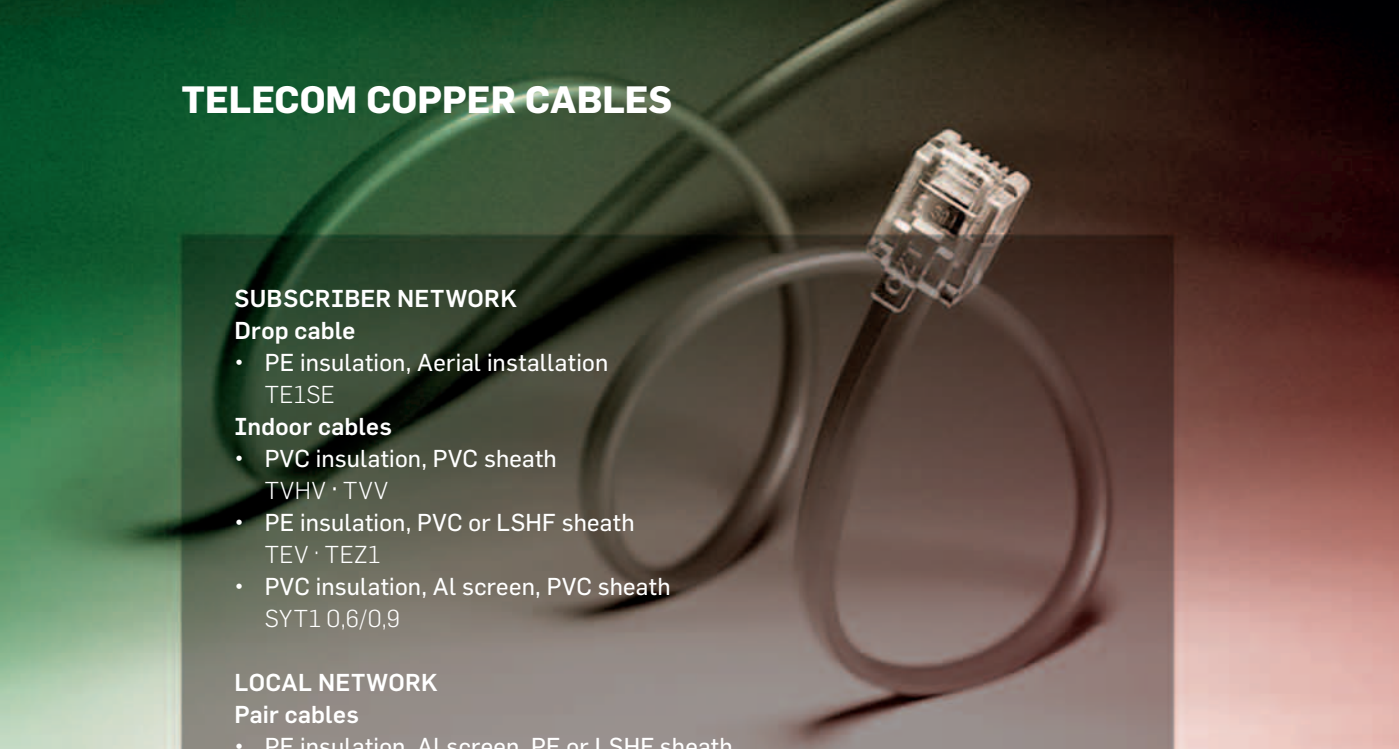
TELECOM COPPER CABLES



SUBSCRIBER NETWORK

Drop cable

- PE insulation, Aerial installation
  TE1SE

Indoor cables

- PVC insulation, PVC sheath
  TVHV · TVV
- PE insulation, PVC or LSHF sheath
  TEV · TEZ1
- PVC insulation, Al screen, PVC sheath
  SYT1 0,6/0,9

LOCAL NETWORK

Pair cables

- PE insulation, Al screen, PE or LSHF sheath
  TE1HE · TE1HZ1 · TE1HE2AE · TE1HES
- PE insulation, Jelly filled
  T1EG1HE · T1EG1HEAE

Quad cables

- PE insulation, Al screen, PE sheath
  TE1HE · TE1HEAV · TE1HEAE
  Smart grid, PVC insulation, Al screen, PVC sheath
  Téléreport Armé · Téléreport Non Armé

Photo by: Jeff Wong

APPLICATION

Circular shape cables with 1 or 2 pairs, with transmission characteristics similar to category 3.
For aerial installation in the subscribers network (tensile strength > 1350 N).

CABLE DESIGNATION

TE1SE

CONSTRUCTION CHARACTERISTICS

Conductor
Solid annealed copper, nominal diameter of 0,5 or 0,8 mm.

Insulation
Solid polyethylene.

Arrangement (formation)
Pairs.

Mechanical reinforcement
Aramid yarns applied parallel to the cable core.

Oversheath (jacket)
Black, low density polyethylene (PE).

COLOUR AND CABLE MARKING

Black.
Sheath (jacket) will be marked, at regular intervals, with the following information:
<Manufacturer's name> <type of cable> <year> <metric marking>

COLOUR CODE

N.º Pair	Conductor "a"	Conductor "b"
1	White	Blue
2	Yellow	Black

GENERAL AND ELECTRICAL CHARACTERISTICS (20°C)

	Ø 0,5 mm	Ø 0,8 mm
Maximum Ohmic resistance at 20°C dc(Ω/km)	95	37
Resistance unbalance	Maximum individual value: 2%	
Minimum insulation resistance at 20°C, 500Vdc	10 000 MΩ x km	
Dielectric strength	Cond-Cond – 1kV$_{dc}$ (60s) or 2kV$_{dc}$ (3s)	
Mutual capacitance at 1 kHz	Maximum value: 55 nF/Km	
Maximum capacitance unbalance (pair-pair) (pF/km)(*)	300	

(*) – Only applies to cables with 2 pairs

Frequency	Attenuation (dB/km)		Characteristic Impedance (Zc)	Return Loss (RL)	NEXT (*)	FEXT (*)
(Hz)	Ø 0,5mm	Ø 0,8mm	(Ohm)	(dB)	(dB)	(dB)
800	< 1,5	< 1,0	600 ± 50	Nd	Nd	Nd
64k	< 8,0	< 5,0	125 ± 25	Nd	Nd	Nd
256k	< 11,0	< 7,6	Nd	Nd	Nd	Nd
512k	< 15,5	< 11,0	Nd	Nd	Nd	Nd
772k	< 18,0	< 13,0	100 ± 15	> 18	> 64	>64
1M	< 21,0	< 15,0	100 ± 15	> 18	> 62	>62
4M	< 43,0	< 30,0	100 ± 15	> 18	> 53	>53
10M	< 66,0	< 47,0	100 ± 15	> 15	> 47	>47
16M	< 82,0	< 62,0	100 ± 15	> 15	> 44	>44

(*) – Only applies to cables with 2 pairs • Nd – not defined

DIMENSIONAL CHARACTERISTICS

N.º of pairs	Ø 0,5 mm		Ø 0,8 mm	
	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)
1	5,5	23	5,5	27
2	5,5	25	8,0	55

APPLICATION

Cables ranging from 1 to 200 pairs, used for inside installations.

CABLE DESIGNATION

TVHV
TVV (without metallic screen)

CONSTRUCTION CHARACTERISTICS

Conductor

Solid annealed copper, nominal diameter of 0,5 mm.

Insulation

PVC.

Arrangement (formation)

Pairs (the two pair cable has the arrangement (formation) of a star-quad).

Core assembly

Units of 10 or 50 pairs.

Core wrapping

Dielectric tape, helically applied with an overlap.

Metallic screen (only for TVHV)

One aluminium/ polyester (9µm /12,5µm) tape spirally applied, with an overlap. Under the metallic screen a tinned copper wire with nominal diameter of 0,5mm, is longitudinally applied.

Oversheath (jacket)

PVC.

COLOUR AND CABLE MARKING

Grey.
Sheath (jacket) will be marked, at regular intervals, with the following information:
<Manufacturer's name> <type of cable> <year> <metric marking>

COLOUR CODE

N.º Pair	Conductor "a"	Conductor "b"	N.º Pair	Conductor "a"	Conductor "b"
1	White	Blue	6	Red	Blue
2	White	Orange	7	Red	Orange
3	White	Green	8	Red	Green
4	White	Brown	9	Red	Brown
5	White	Grey	10	Red	Grey

For cables with triads, each triad has a black third conductor.

GENERAL AND ELECTRICAL CHARACTERISTICS (20°C)

Maximum Ohmic resistance at 20°C dc(Ω/km)	95,9
Minimum insulation resistance at 20°C, 500Vdc	500 MΩ x km
Dielectric strength (60s)	Cond-Cond – 1kVdc or 1,5kVac
Mutual capacitance at 0,8kHz (maximum value)	
N.º pairs in the cable ≤6	132 nF/Km
N.º pairs in the cable >6	120 nF/Km
Maximum capacitance unbalance (pair-pair) (pF/500)	400

DIMENSIONAL CHARACTERISTICS

Pairs • PVC insulation • Al screen • PVC sheath – TVHV

N.º of pairs/triads	Ø 0,5 mm	
	Diameter (mm)	Weight (kg/km)
1x2	3,7	20
1x3	4,1	24
2x2	4,1	26
3x2	5,1	36
6x2	6,1	54
10x2	7,2	77
10x3	9,4	110
15x2	8,0	105
20x2	9,3	140
20x3	12,5	210
30x2	11,5	195
40x2	12,3	245
50x2	13,5	300
60x2	14,5	350
100x2	18,3	555
200x2	25,6	1 100

APPLICATION

Cables of 1, 2 and 3 pairs used as a connection from inside building up to subscribers' houses.

CABLE DESIGNATION

TEV
TEZ1 (with LSHF sheath)

CONSTRUCTION CHARACTERISTICS

Conductor

Solid annealed copper, nominal diameter of 0,5 mm or 0,6 mm.

Insulation

Solid polyethylene.

Arrangement (Formation)

Pairs (optionally, the two pair cable may have the arrangement (formation) of a star-quad).

Oversheath (jacket)

Extruded PVC or LSHF – Low Smoke Halogen Free thermoplastic compound.

COLOUR AND CABLE MARKING

Ivory.
Sheath (jacket) will be marked, at regular intervals, with the following information:
<Manufacturer's name> <type of cable> <year> <metric marking>

COLOUR CODE

N.º Pair	Conductor "a"	Conductor "b"
1	Brown	White
2	Red	Green
3	Blue	Yellow

GENERAL AND ELECTRICAL CHARACTERISTICS (20°C)

		Ø 0,5 mm	Ø 0,6 mm			
Maximum Ohmic resistance at 20°C dc(Ω/km)		93	66			
Resistance unbalance		Maximum individual value: 2%				
Minimum insulation resistance at 15°C, 500Vdc		8 000 MΩ x km				
Dielectric strength		Cond-Cond – 3kVdc (3s)				
Mutual capacitance at 1 kHz		Maximum value: 56 nF/Km				
Capacitance unbalance (pair-pair) (pF/225m), 800Hz		Maximum value: 510				
Nominal attenuation (dB /Km)		0,8 kHz	1,5 kHz	3 kHz	40 kHz	96 kHz
	Ø 0,5 mm	1,7	1,8	2,3	9,0	24,5
	Ø 0,6 mm	1,2	1,6	2,0	6,0	19,0

DIMENSIONAL CHARACTERISTICS

Pairs • PE insulation • PVC Sheath – TEV

N.º of pairs	Ø 0,5 mm		Ø 0,8 mm	
	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)
1	3,7	17	4,0	20
2	5,0	27	5,9	33
3	5,8	33	6,5	42

APPLICATION

Cables ranging from 1 to 112 pairs, used for inside installations.

CABLE DESIGNATION

SYT1

CONSTRUCTION CHARACTERISTICS

Conductor

Solid annealed copper, nominal diameter of 0,6 mm or 0,9 mm.

Insulation

PVC.

Arrangement (Formation)

Pairs.

Core assembly

Concentric layers or bundles for cables with 56 pairs (4x14) or 112 pairs (8x14).

Core wrapping

Dielectric tape, helically applied with an overlap.

Metallic screen

One aluminium/ polyester (9µm /12,5µm) tape spirally applied, with an overlap. Under the metallic screen a tinned copper wire with nominal diameter of 0,5mm, is longitudinally applied.

Oversheath (jacket)

PVC.

COLOUR AND CABLE MARKING

Grey.
Sheath (jacket) will be marked, at regular intervals, with the following information:
<Manufacturer's name> <type of cable> <year> <metric marking>

COLOUR CODE

For cables with pairs in concentric layers, the pairs are identified according to the following table:

Conductor "a"	Conductor "b"						
	White	Blue	Yellow	Brown	Black	Red	Green
Light-Blue	1	2	3	4	5	6	7
Grey	8	9	10	11	12	13	14
Orange	15	16	17	18	19	20	21
Purple	22	23	24	25	26	27	28
Light-Blue	29	30	31	32	33	34	35
Grey	36	37	38	39	40	41	42

For cables assembled in bundles, each bundle will have a winding tape with the following successively colours:
White • blue • yellow • brown • black • red • green • purple.

GENERAL AND ELECTRICAL CHARACTERISTICS (20°C)

	Ø 0,6 mm	Ø 0,9 mm
Maximum Ohmic resistance at 20°C dc(Ω/km)	133,4	59,3
Minimum insulation resistance at 20°C, 500Vdc	500 MΩ x km	
Dielectric strength (60s)	Cond-Cond – 1,5kVdc	
Mutual capacitance at 0,8kHz (maximum value)		
N.º pairs in the cable < 10	160 nF/Km	
N.º pairs in the cable ≥ 10	130 nF/Km	
Maximum capacitance unbalance (pair-pair) (pF/500)	400	

DIMENSIONAL CHARACTERISTICS

Pairs • PVC insulation • Al screen • PVC sheath – SYT1

N.º of pairs	Ø 0,6 mm		Ø 0,9 mm	
	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)
1	4,2	26	5,2	40
2	5,5	40	7,6	75
3	5,7	50	7,9	90
5	7,0	75	9,2	130
7	7,6	90	10,5	170
10	8,6	115	12,0	225
15	9,6	155	13,5	310
21	11,3	210	15,5	410
30	13,0	280	18,4	580
56	16,6	480	24,5	1 020
112	23,1	910	34,0	1 980

APPLICATION

Cables ranging from 6 to 2 424 pairs, for distribution to subscribers or connecting multiline telephone systems. Suitable for underground or duct installation. Can be used for aerial installation with a susppension strand.

CABLE DESIGNATION

TE1HE · TE1HZ1 (PE or LSHF sheath)
TE1HE2AE (corrugated armoured cable)
TE1HES (figure 8 cables, for aerial installation)

CONSTRUCTION CHARACTERISTICS

Conductor
Solid annealed copper, nominal diameter of 0,40; 0,51; 0,64 and 0,91 mm.

Insulation
Solid polyethylene.

Arrangement (formation)
Pairs.

Core assembly
Units of 12, 13, 25, 50 and 100 pairs.

Core wrapping
Dielectric tape, helically applied with an overlap.

Shield (screen)
Aluminium tape with copolymer on both sides, applied longitudinally with an overlap.

Inner sheath (jacket)
Armoured cables shall have a black, low density polyethylene (PE).
or fire proof material (halogen free) sheath.

Armour
Armoured cables shall have a corrugated steel tape applied longitudinally with an overlap.

Oversheath (jacket)
Low density polyethylene (PE) or LSHF – Low Smoke Halogen Free thermoplastic compound, fire retardant.

Steel strength member (fig.8 cables)
Cables for aerial installation shall have a galvanized steel wires strand.

