15-0.045	1.3	1.2	19.1	505
20x1x1.4mm	0.045-0.15-0.045	1.3	1.2	20.9	635
4x1x1.8mm	0.045-0.15-0.045	1.3	1.2	16.0	305
20x1x1.8mm	0.045-0.15-0.045	1.3	1.2	25.0	890
40x1x1.8mm	0.045-0.15-0.045	1.3	1.3	32.0	1565

Other cable sizes available upon request.



DB AG 416.0113 v2.0

AJ-2YOF(L)2YDB2Y nx1x0.9-1.4-1.8 (H115/H145) rk600

Armoured and screened jelly-filled signal cables for signal installations along the railway tracks with reduction factor requirements.

Construction

Conductor	Class 1, soft annealed, solid copper
Insulation	solid polyethylene (PE)
Color coding	In each layer, the insulation of the pilot conductor has blue colour, the rest are natural coloured
Stranding elements	cores stranded in concentric layers
Cable core filling	Low-permittivity jelly filling compound
Moisture barrier	PE-AL-PE tape
Inner Sheath	black PE
Screening	Copper wires
Armouring	2 layers of galvanized steel tape of 0.5mm thickness
Outer Sheath	black PE

Temperature range	
Operation	-40°C to +60°C
Installation	-10°C to +60°C

Technical details (at 20°C)

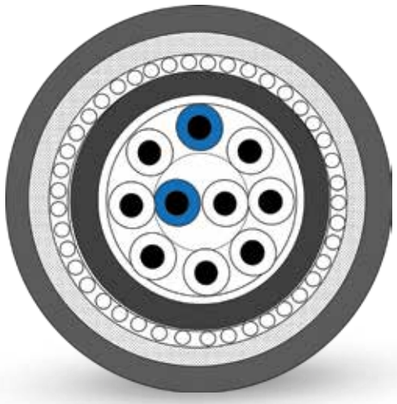
Conductor diameter, nom	mm	0.9	1.4	1.8
Conductor resistance, max	Ohm/km	28.9	11.9	7.2
Insulation resistance, min	Mohm*km	1500		
Mutual capacitance (800Hz), max ***individual wires in cable core**	nF/km	115 120*	145 155*	145 155*
Dielectric strength test, 1 min **Conductor-conductor** **Conductor-screen**	Volts	2500 (AC 50 Hz) 3535 (DC)		
Reduction factor		rk 600		

Cables physical characteristics

Cable size	Inner sheath thickness (nominal) (mm)	Copper wires screen (No x diameter)*	Outer sheath thickness (nominal) (mm)	Cable outer diameter (calculated) (mm)	Cable weight (calculated) (kg/km)
10x1x0.9mm	1.3	16x0.9	1.2	18.8	610
20x1x0.9mm	1.3	16x0.9	1.2	21.1	750
30x1x0.9mm	1.3	18x0.9	1.2	23.0	895
50x1x0.9mm	1.3	20x0.9	1.2	26.5	1190
10x1x1.4mm	1.3	16x0.9	1.2	21.6	785
20x1x1.4mm	1.3	22x0.9	1.2	24.8	1085
30x1x1.4mm	1.3	22x0.9	1.2	27.5	1340
50x1x1.4mm	1.3	27x0.9	1.3	32.4	1860
10x1x1.8mm	1.3	21x0.9	1.2	24.2	1000
20x1x1.8mm	1.3	24x0.9	1.2	28.3	1415
30x1x1.8mm	1.3	28x0.9	1.3	31.7	1825
50x1x1.8mm	1.5	32x0.9	1.3	38.0	2625

** The number and diameter of the copper wires may change but the value of reduction factor shall always be achieved.*

Other cable sizes available upon request.
Cables with different reduction factor index (rk500, rk400) can also be offered upon request.



DB AG 416.0114 v2.0

AJ-2YOF(L)2YDB2Y nx1x1.4-1.8 (H95) rk500

Armoured and screened jelly-filled signal cables for signal installations along the railway tracks with reduction factor requirements.

Temperature range	
Operation	-40°C to +60°C
Installation	-10°C to +60°C

Construction

Conductor	Class 1, soft annealed, solid copper
Insulation	solid polyethylene (PE)
Color coding	In each layer, the insulation of the pilot conductor has blue colour, the rest are natural coloured
Stranding elements	cores stranded in concentric layers
Cable core filling	Low-permittivity jelly filling compound
Moisture barrier	PE-AL-PE tape
Inner Sheath	black PE
Screening	Copper wires
Armouring	2 layers of galvanized steel tape of 0.5mm thickness
Outer Sheath	black PE

Technical details (at 20°C)

Conductor diameter, nom	mm	1.4	1.8
Conductor resistance, max	Ohm/km	11.9	7.2
Insulation resistance, min	Mohm*km	1500	
Mutual capacitance (800Hz), max	nF/km	95	
Dielectric strength test, 1 min **Conductor-conductor** **Conductor-screen**	Volts	2500 (AC 50 Hz) 3535 (DC)	
Reduction factor		rk 500	

Cables physical characteristics

Cable size	Inner sheath thickness (nominal) (mm)	Copper wires screen (No x diameter)*	Outer sheath thickness (nominal) (mm)	Cable outer diameter (calculated) (mm)	Cable weight (calculated) (kg/km)
10x1x1.4mm	1.3	42x0.9	1.2	24.4	1035
20x1x1.4mm	1.3	45x0.9	1.2	28.3	1360
30x1x1.4mm	1.3	54x0.9	1.3	31.9	1720
10x1x1.8mm	1.3	42x0.9	1.2	28.0	1290
20x1x1.8mm	1.3	54x0.9	1.3	33.4	1840
30x1x1.8mm	1.5	34x1.2	1.3	38.7	2415

** The number and diameter of the copper wires may change but the value of reduction factor shall always be achieved.*

Other cable sizes available upon request.
Cables with different reduction factor index (r6500, rk400) can also be offered upon request.

FRANCE

Datasheets of typical railway signaling cables

Cable type	Specification	Stranding elements	Insulation	Moisture barrier	Inner sheath	Electrostatic shield / induction protection	Metallic armour	Outer sheath
ZPAU	SNCF CT 445	pairs	Solid PE	-	PE	Corrugated copper tape	galvanized steel tapes	PVC
ZPFU	SNCF CT 445	pairs	Solid PE	-	PE	-	galvanized steel tapes	PVC
K23	NF F 55-623	pairs	Solid PE	AL-PE tape	LSZH	-	galvanized steel tapes	LSZH

SNCF CT 445

ZPAU nx2x1.0-1.5mm2

Armoured and screened cables for installation in intercity railways electrified at 25kV AC.

Temperature range	
Operation	-40°C to +70°C
Installation	-20°C to +50°C

Construction

Conductor	Class 1, soft annealed, solid copper
Insulation	solid polyethylene (PE)
Identification	Insulation of each conductor according to table 4 of SNCF CT 445
Stranding elements	Pairs stranded in concentric layers (2 pairs cable in star quad formation)
Inner Sheath	black PE
Electromagnetic screen	corrugated copper tape
Bedding	plastic tapes
Armouring	2 layers of galvanized steel tape
Outer Sheath	black PVC

** available also in ZPAU/SH version (LSZH inner-outer sheath).*

***ZPAU: cable complying with IEC 60332-1-2 & NF C 32070 Cat C2.*
****ZPAU-SH: cable complying with IEC 60332-3-24 Cat C, IEC 60754, IEC 61034.*

Technical details (at 20°C)

Conductor cross section, nom	mm2	1.0	1.5
Conductor resistance, max	Ohm/km	18.1	11.9
Insulation resistance, min	Mohm*km	5000	
Mutual capacitance (800Hz), max	nF/km	55	
Capacitance unbalance (800Hz), max **- 2 pairs cables** **- all other sizes**	pF/500m	300 200	300 200
Reduction factor		Complying with the limits of table 26 of SNCF CT 445 specification	
Operating voltage (Vo/V)	Volts	450/750	
Dielectric strength test, 3 min **- Conductor-conductor** **- Conductor-screen**	Volts DC	4500 4500	

Cables physical characteristics

Cable size	Inner sheath thickness (min average.) (mm)	Outer sheath thickness (min average.) (mm)	Cable outer diameter (calculated) (mm)	Cable weight (calculated) (kg/km)
1x2x1mm2	1.0	1.5	13.7	295
2x2x1mm2	1.0	1.5	14.6	345
4x2x1mm2	1.0	1.5	17.6	460
14x2x1mm2	1.2	1.7	26.9	1195
28x2x1mm2	1.2	2.0	35.0	1860
56x2x1mm2	1.3	2.2	45.0	3020
4x2x1.5mm2	1.0	1.5	21.3	790
7x2x1.5mm2	1.0	1.6	23.5	960
28x2x1.5mm2	1.2	2.2	40.1	2400

Other cable sizes available upon request.

SNCF CT 445

ZPFU nx2x1.0mm2

Armoured cables for installation in intercity railways electrified at 25kV AC.