COLOUR AND CABLE MARKING

Black.
Sheath (jacket) will be marked, at regular intervals, with the following information:
<Manufacturer's name> <type of cable> <year> <metric marking>

COLOUR CODE

N.º Pair	Conductor "a"	Conductor "b"	N.º Pair	Conductor "a"	Conductor "b"
1	White	Blue	14	Black	Brown
2	White	Orange	15	Black	Grey
3	White	Green	16	Yellow	Blue
4	White	Brown	17	Yellow	Orange
5	White	Grey	18	Yellow	Green
6	Red	Blue	19	Yellow	Brown
7	Red	Orange	20	Yellow	Grey
8	Red	Green	21	Violet	Blue
9	Red	Brown	22	Violet	Orange
10	Red	Grey	23	Violet	Green
11	Black	Blue	24	Violet	Brown
12	Black	Orange	25	Violet	Grey
13	Black	Green	26	White	Black

GENERAL AND ELECTRICAL CHARACTERISTICS (20°C)

Flame retardant	IEC 60332-1-2 • EN 60332-1-2 (cable vertically mounted, length of charred cable ≤ 540 mm)
Fire retardant	IEC 60332-3-24 • EN 60332-3-24 (bunch of cables vertically mounted on a ladder, length of charred cables ≤ 2,5 m)
Halogen free	
Low smoke	IEC 61034-2 • EN 61034-2 (cable light transmittance ≥ 60%)
Low toxicity	IEC 60754-1 • EN 50267-2-1 (halogen acid gas content ≤ 0,5%)
Low corrosivity	IEC 60754-2 • EN 50267-2-3 (LSFH sheath: pH ≥4,3 • conductivity ≤ 10µS/mm)

		Ø 0,40 mm	Ø 0,51 mm	Ø 0,64 mm	Ø 0,91 mm
Maximum Ohmic resistance at 20°C dc(Ω/km)		144,2	89,5	56,6	28,5
Dielectric strength (Vdc, 3s)	Cond-Cond	2 500	3 000	3 600	4 500
	Cond-Screen	5 000	5 000	10 000	10 000
Far-end crosstalk (ELFEXT) (dB/km, 1MHz)	Min	57	57	57	57
	Average Min	35	35	37	37
Nominal attenuation (dB/km)	0,8 kHz	1,64	1,30	1,04	0,74
	3 kHz	3,18	2,52	2,01	1,42
	150 kHz	11,40	8,30	6,20	4,40
	1 MHz	27,10	21,40	17,50	12,80
Near-end crosstalk (NEXT) (dB, 500 m, 1MHz)		N.º pairs ≤ 51		N.º pairs > 51	
	(Average-σ)	>50		>55	
	Minimum	40		45	
Resistance unbalance		Average: max. value: 1,5% Maximum individual value: 5%			

Minimum insulation resistance at 15°C, 500Vdc	20 000 MΩ x km			
Mutual capacitance at 1 kHz	Average value: 52 ± 3 nF/Km Maximum value: 58 nF/Km			
Capacitance unbalance (pF/km, 800Hz)		Rms. max	Average max.	Max. value
	Pair-pair (<12p)	—	—	145
	Pair-pair (>12p)	45	—	—
	Pair-ground (<12p)	—	—	2 625
	Pair-ground (>12p)	—	574	2 625

DIMENSIONAL CHARACTERISTICS

Outdoor cable • Pairs • PE insulation • Al screen • PE • Dry core – TE1HE

N.º of Pairs	Ø 0,40 mm		Ø 0,51 mm		Ø 0,64 mm		Ø 0,91 mm	
	Diameter (mm)	Weight (kg/km)	Diameter (kg/km)	Weight (mm)	Diameter (kg/km)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)
6	7,8	60	8,6	80	9,8	100	11,9	160
11	8,9	90	10,0	110	11,5	150	14,3	250
16	9,7	100	11,0	140	12,8	200	16,1	330
21	10,5	130	12,0	170	14,0	240	17,8	410
26	11,2	140	12,9	200	15,1	290	19,3	490
31	11,8	160	13,7	230	16,1	330	20,9	580
51	13,9	230	16,7	350	19,8	510	25,6	900
76	16,4	330	19,8	490	23,7	740	31,3	1 330
101	18,2	420	22,2	630	26,6	950	35,4	1 740
152	21,7	600	26,1	900	31,6	1 370	42,3	2 540
202	24,4	770	30,1	1 160	36,6	1 790	49,4	3 350
303	28,8	1 100	35,8	1 690	43,7	2 600	59,5	4 930
404	32,6	1 430	40,6	2 200	50,1	3 430	68,0	6 500
606	39,0	2 090	49,0	3 240	60,4	5 070	82,0	9 600
909	47,2	3 100	59,0	4 790	73,0	7 540		
1 212	53,7	4 060	67,5	6 310	83,2	9 900		
1 515	59,2	5 000	74,8	7 810				
1 818	64,6	5 980	81,2	9 290				
2 121	69,2	6 910						
2 222	70,7	7 220						
2 424	73,9	7 890						

Indoor cable • Pairs • PE insulation • Al screen • LSHF sheath • Dry core – TE1HZ1

N.º of Pairs	Ø 0,40 mm		Ø 0,51 mm		Ø 0,64 mm		Ø 0,91 mm	
	Diameter (mm)	Weight (kg/km)	Diameter (kg/km)	Weight (mm)	Diameter (kg/km)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)
6	7,8	80	8,6	100	9,8	130	11,9	190
11	8,9	110	10,0	140	11,5	180	14,3	280
16	9,7	130	11,0	170	12,8	230	16,1	370
21	10,5	150	12,0	200	14,0	270	17,8	460
26	11,2	170	12,9	230	15,1	320	19,3	540
31	11,8	190	13,7	260	16,1	370	20,9	640
51	13,9	270	16,7	390	19,8	570	25,6	970
76	16,4	370	19,8	550	23,7	820	31,3	1 450
101	18,2	470	22,2	700	26,6	1 040	35,4	1 880
152	21,7	670	26,1	990	31,6	1 490	42,3	2 710
202	24,4	860	30,1	1 270	36,6	1 930	49,4	3 570
303	28,8	1 200	35,8	1 820	43,7	2 780	59,5	5 210
404	32,6	1 550	40,6	2 360	50,1	3 660	68,0	6 850
606	39,0	2 240	49,0	3 460	60,4	5 360	82,0	10 050
909	47,2	3 310	59,0	5 080	73,0	7 940		
1 212	53,7	4 310	67,5	6 670	83,2	10 350		
1 515	59,2	5 280	74,8	8 220				
1 818	64,6	6 300	81,2	9 730				
2 121	69,2	7 260						
2 222	70,7	7 580						
2 424	73,9	8 290						

Outdoor cable • Pairs • PE insulation • Al screen • PE • Corrugated armour • PE – TE1HE2AE

N.º of Pairs	Ø 0,40 mm		Ø 0,51 mm		Ø 0,64 mm		Ø 0,91 mm	
	Diameter (mm)	Weight (kg/km)	Diameter (kg/km)	Weight (mm)	Diameter (kg/km)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)
6	12,4	160	12,4	180	14,4	210	16,4	290
11	13,4	190	14,4	220	15,4	270	18,5	390
16	14,4	210	15,4	260	17,5	330	21,0	490
21	14,4	240	16,4	300	18,5	380	22,8	600
26	15,4	260	17,5	330	19,5	440	24,2	690
31	16,4	290	17,5	360	21,2	490	26,0	800
51	18,5	380	21,0	500	24,2	700	30,6	1 160
76	21,0	490	24,2	680	28,9	970	36,9	1 650
101	22,6	600	27,3	850	32,1	1 220	42,2	2 120
152	25,8	810	30,6	1 160	36,9	1 690	49,2	3 010
202	28,9	1 010	35,1	1 460	42,2	2 170	55,7	3 900
303	33,6	1 390	42,0	2 050	49,2	3 070	66,9	5 640
404	37,6	1 770	46,2	2 630	57,2	4 000	76,3	7 330
606	46,0	2 510	55,7	3 790	68,5	5 800	90,2	10 620
909	54,0	3 620	66,7	5 490	80,9	8 430		
1 212	60,5	4 670	74,8	7 130	91,8	10 930		
1 515	66,9	5 740	82,4	8 720				
1 818	71,7	6 760	88,7	10 280				
2 121	77,8	7 790						
2 222	77,8	8 100						
2 424	82,4	8 790						

Outdoor cable • Pairs • PE insulation • Al screen • PE • Aerial installation – TE1HES

N.º of Pairs	Ø 0,40 mm		Ø 0,51 mm		Ø 0,64 mm		Ø 0,91 mm	
	Diameter (mm)	Weight (kg/km)	Diameter (kg/km)	Weight (mm)	Diameter (kg/km)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)
6	7,6	210	8,4	230	9,6	250	11,7	310
11	8,7	230	9,8	260	11,3	300	14,1	390
16	9,5	250	10,8	290	12,6	340	15,9	470
21	10,3	270	11,8	320	13,8	390	17,6	650
26	11,0	290	12,7	340	14,9	430	19,1	730
31	11,6	310	13,5	370	15,9	470	21,1	830
51	13,7	380	16,1	480	19,2	640	25,8	1 150
76	15,8	460	18,8	610	23,1	960	30,5	1 540
101	17,6	550	21,6	860	26,0	1 170	34,4	1 930
152	21,3	830	25,5	1 120	30,8	1 580		
202	23,8	1 000	29,3	1 380				
303	28,2	1 320						

Steel messenger type	Minimum breaking load (daN)	Nº of Pairs			
		Ø 0,40 mm	Ø 0,51 mm	Ø 0,64 mm	Ø 0,91 mm
7x1,6 mm	1 570	≤ 101	≤ 76	≤ 51	≤ 16
7x2,1 mm	2 600	> 101	> 76	> 51	> 16

APPLICATION

Cables ranging from 10 to 2400 pairs, for distribution to subscribers or connecting multiline telephone systems. Suitable for underground or duct installation.

CABLE DESIGNATION

T1EG1HE
T1EG1HEAE (armoured cable)

CONSTRUCTION CHARACTERISTICS

Conductor

Solid annealed copper, nominal diameter of 0,4; 0,5; 0,6 and 0,9 mm.

Insulation

Cellular (foam-skin) polyethylene.

Arrangement (formation)

Pairs.

Core assembly

Units of 10, 50 and 100 pairs.

Filling compound

Waterblocking compound, compatible with all the remaining cable components.

Core wrapping

Dielectric tape, helically applied with an overlap.

Shield (screen)

Aluminium tape with copolymer on one side, applied longitudinally with an overlap.

Inner sheath (jacket)

Armoured cables shall have a black, low density polyethylene (PE) sheath.

Armour

Armoured cables shall have a double steel tape armour, helically applied.

Oversheath (jacket)

Black, low density polyethylene (PE).

COLOUR AND CABLE MARKING

Black.
Sheath (jacket) will be marked, at regular intervals, with the following information:
<Manufacturer's name> <type of cable> <year> <metric marking>

COLOUR CODE

N.º Pair	Conductor "a"	Conductor "b"	N.º Pair	Conductor "a"	Conductor "b"
1	White	Blue	6	Red	Blue
2	White	Orange	7	Red	Orange
3	White	Green	8	Red	Green
4	White	Brown	9	Red	Brown
5	White	Grey	10	Red	Grey

GENERAL AND ELECTRICAL CHARACTERISTICS (20°C)

		Ø 0,4 mm	Ø 0,5 mm	Ø 0,6 mm	Ø 0,9 mm
Maximum Ohmic resistance at 20°C dc(Ω/km)	Maximum	150	95,9	66,6	29,0
	Average Max	144	92,1	63,9	27,8
Dielectric strength (Vdc, 3s)	Cond-Cond	1 000 / 500			
	Cond-Screen	2 000 / 1 000			
Resistance unbalance maximum (%)		2,5			
Minimum insulation resistance at 15°C, 500Vdc		10 000 MΩ x km			
Mutual capacitance at 1 kHz		(*) Average maximum: 55 nF/Km Maximum value: 64 nF/Km			
Capacitance unbalance max. (pF/km, 800Hz)		400			

(*) – only applied to cables with more than 20 pairs.

DIMENSIONAL CHARACTERISTICS

Outdoor cable • Pairs • PE foam-skin insulation • Al screen • PE • Jelly filled – T1EG1HE

N.º of Pairs	Ø 0,4 mm		Ø 0,5 mm		Ø 0,6 mm		Ø 0,9 mm	
	Diameter (mm)	Weight (kg/km)	Diameter (kg/km)	Weight (mm)	Diameter (kg/km)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)
10	9	80	10	100	11	140	14	240
20	10	120	11	160	14	220	17	420
30	12	160	13	220	16	300	21	600
50	14	250	16	340	19	450	25	950
100	18	450	21	600	25	850	35	1 800
150	22	650	25	900	31	1 300	42	2 750
200	25	850	28	1 200	35	1 750	48	3 600
300	29	1 250	36	1 750	44	2 600	60	5 350
400	34	1 650	40	2 300	50	3 400		
600	40	2 400	49	3 400	60	5 000		
800	46	3 150	56	4 500	68	6 600		
900	49	3 500	58	5 000	72	7 400		
1 000	51	3 900	61	5 600	75	8 200		
1 200	56	4 650	67	6 600				
1 600	64	6 100	76	8 800				
1 800	68	6 900	79	9 800				
2 000	71	7 600						
2 400	78	9 100						

APPLICATION

Cables ranging from 1 to 52 quads, for distribution to subscribers or connecting multiline telephone systems. Suitable for underground or duct installation.

CABLE DESIGNATION

TE1HE
TE1HEAV · TE1HEAE (armoured cable)

CONSTRUCTION CHARACTERISTICS

Conductor
Solid annealed copper, nominal diameter of 0,6 or 0,9 mm.

Insulation
Solid polyethylene.

Arrangement (formation)
Star-quads.

Core assembly
In layers.

Core wrapping
Dielectric tape, helically applied with an overlap.

Shield (screen)
Aluminium tape with copolymer on one side, applied longitudinally with an overlap.

Inner sheath (jacket)
Armoured cables shall have a black, low density polyethylene (PE) sheath.

Armour
Armoured cables shall have a double steel tape armour, helically applied.

Oversheath (jacket)
Black, low density polyethylene (PE) or PVC (in option for armoured cables).

COLOUR AND CABLE MARKING

Black.
Sheath (jacket) will be marked, at regular intervals, with the following information:
<Manufacturer's name> <type of cable> <year> <metric marking>

COLOUR CODE

	Insulation colour				
	Cond. "a"	Cond. "b"		Cond. "c"	Cond. "d"
Quad position in the centre or in the layer		Centre and even layers	Odd layers		
1st (pilot)	Yellow	White	Violet	Green	Grey
2nd, 4th, 6th, etc.	Blue	White	Violet	Green	Grey
3rd, 5th, 7th, etc	Red	White	Violet	Green	Grey
Last (reference)	Brown	White	Violet	Green	Grey

GENERAL AND ELECTRICAL CHARACTERISTICS (20°C)

		Ø 0,6 mm	Ø 0,9 mm
Maximum Ohmic resistance at 20°C dc(Ω/km)	Maximum	66,6	29,0
	Average Max	63,9	27,8
Dielectric strength (Vdc, 3s)	Cond-Cond (3s or 60s)	2 000 / 1 000	
	Cond-Screen (3s or 60s)	6 000 / 3 000	
Resistance unbalance maximum (%)		2,5	2,0
Mutual capacitance at 800Hz – average (nF/km)		42±5%	41±5%
Minimum insulation resistance at 15°C, 500Vdc		20 000 MΩ x km	

		Max. Average value	Max. value
Capacitance unbalance (pF/km, 800Hz)	Pair-pair:		
	Same quad	40	150
	Adjacent quads	40	170
	Pair-ground	150	600

DIMENSIONAL CHARACTERISTICS

Quads – PE insulation /Al screen /PE – TE1HE

N.º of Pairs	Ø 0,6 mm		Ø 0,9 mm	
	Diameter (kg/km)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)
1	8	60	9	90
3	11	110	14	180
7	14	180	17	330
12	16	270	22	530
14	17	310	24	610
19	20	410	28	830
27	23	550	32	1 130
30	25	640	33	1 230
37	27	750	36	1 470
48	30	930	40	1 850
52	31	1 000	42	1 980

CABLE TÉLÉREPORT ARMÉ AND NON-ARMÉ

Local Network • Smart grid

PVC insulation • Al screen • PVC sheath

APPLICATION

Cable with one quad, used for inside installations and used to transmit the readings for consumed and delivered energy to a remote unit.

CABLE DESIGNATION

Cable Téléreport armé
Cable Téléreport non-armé

CONSTRUCTION CHARACTERISTICS

Conductor

Solid annealed copper, nominal diameter of 0,6 mm.

Insulation

PVC.

Arrangement (formation)

Star-quads.

Core wrapping

Dielectric tape, helically applied with an overlap.