Temperature range	
Operation	-40°C to +70°C
Installation	-20°C to +50°C

Construction

Conductor	Class 1, soft annealed, solid copper
Insulation	solid polyethylene (PE)
Identification	Insulation of each conductor according to table 4 of SNCF CT 445
Stranding elements	Pairs stranded in concentric layers (2 pairs cable in star quad formation)
Inner Sheath	black PE
Bedding	plastic tapes
Armouring	2 layers of galvanized steel tape
Outer Sheath	black PVC

** available also in ZPFU/SH version (LSZH inner-outer sheath).*

***ZPFU: cable complying with IEC 60332-1-2 & NF C 32070 Cat C2..*
****ZPFU-SH: cable complying with IEC 60332-3-24 Cat C, IEC 60754, IEC 61034.*

Technical details (at 20°C)

Conductor cross section, nom	mm2	1.0
Conductor resistance, max	Ohm/km	18.1
Insulation resistance, min	Mohm*km	5000
Mutual capacitance (800Hz), max	nF/km	55
Capacitance unbalance (800Hz), max **- 2 pairs cables** **- all other sizes**	pF/500m	300 200
Operating voltage (Vo/V)	Volts	450/750
Dielectric strength test, 3 min **- Conductor-conductor** **- Conductor-screen**	Volts DC	4500 4500

Cables physical characteristics

Cable size	Inner sheath thickness (min average.) (mm)	Outer sheath thickness (min average.) (mm)	Cable outer diameter (calculated) (mm)	Cable weight (calculated) (kg/km)
1x2x1mm2	1.0	1.5	11.7	200
2x2x1mm2	1.0	1.5	12.6	240
4x2x1mm2	1.0	1.5	16.3	365
7x2x1mm2	1.0	1.5	20.1	645
14x2x1mm2	1.2	1.6	25.9	1060
21x2x1mm2	1.2	1.7	29.3	1300
28x2x1mm2	1.2	2.0	35.0	1860

Other cable sizes available upon request.

NF F 55-623

K23 nx2x1.0-1.5mm2

Armoured LSZH cables used for transmission of low frequency signals, suitable for installation in cable conduits or ducts.

Construction

Conductor	Class 1, soft annealed, solid copper
Insulation	solid polyethylene (PE)
Identification	Insulation colour of each conductor according to NF F 55-623
Stranding elements	Quads stranded in concentric layers (1 & 4 pairs cable in pair formation)
Moisture Barrier	AL-PE tape in contact with copper drain wire
Inner Sheath	black LSZH
Bedding	plastic tape
Armouring	2 layers of galvanized steel tape
Outer Sheath	black LSZH

***cable complying with IEC 60332-1-2, IEC 60332-3-24 Cat C, IEC 60754, IEC 61034.*

Technical details (at 20°C)

Conductor cross section, nom	mm	1.0	1.2
Conductor resistance, max	Ohm/km	23.06	16.02
Insulation resistance, min	Mohm*km	5000	
Mutual capacitance (800Hz), max **- 1 pair cable** **- 4 pairs cable** **- All other cables**	nF/km	67 62 57.5	
Capacitance unbalance (800Hz), max **- within quad (95%/100% of values)** **- between adjacent quads or pairs (95%/100% of values)**	pF/500m	260/435 130/220	
Dielectric strength test, 1 min **- Conductor-conductor** **- Conductor-screen**	pF/500m	3000 1500	

Cables physical characteristics

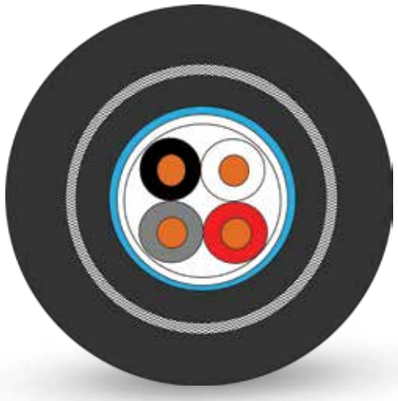
Cable size	Inner sheath thickness (min at any point) (mm)	Outer sheath thickness (min average.) (mm)	Cable outer diameter (calculated) (mm)	Cable weight (calculated) (kg/km)
2x2x1mm	1.0	1.0	11.6	250
8x2x1mm	1.0	1.4	18.5	525
56x2x1mm	1.0	1.8	38.3	1905
2x2x1.2mm	1.0	1.2	13.5	310
4x2x1.2mm	1.0	1.2	17.2	465
14x2x1.2mm	1.0	1.4	23.4	865
28x2x1.2mm	1.0	1.6	30.7	1415

Other cable sizes available upon request.

SPAIN

Datasheets of typical railway signaling cables

Cable type	Specification	Stranding elements	Insulation	Moisture barrier	Electrostatic shield / induction protection	Inner sheath	Metallic armour	Supporting element	Outer sheath	Optional cable type with LSZH sheaths
EAPSP	E.T. 03.365.052.4	cores	Solid PE	PE - AL - PE tape	-	PE	corrugated soft steel tape	-	PE	**EATST**
EAPSP	E.T. 03.365.052.4	quads	Solid PE	PE - AL - PE tape	-	PE	corrugated soft steel tape	-	PE	**EATST**
EAPSSP	E.T. 03.365.052.4	cores	Solid PE	PE - AL - PE tape	-	PE	galvanized steel tapes	-	PE	**EATSST**
EAPSSP	E.T. 03.365.052.4	quads	Solid PE	PE - AL - PE tape	-	PE	galvanized steel tapes	-	PE	**EATSST**
EAPSSP-8	E.T. 03.365.052.4	cores	Solid PE	PE - AL - PE tape	-	PE	galvanized steel tapes	steel wires rope	PE	**-**
EAPSSP-8	E.T. 03.365.052.4	quads	Solid PE	PE - AL - PE tape	-	PE	galvanized steel tapes	steel wires rope	PE	**-**
CCPSSP	E.T. 03.365.052.4	cores	Solid PE	-	corrugated copper tape	PE	galvanized steel tapes	-	PE	**CCTSST**
	E.T. 03.365.052.4	quads		-				-		



ADIF 03.365.52.4

EAPSP/EATST nx1x1.4mm

Railway signaling cables, with dry cable core, stranded insulated conductors, for installation in railway control centers and surveillance systems.

Construction

Conductor	Class 1, soft annealed, solid copper
Insulation	solid polyethylene (PE)
Identification	Insulation of each conductor according ADIF specification color coding
Stranding elements	Conductors stranded in concentric layers
Cable core wrapping	Non-hygroscopic tapes
Moisture barrier	PE-AL-PE tape
Inner Sheath	black PE (EAPSP) black LSZH (EATST)
Armouring	Soft corrugated laminated steel tape
Outer Sheath	black PE (EAPSP) black LSZH (EATST)

** cable type EAPSP-R also available (jelly filled cable core and PE sheaths).*
***EATST cables compliant with IEC 60332-3-24 Cat C, IEC 60754 & IEC 61034.*

Technical details (at 20°C)

Conductor diameter, nom	mm	1.4
Conductor resistance, **Average value** **Max value**	Ohm/km	11.2±0.5 11.9
Insulation resistance, min	Mohm*km	35000
Dielectric strength test 10 sec **- Conductor-conductor** **- Conductor-screen** **- Metallic screen - metallic armour**	Volts DC	3000 3500 2800

Cables physical characteristics

Cable size	Inner sheath thickness (nominal) (mm)	Outer sheath thickness (nominal) (mm)	Cable outer diameter (calculated) (mm)	EAPSP Cable weight (calculated) (kg/km)	EATST Cable weight (calculated) (kg/km)
4x1x1.4mm	1.4	1.2	14.1	220	295
7x1x1.4mm	1.4	1.2	15.5	290	370
9x1x1.4mm	1.4	1.2	17.1	345	440
12x1x1.4mm	1.4	1.2	18.1	410	500
19x1x1.4mm	1.4	1.2	20.1	545	665
27x1x1.4mm	1.4	1.3	22.9	715	845
37x1x1.4mm	1.4	1.3	24.9	900	1045
48x1x1.4mm	1.4	1.4	27.7	1125	1290
61x1x1.4mm	1.4	1.4	29.7	1365	1550

The minimum average value of inner and outer sheath thickness is 80% of the nominal value, while the minimum at any point sheath thickness is 70% of the nominal value.

Other cable sizes available upon request.

ADIF 03.365.52.4

EAPSP/EATST nx4x0.9-1.4mm

Railway signaling cables, with dry cable core, quads of insulated conductors stranded together, for installation in railway control centers and surveillance systems.