Metallic screen

One aluminium/ polyester (9µm /12,5µm) tape spirally applied, with an overlap. Under the metallic screen a tinned copper wire with nominal diameter of 0,5 mm, is longitudinally applied.

Inner sheath (jacket)

The armoured cables shall have a PVC inner sheath, colour: ivory.

Armour

The armoured cables shall have a double steel tape armour, helically applied.

Oversheath (jacket)

The cables shall have an oversheath of PVC.

COLOUR AND CABLE MARKING

Unarmoured cables: Ivory. Armoured cables: Black.
Sheath (jacket) will be marked, at regular intervals, with the following information:
<type of cable><Manufacturer's name> <Manufacturer order> <Reference standard>

COLOUR CODE

N.º Quad	Conductor "a"	Conductor "b"	Conductor "c"	Conductor "d"
1	White	Blue	Red	Dark Blue

GENERAL AND ELECTRICAL CHARACTERISTICS (20°C)

Ohmic resistance at 20°C dc (Ω/km)	Minimum	120
	Maximum	133,2
Mutual capacitance at 50kHz (nF/km)	Minimum	80
	Maximum	130
Impedance characteristic at 50kHz (Ohm)	Minimum	75
	Maximum	115
Minimum insulation resistance at 20°C, 500Vdc		100 MΩ x km
Dielectric strength (Vac) (60s)	Cond-Cond	1 500
	Cond-Screen	1 500

DIMENSIONAL CHARACTERISTICS

(1) – Quad - PVC insulation • Al screen • PVC sheath – Cable Téléreport non-armé
(2) – Quad - PVC insulation • Al screen • PVC sheath • Armour • PVC sheath – Cable Téléreport armé

N.º of Quad	NON-ARMOURED (1)		ARMOURED (2)	
	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)
1	5,3	40	10	140

RAILWAY SIGNALING CABLES

Pair Cables

- PE insulation · Al screen · Corrugated armour · Dry core
  TE1HE2AE • TE1HZ12AZ1 • TE1HE2AES
- PE insulation · Al screen · Corrugated armour · Jelly filled
  TEG1HE2AE

Quad Cables

- PE insulation · Al screen · Corrugated armour · Dry core
  TE1HE2AE • TE1HZ12AZ1 • TE1HE2AES
- PE insulation · Al screen · Corrugated armour · Jelly filled
  TEG1HE2AE

CABLES WITH REDUCTION FACTOR

Pair Cables

- PE insulation · Copper screen + armour · PVC
  ZPAU
- PE insulation · Copper or Al screen + armour · PE or LSHF
  TEOEAE · TEOZ1AZ1 · TE1REAE · TE1RZ1AZ1 · TE3HEAE · TE3HZ1AZ1
- PE insulation · Copper or Al screen + armour · PE · Jelly filled
  TEGOEAE • TEG1REAE

Quad Cables

- PE insulation · Copper or Al screen + armour · PE or LSHF
  TEOEAE · TEOZ1AZ1 · TE1REAE · TE1RZ1AZ1 · TE3HEAE · TE3HZ1AZ1
- PE insulation · Copper or Al screen + armour · PE · Jelly filled
  TEGOEAE • TEG1REAE

Photo by: António Chaves I www.antoniochaves.com

APPLICATION

Cables ranging from 3 to 150 pairs, used as control and signalling cables. The sheath offers special protection of the core against rodents. Indicated for installations, indoor or outdoor, protected or not. Can be installed directly buried and some types can be used for aerial self-supported installation.

CABLE DESIGNATION

PE isulation / Aluminium tape screen / PE / Steel corrugated tape armour /PE: **TE1HE2AE**
PE isulation / Aluminium tape screen / LSHF / Steel corrugated tape armour / LSHF: **TE1HZ12AZ1**
PE isulation / Aluminium tape screen / PE / Steel corrugated tape armour /PE /Steel mesenger: **TE1HE2AES**

CONSTRUCTION CHARACTERISTICS

Conductor
Solid annealed copper, nominal diameter of 0,64; 0,9 and 1,3 mm.

Insulation
Solid polyethylene.

Arrangement (formation)
Pairs.

Core assembly
Units of 12, 13, 25 pairs.

Core wrapping
Dielectric tape, helically applied with an overlap.

Shield (screen)
Aluminium tape with copolymer on both sides, applied longitudinally with an overlap.

Inner sheath (jacket)
Black, low density polyethylene (PE) or LSHF – Low Smoke Halogen Free thermoplastic compound.

Armour
Corrugated steel tape applied longitudinally with an overlap.

Oversheath (jacket)
Black, low density polyethylene (PE) or LSHF – Low Smoke Halogen Free thermoplastic compound, fire retardant.

Steel strength member (fig.8 cables)
Galvanized steel wires strand.

COLOUR AND CABLE MARKING

Black. Sheath (jacket) will be marked, at regular intervals, with the following information:
<Manufacturer's name> <type of cable> <year> <metric marking>

COLOUR CODE

N.º Pair	Conductor "a"	Conductor "b"	N.º Pair	Conductor "a"	Conductor "b"
1	White	Blue	14	Black	Brown
2	White	Orange	15	Black	Grey
3	White	Green	16	Yellow	Blue
4	White	Brown	17	Yellow	Orange
5	White	Grey	18	Yellow	Green
6	Red	Blue	19	Yellow	Brown
7	Red	Orange	20	Yellow	Grey
8	Red	Green	21	Violet	Blue
9	Red	Brown	22	Violet	Orange
10	Red	Grey	23	Violet	Green
11	Black	Blue	24	Violet	Brown
12	Black	Orange	25	Violet	Grey
13	Black	Green	26	White	Black

GENERAL AND ELECTRICAL CHARACTERISTICS (20°C)

		Ø 0,64 mm	Ø 0,9 mm	Ø 1,3 mm
Maximum Ohmic resistance at 20°C dc(Ω/km)		58,0	29,0	13,9
Nominal attenuation (dB/km)	0,8 kHz	1,04	0,74	0,52
	1,5 kHz	1,42	1,01	0,71
	3 kHz	2,01	1,42	1,01
	1 MHz	17,5	12,8	8,62
Resistance unbalance		Maximum/average value: 1% Maximum individual value: 2%		
Minimum insulation resistance at 15°C, 500Vdc		35 000 MΩ x km		
Dielectric strength (3s)		Cond-Cond – 3 kVdc or 2,1 kVac Cond-Screen – 3,5 kVdc or 2,5 kVac		
Mutual capacitance at 1 kHz		Average value: 52 ± 4 nF/Km Maximum value: 58 nF/Km		
Capacitance unbalance (pF/km, 1 kHz)		Max. Average value	Max. value	
	Pair-pair	45	260	
	Pair-ground	650	2625	

ADDITIONAL CHARACTERISTICS*

Flame retardant	IEC 60332-1-2 • EN 60332-1-2 (cable vertically mounted, length of charred cable ≤ 540 mm)
Fire retardant	IEC 60332-3-24 • EN 60332-3-24 (bunch of cables vertically mounted on a ladder, length of charred cables ≤ 2,5 m)
Halogen free	
Low smoke	IEC 61034-2 • EN 61034-2 (cable light transmittance ≥ 60%)
Low toxicity	IEC 60754-1 • EN 50267-2-1 (halogen acid gas content ≤ 0,5%)
Low corrosivity	IEC 60754-2 • EN 50267-2-3 (LSFH sheath: pH ≥4,3 • conductivity ≤ 10µS/mm)

* Applicable only for TE1HZ12AZ1 cable.

DIMENSIONAL CHARACTERISTICS

PE insulation • Al screen • PE • Corrugated Armour • PE – TE1HE2AE

N.º of pairs	Ø 0,64 mm		Ø 0,9 mm		Ø 1,3 mm	
	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)
3	13,0	180	15,0	220	17,0	310
4	14,0	200	16,0	260	18,0	360
7	15,0	230	17,0	320	21,5	490
10	16,0	270	19,0	390	23,5	620
15	17,0	330	20,0	480	26,5	820
20	18,0	380	23,0	600	29,5	1 020
25	19,0	430	24,5	700	31,0	1 200
50	24,5	700	31,0	1 160	42,5	2 150
75	28,0	940	35,5	1 600	51,0	3 060
100	31,0	1 170	41,0	2 040	57,5	3 950
150	35,5	1 620	48,0	2 890	68,0	5 710

RAILWAY SIGNALING CABLE

APPLICATION

Cables ranging from 3 to 150 pairs, used as control and signalling cables. The sheath offers special protection of the core against rodents. Recommended for duct or direct buried installations.

CABLE DESIGNATION

PE isulation / Jelly /Aluminium screen / PE / Steel armour /PE: **TEG1HE2AE**

CONSTRUCTION CHARACTERISTICS

Conductor

Solid annealed copper, nominal diameter of 0,64; 0,9 and 1,3 mm.

Insulation

Solid polyethylene.

Arrangement (formation)

Pairs.

Core assembly

Units of 12, 13, 25 pairs.

Filling compound

Waterblocking compound, compatible with all the remaining cable components.

Core wrapping

Dielectric tape, helically applied with an overlap.

Shield (screen)

Aluminium tape with copolymer on both sides, applied longitudinally with an overlap.

Inner sheath (jacket)

Black, low density polyethylene (PE).

Armour

Corrugated steel tape applied longitudinally with an overlap.

Oversheath (jacket)

Black, low density polyethylene (PE).

COLOUR AND CABLE MARKING

Black.
Sheath (jacket) will be marked, at regular intervals, with the following information:
<Manufacturer's name> <type of cable> <year> <metric marking>

COLOUR CODE

N.º Pair	Conductor "a"	Conductor "b"	N.º Pair	Conductor "a"	Conductor "b"
1	White	Blue	8	Red	Green
2	White	Orange	9	Red	Brown
3	White	Green	10	Red	Grey
4	White	Brown	11	Black	Blue
5	White	Grey	12	Black	Orange
6	Red	Blue	13	Black	Green
7	Red	Orange	14	Black	Brown

N.º Par	Conductor "a"	Conductor "b"	N.º Par	Conductor "a"	Conductor "b"
15	Black	Grey	21	Violet	Blue
16	Yellow	Blue	22	Violet	Orange
17	Yellow	Orange	23	Violet	Green
18	Yellow	Green	24	Violet	Brown
19	Yellow	Brown	25	Violet	Grey
20	Yellow	Grey	26	White	Black

GENERAL AND ELECTRICAL CHARACTERISTICS (20°C)

		Ø 0,64 mm	Ø 0,9 mm	Ø 1,3 mm
Maximum Ohmic resistance at 20°C dc(Ω/km)		58,0	29,0	13,9
Nominal attenuation (dB/km)	0,8 kHz	1,04	0,74	0,52
	1,5 kHz	1,42	1,01	0,71
	3 kHz	2,01	1,42	1,01
	1 MHz	17,5	12,8	8,62
Resistance unbalance		Maximum/average value: 1% Maximum individual value: 2%		
Minimum insulation resistance at 15°C, 500Vdc		25 000 MΩ x km		
Dielectric strength (3s)		Cond-Cond – 3 kVdc or 2,1 kVac Cond-Screen – 3,5 kVdc or 2,5 kVac		
Mutual capacitance at 1 kHz		Average value: 52 ± 4 nF/Km Maximum value: 58 nF/Km		
Capacitance unbalance (pF/km, 1 kHz)		Max. Average value	Max. value	
	Pair-pair	45	260	
	Pair-ground	650	2625	

DIMENSIONAL CHARACTERISTICS

PE insulation • Al screen • PE • Corrugated Armour • PE • Jelly filled – TEG1HE2AE

N.º of pairs	Ø 0,64 mm		Ø 0,9 mm		Ø 1,3 mm	
	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)
3	14,0	200	15,0	250	19,0	390
4	15,0	230	16,0	290	20,0	450
7	16,0	280	18,0	380	23,5	620
10	18,0	340	20,0	470	26,5	800
15	19,0	400	22,0	580	29,5	1 060
20	20,0	470	25,0	730	32,5	1 330
25	21,5	550	27,0	870	36,0	1 610
50	28,0	910	35,0	1 490	50,0	3 000
75	32,5	1 250	42,0	2 110	59,5	4 290
100	35,5	1 560	47,5	2 690	67,0	5 550
150	43,0	2 210	55,5	3 830	79,5	8 010

APPLICATION

Cables ranging from 1 to 28 star quads used as control and signalling cables. Sheaths used are designed to offer special protection against rodents. Indicated for installations, indoor or outdoor, protected or not. Can be installed directly buried and some types can be used for aerial self-supported installation.

CABLE DESIGNATION

PE isulation / Aluminium tape screen / PE / Steel corrugated tape armour /PE: **TE1HE2AE**
PE isulation / Aluminium tape screen / LSHF / Steel corrugated tape armour / LSHF: **TE1HZ12AZ1**
PE isulation / Aluminium tape screen / PE / Steel corrugated tape armour /PE /Steel mesenger: **TE1HE2AES**

CONSTRUCTION CHARACTERISTICS

Conductor
Solid annealed copper, nominal diameter of 0,9; 1,3 and 1,4 mm.

Insulation
Solid polyethylene.

Arrangement (formation)
Star-quads.

Core assembly
In layers.

Core wrapping
Dielectric tape, helically applied with an overlap.

Shield (screen)
Aluminium tape with copolymer on both sides, applied longitudinally with an overlap.

Inner sheath (jacket)
Black, low density polyethylene (PE) or LSHF – Low Smoke Halogen Free thermoplastic compound.

Armour
Corrugated steel tape applied longitudinally with an overlap.

Oversheath (jacket)
Black, low density polyethylene (PE) or LSHF – Low Smoke Halogen Free thermoplastic compound, fire retardant.

Steel strength member (fig.8 cables)
Galvanized steel wires strand.

COLOUR AND CABLE MARKING

Black.
Sheath (jacket) will be marked, at regular intervals, with the following information:
<Manufacturer's name> <type of cable> <year> <metric marking>

COLOUR CODE

	Insulation colour				
	Cond. "a"	Cond. "b"	Cond. "c"	Cond. "d"	
Quad position in the centre or in the layer				Centre and even layers	Odd layers
1st (pilot)	Orange	Green	Red	White	Black
2nd, 4th, 6th, etc.	Yellow	Green	Blue	White	Black
3rd, 5th, 7th, etc	Yellow	Green	Red	White	Black
Last (reference)	Orange	Green	Blue	White	Black

GENERAL AND ELECTRICAL CHARACTERISTICS (20°C)

		Ø 0,9 mm	Ø 1,3 mm	Ø 1,4 mm
Maximum Ohmic resistance at 20°C dc(Ω/km)		29,0	13,9	11,9
Mutual capacitance at 1 kHz (nF/km)	Average value	38 ± 3	41 ± 4	41 ± 4
	Maximum value	45	48	50
Resistance unbalance		Maximum individual value: 2,5%		
Minimum insulation resistance at 15°C, 500Vdc		35 000 MΩ x km		
Dielectric strength (3s)		Cond-Cond – 3 kVdc or 2,1 kVac Cond-Screen – 3,5 kVdc or 2,5 kVac		

Capacitance unbalance (pF/460m, 1 kHz)	Max. Average value(1)	Max. value
Pair-pair:		
Same quad	35	250
Adjacent quads	35	250
Non adjacent quads	—	250
Pair-ground	320	1200

(1) Average limits only apply for cables with more than seven quads.

ADDITIONAL CHARACTERISTICS*

Flame retardant	IEC 60332-1-2 • EN 60332-1-2 (cable vertically mounted, length of charred cable ≤ 540 mm)
Fire retardant	IEC 60332-3-24 • EN 60332-3-24 (bunch of cables vertically mounted on a ladder, length of charred cables ≤ 2,5 m)
Halogen free	
Low smoke	IEC 61034-2 • EN 61034-2 (cable light transmittance ≥ 60%)
Low toxicity	IEC 60754-1 • EN 50267-2-1 (halogen acid gas content ≤ 0,5%)
Low corrosivity	IEC 60754-2 • EN 50267-2-3 (LSFH sheath: pH ≥4,3 • conductivity ≤ 10µS/mm)

* Applicable only for TE1HZ12AZ1 cable.