Construction

Conductor	Class 1, soft annealed, solid copper
Insulation	solid polyethylene (PE)
Identification	Insulation of each conductor according ADIF specification color coding
Stranding elements	Quads stranded in concentric layers
Cable core wrapping	Non-hygroscopic tapes
Moisture barrier	PE-AL-PE tape
Inner Sheath	black PE (EAPSP) black LSZH (EATST)
Armouring	Soft corrugated laminated steel tape
Outer Sheath	black PE (EAPSP) black LSZH (EATST)

** cable type EAPSP-R also available (jelly filled cable core and PE sheaths).*
***EATST cables compliant with IEC 60332-3-24 Cat C, IEC 60754 & IEC 61034.*

Technical details (at 20°C)

Conductor diameter, nom	mm	0.9	1.4
Conductor resistance, **Average value** **Max value**	Ohm/km	27.5±1 29.0	11.2±0.5 11.9
Resistance unbalance **Average value** **Max individual value**	%	1% 2%	1% 2%
Insulation resistance, min	Mohm*km	35000	
Mutual capacitance, max	nF/km	45	48
Capacitance unbalance, **Between pairs** **Between pairs and earth**	pF/460m	250 1200	
Attenuation, max **- At 1kHz** **- At 10kHz** **- At 30kHz**	pF/460m	0.7 1.6 2.1	0.46 0.85 1.3
Dielectric strength test 10 sec **- Conductor-conductor** **- Conductor-screen** **- Metallic screen - metallic armour**	Volts DC	3000 3500 2800	

Cables physical characteristics

Cable size	Inner sheath thickness (nominal) EAPSP/EATST (mm)	Outer sheath thickness (nominal) EAPSP/EATST (mm)	Cable outer diameter (calculated) (mm)	EAPSP Cable weight (calculated) (kg/km)	EATST Cable weight (calculated) (kg/km)
1x4x0.9mm	1.3/1.4	1.4/1.2	14.3	215	260
3x4x0.9mm	1.3/1.4	1.4/1.2	19.5	360	435
5x4x0.9mm	1.3/1.4	1.4/1.3	22.3	475	580
7x4x0.9mm	1.3/1.4	1.4/1.3	23.7	555	670
10x4x0.9mm	1.3/1.4	1.4/1.4	27.5	710	855
14x4x0.9mm	1.4/1.4	1.6/1.4	30.2	890	1050
1x4x1.4mm	1.3/1.4	1.4/1.2	17.0	300	365
3x4x1.4mm	1.3/1.4	1.4/1.3	25.2	575	705
5x4x1.4mm	1.4/1.4	1.6/1.4	29.5	825	995
7x4x1.4mm	1.4/1.4	1.6/1.5	32.0	1020	1180
10x4x1.4mm	1.4/1.5	1.6/1.7	36.5	1335	1565
14x4x1.4mm	1.5/1.6	1.6/1.8	41.5	1705	2040

The minimum average value of inner and outer sheath thickness is 80% of the nominal value, while the minimum at any point sheath thickness is 70% of the nominal value.

Other cable sizes available upon request.

ADIF 03.365.52.4

EAPSSP/EATSST nx1x1.4mm

Railway signaling cables, with dry cable core, stranded insulated conductors, for installation in railway control centers and surveillance systems.

Construction

Conductor	Class 1, soft annealed, solid copper
Insulation	solid polyethylene (PE)
Identification	Insulation of each conductor according ADIF specification color coding
Stranding elements	Conductors stranded in concentric layers
Cable core wrapping	Non-hygroscopic tapes
Moisture barrier	PE-AL-PE tape
Inner Sheath	black PE (EAPSSP) black LSZH (EATSST)
Armouring	2 layers of galvanized steel tapes of 0.2-0.3mm thickness
Outer Sheath	black PE (EAPSSP) black LSZH (EATSST)

** EATSST cables compliant with IEC 60332-3-24 Cat C, IEC 60754 & IEC 61034*

Technical details (at 20°C)

Conductor diameter, nom	mm	1.4
Conductor resistance, **Average value** **Max value**	Ohm/km	11.2±0.5 11.9
Insulation resistance, min	Mohm*km	15000
Dielectric strength test 10 sec **- Conductor-conductor** **- Conductor-screen** **- Metallic screen - metallic armour**	Volts DC	3000 3500 2800

Cables physical characteristics

Cable size	Inner sheath thickness (nominal) (mm)	Outer sheath thickness (nominal) (mm)	Cable outer diameter (calculated) (mm)	EAPSSP Cable weight (calculated) (kg/km)	EATSST Cable weight (calculated) (kg/km)
4x1x1.4 mm	1.4	1.2	13.5	255	325
7x1x1.4 mm	1.4	1.2	15.0	330	410
9x1x1.4 mm	1.4	1.2	16.7	395	480
12x1x1.4 mm	1.4	1.2	17.7	465	560
19x1x1.4 mm	1.4	1.2	19.8	620	730
27x1x1.4 mm	1.4	1.3	22.8	810	940
37x1x1.4 mm	1.4	1.3	24.9	1020	1160
48x1x1.4 mm	1.4	1.4	27.8	1265	1430

The minimum average value of inner and outer sheath thickness is 80% of the nominal value, while the minimum at any point sheath thickness is 70% of the nominal value.

Other cable sizes available upon request.

ADIF 03.365.52.4

EAPSSP/EATSST nx4x0.9-1.4mm

Railway signaling cables, with dry cable core, quads of insulated conductors stranded together, for installation in railway control centers and surveillance systems.

Construction

Conductor	Class 1, soft annealed, solid copper
Insulation	solid polyethylene (PE)
Identification	Insulation of each conductor according ADIF specification color coding
Stranding elements	Quads stranded in concentric layers
Cable core wrapping	Non-hygroscopic tapes
Moisture barrier	PE-AL-PE tape
Inner Sheath	black PE (EAPSSP) black LSZH (EATSST)
Armouring	2 layers of galvanized steel tapes of 0.2-0.3mm thickness
Outer Sheath	black PE (EAPSSP) black LSZH (EATSST)

** EATSST cables compliant with IEC 60332-3-24 Cat C, IEC 60754 & IEC 61034*

Technical details (at 20°C)

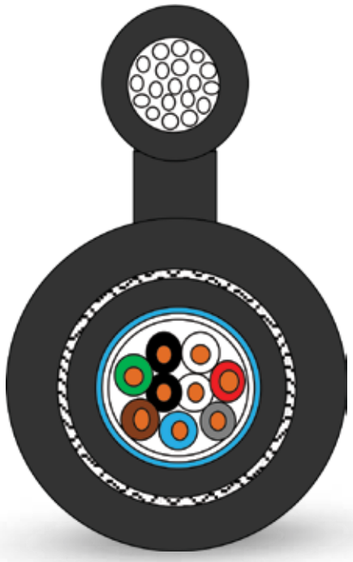
Conductor diameter, nom	mm	0.9	1.4
Conductor resistance, **Average value** **Max value**	Ohm/km	27.5±1 29.0	11.2±0.5 11.9
Resistance unbalance **Average value** **Max individual value**	%	1% 2%	1% 2%
Insulation resistance, min	Mohm*km	15000	
Mutual capacitance, max	nF/km	45	48
Capacitance unbalance, **Between pairs** **Between pairs and earth**	pF/460m	250 1200	
Attenuation, max **- At 1kHz** **- At 10kHz** **- At 30kHz**	pF/460m	0.7 1.6 2.1	0.46 0.85 1.3
Dielectric strength test 10 sec **- Conductor-conductor** **- Conductor-screen** **- Metallic screen - metallic armour**	Volts DC	3000 3500 2800	

Cables physical characteristics

Cable size	Inner sheath thickness (nominal) EAPSSP/EATSST (mm)	Outer sheath thickness (nominal) EAPSSP/EATSST (mm)	Cable outer diameter (calculated) (mm)	EAPSSP Cable weight (calculated) (kg/km)	EATSST Cable weight (calculated) (kg/km)
1x4x0.9mm	1.3/1.4	1.4/1.2	13.7	230	280
3x4x0.9mm	1.3/1.4	1.4/1.2	19.1	395	480
5x4x0.9mm	1.3/1.4	1.4/1.3	21.7	520	630
7x4x0.9mm	1.3/1.4	1.4/1.3	23.1	600	720
10x4x0.9mm	1.3/1.4	1.4/1.4	27.1	770	925
14x4x0.9mm	1.4/1.4	1.6/1.4	32.2	980	1150
1x4x1.4mm	1.3/1.4	1.4/1.2	16.3	325	395
3x4x1.4mm	1.3/1.4	1.4/1.3	24.9	650	795
5x4x1.4mm	1.4/1.4	1.6/1.4	29.9	930	1120
7x4x1.4mm	1.4/1.4	1.6/1.5	32.1	1120	1295
10x4x1.4mm	1.4/1.5	1.6/1.7	37.5	1470	1720
14x4x1.4mm	1.5/1.6	1.6/1.8	43.3	1925	2300

The minimum average value of inner and outer sheath thickness is 80% of the nominal value, while the minimum at any point sheath thickness is 70% of the nominal value.

Other cable sizes available upon request.



ADIF 03.365.52.4

EAPSSP-8 nx1x1.4mm

Aerial railway signaling cables, with dry cable core, stranded insulated conductors, for installation in poles.

Construction

Conductor	Class 1, soft annealed, solid copper
Insulation	solid polyethylene (PE)
Identification	Insulation of each conductor according ADIF specification color coding
Stranding elements	Conductors stranded in concentric layers
Cable core wrapping	Non-hygroscopic tapes
Moisture barrier	PE-AL-PE tape
Inner Sheath	black PE
Armouring	2 layers of galvanized steel tapes of 0.2-0.3mm thickness
Supporting element	Steel wires rope
Outer Sheath	black PE

Technical details (at 20°C)

Conductor diameter, nom	mm	1.4
Conductor resistance, Average value Max value	Ohm/km	11.2±0.5 11.9
Insulation resistance, min	Mohm*km	15000
Dielectric strength test 10 sec - Conductor-conductor - Conductor-screen - Metallic screen - metallic armour	Volts DC	3000 3500 2800

Cables physical characteristics

Cable size	Inner sheath thickness (nominal) (mm)	Outer sheath thickness (nominal) (mm)	Cable outer diameter x height (calculated) (mm)	Cable weight (calculated) (kg/km)
4x1x1.4 mm	1.4	2.0	15.2 x 25.7	375
7x1x1.4 mm	1.4	2.5	17.5 x 31.6	620
9x1x1.4 mm	1.4	2.5	19.2 x 33.2	690
12x1x1.4 mm	1.4	2.5	20.2 x 34.2	760
19x1x1.4 mm	1.4	2.5	22.2 x 36.2	925
27x1x1.4 mm	1.4	2.5	24.8 x 38.8	1120
37x1x1.4 mm	1.4	2.5	26.8 x 40.8	1330
48x1x1.4 mm	1.4	2.5	29.4 x 43.4	1590
61x1x1.4 mm	1.4	2.5	31.4 x 45.4	1880

The minimum average value of inner and outer sheath thickness is 80% of the nominal value, while the minimum at any point sheath thickness is 70% of the nominal value.

Other cable sizes available upon request.

ADIF 03.365.52.4

EAPSSP-8 nx4x0.9-1.4mm

Aerial railway signaling cables, with dry cable core, quads of insulated conductors stranded together, for installation in poles.

Construction

Conductor	Class 1, soft annealed, solid copper
Insulation	solid polyethylene (PE)
Identification	Insulation of each conductor according ADIF specification color coding
Stranding elements	Quads stranded in concentric layers
Cable core wrapping	Non-hygroscopic tapes
Moisture barrier	PE-AL-PE tape
Inner Sheath	Black PE
Armouring	2 layers of galvanized steel tapes of 0.2-0.3mm thickness
Supporting element	Steel wires rope
Outer Sheath	Black PE

Technical details (at 20°C)

Conductor diameter, nom	mm	0.9	1.4
Conductor resistance, Average value Max value	Ohm/km	27.5±1 29.0	11.2±0.5 11.9
Resistance unbalance Average value Max individual value	%	1% 2%	1% 2%
Insulation resistance, min	Mohm*km	15000	
Mutual capacitance, max	nF/km	45	48
Capacitance unbalance, Between pairs Between pairs and earth	pF/460m	250 1200	
Attenuation, max - At 1kHz - At 10kHz - At 30kHz	pF/460m	0.7 1.6 2.1	0.46 0.85 1.3
Dielectric strength test 10 sec - Conductor-conductor - Conductor-screen - Metallic screen - metallic armour	Volts DC	3000 3500 2800	

Cables physical characteristics

Cable size	Inner sheath thickness (nominal) (mm)	Outer sheath thickness (nominal) (mm)	Cable outer diameter x height (calculated) (mm)	Cable weight (calculated) (kg/km)
1x4x0.9mm	1.4	2.0	15.4 x 25.9	340
3x4x0.9mm	1.4	2.0	19.8 x 30.7	490
5x4x0.9mm	1.4	2.5	23.4 x 37.4	790
7x4x0.9mm	1.4	2.5	25.6 x 39.6	890
10x4x0.9mm	1.4	2.5	27.8 x 41.8	1040
14x4x0.9mm	1.4	2.5	31.0 x 45.0	1235
1x4x1.4mm	1.4	2.0	17.6 x 28.1	430
3x4x1.4mm	1.4	2.0	25.0 x 35.5	740
5x4x1.4mm	1.4	2.5	30.0 x 44.0	1150
7x4x1.4mm	1.4	2.5	32.3 x 46.3	1375
10x4x1.4mm	1.4	2.5	36.8 x 50.8	1715
14x4x1.4mm	1.5	2.5	41.7 x 55.7	2170

The minimum average value of inner and outer sheath thickness is 80% of the nominal value, while the minimum at any point sheath thickness is 70% of the nominal value.

Other cable sizes available upon request.

ADIF 03.365.52.4

CCPSSP/CCTSST nx1x1.4mm

Railway signaling cables, with dry cable core, stranded insulated conductors, protection against inductive interference and armouring.

Construction

Conductor	Class 1, soft annealed, solid copper
Insulation	solid polyethylene (PE)
Identification	Insulation of each conductor according ADIF specification color coding
Stranding elements	Conductors stranded in concentric layers
Cable core wrapping	Non-hygroscopic tapes
Screen	Corrugated copper tape with overlap
Inner Sheath	black PE (CCPSSP) LSZH (CCTSST)
Armouring	2 layers of galvanized steel tape
Outer Sheath	black PE (CCPSSP) LSZH (CCTSST)

** cable type CCPSSP-R also available (jelly filled cable core and PE sheaths).*
*** CCTSST cables compliant with IEC 60332-3-24 Cat C, IEC 60754 & IEC 61034.*

Technical details (at 20°C)

Conductor diameter, nom	mm	1.4
Conductor resistance, Average value Max value	Ohm/km	11.2±0.5 11.9
Insulation resistance, min	Mohm*km	35000
Reduction factor, at 50 Hz, 110-320 V/km		≤ 0.3
Dielectric strength test 10 sec - Conductor-conductor - Conductor-screen - Metallic screen - metallic armour	Volts DC	3000 3500 2800

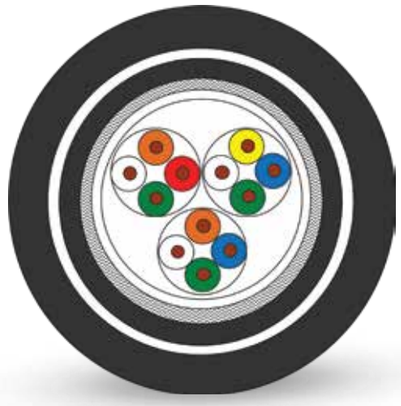
Cables physical characteristics

Cable size	Inner sheath thickness (nominal) (mm)	Outer sheath thickness (nominal) (mm)	Cable outer diameter (calculated) (mm)	CCPSSP Cable weight (calculated) (kg/km)	CCTSST Cable weight (calculated) (kg/km)
4x1x1.4mm	1.5	1.6	15.8	435	505
9x1x1.4mm	1.5	1.6	18.9	620	710
12x1x1.4mm	1.5	1.6	20.1	725	850
19x1x1.4mm	1.5	1.6	22.1	895	1040
27x1x1.4mm	1.5	1.6	24.8	1120	1245
37x1x1.4mm	1.5	1.6	26.9	1360	1495
48x1x1.4mm	1.6	1.8	30.3	1670	1835

The minimum average value of inner and outer sheath thickness is 80% of the nominal value, while the minimum at any point sheath thickness is 70% of the nominal value.

The copper tape thickness and width is such, so that the cable can conform with the reduction factor requirement.

Other cable sizes available upon request.



ADIF 03.365.52.4

CCPSSP/CCTSST nx4x0.9-1.4mm

Railway signaling cables, with dry cable core consisting of quads of insulated conductors stranded together, protection against inductive interference and armouring.

Construction

Conductor	Class 1, soft annealed, solid copper
Insulation	solid polyethylene (PE)
Identification	Insulation of each conductor according ADIF specification color coding
Stranding elements	Quads stranded in concentric layers
Cable core wrapping	Non-hygroscopic tapes
Screen	Corrugated copper tape with overlap
Inner Sheath	black PE (CCPSSP) LSZH (CCTSST)
Armouring	2 layers of galvanized steel tape
Outer Sheath	black PE (CCPSSP) LSZH (CCTSST)

** cable type CCPSSP-R also available (jelly filled cable core and PE sheaths).*
*** CCTSST cables compliant with IEC 60332-3-24 Cat C, IEC 60754 & IEC 61034.*

Technical details (at 20°C)

Conductor diameter, nom	mm	0.9	1.4
Conductor resistance, Average value Max value	Ohm/km	27.5±1 29.0	11.2±0.5 11.9
Resistance unbalance Average value Max individual value	%	1% 2%	1% 2%
Insulation resistance, min	Mohm*km	35000	
Mutual capacitance, max	nF/km	45	48
Capacitance unbalance, Between pairs Between pairs and earth	pF/460m	250 1200	
Attenuation, max - At 1kHz - At 10kHz - At 30kHz	pF/460m	0.7 1.6 2.1	0.46 0.85 1.3
Reduction factor, at 50 Hz, 110-320 V/km		≤ 0.3	
Dielectric strength test 10 sec - Conductor-conductor - Conductor-screen - Metallic screen - metallic armour	Volts DC	3000 3500 2800	

Cables physical characteristics

Cable size	Inner sheath thickness (nominal) (mm)	Outer sheath thickness (nominal) EAPSP/EATST (mm)	Cable outer diameter (calculated) (mm)	EAPSP Cable weight (calculated) (kg/km)	EATST Cable weight (calculated) (kg/km)
1x4x0.9mm	1.5	1.6	15.8	415	495
3x4x0.9mm	1.5	1.6	21.1	660	750
5x4x0.9mm	1.5	1.6	23.6	825	920
7x4x0.9mm	1.5	1.6	25.3	945	1050
10x4x0.9mm	1.5	1.6	27.8	1125	1250
14x4x0.9mm	1.6	1.8	30.9	1380	1525
1x4x1.4mm	1.5	1.6	18.5	560	660
3x4x1.4mm	1.5	1.6	26.8	985	1120
5x4x1.4mm	1.5	1.6	31.0	1295	1480
7x4x1.4mm	1.6	1.8	34.8	1590	1790
10x4x1.4mm	1.6	1.8	40.2	2025	2255
14x4x1.4mm	1.7	1.8	44.4	2510	2775

The minimum average value of inner and outer sheath thickness is 80% of the nominal value, while the minimum at any point sheath thickness is 70% of the nominal value.