DIMENSIONAL CHARACTERISTICS

PE insulation • Al screen • PE • Corrugated Armour • PE – TE1HE2AE

N.º of pairs	Ø 0,9 mm		Ø 1,3 mm		Ø 1,4 mm	
	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)
1	12,4	180	14,4	240	15,4	280
3	17,5	320	19,5	440	24,0	560
5	19,5	420	22,6	610	27,1	770
7	21,2	500	24,4	770	30,6	990
10	24,4	660	29,1	1 020	35,1	1 310
12	26,0	740	30,6	1 170	36,7	1 490
14	27,5	830	32,3	1 320	40,4	1 710
19	30,8	1 040	37,0	1 700	45,9	2 220
25	34,0	1 290	42,3	2 170	50,6	2 810
28	37,2	1 510	—	—	—	—

PE insulation • Al screen • LSHF • Corrugated Armour • LSHF – TE1HZ12AZ1

N.º of pairs	Ø 0,9 mm		Ø 1,3 mm		Ø 1,4 mm	
	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)
1	12,4	220	14,4	290	15,4	330
3	17,5	380	19,5	510	24,0	650
5	19,5	490	22,6	700	27,1	880
7	21,2	590	24,4	870	30,6	1 120
10	24,4	760	29,1	1 150	35,1	1 460
12	26,0	850	30,6	1 300	36,7	1 660
14	27,5	940	32,3	1 460	40,4	1 890
19	30,8	1 180	37,0	1 870	45,9	2 440
25	34,0	1 450	42,3	2 370	50,6	3 070
28	37,2	1 690	—	—	—	—

APPLICATION

Cables ranging from 1 to 28 star quads used as control and signalling cables. The sheath offers special protection of the core against rodents. Recommended for duct or direct buried installations.

CABLE DESIGNATION

PE isulation / Jelly /Aluminium screen / PE / Steel armour /PE: **TEG1HE2AE**

CONSTRUCTION CHARACTERISTICS

Conductor

Solid annealed copper, nominal diameter of 0,9 mm.

Insulation

Solid polyethylene.

Arrangement (formation)

Star-quads.

Core assembly

In layers.

Filling compound

Waterblocking compound, compatible with all the remaining cable components.

Core wrapping

Dielectric tape, helically applied with an overlap.

Shield (screen)

Aluminium tape with copolymer on both sides, applied longitudinally with an overlap.

Inner sheath (jacket)

Black, low density polyethylene (PE).

Armour

Corrugated steel tape applied longitudinally with an overlap.

Oversheath (jacket)

Black, low density polyethylene (PE).

COLOUR AND CABLE MARKING

Black.
Sheath (jacket) will be marked, at regular intervals, with the following information:
<Manufacturer's name> <type of cable> <year> <metric marking>

COLOUR CODE

	Insulation colour				
	Cond. "a"	Cond. "b"	Cond. "c"	Cond. "d"	
Quad position in the centre or in the layer				Centre and even layers	Odd layers
1st (pilot)	Orange	Green	Red	White	Black
2nd, 4th, 6th, etc.	Yellow	Green	Blue	White	Black
3rd, 5th, 7th, etc	Yellow	Green	Red	White	Black
Last (reference)	Orange	Green	Blue	White	Black

GENERAL AND ELECTRICAL CHARACTERISTICS (20°C)

Maximum Ohmic resistance at 20°C dc(Ω/km)	29,0
Mutual capacitance at 1 kHz	Average value: 38 ± 3 nF/Km Maximum value: 45 nF/Km
Resistance unbalance	Maximum individual value: 2,5%
Minimum insulation resistance at 15°C, 500Vdc	25 000 MΩ x km
Dielectric strength (3s)	Cond-Cond – 3 kVdc or 2,1 kVac Cond-Screen – 3,5 kVdc or 2,5 kVac

Capacitance unbalance (pF/460m, 1 kHz)

	Max. Average value(1)	Max. value
Pair-pair:		
Same quad	35	250
Adjacent quads	35	250
Non adjacent quads	—	250
Pair-ground	320	1 200

(1) Average limits only apply for cables with more than seven quads.

DIMENSIONAL CHARACTERISTICS

PE insulation • Al screen • PE • Corrugated Armour • PE – TEG1HE2AE

N.º of pairs	Ø 0,9 mm	
	Diameter (mm)	Weight (kg/km)
1	13,8	220
3	18,9	400
5	23,0	560
7	24,6	670
10	27,9	890
12	29,5	1 000
14	31,0	1 110
19	35,7	1 430
25	39,5	1 780
28	43,8	2 080

RAILWAY SIGNALING CABLE

APPLICATION

Cables ranging from 4 to 28 pairs, used as control and signalling cables. Installation is recommended in trenches. The sheath is specially designed to protect the core against inductive interferences.

CABLE DESIGNATION

PE insulation / PVC / Copper screen /armour / PVC: **ZPAU**

CONSTRUCTION CHARACTERISTICS

Conductor

Solid annealed copper, nominal cross section of 1,0 mm^2 or 1,5 mm^2.

Insulation

Solid polyethylene.

Arrangement (formation)

Pairs.

Core assembly

Concentric layers.

Core wrapping

Dielectric tape, helically applied with an overlap.

Inner sheath (jacket)

Black, low density polyethylene (PE).

Induction screen (protection)

One corrugated copper tape, applied longitudinally with an overlap.

Bedding layer (armour bedding)

Polyethylene tapes helically applied with an overlap.

Electromagnetic shield (protection)

Double layer of steel tapes helically applied with a gap not exceeding 50% the tapes' width.
The outer tape will cover the gap left by the inner tape.

Oversheath (jacket)

Black PVC.

COLOUR AND CABLE MARKING

Black. Sheath (jacket) will be marked, at regular intervals, with the following information:
<Manufacturer's name> <type of cable> <year> <metric marking>

COLOUR CODE

For all pairs, conductor A is colorless and conductor B follows the following sequence in each layer until completing the number of pairs of the layer.

Pilot pair	Remaining pairs (The sequence is repeated until completing the number of pairs of the layer)			
Black	Blue	Yellow	Red	Green

In the particular case of the 2 pair cable, stranding is in star quad:
Pair 1: Colorless and black. **Pair 2:** Yellow and blue.

GENERAL AND ELECTRICAL CHARACTERISTICS (20°C)

Reference standard		NF F 55 698
Maximum Ohmic resistance at 20°C dc(Ω/km)	1,0 mm²	18,46
	1,5 mm²	12,31
Resistance unbalance		Maximum value: 2,5%
Minimum insulation resistance at 15°C, 500Vdc		5 000 MΩ x km
Dielectric strength (Vdc, 3s)		Cond-Cond: 4 kV Cond-Screen: 4,5 kV
Mutual capacitance at 1 kHz		Maximum value: 55 nF/Km
Capacitance unbalance, pair-pair (pF/500 m, 1000 Hz)		Maximum value for 90% of measured values: 200 Maximum value: 400

Reduction factor, Rk (50Hz)

Inductive voltage (V/km)	Max. Rk
28	0,75
32	0,70
37	0,60
42	0,50
47	0,40
54	0,35
70	0,30
80	0,28
100	0,26
120	0,25
170	0,24
225	0,25

DIMENSIONAL CHARACTERISTICS

N.º of pairs	1 mm²		1,5 mm²	
	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)
4	21	720	22	650
7	24	920	27	1 150
14	30	1 370	33	1 700
21	34	1 720	37	2 050
28	38	2 000	43	2 360

APPLICATION

Cables ranging from 3 to 24 pairs, used as control and signalling cables. The sheath is specially designed to protect the core against inductive interferences. Indicated for installations, indoor or outdoor, protected or not. Can be installed directly buried.

CABLE DESIGNATION

PE isulation / Copper wire screen / PE / Steel tape armour / PE: **TEOEAE**
PE isulation / Aluminium wire screen / PE / Steel tape armour / PE: **TE1REAE**
PE isulation / Copper corrugated tape screen / PE / Steel tape armour / PE: **TE3HEAE**
PE isulation / Copper wire screen / LSHF/ Steel tape armour / LSHF: **TEOZ1AZ1**
PE isulation / Aluminium wire screen / LSHF / Steel tape armour / LSHF: **TE1RZ1AZ1**
PE isulation / Copper corrugated tape screen / LSHF / Steel tape armour / LSHF: **TE3HZ1AZ1**

CONSTRUCTION CHARACTERISTICS

Conductor

Solid annealed copper, nominal diameter of 0,9 mm.

Insulation

Solid polyethylene.

Arrangement (formation)

Pairs.

Core assembly

Concentric layers.

Core wrapping

Dielectric tape, helically applied with an overlap.

Induction screen (protection)

Copper wires helically applied, aluminium wires helically applied or corrugated copper longitudinally applied, depending on the reduction factor requirement.

Inner sheath (jacket)

Black, low density polyethylene (PE) or LSHF – Low Smoke Halogen Free thermoplastic compound.

Electromagnetic shield (protection)

Double layer of steel tapes helically applied.

Oversheath (jacket)

Black, low density polyethylene (PE) or LSHF – Low Smoke Halogen Free thermoplastic compound, fire retardant.

COLOUR AND CABLE MARKING

Black.
Sheath (jacket) will be marked, at regular intervals, with the following information:
<Manufacturer's name> <type of cable> <year> <metric marking>

COLOUR CODE

N.º Pair	Conductor "a"	Conductor "b"	N.º Pair	Conductor "a"	Conductor "b"
1	White	Blue	14	Black	Brown
2	White	Orange	15	Black	Grey
3	White	Green	16	Yellow	Blue
4	White	Brown	17	Yellow	Orange
5	White	Grey	18	Yellow	Green
6	Red	Blue	19	Yellow	Brown
7	Red	Orange	20	Yellow	Grey
8	Red	Green	21	Violet	Blue
9	Red	Brown	22	Violet	Orange
10	Red	Grey	23	Violet	Green
11	Black	Blue	24	Violet	Brown
12	Black	Orange	25	Violet	Grey
13	Black	Green	26	White	Black

GENERAL AND ELECTRICAL CHARACTERISTICS (20°C)

Maximum Ohmic resistance at 20°C dc(Ω/km)	29,0		
Resistance unbalance	Maximum/average value: 1% Maximum individual value: 2%		
Minimum insulation resistance at 15°C, 500Vdc	35 000 MΩ x km		
Dielectric strength (3s)	Cond-Cond – 3 kVdc or 2,1 kVac Cond-Screen – 3,5 kVdc or 2,5 kVac		
Mutual capacitance at 1 kHz	Average value: 52 ± 4 nF/Km Maximum value: 58 nF/Km		
Capacitance unbalance (pF/km, 1 kHz)		Max. Average value	Max. value
	Pair-pair	45	260
	Pair-ground	650	2625
Reduction factor, Rk – FR=0,1 (50Hz)		Inductive voltage (V/km)	Max. Rk
	FR=0,1	200-500	0,1
	FR=0,3	110-320	0,3

ADDITIONAL CHARACTERISTICS*

Flame retardant	IEC 60332-1-2 • EN 60332-1-2 (cable vertically mounted, length of charred cable ≤ 540 mm)
Fire retardant	IEC 60332-3-24 • EN 60332-3-24 (bunch of cables vertically mounted on a ladder, length of charred cables ≤ 2,5 m)
Halogen free	
Low smoke	IEC 61034-2 • EN 61034-2 (cable light transmittance ≥ 60%)
Low toxicity	IEC 60754-1 • EN 50267-2-1 (halogen acid gas content ≤ 0,5%)
Low corrosivity	IEC 60754-2 • EN 50267-2-3 (LSFH sheath: pH ≥4,3 • conductivity ≤ 10µS/mm)

* Applicable only for TEOZ1AZ1, TE1RZ1AZ1, TE3HZ1AZ1 cables.

DIMENSIONAL CHARACTERISTICS

Cables with reduction factor • Pairs • PE insulation • Copper wire screen + armour • PE – TEOEAE

N.º of pairs	Ø 0,9 mm (FR=0,1)		Ø 0,9 mm (FR=0,3)	
	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)
3	18,5	780	17,0	480
4	19,5	840	17,5	530
7	21,0	970	19,0	630
10	22,5	1 100	21,0	730
14	24,0	1 240	22,0	830
20	26,5	1 480	24,5	990
24	28,0	1 600	25,5	1 100

APPLICATION

Cables ranging from 3 to 24 pairs, used as control and signalling cables. The sheath is specially designed to protect the core against inductive interferences. Indicated for installations, indoor or outdoor, protected or not. Can be installed directly buried.

CABLE DESIGNATION

PE isulation / Jelly / Copper wire screen / PE / Steel tape armour /PE: **TEGOEAE**
PE isulation /Jelly / Aluminium wire screen / PE / Steel tape armour / PE: **TEG1REAE**

CONSTRUCTION CHARACTERISTICS

Conductor
Solid annealed copper, nominal diameter of 0,9 mm.

Insulation
Solid polyethylene.

Arrangement (formation)
Pairs.

Core assembly
Concentric layers.

Filling compound
Waterblocking compound, compatible with all the remaining cable components.

Core wrapping
Dielectric tape, helically applied with an overlap.

Induction screen (protection)
Copper wires helically applied or aluminium wires helically applied, depending on the reduction factor requirement.

Inner sheath (jacket)
Black, low density polyethylene (PE).

Electromagnetic shield (protection)
Double layer of steel tapes helically applied.

Oversheath (jacket)
Black, low density polyethylene (PE).

COLOUR AND CABLE MARKING

Black.
Sheath (jacket) will be marked, at regular intervals, with the following information:
<Manufacturer's name> <type of cable> <year> <metric marking>

COLOUR CODE

N.º Pair	Conductor "a"	Conductor "b"	N.º Pair	Conductor "a"	Conductor "b"
1	White	Blue	5	White	Grey
2	White	Orange	6	Red	Blue
3	White	Green	7	Red	Orange
4	White	Brown	8	Red	Green

N.º Pair	Conductor "a"	Conductor "b"	N.º Pair	Conductor "a"	Conductor "b"
9	Red	Brown	18	Yellow	Green
10	Red	Grey	19	Yellow	Brown
11	Black	Blue	20	Yellow	Grey
12	Black	Orange	21	Violet	Blue
13	Black	Green	22	Violet	Orange
14	Black	Brown	23	Violet	Green
15	Black	Grey	24	Violet	Brown
16	Yellow	Blue	25	Violet	Grey
17	Yellow	Orange	26	White	Black

GENERAL AND ELECTRICAL CHARACTERISTICS (20°C)

Maximum Ohmic resistance at 20°C dc(Ω/km)	29,0		
Resistance unbalance	Maximum/average value: 1% Maximum individual value: 2%		
Minimum insulation resistance at 15°C, 500Vdc	25 000 MΩ x km		
Dielectric strength (3s)	Cond-Cond – 3 kVdc or 2,1 kVac Cond-Screen – 3,5 kVdc or 2,5 kVac		
Mutual capacitance at 1 kHz	Average value: 52 ± 4 nF/Km Maximum value: 58 nF/Km		
Capacitance unbalance (pF/km, 1 kHz)		Max. Average value	Max. value
	Pair-pair	45	260
	Pair-ground	650	2625
Reduction factor, Rk – FR=0,1 (50Hz)		Inductive voltage (V/km)	Max. Rk
	FR=0,1	200-500	0,1
	FR=0,3	110-320	0,3

DIMENSIONAL CHARACTERISTICS

Cables with reduction factor • Pairs • PE insulation • Copper wire screen + armour • PE – TEGOEAE

N.º of pairs	Ø 0,9 mm (FR=0,1)		Ø 0,9 mm (FR=0,3)	
	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)
3	19,5	850	18,0	560
4	20,5	920	19,0	610
7	22,5	1 080	21,0	730
10	24,0	1 240	23,0	860
14	27,0	1 470	24,5	970
20	29,5	1 760	27,5	1 200
24	31,0	1 890	29,0	1 330

APPLICATION

Cables ranging from 3 to 48 star quads, used as control and signalling cables. The sheath is specially designed to protect the core against inductive interferences. Indicated for installations, indoor or outdoor, protected or not. Can be installed directly buried.

CABLE DESIGNATION

PE isulation / Copper wire screen / PE / Steel tape armour / PE: **TEOEAE**
PE isulation / Aluminium wire screen / PE / Steel tape armour / PE: **TE1REAE**
PE isulation / Copper corrugated tape screen / PE / Steel tape armour / PE: **TE3HEAE**
PE isulation / Copper wire screen / LSHF/ Steel tape armour / LSHF: **TEOZ1AZ1**
PE isulation / Aluminium wire screen / LSHF / Steel tape armour / LSHF: **TE1RZ1AZ1**
PE isulation / Copper corrugated tape screen / LSHF / Steel tape armour / LSHF: **TE3HZ1AZ1**

CONSTRUCTION CHARACTERISTICS

Conductor
Solid annealed copper, nominal diameter of 0,9 mm.