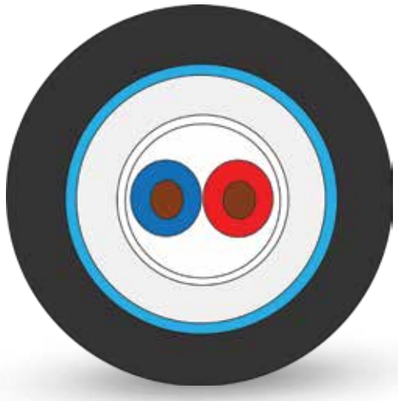
The copper tape thickness and width is such, so that the cable can conform with the reduction factor requirement.

Other cable sizes available upon request.

GREAT BRITAIN

Datasheets of typical railway signaling cables

Cable type	Specification	Stranding elements	Insulation	Longitudinal watertightness	Electrical screen	Inner sheath	Metallic armour	Outer sheath	Optional cable type with LSZH sheaths
TWIN DATALINK	BR 1932	1 pair	PE	-	AL - PE tape	PE	-	PE	**TWIN DATALINK LSZH**
A-2YF(L)2YAWA2Y	NR PS ELP 27220	pairs	PE	Jelly-filling compound	AL - PE tape	PE	aluminium wires	PE	**A-2YF(L)HAWAH**
PE/PJF/PE/SWA/PVC	BS 7870-8.2	pairs	PE	Jelly-filling compound	-	PE	steel wires	PVC	**PE/PJF/PE/SWA/LSZH**
PE/PE/SWA/PVC	BS 7870-8.2	pairs	PE	-	-	PE	steel wires	PVC	**PE/PE/SWA/LSZH**



BR 1932

TWIN DATALINK (PE/LSZH)

Railway signaling cable, consisting of 1 pairs, following British Rail Standard.

Construction

Conductor	Class 1, soft annealed, solid copper
Insulation	solid polyethylene (PE)
Identification	Red, blue insulated conductors
Stranding elements	1 pair
Cable core wrapping	Non-hygroscopic tapes
Inner Sheath	natural PE
Moisture barrier	AL-PE tape
Outer Sheath	Coloured PE (PE version) * Coloured LSZH (LSZH version)

Technical details (at 20°C)

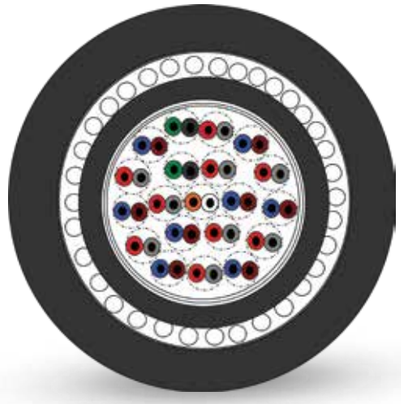
Characteristics	Values	Test type
Spark test of insulation kV h.f. (rms) kV a.c.	 7 6	T, R
Insulation resistance (5', 500Vd.c.) min. GΩkm	40	T, R
Long term insulation resistance to d.c. - on 5m sample (10 days immersion in saline solution, 220V d.c., 60±5°C)	No breakdown	T
Spark test on sheathing kV h.f. (rms – frequencies between 500Hz and 4kHz) kV a.c.	 17 16	T, R
Conductor resistance, max. Ω/km	14	T, R
Voltage test on complete cable - 20m sample (2kV a.c. 15' after 1h immersion in water)	No breakdown	T
Voltage test on cores - 5m sample (2kV a.c. 5' after 1h immersion in water)	No breakdown	T
Voltage test conductor – shield (5', 5kV a.c.)	No breakdown	R
Mutual capacitance at 10kHz, max., nF/km	55	T, S, R
Capacitance unbalance conductor-shield at 10 kHz, max., pF/km	4000	T, S, R
Characteristic impedance at 10MHz, Ω - max. - min.	 110 90	T, S, R

R: routine test, S: sample test, T: type test

Cables physical characteristics

Cable size	Inner sheath thickness (nominal) (mm)	Outer sheath thickness (nominal) (mm)	Cable outer diameter (calculated) (mm)	Cable weight (calculated) (kg/km)
1x2x1.27mm PE	0.7	2.5	12.5	150
1x2x1.27mm LSZH	0.7	2.5	12.5	200

Other cable sizes available upon request.



NR PS ELP 27220

A-2YF(L)2YAWA2Y/A-2YF(L)HAWAH nx2x0.9

Paired core, compound filled supervisory cables, complying with NETWORK Rail Standard.

Construction

Conductor	Class 1, soft annealed, solid copper
Insulation	solid polyethylene (PE)
Color coding	Insulation of each conductor according to NR PS ELP 27220 specification color coding
Stranding elements	Pairs in concentric layers
Cable core filling	Jelly-filling compound
Moisture barrier	PE-AL-PE tape
Inner Sheath	black PE (A-2YF(L)2YAWA2Y) black LSZH (A-2YF(L)HAWAH)
Screening	Aluminium wires
Outer sheath	black PE (A-2YF(L)2YAWA2Y) * black LSZH (A-2YF(L)HAWAH)

Temperature range	
along the cable route	-15°C to +35°C

Technical details (at 20°C)

Conductor diameter, nom.	mm	0.9
Conductor resistance, max	Ohm/km	30
Resistance unbalance, max	%	2
Insulation resistance, min	Mohm*km	1500
Mutual capacitance (1000Hz), max	nF/km	71
Capacitance unbalance (1000Hz), pair-to-pair, max	pF/500m	275
Dielectric strength test, 2 min, 50 Hz **- Between conductors** **- Between the aluminium laminate and aluminium wires, with the conductors connected to the aluminium wires and earth**	Volts DC	 2000 1500

Cables physical characteristics

Cable size	Inner sheath thickness (nominal) (mm)	Outer sheath thickness (nominal) (mm)	Cable outer diameter (calculated) (mm)	A-2YF(L)2YAWA2Y Cable weight (calculated) (kg/km)	A-2YF(L)HAWAH Cable weight (calculated) (kg/km)
20x2x0.9mm	1.8	2.0	26.5	900	990
30x2x0.9mm	1.8	2.0	31.6	1170	1360

Other cable sizes available upon request.

BS 7870-8.2

PE/PJF/PE/SWA/PVC nx2x0.8 (5kV < induced voltage < 15kV)

Polyethylene insulated, jelly-filled, multipair cables for use underground, in wet conditions and also for withstanding high levels of induced voltage.

Construction

Conductor	Class 1, soft annealed, solid copper
Insulation	solid polyethylene (PE)
Color coding	Insulation of each conductor according to BS7870-8.2 specification
Stranding elements	Pairs in concentric layers
Cable core filling	Jelly-filling compound
Cable core wrapping	Pre-impregnated paper tape
Inner Sheath	black PE, type TMY
Armour	Steel wires
Outer Sheath	black PVC, type TM1

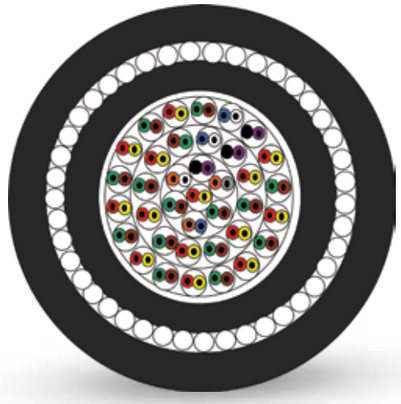
Technical details (at 20°C)

Conductor diameter, nom.	mm	0.8
Conductor loop resistance, max	Ohm/km	73.6
Insulation resistance, min	Mohm*km	5000
Mutual capacitance, max average	nF/km	50
Capacitance unbalance, pair-to-pair, max individual	pF/500m	500
Voltage test, 50Hz, 1 minute Between each conductor and the remaining conductors connected to the armour and earthed	Volts AC	10000

Cables physical characteristics

Cable size	Inner sheath thickness (nominal) (mm)	Outer sheath thickness (nominal) (mm)	Cable outer diameter (calculated) (mm)	Cable weight (calculated) (kg/km)
7x2x0.8mm	1.8	1.6	21.7	785
19x2x0.8mm	1.8	1.9	30.3	1510
37x2x0.8mm	1.8	2.1	39.8	2585
61x2x0.8mm	1.8	2.4	49.1	3965

Other cable sizes available upon request.



BS 7870-8.2

PE/PE/SWA/PVC nx2x0.8 (induced voltage < 5kV)

Polyethylene insulated, dry, multipair cables for use underground, in wet conditions and also for withstanding high levels of induced voltage.

Construction

Conductor	Class 1, soft annealed, solid copper
Insulation	solid polyethylene (PE)
Color coding	Insulation of each conductor according to BS7870-8.2 specification
Stranding elements	Pairs in concentric layers
Cable core wrapping	Plastic tape
Inner Sheath	black PE, type TMY
Armour	Steel wires
Outer Sheath	black PVC, type TM1

Technical details (at 20°C)

Conductor diameter, nom.	mm	0.8
Conductor loop resistance, max	Ohm/km	73.6
Insulation resistance, min	Mohm*km	4000
Mutual capacitance, max average	nF/km	50
Capacitance unbalance, pair-to-pair, max individual	pF/500m	500
Voltage test, 50Hz, 1 minute Between each conductor and the remaining conductors connected to the armour and earthed	Volts AC	5000

Cables physical characteristics

Cable size	Inner sheath thickness (nominal) (mm)	Outer sheath thickness (nominal) (mm)	Cable outer diameter (calculated) (mm)	Cable weight (calculated) (kg/km)
7x2x0.8mm	0.8	1.5	15.1	405
19x2x0.8mm	1.0	1.7	22.7	995
37x2x0.8mm	1.0	1.9	29.1	1455
61x2x0.8mm	1.2	2.1	35.5	2320

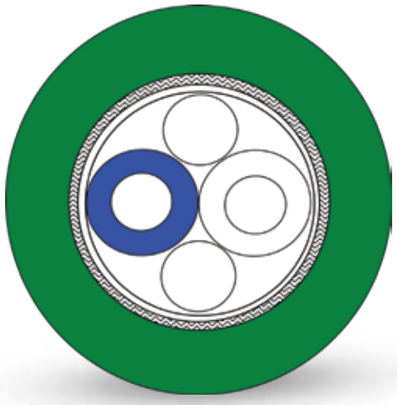
Other cable sizes available upon request.