Insulation
Solid polyethylene.

Arrangement (formation)
Star-quads.

Core assembly
Concentric layers.

Core wrapping
Dielectric tape, helically applied with an overlap.

Induction screen (protection)
Copper wires helically applied, aluminium wires helically applied or corrugated copper longitudinally applied, depending on the reduction factor requirement.

Inner sheath (jacket)
Black, low density polyethylene (PE) or LSHF – Low Smoke Halogen Free thermoplastic compound.

Electromagnetic shield (protection)
Double layer of steel tapes helically applied.

Oversheath (jacket)
Black, low density polyethylene (PE) or LSHF – Low Smoke Halogen Free thermoplastic compound, fire retardant.

COLOUR AND CABLE MARKING

Black.
Sheath (jacket) will be marked, at regular intervals, with the following information:
<Manufacturer's name> <type of cable> <year> <metric marking>

COLOUR CODE

	Insulation colour				
	Cond. "a"	Cond. "b"	Cond. "c"	Cond. "d"	
Quad position in the centre or in the layer				Centre and even layers	Odd layers
1st (pilot)	Orange	Green	Red	White	Black
2nd, 4th, 6th, etc.	Yellow	Green	Blue	White	Black
3rd, 5th, 7th, etc	Yellow	Green	Red	White	Black
Last (reference)	Orange	Green	Blue	White	Black

GENERAL AND ELECTRICAL CHARACTERISTICS (20°C)

Maximum Ohmic resistance at 20°C dc(Ω/km)	29,0		
Maximum resistance unbalance	2,5%		
Minimum insulation resistance at 15°C, 500Vdc	35 000 MΩ x km		
Dielectric strength (3s)	Cond-Cond – 3 kVdc or 2,1 kVac Cond-Screen – 3,5 kVdc or 2,5 kVac		
Mutual capacitance at 1 kHz	Average value: 38 ± 3 nF/Km Maximum value: 45 nF/Km		
Capacitance unbalance (pF/460m, 1 kHz)		Max. Average value(1)	Max. value
	Pair-pair:		
	Same quad	35	250
	Adjacent quads	35	250
	Non adjacent quads	—	250
	Pair-ground	320	1200
Reduction factor, Rk – FR=0,1 (50Hz)		Inductive voltage (V/km)	Max. Rk
	FR=0,1	200-500	0,1
	FR=0,3	110-320	0,3

(1) Average limits only apply for cables with more than seven quads.

ADDITIONAL CHARACTERISTICS*

Flame retardant	IEC 60332-1-2 • EN 60332-1-2 (cable vertically mounted, length of charred cable ≤ 540 mm)
Fire retardant	IEC 60332-3-24 • EN 60332-3-24 (bunch of cables vertically mounted on a ladder, length of charred cables ≤ 2,5 m)
Halogen free	
Low smoke	IEC 61034-2 • EN 61034-2 (cable light transmittance ≥ 60%)
Low toxicity	IEC 60754-1 • EN 50267-2-1 (halogen acid gas content ≤ 0,5%)
Low corrosivity	IEC 60754-2 • EN 50267-2-3 (LSFH sheath: pH ≥4,3 • conductivity ≤ 10µS/mm)

* Applicable only for TEOZ1AZ1, TE1RZ1AZ1, TE3HZ1AZ1 cables.

DIMENSIONAL CHARACTERISTICS

Cables with reduction factor • Quads • PE insulation • Copper screen + armour • PE – TEOEAE

N.º of pairs	Ø 0,9 mm (FR=0,1)		Ø 0,9 mm (FR=0,3)	
	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)
3	22,0	1 040	20,5	670
5	24,5	1 250	23,0	820
7	26,5	1 420	24,5	930
10	30,0	1 720	27,5	1 140
14	33,0	2 020	30,5	1 380
19	36,5	2 400	33,5	1 650
27	41,0	2 940	38,5	2 090
37	46,0	3 600	43,5	2 600
48	50,5	4 260	47,5	3 110

APPLICATION

Cables ranging from 3 to 48 star quads, used as control and signalling cables. The sheath is specially designed to protect the core against inductive interferences. Indicated for installations, indoor or outdoor, protected or not. Can be installed directly buried.

CABLE DESIGNATION

PE isulation / Jelly / Copper wire screen / PE / Steel tape armour / PE: **TEGOEAE**
PE isulation /Jelly / Aluminium wire screen / PE / Steel tape armour / PE: **TEG1REAE**

CONSTRUCTION CHARACTERISTICS

Conductor
Solid annealed copper, nominal diameter of 0,9 mm.

Insulation
Solid polyethylene.

Arrangement (formation)
Star-quads.

Core assembly
Concentric layers.

Filling compound
Waterblocking compound, compatible with all the remaining cable components.

Core wrapping
Dielectric tape, helically applied with an overlap.

Induction screen (protection)
Copper wires helically applied or aluminium wires helically applied, depending on the reduction factor requirement.

Inner sheath (jacket)
Black, low density polyethylene (PE).

Electromagnetic shield (protection)
Double layer of steel tapes helically applied.

Oversheath (jacket)
Black, low density polyethylene (PE).

COLOUR AND CABLE MARKING

Black. Sheath (jacket) will be marked, at regular intervals, with the following information:
<Manufacturer's name> <type of cable> <year> <metric marking>

COLOUR CODE

	Insulation colour				
	Cond. "a"	Cond. "b"	Cond. "c"	Cond. "d"	
Quad position in the centre or in the layer				Centre and even layers	Odd layers
1st (pilot)	Orange	Green	Red	White	Black
2nd, 4th, 6th, etc.	Yellow	Green	Blue	White	Black

	Insulation colour				
	Cond. “a”	Cond. “b”	Cond. “c”	Cond. “d”	
Quad position in the centre or in the layer				Centre and even layers	Odd layers
3rd, 5th, 7th, etc	Yellow	Green	Red	White	Black
Last (reference)	Orange	Green	Blue	White	Black

GENERAL AND ELECTRICAL CHARACTERISTICS (20°C)

Maximum Ohmic resistance at 20°C dc(Ω/km)	29,0		
Maximum resistance unbalance	2,5%		
Minimum insulation resistance at 15°C, 500Vdc	25 000 MΩ x km		
Dielectric strength (3s)	Cond-Cond – 3 kVdc or 2,1 kVac Cond-Screen – 3,5 kVdc or 2,5 kVac		
Mutual capacitance at 1 kHz	Average value: 38 ± 3 nF/Km Maximum value: 45 nF/Km		
Capacitance unbalance (pF/460m, 1 kHz)		Max. Average value(1)	Max. value
	Pair-pair:		
	Same quad	35	250
	Adjacent quads	35	250
	Non adjacent quads	—	250
	Pair-ground	320	1200
Reduction factor, Rk – FR=0,1 (50Hz)		Inductive voltage (V/km)	Max. Rk
	FR=0,1	200-500	0,1
	FR=0,3	110-320	0,3

(1) Average limits only apply for cables with more than seven quads.

DIMENSIONAL CHARACTERISTICS

Cables with reduction factor • Quads • PE insulation • Copper screen • armour • PE – TEGOEAE

N.º of pairs	Ø 0,9 mm (FR=0,1)		Ø 0,9 mm (FR=0,3)	
	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)
3	24,0	1 160	22,0	760
5	28,0	1 490	25,0	950
7	29,5	1 640	27,0	1 100
10	33,0	2 040	30,5	1 380
14	36,0	2 360	33,5	1 650
19	39,5	2 820	37,5	2 030
27	45,0	3 520	42,5	2 550
37	50,5	4 380	48,0	3 220
48	55,5	5 240	53,0	3 890

CONTROL & INSTRUMENTATION CABLES

MULTICORE, OVERALL SCREEN

Unarmoured

- Cu / PVC, PE or XLPE / Al or Copper screen / PVC or LSHF
  VHV • FVHV • EHV • FEHV • XHV • FXHV • XHZ1 • FXHZ1
- Cu / LSHF / Al screen / LSHF
  Z1HZ1

Armoured

- Cu / PE / Al screen / PE or LSHF / Corrugated Armour / PE or LSHF
  E1HE2AE • E1HZ12AZ1

PAIRS, OVERALL SCREEN

Unarmoured

- Cu / PE, PVC or XLPE / Al screen / PVC
  EHV · FEHV · VHV · FVHV · XHV • FXHV
- Cu / XLPE / Al screen / LSHF
  XHZ1 · FXHZ1

Armoured

- Cu / PVC, PE or XLPE / Al Screen / PVC / STA or SWA / PVC
  VHVRV • FVHVRV • VHVAV • FVHVAV • EHVRV • FEHVRV • EHVAV • FEHVAV • XHVRV
  FXHVRV • XHVAV • FXHVAV
- Cu / XLPE / Al Screen / LSHF / STA or SWA / LSHF
  XHZ1RZ1 • FXHZ1RZ1 • XHZ1AZ1 • FXHZ1AZ1

PAIRS, SCREENED PAIR

Unarmoured

- Cu / PVC, PE or XLPE / Al Screen / Al Screen / PVC
  VHIV • FVHIV • VHIV • FVHIV • EHIV • FEHIV • EHIV • FEHIV • XHIV • FXHIV • XHIV • FXHIV
- Cu / XLPE / Al Screen / Al Screen / Al Screen / LSHF
  XHIZ1 • FXHIZ1 • XHIZ1 • FXHIZ1

Armoured

- Cu / PVC, PE or XLPE / Al Screen / Al Screen / PVC / STA or SWA / PVC
  VHIVRV • FVHIVRV • VHIVAV • FVHIVAV • EHIVRV • FEHIVRV • EHIVAV
  FEHIVAV • XHIVRV • FXHIVRV • XHIVAV • FXHIVAV
- Cu / XLPE / Al Screen / Al Screen / LSHF / STA or SWA / LSHF
  XHIZ1RZ1 • FXHIZ1RZ1 • XHIZ1AZ1 • FXHIZ1AZ1

Photo by: James Knight

APPLICATION

Cables for signalling systems, instrumentation and control of electrical mechanisms. Maximum rated voltage 500 V (peak value, not for power supply). Indicated for fixed installations, indoor or outdoor, protected or not.

CABLE DESIGNATION

Cu / PVC / Al or Copper screen / PVC: **VHV · FVHV**
Cu / PE / Al or Copper screen / PVC: **EHV · FEHV**
Cu / XLPE / Al or Copper screen / PVC: **XHV · FXHV**
Cu / XLPE / Al or Copper screen / LSHF: **XHZ1 · FXHZ1**
F – Flexible

CONSTRUCTION CHARACTERISTICS

Conductor

Rigid (class 2) or flexible (class 5) copper, sizes 0,5 mm^2; 1,0 mm^2 and 1,5 mm^2, as per IEC 60228.

Insulation

PVC, solid polyethylene or cross-linked polyethylene.

Arrangement (formation)

Multicore, stranded.

Core assembly

Concentric layers.

Core wrapping

Dielectric tape, helically applied with an overlap.

Shield (screen)

Aluminium/polyester tape (9/12,5 µm thickness), applied helically with an overlap. A 0,8 mm diameter copper drain wire is applied under the tape.
Alternatively, a copper tape (0,10 mm thickness), helically applied with an overlap may be used.

Over sheath (jacket)

Extruded PVC or LSHF – Low Smoke Halogen Free compound.

COLOUR AND CABLE MARKING

Grey. Other colours by request.
Sheath (jacket) will be marked, at regular intervals, with the following information:
<Manufacturer's name> <type of cable> <year> <metric marking>

GENERAL AND ELECTRICAL CHARACTERISTICS (20°C)

		0,5 mm^2	1,0 mm^2	1,5 mm^2
Maximum resistance of conductor at 20°C dc(Ω/km)	Class 2	36,0	18,1	12,1
	Class 5	39,0	19,5	13,3
Dielectric strength (60s) – 500 V rating	3 kV_{dc} or 2,0 kV_{ac}			

DIMENSIONAL CHARACTERISTICS

Rigid Cu • PVC • Al screen • PVC – VHV 500V rating

N.º of conductors	0,5 mm^2		1,0 mm^2		1,5 mm^2	
	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)
4	7,5	80	8,5	110	9,5	140
7	9,0	120	10,0	160	11,0	210
9	11,0	150	12,0	200	13,5	260
12	11,5	180	13,0	250	14,5	330
19	13,5	260	15,5	370	17,0	490
27	16,5	360	18,5	510	20,5	670
37	18,5	480	20,5	670	23,0	890
48	21,0	610	23,5	850	26,5	1 150
61	23,0	740	26,0	1 060	29,0	1 430

Flexible Cu • PVC • Al screen • PVC – FVHV 500V rating

N.º of conductors	0,5 mm^2		1,0 mm^2		1,5 mm^2	
	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)
4	7,5	80	9,0	110	9,5	130
7	9,0	120	10,5	160	11,0	200
9	11,0	150	12,5	210	13,5	250
12	11,5	180	13,5	260	14,5	320
19	13,5	260	15,5	380	17,0	470
27	16,0	350	19,0	520	20,5	650
37	18,0	460	21,0	690	23,0	860
48	21,0	580	24,5	880	26,5	1 100
61	23,0	700	26,0	1 090	29,5	1 360

APPLICATION

Cables for signalling systems, instrumentation and control of electrical mechanisms, halogen free. Maximum rated voltage 500 V (peak value, not for power supply). Indicated for fixed installations, indoor or outdoor, protected or not.

CABLE DESIGNATION

Cu / LSHF / Al screen / LSHF: **Z1HZ1**

CONSTRUCTION CHARACTERISTICS

Conductor

Rigid (class 2) copper, sizes 1,5 mm^2 and 2,5 mm^2, as per IEC 60228.

Insulation

Low Smoke Halogen Free compound.

Arrangement (formation)

Multicore, stranded.

Core assembly

Concentric layers.

Core wrapping

Dielectric tape, helically applied with an overlap.

Shield (screen)

Aluminium/polyester tape (9/12,5 µm thickness), applied helically with an overlap.
A 0,8 mm diameter copper drain wire is applied under the tape.
Alternatively, a copper tape helically applied with overlap may be used.

Oversheath (jacket)

LSHF – Low Smoke Halogen Free thermoplastic compound.

COLOUR AND CABLE MARKING

Grey. Other colours by request.
Sheath (jacket) will be marked, at regular intervals, with the following information:
<Manufacturer's name> <type of cable> <year> <metric marking>

GENERAL AND ELECTRICAL CHARACTERISTICS (20°C)

		1,5 mm^2	2,5 mm^2
Maximum resistance of conductor at 20°C dc(Ω/km)	Class 2	12,1	7,41
Dielectric strength (60s) – 500 V rating	3 kV_{dc} or 2,0 kV_{ac}		

DIMENSIONAL CHARACTERISTICS

Cu • LSHF • Al screen • LSHF – Z1HZ1 500V rating

N.º of conductors	1,5 mm^2		2,5 mm^2	
	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)
4	9,5	130	11,0	190
7	11,0	210	13,5	300
9	13,5	260	16,0	380
12	14,5	330	17,5	490
19	17,0	490	20,5	750
27	20,5	680	24,5	1 030
37	23,0	910	28,0	1 380
48	26,5	1 160	32,0	1 780
61	29,0	1 450	35,5	2 250

APPLICATION

Cables ranging from 4 to 61 conductors used as signaling and control cables.
The sheath offers special protection of the core against rodents.

CABLE DESIGNATION

Cu / PE / Al screen / PE / Corrugated Armour / PE: **E1HE2AE**
Cu / PE / Al screen / LSHF / Corrugated Armour / LSHF: **E1HZ12AZ1**

CONSTRUCTION CHARACTERISTICS

Conductor
Annealed copper, nominal diameter 1,4 mm.

Insulation
Solid polyethylene.

Arrangement (formation)
Multicore, stranded.

Core assembly
Concentric layers.

Core wrapping
Dielectric tape, helically applied with an overlap.

Shield (screen)
Aluminium tape with copolymer on both sides, applied longitudinally with an overlap.