BALISE

Datasheets of typical railway signaling cables

Cable type	Cable size	Insulation	Longitudinal watertightness	Moisture barrier	Electrostatic shield / induction protection	Inner sheath	Metallic armour	Outer sheath
A-2Y(SR)H	1x2x0.9	Solid PE	-	-	-		soft corrugated steel tape	PE
A-2Y(L)2Y(SR)2Y	1x2xx1.02	Solid PE	-	AL-PE tape		PE	soft corrugated steel tape	PE
A-2Y(L)2YB2Y	1x4x1.53	Solid PE	-	AL-PE tape		PE	galvanized steel tapes	PE
A-2YTF2Y(L)2YBY	1x2x1.4	Solid PE	waterblocking materials	AL-PE tape	-	PE	galvanized steel tapes	PVC
A-2YTF2Y(L)HBH	1x2x1.4	Solid PE	waterblocking materials	AL-PE tape	-	LSZH	galvanized steel tapes	LSZH
AJ-2Y(ST)2YB2Y	1x2x1.4	Solid PE	-	-	corrugated copper tape	PE	galvanized steel tapes	PE
A-02YSTF(L)2YB2Y	1x4x0.8	foam-skin PE	waterblocking materials	AL-PE tape	-	PE	galvanized steel tapes	PE

ertms



BALISE

A-2Y(SR)H 1x2x0.9

Balise cables with PE insulation, longitudinally applied corrugated steel tape and LSZH sheath.

Working temperature
-30°C to +70°C

Construction

Conductor	Class 1, soft annealed, solid copper
Insulation	solid polyethylene (PE)
Color coding	According to customer request
Stranding elements	2 insulated conductors & 2 filler elements
Cable core wrapping	Non-hygroscopic tapes
Armour	Soft corrugated steel tape armour
Outer Sheath	LSZH sheath

** cable compliant with IEC 60332-3-24 Cat C, IEC 60754 & IEC 61034.*

Technical details (at 20°C)

Conductor diameter, nom.	mm	0.9
Conductor loop resistance **Minimum** **maximum**	Ohm/km	27.62 28.40
Insulation resistance, min	Mohm*km	10000
Mutual capacitance **minimum** **maximum**	nF/km	39.4 50
Characteristic Impedance **-at 10kHz** **-at 20kHz** **-at 50kHz** **-at 282kHz** **-at 565kHz** **-at 1000kHz**	Ohm	175±20% 142±20% 129±20% 120±20% 117±20% 112±20%
Attenuation **- min/max at 10kHz** **- min/max at 20kHz** **- min/max at 50kHz** **- min/max at 282kHz** **- min/max at 565kHz** **- min/max at 1000kHz**	dB/km	1.33 / 1.75 1.61 / 2.2 1.84 / 2.55 6.54 / 8.3 10.39 / 12.3 15.22 / 17.8
Voltage test, 1 minute	Volts DC	3000
Voltage rating	Volts	100

Cables physical characteristics

Cable size	Outer sheath thickness (nominal) (mm)	Cable outer diameter (calculated) (mm)	Cable weight (calculated) (kg/km)
1x2x0.9mm	1.5	10.5	125

ertms

BALISE

A-2Y(L)2Y(SR)2Y 1x2x1.02

Balise cables with moisture barrier, longitudinally applied corrugated steel tape and PE sheath.

Temperature range	
Operation	-25°C to +70°C
Installation	-15°C to +40°C
Storage & transportation	-25°C to +70°C

Construction

Conductor	Class 1, soft annealed, solid copper
Insulation	solid polyethylene (PE)
Color coding	According to customer request
Stranding elements	2 insulated conductors & 2 filler elements
Cable core wrapping	swellable tape
Moisture barrier	AL-PE tape in contact with tinned copper drain wire
Inner sheath	PE sheath
Armour	Soft corrugated steel tape armour
Outer Sheath	PE sheath

Technical details (at 20°C)

Conductor diameter, nom.	mm	1.02
Conductor resistance, max	Ohm/km	21.5
Resistance unbalance, max	%	2
Insulation resistance, min	Mohm*km	10000
Mutual capacitance **- Average** **- Maximum**	nF/km	44±2 50
Capacitace unbalance, pair-to-pair, 800Hz, max	pF/km	150
Capacitace unbalance, pair-to-earth, 800Hz **- Average** **- Maximum**	pF/km	600 1200
Characteristic Impedance, at 1 MHz **-nominal** **-maximum** **-minimum**	Ohm	115 125 105
Attenuation, max **- at 10kHz** **- at 25kHz** **- at 50kHz** **- at 100kHz** **- at 250kHz** **- at 565kHz** **- at 1MHz**	dB/km	1.7 2.1 2.4 3.1 4.7 7.0 9.5
Voltage test, 1 minute **Core - core / core - screen**	Volts DC	1500/5000

Cables physical characteristics

Cable size	Inner sheath thickness (nominal) (mm)	Outer sheath thickness (nominal) (mm)	Cable outer diameter (calculated) (mm)	Cable weight (calculated) (kg/km)
1x2x1.02mm	1.2	1.5	14.0	195

ertms

BALISE

A-2Y(L)2YB2Y 1x4x1.53

Used for train detection ETCS, for installation in train lines, laying in ground, ducts or tunnels.

Construction

Conductor	Class 1, soft annealed, solid copper
Insulation	solid polyethylene (PE)
Color coding	According to customer request
Stranding elements	1 Quad plus central filler element
Cable core wrapping	Non-hygroscopic tapes
Moisture barrier	AL-PE tape in contact with 2 tinned copper drain wires
Inner sheath	PE sheath
Armour	Galvanized steel tapes
Outer Sheath	PE sheath

Temperature range	
Operation	-35°C to +70°C
Installation	-5°C to +70°C

Technical details (at 20°C)

Conductor diameter, nom.	mm	1.53
Conductor loop resistance, max	Ohm/km	19.8
Insulation resistance, min	Mohm*km	5000
Mutual capacitance, max	nF/km	42±15%
Capacitace unbalance, 800Hz, max **- k1** **- e1/2**	pF/km	400 650
Characteristic Impedance **- at 0.56 MHz** **- at 0.80 MHz** **- at 1.8 MHz**	Ohm	120±10% 120±10% 120±5%
Attenuation, max **- at 10 kHz** **- at 0.56 MHz** **- at 0.8 MHz** **- at 1.8 MHz**	dB/100m	0.08 0.4 0.5 0.85
Voltage test, 2 minute **Core – core / core – screen**	Volts AC	2000/2000

Cables physical characteristics

Cable size	Inner sheath thickness (nominal/min.) (mm)	Outer sheath thickness (nominal/min.) (mm)	Cable outer diameter (maximum) (mm)	Cable weight (calculated) (kg/km)
1x4x1.53mm	1.2/1.0	1.1/0.9	18.0	385

ertms

BALISE

A-2YTF2Y(L)2YBY / A-2YTF2Y(L)HBH 1x2x1.4

Railway signaling cables for ERTMS application, filled with waterblocking materials and armoured with 2 layers of steel tape armour.

Construction

Conductor	Class 1, soft annealed, solid copper
Insulation	solid polyethylene (PE)
Color coding	According to customer request
Stranding elements	2 insulated conductors plus 2 filler elements
Cable core filling	Waterblocking materials (yarns, tapes)
Cable core wrapping	Plastic & waterblocking tapes
Inner sheath	PE sheath
Moisture barrier	PE- AL-PE tape
Intermediate sheath	PE sheath (A-2YTF2Y(L)2YBY cable type) LSZH sheath (A-2YTF2Y(L)HBH cable type)
Armour	Galvanized steel tapes
Outer Sheath	PVC sheath (A-2YTF2Y(L)2YBY cable type) LSZH sheath (A-2YTF2Y(L)HBH cable type)

** cable type A-2YTF2Y(L)2YBY compliant with IEC 60332-1-2.*
*** cable type A-2YTF2Y(L)HBH compliant with IEC 60332-3-24 Cat C, IEC 60754.*

Technical details (at 20°C)

Conductor diameter, nom.	mm	1.4±2%
Conductor resistance, max	Ohm/km	11.9
Insulation resistance, min	Mohm*km	10000
Mutual capacitance, at 800Hz, max	nF/km	50
Characteristic Impedance, at 10 kHz, nom.	Ohm	140
Attenuation,at 560 kHz, nom.	dB/100m	4.3
Reduction factor, at 100 V/km, 50 Hz		0.63
Voltage test, 1 minute **Core – core / core – screen**	Volts AC	3000/1000

Cables physical characteristics

Cable size	Inner sheath thickness (nominal) (mm)	Intermediate sheath thickness (nominal) (mm)	Outer sheath thickness (nominal) (mm)	Cable outer diameter (maximum) (mm)	A-2YTF2Y(L)2YBY Cable weight (calculated) (kg/km)	A-2YTF2Y(L)HBH Cable weight (calculated) (kg/km)
1x2x1.4mm	1.5	1.2	1.4	17.7	405	425

ertms

BALISE

AJ-2Y(ST)2YB2Y 1x2x1.4

Balise with reduction factor for installation in train lines, laying in ground, ducts or tunnels.