Inner sheath (jacket)
Black, low density polyethylene (PE) or LSHF – Low Smoke Halogen Free thermoplastic compound.

Armour
Corrugated Steel tape applied longitudinally with an overlap.

Oversheath (jacket)
Black, low density polyethylene (PE) or LSHF – Low Smoke Halogen Free thermoplastic compound, fire retardant.

COLOUR AND CABLE MARKING

Black.
Sheath (jacket) will be marked, at regular intervals, with the following information:
<Manufacturer's name> <type of cable> <year> <metric marking>

COLOUR CODE

Conductors are identified by insulation coloring as per the following color code:
On each layer: 1st black, 2nd white and the remaining conductors will follow the sequence, red, grey, blue, brown, green, yellow.

GENERAL AND ELECTRICAL CHARACTERISTICS (20°C)

Maximum resistance of conductor at 20°C dc(Ω/km)	Average: 11,2 ± 0,5 Maximum value: 12,1
Insulation resistance (MΩ x km, 15°C, 500Vcc.)	Minimum value: 35 000
Dielectric strength (Vcc-3 s)	Cond-Cond: 3 000 Cond-Screen: 4 500

DIMENSIONAL CHARACTERISTICS

Cu • PE • Al screen • PE • Corrugated Armour • PE – E1HE2AE
Cu • PE • Al screen • LSHF • Corrugated Armour • LSHF – E1HZ12AZ1

N.º of conductors	Diameter (mm)	E1HE2AE Weight (kg/km)	E1HZ12AZ1 Weight (kg/km)
4	13,4	230	280
7	15,4	310	370
9	17,5	380	440
12	17,5	430	500
19	19,5	580	650
27	22,8	770	860
37	25,8	970	1 080
48	29,1	1 220	1 350
61	30,6	1 460	1 600

APPLICATION

Cables for signalling systems, instrumentation and control of electrical mechanisms grouped in pairs. Maximum rated voltage 500 V (peak value, not for power supply). Indicated for fixed installations, indoor or outdoor, protected or not.

CABLE DESIGNATION

Cu / PVC / Al screen / PVC: **VHV · FVHV**
Cu / PE / Al screen / PVC: **EHV · FEHV**
Cu / XLPE / Al screen / PVC: **XHV · FXHV**
Cu / XLPE / Al screen / LSHF: **XHZ1 · FXHZ1**
F – Flexible

CONSTRUCTION CHARACTERISTICS

Conductor

Rigid (class 2) of flexible (class 5) copper, sizes 0,5 mm^2; 1,0 mm^2 and 1,5 mm^2, as per IEC 60228.

Insulation

PVC, solid polyethylene or cross-linked polyethylene.

Arrangement (formation)

Stranded pairs.

Core assembly

Concentric layers.

Core wrapping

Dielectric tape, helically applied with an overlap.

Shield (screen)

Aluminium/polyester tape (9/12,5 µm thickness), applied helically with an overlap.
A 0,5 mm^2 class 2 copper drain wire is applied under the tape.

Oversheath (jacket)

Extruded PVC or LSHF – Low Smoke Halogen Free thermoplastic compound, fire retardant.

COLOUR AND CABLE MARKING

Grey. Other colours by request.
Sheath (jacket) will be marked, at regular intervals, with the following information:
<Manufacturer's name> <type of cable> <year> <metric marking>

GENERAL AND ELECTRICAL CHARACTERISTICS (20°C)

		0,5 mm²	1,0 mm²	1,5 mm²
Maximum resistance of conductor at 20°C dc(Ω/km)	Class 2	36,7	18,5	12,3
	Class 5	39,8	19,9	13,6
Dielectric strength (60s) – 500 V rating		3 kV_{dc} or 2,0 kV_{ac}		
Mutual capacitance		Polyolefin: < 150 nF/km PVC: < 250 nF/km		
Capacitance unbalance		500 pF/500m		

DIMENSIONAL CHARACTERISTICS

Rigid Cu • PE • Al screen • PVC – EHV 500V rating

N.º of pairs	0,5 mm²		1,0 mm²		1,5 mm²	
	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)
4	11,0	130	12,5	170	14,0	230
7	13,5	190	15,0	270	16,5	360
9	16,5	250	18,5	350	20,5	470
12	18,0	320	20,0	430	22,0	580
19	21,0	460	24,0	650	26,5	890
27	25,5	640	28,5	900	31,5	1 230
37	28,5	840	32,0	1 200	36,0	1 650

Flexible Cu • PE • Al screen • PVC – FEHV 500V rating

N.º of pairs	0,5 mm²		1,0 mm²		1,5 mm²	
	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)
4	11,0	130	12,5	180	14,0	230
7	13,0	190	15,5	280	17,0	350
9	16,0	250	19,0	360	20,5	450
12	17,5	310	20,5	450	22,5	560
19	21,0	440	24,5	670	26,5	850
27	25,0	610	29,5	930	32,0	1 170
37	28,5	790	33,0	1 220	36,5	1 570

APPLICATION

Armoured cables for signalling systems, instrumentation and control of electrical mechanisms grouped in pairs. Maximum rated voltage 500 V (peak value, not for power supply). Indicated for fixed installations, indoor or outdoor, protected or not. Can be installed directly buried.

CABLE DESIGNATION

Cu / PVC / Al Screen / PVC / STA (Steel tape armour) / PVC: **VHVAV · FVHVAV**
Cu / PVC / Al Screen / PVC / SWA(Steel wire armour) / PVC: **VHVRV · FVHVRV**
Cu / PE / Al Screen / PVC / STA (Steel tape armour) / PVC: **EHVAV · FEHVAV**
Cu / PE / Al Screen / PVC / SWA(Steel wire armour) / PVC: **EHVRV · FEHVRV**
Cu / XLPE / Al Screen / PVC / STA (Steel tape armour) / PVC: **XHVAV · FXHVAV**
Cu / XLPE / Al Screen / PVC / SWA(Steel wire armour) / PVC: **XHVRV · FXHVRV**
Cu / XLPE / Al Screen / LSHF / STA (Steel tape armour) / LSHF: **XHZ1AZ1 · FXHZ1AZ1**
Cu / XLPE / Al Screen / LSHF / SWA(Steel wire armour) / LSHF: **XHZ1RZ1 · FXHZ1RZ1**
F – Flexible

CONSTRUCTION CHARACTERISTICS

Conductor

Rigid (class 2) of flexible (class 5) copper, sizes 0,5 mm^2; 1,0 mm^2 and 1,5 mm^2, as per IEC 60228.

Insulation

PVC, solid polyethylene or cross-linked polyethylene.

Arrangement (formation)

Stranded pairs.

Core assembly

Concentric layers.

Core wrapping

Dielectric tape, helically applied with an overlap.

Shield (screen)

Aluminium/polyester tape (9/12,5 µm thickness), applied helically with an overlap.
A 0,5 mm^2 class 2 copper drain wire is applied under the tape.

Inner sheath (jacket)

Extruded PVC or LSHF – Low Smoke Halogen Free thermoplastic compound.

Armour

Two steel tapes armour or galvanised steel wire armour, helically applied.

Oversheath (jacket)

Extruded PVC or LSHF – Low Smoke Halogen Free thermoplastic compound.

COLOUR AND CABLE MARKING

Grey. Other colours by request.
Sheath (jacket) will be marked, at regular intervals, with the following information:
<Manufacturer's name> <type of cable> <year> <metric marking>

GENERAL AND ELECTRICAL CHARACTERISTICS (20°C)

		0,5 mm²	1,0 mm²	1,5 mm²
Maximum resistance of conductor at 20°C dc(Ω/km)	Class 2	36,7	18,5	12,3
	Class 5	39,8	19,9	13,6
Dielectric strength (60s) – 500 V rating		3 kV_{dc} or 2,0 kV_{ac}		
Mutual capacitance		Polyolefin: < 150 nF/km PVC: < 250 nF/km		
Capacitance unbalance		500 pF/500m		

DIMENSIONAL CHARACTERISTICS

Rigid Cu • PE • Al screen • PVC • SWA • PVC – EHVRV 500V rating

N.º of pairs	0,5 mm²		1,0 mm²		1,5 mm²	
	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)
4	15,5	420	17,0	480	18,0	570
7	17,5	520	19,5	630	21,0	750
9	20,5	650	22,5	780	25,5	1 130
12	22,0	730	25,0	1 090	27,5	1 310
19	26,0	1 140	29,0	1 400	31,5	1 720
27	30,5	1 440	33,5	1 790	37,5	2 450
37	33,5	1 730	37,5	2 200	42,0	3 050

Flexible Cu • PE • Al screen • PVC • SWA • PVC – FEHVRV 500V rating

N.º of pairs	0,5 mm²		1,0 mm²		1,5 mm²	
	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)
4	15,5	410	17,0	490	18,5	570
7	17,5	520	20,0	650	21,0	740
9	20,5	630	23,0	790	26,0	1 120
12	22,0	720	25,5	1 110	27,5	1 290
19	26,0	1 110	29,5	1 440	31,5	1 690
27	30,0	1 400	34,5	1 840	38,0	2 390
37	33,5	1 680	38,0	2 250	42,5	2 990

APPLICATION

Cables for signalling systems, instrumentation and control of electrical mechanisms, grouped in individual shielded pairs. Maximum rated voltage 500 V (peak value, not for power supply). Indicated for fixed installations, indoor or outdoor, protected or not.

CABLE DESIGNATION

Cu / PVC / Al Screen / Al Screen / PVC: **VHIV · FVHIV**
Cu / PE / Al Screen / Al Screen / PVC: **EHIV · FEHIV**
Cu / XLPE / Al Screen / Al Screen / PVC: **XHIV · FXHIV**
Cu / XLPE / Al Screen / Al Screen / LSHF: **XHIZ1 · FXHIZ1**
F – Flexible

CONSTRUCTION CHARACTERISTICS

Conductor

Rigid (class 2) of flexible (class 5) copper, sizes 0,5 mm^2; 1,0 mm^2 and 1,5 mm^2, as per IEC 60228.

Insulation

PVC, solid polyethylene or cross-linked polyethylene.

Arrangement (formation)

Stranded pairs.

Shield (pair)

Aluminium/polyester tape (9/12,5 µm thickness), applied helically with an overlap.
A 0,5 mm^2 class 2 copper drain wire is applied under the tape.

Core assembly

Concentric layers.

Core wrapping

Dielectric tape, helically applied with an overlap.

Shield (screen)

Aluminium/polyester tape (9/12,5 µm thickness), applied helically with an overlap.
A 0,5 mm^2 class 2 copper drain wire is applied under the tape.

Oversheath (jacket)

Extruded PVC or LSHF – Low Smoke Halogen Free thermoplastic compound, fire retardant.

COLOUR AND CABLE MARKING

Grey. Other colours by request.
Sheath (jacket) will be marked, at regular intervals, with the following information:
<Manufacturer's name> <type of cable> <year> <metric marking>

GENERAL AND ELECTRICAL CHARACTERISTICS (20°C)

		0,5 mm²	1,0 mm²	1,5 mm²
Maximum resistance of conductor at 20°C dc(Ω/km)	Class 2	36,7	18,5	12,3
	Class 5	39,8	19,9	13,6
Dielectric strength (60s) – 500 V rating		3 kV_{dc} or 2,0 kV_{ac}		
Mutual capacitance		Polyolefin: < 150 nF/km PVC: < 250 nF/km		
Capacitance unbalance		500 pF/500m		

DIMENSIONAL CHARACTERISTICS

Rigid Cu • XLPE • Al screen • Al screen • PVC – XHIV 500V rating

N.º of pairs	0,5 mm²		1,0 mm²		1,5 mm²	
	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)
4	12,5	140	14,0	190	15,0	240
7	15,0	210	17,0	290	18,5	370
9	18,5	270	20,5	380	23,0	500
12	20,0	340	22,5	480	25,0	630
19	23,5	490	26,5	690	29,5	930
27	28,5	670	32,0	970	36,0	1 300
37	32,5	900	36,5	1 270	40,5	1 740

Flexible Cu • XLPE • Al screen • Al screen • PVC – FXHIV 500V rating

N.º of pairs	0,5 mm²		1,0 mm²		1,5 mm²	
	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)
4	12,5	140	14,5	200	15,5	240
7	15,0	210	17,0	300	18,5	360
9	18,5	270	21,0	390	23,0	480
12	20,0	330	23,0	490	25,0	610
19	23,5	470	27,5	710	30,0	890
27	28,5	650	33,0	990	36,5	1 240
37	32,0	850	37,5	1 300	41,0	1 650

APPLICATION

Armoured cables for signalling systems, instrumentation and control of electrical mechanisms, grouped in individual shielded pairs. Maximum rated voltage 500 V (peak value, not for power supply). Indicated for fixed installations, indoor or outdoor, protected or not. Can be installed directly buried.

CABLE DESIGNATION

Cu / PVC / Al Screen / Al Screen / PVC / STA (Steel tape armour) / PVC: **VHIVAV · FVHIVAV**
Cu / PVC / Al Screen / Al Screen / PVC / SWA(Steel wire armour) / PVC: **VHIVRV · FVHIVRV**
Cu / PE / Al Screen / Al Screen / PVC / STA (Steel tape armour) / PVC: **EHIVAV · FEHIVAV**
Cu / PE / Al Screen / Al Screen / PVC / SWA(Steel wire armour) / PVC: **EHIVRV · FEHIVRV**
Cu / XLPE / Al Screen / Al Screen / PVC / STA (Steel tape armour) / PVC: **XHIVAV · FXHIVAV**
Cu / XLPE / Al Screen / Al Screen / PVC / SWA(Steel wire armour) / PVC: **XHIVRV · FXHIVRV**
Cu / XLPE / Al Screen / Al Screen / LSHF / STA (Steel tape armour) / LSHF: **XHIZ1AZ1 · FXHIZ1AZ1**
Cu / XLPE / Al Screen / Al Screen / LSHF / SWA(Steel wire armour) / LSHF: **XHIZ1RZ1 · FXHIZ1RZ1**
F – Flexible

CONSTRUCTION CHARACTERISTICS

Conductor

Rigid (class 2) of flexible (class 5) copper, sizes 0,5 mm^2; 1,0 mm^2 and 1,5 mm^2, as per IEC 60228.

Insulation

PVC, solid polyethylene or cross-linked polyethylene.

Arrangement (formation)

Stranded pairs.

Shield (pair)

Aluminium/polyester tape (9/12,5 µm thickness), applied helically with an overlap.
A 0,5 mm^2 class 2 copper drain wire is applied under the tape.

Core assembly

Concentric layers.

Core wrapping

Dielectric tape, helically applied with an overlap.

Shield (screen)

Aluminium/polyester tape (9/12,5 µm thickness), applied helically with an overlap.
A 0,5 mm^2 class 2 copper drain wire is applied under the tape.

Inner sheath (jacket)

Extruded PVC or LSHF – Low Smoke Halogen Free thermoplastic compound, fire retardant.

Armour

Double steel tape armour or galvanised steel wire armour, helically applied.

Oversheath (jacket)

Extruded PVC or LSHF – Low Smoke Halogen Free thermoplastic compound, fire retardant.