Working temperature
-35°C to +70°C

Construction

Conductor	Class 1, soft annealed, solid copper
Insulation	solid polyethylene (PE)
Color coding	According to customer request
Stranding elements	2 insulated conductors plus 2 filler elements
Cable core wrapping	Plastic tapes
Screen	Corrugated copper tape with overlap
Inner sheath	PE sheath
Armour	2 layers of galvanized steel tape of 0.5mm thickness
Outer sheath	PE sheath

** cable type A-2YTF2Y(L)2YBY compliant with IEC 60332-1-2.*
*** cable type A-2YTF2Y(L)HBH compliant with IEC 60332-3-24 Cat C, IEC 60754.*

Technical details (at 20°C)

Conductor diameter, nom.	mm	1.4
Conductor loop resistance, max	Ohm/km	11.9
Resistance unbalance, max	%	3
Insulation resistance, min	Mohm*km	10000
Mutual capacitance, max	nF/km	45
Capacitace unbalance, 800Hz, max	pF/km	3000
Reduction factor, at 50Hz, 110-320 V/km		0.3
Characteristic Impedance, nominal **- at 10kHz** **- at 560 kHz**	Ohm	147±15% 120±15%
Attenuation, max **- at 10kHz** **- at 560 kHz**	dB/100m	0.9 5.5
Dielectric strength test, 1 min, 50Hz **- Conductor-conductor** **- Conductor-screen**	Volts AC	3000 3000

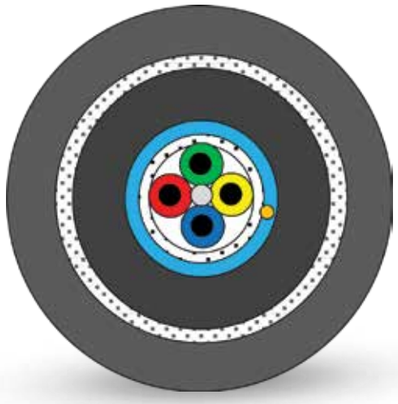
Cables physical characteristics

Cable size	Inner sheath thickness (nominal/min.) (mm)	Outer sheath thickness (nominal/min.) (mm)	Cable outer diameter (calculated) (mm)	Cable weight (calculated) (kg/km)
1x2x1.4mm	1.5	1.6	20.0	590

The minimum average value of inner and outer sheath thickness is 80% of the nominal value, while the minimum at any point sheath thickness is 70% of the nominal value.

The copper tape thickness and width is such, so that the cable can conform with the reduction factor requirement.

ertms



BALISE

A-02YSTF(L)2YB2Y 1x4x0.8

Railway signalling cables according to TL 416.0119 are used for controlling the track and switching magnets of the PZB. They can be laid in the ground, in trough channels, in pipe conduits, and on cable holders in shaft and tunnel walls.

Temperature range	
Operation	-35°C to +70°C
Installation	-5°C to +50°C

Construction

Conductor	Class 1, soft annealed, solid copper
Insulation	Foam-skin polyethylene (PE)
Color coding	According to customer request
Stranding elements	1 Quad plus swellable yarn in its center
Cable core wrapping	Water-blocking tape
Moisture barrier	AL-PE tape in contact with tinned copper drain wire
Inner Sheath	PE sheath
Armouring	2 galvanized steel tapes of 0.1mm thickness
Outer sheath	PE sheath

Technical details (at 20°C)

Conductor diameter, nom.	mm	0.8
Conductor loop resistance, max	Ohm/km	73.2
Insulation resistance, min	Mohm*km	5000
Mutual capacitance, max	nF/km	30
Dielectric Strength at 50Hz, 1 min **Conductor – Conductor** **Conductor - shield**	Volts	2500 (AC 50 Hz) 3535 (DC)

Cables physical characteristics

Cable size	Inner sheath thickness (nominal) (mm)	Outer sheath thickness (nominal) (mm)	Cable outer diameter (calculated) (mm)	Cable weight (calculated) (kg/km)
1x4x0.8mm	1.3	1.3	14.0	180

ADDITIONAL COPPER SIGNALLING & CONTROL CABLES

Datasheets of typical railway signaling cables

Country	Cable type	Stranding elements	Insulation	Longitudinal watertightness	Moisture barrier	Inner sheath	Electrostatic shield / induction protection	Metallic armour	Outer sheath
HUNGARY	BRQA	cores	Solid PE	-	AL-PE tape	PE	AL tape	galvanized steel tapes	PE
	HVRQ	quads	foam-skin PE	Jelly filling compound + waterblocking materials	PE-AL-PE tape	PE	copper wires screen	-	PE
	AJ-02YSOF(L)2YDB2Y	quads	foam-skin PE	Low permittivity jelly	PE-AL-PE tape	PE	copper wires screen	galvanized steel tapes	PE
ISRAEL	A-2YOF(L)2YB2Y	cores quads	solid PE	Low permittivity jelly	AL-PE tape	PE	-	galvanized steel tapes	PE
	AJ-2YOF(L)2YDB2Y RF0.2	cores quads	solid PE	Low permittivity jelly	AL-PE tape	PE	copper wires screen	galvanized steel tapes	PE
	AJ-02YSOF(L)2YDB2Y RF0.1	pairs	foam-skin PE	Low permittivity jelly	PE-AL-PE tape	PE	copper wires screen	galvanized steel tapes	PE
	AJ-02YSOF(L)2Y(SR)2Y	pairs	foam-skin PE	Low permittivity jelly	PE-AL-PE tape	PE	-	corrugated steel tape armour	
LITHUANIA	AJ-2YOF(L)2YDB2Y RF0.1 & RF0.3	cores	solid PE	Low permittivity jelly	PE-AL-PE tape	PE	copper wires screen	galvanized steel tapes	PE
	A-2YF(L)2YB2Y	pairs	Solid PE	Jelly filling compound	PE-AL-PE tape	PE	-	galvanized steel tapes	PE
AUSTRIA	S-2Y2YCB2Y	cores quads	solid PE	-	-	PE	copper wires screen	galvanized steel tapes	PE
	S-2Y2YBY	cores quads	solid PE	-	-	PE	-	galvanized steel tapes	PE

Fiber Optic Cable

A-DQ(ZN)(SR)2Y

Loose tube, outdoor, corrugated steel tape armoured FO cable suitable for laying on cable trays and in open trenches or for direct buried installation in the ground.

Standards

VDE0888, IEC 60794, DB
or as per customer's request.

Construction

Optical fiber	Coloured glass fiber
Central Strength Member (CSM)	Dielectric, glass fiber reinforced plastic (FRP)
Loose tube	PBT tube, filled with jelly compound
Water blocking element	Swellable, polyester yarns longitudinally applied
Reinforcing elements	Glass yarns with water blocking coating
Wrapping	Water blocking tape, longitudinally applied with overlap
Ripcord	Polyester or aramide thread of sufficient strength
Armouring	Corrugated steel tape, PE coated on both sides, longitudinally applied with overlap
Outer jacket	Black, UV resistant PE

Cables physical characteristics

Fibers	Tubes	Fibers/ Tubes	Fillers	Sheath thickness	Steel tape thickness (PE-Steel-PE) Nominal (mm)	Diameter Nominal (mm)	Cable weight (kg)
12	1	12	4	1.5	0.05 - 0.155 - 0.05	11.5	125
24	2	12	3	1.5		11.5	125
36	3	12	2	1.5		11.5	125
48	4	12	1	1.5		11.5	125
60	5	12	0	1.5		11.5	125
72	6	12	0	1.5		11.5	130
96	8	12	0	1.5		13	165
144	12	12	0	1.5		16.0	225

Mechanical Characteristics - tested according to IEC 60794-1-21	**Environmental Characteristics** - tested according to IEC 60794-1-22
Tensile strength: 1.5xW (min. 2700N) [Fiber Strain< 0.33 %] Crush resistance: 2000 N/10cm Bending (static/dynamic) : 15xD/20xD Impact resistance: 10 N. m, 3 impacts spaced, R= 300 mm Torsion: ±180°, 3 cycles, 50 N (Δα reversible, no damage)	Temperature Range TL= -30°C, TH= +70°C Storage & Transport TL= -10°C, TH= +50°C Installation Δα < 0.05 dB/km TL= -30°C, TH= +70°C Operation Δα < 0.10 dB/km Water Penetration: 3m cable, 1 m water column, 24 h - no water detected with UV light

Other cable sizes and different mechanical characteristics available upon request
Technical parameters are subject to modifications.

Fiber Optic Cable

A-DQ(ZN)2Y(SR)2Y

Loose tube, outdoor, corrugated steel tape armoured, double jacketed FO cable suitable for laying on cable trays and in open trenches or for direct buried installation in the ground.

Standards

VDE0888, IEC 60794, DB
or as per customer's request.

Construction

Optical fiber	Coloured glass fiber
Central Strength Member (CSM)	Dielectric, glass fiber reinforced plastic (FRP)
Loose tube	PBT tube, filled with jelly compound
Water blocking element	Swellable, polyester yarns longitudinally applied
Reinforcing elements	Glass yarns with water blocking coating
Ripcord	Polyester or aramide thread of sufficient strength
Inner sheath	Black PE
Armouring	Corrugated steel tape, PE coated on both sides, longitudinally applied with overlap
Outer jacket	Black, UV resistant PE

Cables physical characteristics

Fibers	Tubes	Fibers/ Tubes	Fillers	Sheath thickness Nominal (mm)		Steel tape thickness (PE-Steel-PE) Nominal (mm)	Diameter Nominal (mm)	Cable weight (kg)
				Inner	Outer			
12	1	12	4	1.0	1.5	0.05 - 0.155 - 0.05	13.0	165
24	2	12	3	1.0	1.5		13.0	165
36	3	12	2	1.0	1.5		13.0	165
48	4	12	1	1.0	1.5		13.0	165
60	5	12	0	1.0	1.5		13.0	165
72	6	12	0	1.0	1.5		13.5	165
96	8	12	0	1.0	1.5		14.5	195
144	12	12	0	1.0	1.5		17.0	275

Mechanical Characteristics - tested according to IEC 60794-1-21	**Environmental Characteristics** - tested according to IEC 60794-1-22
Tensile strength: 1.5xW (min. 2700N) [Fiber Strain< 0.33 %] Crush resistance: 4000 N/10cm Bending (static/dynamic): 15xD/20xD Impact resistance: 15 N. m, 3 impacts spaced, R= 300 mm Torsion: ±180°, 3 cycles, 50 N (Δα reversible, no damage)	Temperature Range TL= -30°C, TH= +70°C Storage & Transport TL= -10°C, TH= +50°C Installation Δα < 0.05 dB/km TL= -30°C, TH= +70°C Operation Δα < 0.10 dB/km Water Penetration: 3m cable, 1 m water column, 24 h - no water detected with UV light

Other cable sizes and different mechanical characteristics available upon request
Technical parameters are subject to modifications.

Fiber Optic Cable

A/I-DQ(ZN)H(SR)H CPR B2ca

Loose tube, indoor / outdoor, corrugated steel tape armoured FO cables suitable for drawing or air-blown installation in plastic cable ducts, laying on open or protected trenches or even for direct buried installation in the ground.

Standards

VDE0888, IEC 60794, DB
or as per customer's request.

Construction

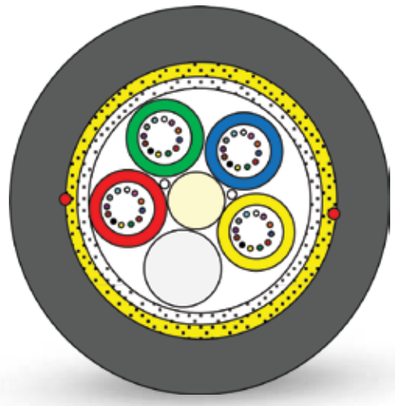
Optical fiber	Coloured glass fiber
Central Strength Member (CSM)	Dielectric, glass fiber reinforced plastic (FRP)
Loose tube	PBT tube, filled with jelly compound
Water blocking element	Swellable, polyester yarns longitudinally applied
Reinforcing elements	Glass yarns with water blocking coating
Ripcord	Polyester or aramide thread of sufficient strength
Inner sheath	Black FR LSZH compound
Armouring	Corrugated steel tape, PE coated on both sides, longitudinally applied with overlap
Outer jacket	Black FR LSZH compound

Cables physical characteristics

Fibers	Tubes	Fibers/ Tubes	Fillers	Sheath thickness Nominal (mm)		Steel tape thickness (PE-Steel-PE) Nominal (mm)	Diameter Nominal (mm)	Cable weight (kg)
				Inner	Outer			
12	1	12	4	1.0	1.5	0.05 - 0.155 - 0.05	13.0	210
24	2	12	3	1.0	1.5		13.0	210
36	3	12	2	1.0	1.5		13.0	210
48	4	12	1	1.0	1.5		13.0	210
60	5	12	0	1.0	1.5		13.0	210
72	6	12	0	1.0	1.5		13.5	220
96	8	12	0	1.0	1.5		14.5	250

Mechanical Characteristics - tested according to IEC 60794-1-21	Environmental Characteristics - tested according to IEC 60794-1-22
Tensile strength: 1.5xW (min. 3000N) [Fiber Strain< 0.33 %] Crush resistance: 4000 N/10cm Bending (static/dynamic) : 15xD/20xD Impact resistance: 15 N. m, 3 impacts spaced, R= 300 mm Torsion: ±180°, 3 cycles, 50 N (Δα reversible, no damage)	Temperature Range TL= -20°C, TH= +70°C Storage & Transport TL= -10°C, TH= +50°C Installation Δα < 0.05 dB/km TL= -20°C, TH= +70°C Operation Δα < 0.10 dB/km Water Penetration: 3m cable, 1 m water column, 24 h - no water detected with UV light Fire behavior: Euroclass B2ca- s1, d0, a1 (EN 13501-6)

Other cable sizes and different mechanical characteristics available upon request
Technical parameters are subject to modifications.



Fiber Optic Cable

ADSS short span

Loose tube, outdoor, fully dielectric FO cables suitable for self-supporting aerial installation along existing aerial rights-of-way. They are also suitable for underground installation inside cable ducts.

Standards

VDE0888, IEC 60794, IEEE 1222
or as per customer's request.

Construction

Optical fiber	Coloured glass fiber
Central Strength Member (CSM)	Dielectric, glass fiber reinforced plastic (FRP)
Loose tube	PBT tube, filled with jelly compound
Water blocking element	Swellable, polyester yarns longitudinally applied
Filler elements	Natural polymer compound
Wrapping	Water blocking tape longitudinally applied with overlap
Reinforcing elements	Aramid yarns
Ripcord	Polyester thread of sufficient strength
Outer jacket	Black, UV Resistant, HDPE

Cables physical characteristics

Fibers	Tubes	Fibers/ Tubes	Fillers	Sheath thickness Nominal (mm)	Diameter Nominal (mm)	Cable weight (kg)	Span Length* Max (m)
12	3	4	3	1.5	10.0	80	80
24	6	4	0	1.5	10.0	80	
48	6	8	0	1.5	10.0	80	
72	6	12	0	1.5	10.0	80	
96	8	12	0	1.5	11.0	100	
144	12	12	0	1.5	14.0	150	

**Assuming worst external loading conditions: wind speed 60km/h together with ice thickness 6.5mm*

Mechanical Characteristics - tested according to IEC 60794-1-21	Environmental Characteristics - tested according to IEC 60794-1-22
Tensile strength: 2000-3000N [Safe Fiber Strain< 0.2 %] Crush resistance: 1500 N/10cm Bending (static/dynamic): 10xD/15xD Impact resistance: 10 N. m, 3 impacts spaced, R= 300 mm Torsion: ±180°, 3 cycles, 50 N (Δαreversible, no damage)	Temperature Range TL= -30°C, TH= +70°C Storage & Transport TL= -10°C, TH= +50°C Installation Δα < 0.05 dB/km TL= -30°C, TH= +70°C Operation Δα < 0.10 dB/km Water Penetration: 3m cable, 1 m water column, 24 h - no water detected with UV light

Other cable sizes and different mechanical characteristics available upon request
Technical parameters are subject to modifications.

www.hellenic-cables.com **Railway signaling** cables

P. 12/2023

HELLENIC CABLES

Member of CENERGY HOLDINGS

www.hellenic-cables.com

HEAD OFFICE:

33, Amaroussiou - Halandriou Str., 151 25 Maroussi, Athens, GREECE
Tel.: +30 210 6787 416, +30 210 6787 900
Fax: +30 210 6787 406
e-mail: info@hellenic-cables.com

PRODUCTION PLANTS:

Corinth
Submarine Cables Plant
Soussaki, P.O. 11, 201 00
Corinth, GREECE
Tel.: +30 27410 48401
Fax: +30 27410 48392

Thiva
Cables Plant
69th km Athens-Thiva
Old National Road,
Agios Tryphonas, 32 200
Thiva, GREECE
Tel.: +30 22620 86616
Fax: +30 22620 86606

ICME ECAB
Cables & Compounds Plant
42, Drumul intre
Tarlale Str. 3rd sector,
032982, Bucharest, ROMANIA
Tel.: +40 21 2090200
Fax: +40 21 2561476

SALES OFFICES:

Hellenic Cables America Co.
750 Town and Country, Blvd Ste 675,
Houston, TX 77024, USA
Tel.: +1 (281) 752-7333

METAL AGENCIES
Suite 4, Cobb House, 2-4
Oyster Lane, Byfleet, Surrey
KT14 7DU, UNITED KINGDOM
Tel.: +44 1932 33 11 38
Fax: +44 1932 33 11 90

GENECOS S.A.
19 Rue de Passy,
750 16 Paris, FRANCE
Tel.: +33 14527 0754
Fax: +33 14527 0708

TEPRO METAL Vertriebs GmbH
Ursulastrasse 33-41, D-50354,
Hurth, GERMANY
Tel.: +49 2233 39621 11
Fax: +49 2233 39621 90