COLOUR AND CABLE MARKING

Grey. Other colours by request.
Sheath (jacket) will be marked, at regular intervals, with the following information:
<Manufacturer's name> <type of cable> <year> <metric marking>

GENERAL AND ELECTRICAL CHARACTERISTICS (20°C)

		0,5 mm2	1,0 mm2	1,5 mm2
Maximum resistance of conductor at 20°C dc(Ω/km)	Class 2	36,7	18,5	12,3
	Class 5	39,8	19,9	13,6
Dielectric strength (60s) – 500 V rating		3 kV_{dc} or 2,0 kV_{ac}		
Mutual capacitance		Polyolefin: < 150 nF/km PVC: < 250 nF/km		
Capacitance unbalance		500 pF/500m		

DIMENSIONAL CHARACTERISTICS

Rigid Cu • XLPE • Al screen • Al screen • PVC • SWA • PVC – XHIVRV 500V rating

N.º of pairs	0,5 mm²		1,0 mm²		1,5 mm²	
	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)
4	17,0	460	18,5	540	19,5	610
7	19,5	580	21,0	690	23,5	990
9	23,5	890	26,0	1 060	28,0	1 220
12	25,0	990	27,5	1 200	30,0	1 420
19	29,0	1 250	31,5	1 530	34,5	1 850
27	33,5	1 580	38,0	2 170	42,0	2 680
37	38,0	2 120	42,5	2 690	47,0	3 590

Flexible Cu • XLPE • Al screen • Al screen • PVC • SWA • PVC – FXHIVRV 500V rating

N.º of pairs	0,5 mm²		1,0 mm²		1,5 mm²	
	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)	Diameter (mm)	Weight (kg/km)
4	16,5	450	18,5	550	20,0	610
7	19,5	570	21,5	700	24,0	980
9	23,5	870	26,5	1 080	28,5	1 220
12	25,0	980	28,0	1 220	30,5	1 410
19	28,5	1 220	32,5	1 570	35,0	1 820
27	33,5	1 540	38,5	2 230	42,5	2 640
37	38,0	2 060	43,5	2 740	47,5	3 540

OPTICAL FIBRE CABLES

Unarmoured

- Unitube – TOU ZvE
- Unitube flame retardant – TOU ZvZ1
- Unitube anti-rodent – TOU ZrE
- Unitube anti-rodent, flame retardant – TOU ZrZ1
- Multitube – TON ZvE
- Multitube flame retardant – TON ZvZ1
- Multitube anti-rodent – TON ZrE
- Multitube anti-rodent, flame retardant – TON ZrZ1
- Multitube double jacket – TON EZaE • PKP
- Multitube double jacket, fire retardant – TON Z1ZaZ1 • TKT

Armoured

- Unitube – TOU ZvE2AE
- Unitube fire retardant – TOU ZvZ12AZ1
- Multitube – TON ZvE2AE
- Multitube fire retardant – TON ZvZ12AZ1
- Multitube – TON Zv2AE
- Multitube double jacket, jelly filled – PESP-DR • fire retardant TEST-DR
- Multitube double jacket, jelly filled, tensile reinforced – PKESP-DR • fire retardant TEST-DR

Aerial

- TON ES – 8 figure short span
- ADSS – short span
- ADSS – medium span

APPLICATION

Unitube cable, loose type, non-metallic, low dimensions, lightweight, watertight.
Designed for indoor/outdoor applications in ducts. Cable installation by pulling or blowing.
Easy handling and installation.

CONSTRUCTION CHARACTERISTICS

Optical fibres (at choice)

Single-mode (Dispersion unshifted) – IEC 60793-2 and ITU-T Rec. G.652.
Single-mode NZD – ITU-T Rec. G.655.
Multi-mode type 50/125 µm – IEC 60793-2 (A1.a) and ITU-T Rec. G.651.
Multi-mode type 62,5/125 µm – IEC 60793-2 (A1.b).

Loose Tube

PBT – tube with optical fibres and filled with gel.

Mechanical reinforcement

Glass fibre yarns.

Ripcord

Oversheath

Polyethylene.

COLOUR AND CABLE MARKING

Black.
Oversheath marked at regular intervals with the following information:
<CABELTE> <type of cable> <composition> <year of manufacture> <metric marking>

FIBRES IDENTIFICATION

1 · White	2 · Red	3 · Green	4 · Blue
5 · Black	6 · Yellow	7 · Orange	8 · Grey
9 · Brown	10 · Rose	11 · Violet	12 · Turquoise
13 · White / Black	14 · Yellow / Black	15 · Orange / Black	16 · Red / Black

MECHANICAL AND DIMENSIONAL CHARACTERISTICS

Fibres count per cable	Fibres per tube	Cable diameter	Cable weight	Max. pulling force		Mechanical resistance		Minimum bending radius	
				Installed	In service	Crush	Impact	Installed	In service
		(mm)	(kg/km)	(N)	(N)	(N/cm)	(J)	(mm)	(mm)
2	2	6,0	30	550	200	100	0,5	110	85
4	4	6,0	30	550	200	100	0,5	110	85
6	6	6,0	30	550	200	100	0,5	110	85
8	8	6,0	30	550	200	100	0,5	110	85
12	12	6,0	30	550	200	100	0,5	110	85
16	16	6,5	35	700	250	100	0,5	120	90

Temperature: Storage and transport: - 10°C up to 60°C.
Temperature: Operation: - 20°C up to 60°C.

TOU ZvZ1
Unitube
Unarmoured • Flame Retardant

APPLICATION

Unitube cable, loose type, non-metallic, low dimensions, lightweight, flame retardant and with a LSHF oversheath. Designed for indoor/outdoor applications in ducts. Cable installation by pulling or blowing. Easy handling and installation.

CONSTRUCTION CHARACTERISTICS

Optical fibres (at choice)

Single-mode (Dispersion unshifted) – IEC 60793-2 and ITU-T Rec. G.652.
Single-mode NZD – ITU-T Rec. G.655.
Multi-mode type 50/125 µm – IEC 60793-2 (A1.a) and ITU-T Rec. G.651.
Multi-mode type 62,5/125 µm – IEC 60793-2 (A1.b).

Loose Tube

PBT – tube with optical fibres and filled with gel.

Mechanical reinforcement

Glass fibre yarns.

Ripcord

Oversheath

LSHF – Low Smoke Halogen Free thermoplastic compound, flame retardant.

COLOUR AND CABLE MARKING

Black.
Oversheath marked at regular intervals with the following information:
<CABELTE> <type of cable> <composition> <year of manufacture> <metric marking>

FIBRES IDENTIFICATION

1 · White	2 · Red	3 · Green	4 · Blue
5 · Black	6 · Yellow	7 · Orange	8 · Grey
9 · Brown	10 · Rose	11 · Violet	12 · Turquoise
13 · White / Black	14 · Yellow / Black	15 · Orange / Black	16 · Red / Black

GENERAL CHARACTERISTICS

Flame retardant	IEC 60332-1-2 • EN 60332-1-2 (cable vertically mounted, length of charred cable ≤ 540 mm)
Halogen free	
Low smoke	IEC 61034-2 • EN 61034-2 (cable light transmittance ≥ 60%)
Low toxicity	IEC 60754-1 • EN 50267-2-1 (halogen acid gas content ≤ 0,5%)
Low corrosivity	IEC 60754-2 • EN 50267-2-3 (pH ≥4,3 • conductivity ≤ 10µS/mm)

MECHANICAL AND DIMENSIONAL CHARACTERISTICS

Fibres count per cable	Fibres per tube	Cable diameter	Cable weight	Max. pulling force		Mechanical resistance		Minimum bending radius	
				Installed	In service	Crush	Impact	Installed	In service
		(mm)	(kg/km)	(N)	(N)	(N/cm)	(J)	(mm)	(mm)
4	4	6,0	40	700	250	100	0,5	110	85
6	6	6,0	40	700	250	100	0,5	110	85
8	8	6,0	40	700	250	100	0,5	110	85
12	12	6,0	40	700	250	100	0,5	110	85
16	16	6,5	45	800	300	100	0,5	120	90

Temperature: Storage and transport: - 10°C up to 60°C.
Temperature: Operation: - 20°C up to 60°C.

TOU ZrE
Unitube
Unarmoured • Anti-rodent

APPLICATION

Unitube cable, loose type, non-metallic, low dimensions, lightweight.
Designed for indoor/outdoor applications, in duct installations in environments with presence of rodents.
Cable installation by pulling or blowing. Easy handling and installation.

CONSTRUCTION CHARACTERISTICS

Optical fibres (at choice)

Single-mode (Dispersion unshifted) – IEC 60793-2 and ITU-T Rec. G.652.
Single-mode NZD – ITU-T Rec. G.655.
Multi-mode type 50/125 µm – IEC 60793-2 (A1.a) and ITU-T Rec. G.651.
Multi-mode type 62,5/125 µm – IEC 60793-2 (A1.b).

Loose Tube

PBT – tube with optical fibres and filled with gel.

Mechanical reinforcement

Compacted layer of glass yarns. Also provide resistance to rodents.

Ripcord

Oversheath

Polyethylene.

COLOUR AND CABLE MARKING

Black.
Oversheath marked at regular intervals with the following information:
<CABELTE> <type of cable> <composition> <year of manufacture> <metric marking>

FIBRES IDENTIFICATION

1 · White	2 · Red	3 · Green	4 · Blue
5 · Black	6 · Yellow	7 · Orange	8 · Grey
9 · Brown	10 · Rose	11 · Violet	12 · Turquoise
13 · White / Black	14 · Yellow / Black	15 · Orange / Black	16 · Red / Black

MECHANICAL AND DIMENSIONAL CHARACTERISTICS

Fibres count per cable	Fibres per tube	Cable diameter	Cable weight	Max. pulling force		Mechanical resistance		Minimum bending radius	
				Installed	In service	Crush	Impact	Installed	In service
		(mm)	(kg/km)	(N)	(N)	(N/cm)	(J)	(mm)	(mm)
4	4	6,0	40	1 000	350	100	0,5	110	85
6	6	6,0	40	1 000	350	100	0,5	110	85
8	8	6,0	40	1 000	350	100	0,5	110	85
12	12	6,0	40	1 000	350	100	0,5	110	85
16	16	6,5	45	1 100	400	100	0,5	120	90

Temperature: Storage and transport: - 10°C up to 60°C.
Temperature: Operation: - 20°C up to 60°C.

TOU ZrZ1

Unitube

Unarmoured • Anti-rodent • Flame Retardant

APPLICATION

Unitube cable, loose type, non-metallic, low dimensions, lightweight, flame retardant and with a LSHF oversheath. Designed for indoor/outdoor applications in duct installation in environments with presence of rodents. Cable installation by pulling or blowing. Easy handling and installation.

CONSTRUCTION CHARACTERISTICS

Optical fibres (at choice)

Single-mode (Dispersion unshifted) – IEC 60793-2 and ITU-T Rec. G.652
Single-mode NZD – ITU-T Rec. G.655
Multi-mode type 50/125 µm – IEC 60793-2 (A1.a) and ITU-T Rec. G.651
Multi-mode type 62,5/125 µm – IEC 60793-2 (A1.b)

Loose Tube

PBT – tube with optical fibres and filled with gel.

Mechanical reinforcement

Compacted layer of glass yarns. Also provide resistance to rodents.

Ripcord

Oversheath

LSHF – Low Smoke Halogen Free thermoplastic compound, flame retardant.

COLOUR AND CABLE MARKING

Black.
Oversheath marked at regular intervals with the following information:
<CABELTE> <type of cable> <composition> <year of manufacture> <metric marking>

FIBRES IDENTIFICATION

1 · White	2 · Red	3 · Green	4 · Blue
5 · Black	6 · Yellow	7 · Orange	8 · Grey
9 · Brown	10 · Rose	11 · Violet	12 · Turquoise
13 · White / Black	14 · Yellow / Black	15 · Orange / Black	16 · Red / Black

GENERAL CHARACTERISTICS

Flame retardant	IEC 60332-1-2 • EN 60332-1-2 (cable vertically mounted, length of charred cable ≤ 540 mm)
Halogen free	
Low smoke	IEC 61034-2 • EN 61034-2 (cable light transmittance ≥ 60%)
Low toxicity	IEC 60754-1 • EN 50267-2-1 (halogen acid gas content ≤ 0,5%)
Low corrosivity	IEC 60754-2 • EN 50267-2-3 (pH ≥4,3 • conductivity ≤ 10µS/mm)

MECHANICAL AND DIMENSIONAL CHARACTERISTICS

Fibres count per cable	Fibres per tube	Cable diameter	Cable weight	Max. pulling force		Mechanical resistance		Minimum bending radius	
				Installed	In service	Crush	Impact	Installed	In service
		(mm)	(kg/km)	(N)	(N)	(N/cm)	(J)	(mm)	(mm)
4	4	6,0	50	1 000	350	100	0,5	110	85
6	6	6,0	50	1 000	350	100	0,5	110	85
8	8	6,0	50	1 000	350	100	0,5	110	85
12	12	6,0	50	1 000	350	100	0,5	110	85
16	16	6,5	55	1 100	400	100	0,5	120	90

Temperature: Storage and transport: - 10°C up to 60°C.
Temperature: Operation: - 20°C up to 60°C.

APPLICATION

Multitube cable, loose type, non-metallic, dry core, low dimensions, lightweight, watertight.
Designed for indoor/outdoor applications in ducts. Cable installation by pulling or blowing.
Easy handling and installation.

CONSTRUCTION CHARACTERISTICS

Optical fibres (at choice)

Single-mode (Dispersion unshifted) – IEC 60793-2 and ITU-T Rec. G.652.
Single-mode NZD – ITU-T Rec. G.655.
Multi-mode type 50/125 µm – IEC 60793-2 (A1.a) and ITU-T Rec. G.651.
Multi-mode type 62,5/125 µm – IEC 60793-2 (A1.b).

Central strength member

Glass fibre reinforced plastic rod (FRP).

Loose Tubes

PBT – tube with optical fibres and filled with gel.

Core watertightness

Dry – waterblocking swelling tape and yarns.

Mechanical reinforcement

Glass fibre yarns.

Ripcord

Oversheath

Polyethylene.

COLOUR AND CABLE MARKING

Black.
Oversheath marked at regular intervals with the following information:
<CABELTE> <type of cable> <composition> <year of manufacture> <metric marking>

FIBRES IDENTIFICATION

Fibres colour code inside tube

1 · White	2 · Red	3 · Green	4 · Blue
5 · Black	6 · Yellow	7 · Orange	8 · Grey
9 · Brown	10 · Rose	11 · Violet	12 · Turquoise

Colour of filling elements

Black

Tubes colour code

Up to 12 tubes

1 · Red	2 up to 11 · Natural	12 · Green

16 tubes

1st jacket	White	Red	Blue	Green
2nd jacket	3 White	3 Red	3 Blue	3 Green

Tubes colour code

18 tubes

1st jacket	2 White	2 Red	2 Blue	
2nd jacket	3 White	3 Red	3 Blue	3 Green

MECHANICAL AND DIMENSIONAL CHARACTERISTICS

Fibres count per cable	N.º of elements	Fibres per tube	Cable diameter (mm)	Cable weight (kg/km)	Max. Pulling force		Mechanical resistance		Minimum bending radius	
					Installed (N)	In service (N)	Crush (N/cm)	Impact (J)	Installed (mm)	In service (mm)
12	5	6	10,0	70	1 150	650	300	1	180	140
24	5	6	10,0	70	1 150	650	300	1	180	140
24	5	8	10,0	70	1 150	650	300	1	180	140
24	5	12	10,5	75	1 350	750	300	1	190	145
32	5	8	10,0	70	1 150	650	300	1	180	140
36	6	6	10,0	75	1 250	650	300	1	180	140
36	5	12	10,5	75	1 350	750	300	1	190	145
48	6	8	10,0	75	1 250	650	300	1	180	140
48	5	12	10,5	75	1 350	750	300	1	190	145
60	5	12	10,5	75	1 350	750	300	1	190	145
64	8	8	12,0	105	1 550	800	300	1	215	170
72	9	8	12,5	115	1 900	950	300	1	225	175
72	6	12	11,0	85	1 750	850	300	1	198	154
96	12	8	14,5	160	2 450	1000	300	1	260	205
96	8	12	12,5	115	1 750	950	300	1	225	175
120	10	12	14,0	145	2 250	1 150	300	1	250	195
128	16	8	15,0	170	2 550	1 050	300	1	270	210
144	18	8	15,0	170	2 550	1 050	300	1	270	210
144	12	12	15,5	180	2 850	1 400	300	1	280	215

Temperature: Storage and transport: - 10°C up to 60°C.
Temperature: Operation: - 20°C up to 60°C.

APPLICATION

Multitube cable, loose type, non-metallic, dry core, low dimensions, lightweight, flame retardant and with a LSHF oversheath. Designed for indoor/outdoor applications in duct installation. Cable installation by pulling or blowing. Easy handling and installation.

CONSTRUCTION CHARACTERISTICS

Optical fibres (at choice)

Single-mode (Dispersion unshifted) – IEC 60793-2 and ITU-T Rec. G.652.
Single-mode NZD – ITU-T Rec. G.655.
Multi-mode type 50/125 µm – IEC 60793-2 (A1.a) and ITU-T Rec. G.651.
Multi-mode type 62,5/125 µm – IEC 60793-2 (A1.b).

Central strength member

Glass fibre reinforced plastic rod (FRP).

Loose Tubes

PBT – tube with optical fibres and filled with gel.

Core watertightness

Dry – waterblocking swelling tape and yarns.

Mechanical reinforcement

Glass fibre yarns.

Ripcord

Oversheath

LSHF – Low Smoke Halogen Free thermoplastic compound, flame retardant.

COLOUR AND CABLE MARKING

Black. Oversheath marked at regular intervals with the following information:
<CABELTE> <type of cable> <composition> <year of manufacture> <metric marking>

FIBRES IDENTIFICATION

Fibres colour code inside tube

1 · White	2 · Red	3 · Green	4 · Blue
5 · Black	6 · Yellow	7 · Orange	8 · Grey
9 · Brown	10 · Rose	11 · Violet	12 · Turquoise

Colour of filling elements

Black

Tubes colour code

Up to 12 tubes

1 · Red	2 up to 11 · Natural	12 · Green

16 tubes

1st jacket	White	Red	Blue	Green
2nd jacket	3 White	3 Red	3 Blue	3 Green

Tubes colour code

18 tubes

1st jacket	2 White	2 Red	2 Blue	
2nd jacket	3 White	3 Red	3 Blue	3 Green

GENERAL CHARACTERISTICS

Flame retardant	IEC 60332-1-2 • EN 60332-1-2 (cable vertically mounted, length of charred cable ≤ 540 mm)
Oversheath halogen free	
Low toxicity	IEC 60754-1 • EN 50267-2-1 (halogen acid gas content ≤ 0,5%)
Low corrosivity	IEC 60754-2 • EN 50267-2-2 (pH ≥4,3 • conductivity ≤ 10µS/mm)

MECHANICAL AND DIMENSIONAL CHARACTERISTICS

Fibres count per cable	N.º of elements	Fibres per tube	Cable diameter (mm)	Cable weight (kg/km)	Max. Pulling force		Mechanical resistance		Minimum bending radius	
					Installed (N)	In service (N)	Crush (N/cm)	Impact (J)	Installed (mm)	In service (mm)
24	5	6	10,0	90	1 400	850	300	1	180	140
24	5	8	10,0	90	1 400	850	300	1	180	140
24	5	12	10,5	100	1 550	1 000	300	1	190	145
32	5	8	10,0	90	1 400	850	300	1	180	140
36	6	6	10,0	100	1 500	850	300	1	180	140
36	5	12	10,5	100	1 550	1 000	300	1	190	145
48	6	8	10,0	100	1 500	850	300	1	180	140
48	5	12	10,5	100	1 550	1 000	300	1	190	145
60	5	12	10,5	100	1 550	1 000	300	1	190	145
64	8	8	12,0	135	2 100	1 250	300	1	215	170
72	9	8	12,5	150	2 250	1 050	300	1	225	175
72	6	12	11,0	110	1 750	850	300	1	198	154
96	12	8	14,5	205	3 100	1 200	300	1	260	205
96	8	12	12,5	150	2 300	1 200	300	1	225	175
120	10	12	14,0	180	2 750	1 450	300	1	250	195
128	16	8	15,0	210	3 200	1 350	300	1	270	210
144	18	8	15,0	210	3 200	1 350	300	1	270	210
144	12	12	15,5	225	3 400	1 650	300	1	280	215

Temperature: Storage and transport: - 10°C up to 60°C.
Temperature: Operation: - 20°C up to 60°C.

APPLICATION

Multitube cable, loose type, non-metallic, dry core, low dimensions, lightweight, watertight.
Designed for indoor/outdoor applications, in duct installations in environments with presence of rodents.
Cable installation by pulling or blowing. Easy handling and installation.

CONSTRUCTION CHARACTERISTICS

Optical fibres (at choice)

Single-mode (Dispersion unshifted) – IEC 60793-2 and ITU-T Rec. G.652.
Single-mode NZD – ITU-T Rec. G.655.
Multi-mode type 50/125 µm – IEC 60793-2 (A1.a) and ITU-T Rec. G.651.
Multi-mode type 62,5/125 µm – IEC 60793-2 (A1.b).

Central strength member

Glass fibre reinforced plastic rod (FRP).

Loose Tubes

PBT – tube with optical fibres and filled with gel.

Core watertightness

Dry – waterblocking swelling tape and yarns.

Mechanical reinforcement

Glass fibre yarns.

Ripcord

Oversheath

Polyethylene.

COLOUR AND CABLE MARKING

Black. Oversheath marked at regular intervals with the following information:
CABELTE <tipo de cable> <composición> <año de fabricación> <marcado métrico>

FIBRES IDENTIFICATION

Fibres colour code inside tube

1 · White	2 · Red	3 · Green	4 · Blue
5 · Black	6 · Yellow	7 · Orange	8 · Grey
9 · Brown	10 · Rose	11 · Violet	12 · Turquoise
13 · White / Black	14 · Yellow / Black	15 · Orange / Black	16 · Red / Black

Colour of filling elements

Black

Tubes colour code

Up to 12 tubes

1 · Red	2 up to 11 · Natural	12 · Green

16 tubes

1st jacket	White	Red	Blue	Green
2nd jacket	3 White	3 Red	3 Blue	3 Green

Tubes colour code

18 tubes

1st jacket	2 White	2 Red	2 Blue	
2nd jacket	3 White	3 Red	3 Blue	3 Green

MECHANICAL AND DIMENSIONAL CHARACTERISTICS

Fibres count per cable	N.º of elements	Fibres per tube	Cable diameter (mm)	Cable weight (kg/km)	Max. Pulling force		Mechanical resistance		Minimum bending radius	
					Installed (N)	In service (N)	Crush (N/cm)	Impact (J)	Installed (mm)	In service (mm)
24	5	6	10,0	90	3 500	1 850	300	1	180	140
24	5	8	10,0	90	3 500	1 850	300	1	180	140
24	5	12	10,5	100	4 100	2 200	300	1	190	145
32	5	8	10,0	90	3 500	1 850	300	1	180	140
36	6	6	10,0	105	3 900	1 800	300	1	180	140
36	5	12	10,5	100	4 100	2 200	300	1	190	145
48	6	8	10,0	105	3 900	1 800	300	1	180	140
48	5	12	10,5	100	4 100	2 200	300	1	190	145
60	5	12	10,5	100	4 100	2 200	300	1	190	145
64	8	8	12,0	135	4 500	2 200	300	1	215	170
72	9	8	12,5	150	4 750	2 150	300	1	225	175
72	6	12	11,0	115	4 500	2 200	300	1	198	154
96	12	8	14,5	200	5 850	2 550	300	1	260	205
96	8	12	12,5	150	5 150	2 750	300	1	225	175
120	10	12	14,0	185	5 900	2 900	300	1	250	195
128	16	8	15,0	205	5 650	2 700	300	1	270	210
144	18	8	15,0	205	5 650	2 700	300	1	270	210
144	12	12	15,5	225	6 900	3 300	300	1	280	215

Temperature: Storage and transport: - 10°C up to 60°C.
Temperature: Operation: - 20°C up to 60°C.

APPLICATION

Multitube cable, loose type, non-metallic, dry core, flame retardant and with a LSHF oversheath. Low dimensions and lightweight. Designed for indoor/outdoor applications in duct installation in environments with presence of rodents. Cable installation by pulling or blowing. Easy handling and installation.

CONSTRUCTION CHARACTERISTICS

Optical fibres (at choice)

Single-mode (Dispersion unshifted) – IEC 60793-2 and ITU-T Rec. G.652
Single-mode NZD – ITU-T Rec. G.655
Multi-mode type 50/125 µm – IEC 60793-2 (A1.a) and ITU-T Rec. G.651
Multi-mode type 62,5/125 µm – IEC 60793-2 (A1.b)

Central strength member

Glass fibre reinforced plastic rod (FRP).

Loose Tubes

PBT – tube with optical fibres and filled with gel.

Core watertightness

Dry – waterblocking swelling tape and yarns.

Mechanical reinforcement

Glass fibre yarns.

Ripcord

Oversheath

LSHF – Low Smoke Halogen Free thermoplastic compound, flame retardant.

COLOUR AND CABLE MARKING

Black. Oversheath marked at regular intervals with the following information:
<CABELTE> <type of cable> <composition> <year of manufacture> <metric marking>

FIBRES IDENTIFICATION

Fibres colour code inside tube

1 · White	2 · Red	3 · Green	4 · Blue
5 · Black	6 · Yellow	7 · Orange	8 · Grey
9 · Brown	10 · Rose	11 · Violet	12 · Turquoise

Colour of filling elements

Black

Tubes colour code

Up to 12 tubes

1 · Red	2 up to 11 · Natural	12 · Green

16 tubes

1st jacket	White	Red	Blue	Green
2nd jacket	3 White	3 Red	3 Blue	3 Green

Tubes colour code

18 tubes

1st jacket	2 White	2 Red	2 Blue	
2nd jacket	3 White	3 Red	3 Blue	3 Green

GENERAL CHARACTERISTICS

Flame retardant	IEC 60332-1-2 • EN 60332-1-2 (cable vertically mounted, length of charred cable ≤ 540 mm)
Oversheath halogen free	
Low toxicity	IEC 60754-1 • EN 50267-2-1 (halogen acid gas content ≤ 0,5%)
Low corrosivity	IEC 60754-2 • EN 50267-2-2 (pH ≥4,3 • conductivity ≤ 10µS/mm)

MECHANICAL AND DIMENSIONAL CHARACTERISTICS

Fibres count per cable	N.º of elements	Fibres per tube	Cable diameter (mm)	Cable weight (kg/km)	Max. Pulling force		Mechanical resistance		Minimum bending radius	
					Installed (N)	In service (N)	Crush (N/cm)	Impact (J)	Installed (mm)	In service (mm)
24	5	6	10,0	115	3 500	1 850	300	1	180	140
24	5	8	10,0	115	3 500	1 850	300	1	180	140
24	5	12	10,5	125	4 100	2 200	300	1	190	145
32	5	8	10,0	115	3 500	1 850	300	1	180	140
36	6	6	10,0	130	3 900	1 800	300	1	180	140
36	5	12	10,5	125	4 100	2 200	300	1	190	145
48	6	8	10,0	130	3 900	1 800	300	1	180	140
48	5	12	10,5	125	4 100	2 200	300	1	190	145
60	5	12	10,5	125	4 100	2 200	300	1	190	145
64	8	8	12,0	165	4 500	2 200	300	1	215	170
72	9	8	12,5	180	4 750	2 150	300	1	225	175
72	6	12	11,0	140	4 500	2 200	300	1	198	154
96	12	8	14,5	240	5 850	2 550	300	1	260	205
96	8	12	12,5	180	5 150	2 750	300	1	225	175
120	10	12	14,0	220	5 900	2 900	300	1	250	195
128	16	8	15,0	240	5 650	2 700	300	1	270	210
144	18	8	15,0	240	5 650	2 700	300	1	270	210
144	12	12	15,5	265	6 900	3 300	300	1	280	215

Temperature: Storage and transport: - 10°C up to 60°C.
Temperature: Operation: - 20°C up to 60°C.

TON EZaE · PKP

Multitube

Unarmoured • Double jacket

APPLICATION

Multitube cable, loose type, non-metallic, double jacketed, up to 144 fibres.
Loose tubes, dry core, longitudinal water sealing, double jacket, resistant to crush, impact and abrasion. Recommended for duct or directly buried installation. Cable installation by pulling or blowing. Easy handling and installation.

CONSTRUCTION CHARACTERISTICS

Optical fibres (at choice)

Single-mode (Dispersion unshifted) – IEC 60793-2 and ITU-T Rec. G.652.
Single-mode NZD – ITU-T Rec. G.655.
Multi-mode type 50/125 µm – IEC 60793-2 (A1.a) and ITU-T Rec. G.651.
Multi-mode type 62,5/125 µm – IEC 60793-2 (A1.b).

Central strength member

Glass fibre reinforced plastic rod (FRP).

Loose Tubes

PBT – tube with optical fibres and filled with gel.

Core watertightness

Dry – waterblocking swelling tape and yarns.

Inner jacket

Polyethylene.

Mechanical reinforcement

Aramid fibre yarns placed around the optical core.

Oversheath

Polyethylene.

COLOUR AND CABLE MARKING

Black.
Oversheath marked at regular intervals with the following information:
<CABELTE> <type of cable> <composition> <year of manufacture> <metric marking>

FIBRES IDENTIFICATION

Fibres colour code inside tube

1 · Green	2 · Red	3 · Blue	4 · Yellow
5 · Grey	6 · Violet	7 · Brown	8 · Orange

Tubes colour code

6 tubes

2 White	2 Red	2 Blue

8 tubes

2 White	2 Red	2 Blue	2 Green

Tubes colour code

12 tubes

3 White	3 Red	3 Blue	3 Green

18 tubes

1st jacket	2 White	2 Red	2 Blue	
2nd jacket	3 White	3 Red	3 Blue	3 Green

GENERAL CHARACTERISTICS

Construction standards	ADIF TE-038.003 • Telefonica ER.f6.205:Dec.2003

MECHANICAL AND DIMENSIONAL CHARACTERISTICS – ADIF CONSTRUCTION

Fibres count per cable	N.º of elements	Fibres per tube	Cable diameter (mm)	Cable weight (kg/km)	Max. pulling force (N)	Mechanical resistance		Minimum bending radius	
						Crush (N/cm)	Impact (J)	Installed (mm)	In service (mm)
16	8	2	13,5	135	3 200	260	5	270	205
32	6	8	14,5	155	3 200	260	5	290	220
64	6	5(12)+1(4)	14,5	155	3 200	260	5	290	220
96	12	8	19,0	270	3 200	260	5	380	285
128	18	8	20,5	285	3 200	260	5	410	310

MECHANICAL AND DIMENSIONAL CHARACTERISTICS – TELEFÓNICA CONSTRUCTION

Fibres count per cable	N.º of elements	Fibres per tube	Cable diameter (mm)	Cable weight (kg/km)	Max. pulling force (N)	Mechanical resistance		Minimum bending radius	
						Crush (N/cm)	Impact (J)	Installed (mm)	In service (mm)
6	6	2	14,5	155	4 200	260	5	290	220
8	6	2	14,5	155	4 200	260	5	290	220
12	6	2	14,5	155	4 200	260	5	290	220
16	6	4	14,5	155	4 200	260	5	290	220
24	6	4	14,5	155	4 200	260	5	290	220
32	6	8	14,5	155	4 200	260	5	290	220
48	6	8	14,5	155	4 200	260	5	290	220
64	8	8	15,5	175	4 200	260	5	310	310
96	12	8	18,5	255	4 200	260	5	370	280
128	18	8	19,5	265	4 200	260	5	390	295
144	18	8	19,5	265	4 200	260	5	390	295

Temperature: Storage and transport: - 10°C up to 60°C.
Temperature: Operation: - 20°C up to 60°C.

TON Z1ZaZ1 · TKT

Multitube

Unarmoured • Double jacket • Fire retardant

APPLICATION

Multitube cable, loose type, non-metallic, flame retardant, halogen free double jacket, up to 256 fibres. Loose tubes, dry core, longitudinal water sealing, double jacket, resistant to crush, impact and abrasion. Recommended for duct or directly buried installation. Cable installation by pulling or blowing. Easy handling and installation.

CONSTRUCTION CHARACTERISTICS

Optical fibres (at choice)

Single-mode (Dispersion unshifted) – IEC 60793-2 and ITU-T Rec. G.652.
Single-mode NZD – ITU-T Rec. G.655.
Multi-mode type 50/125 µm – IEC 60793-2 (A1.a) and ITU-T Rec. G.651.
Multi-mode type 62,5/125 µm – IEC 60793-2 (A1.b).

Central strength member

Glass fibre reinforced plastic rod (FRP).

Loose Tubes

PBT – tube with optical fibres and filled with gel.

Core watertightness

Dry – waterblocking swelling tape and yarns.

Inner jacket

LSHF – Low Smoke Halogen Free thermoplastic compound, flame retardant.

Mechanical reinforcement

Aramid fibre yarns placed around the optical core.

Oversheath

LSHF – Low Smoke Halogen Free thermoplastic compound, flame retardant.

COLOUR AND CABLE MARKING

Yellow or Black.
Oversheath marked at regular intervals with the following information:
<CABELTE> <type of cable> <composition> <year of manufacture> <metric marking>

FIBRES IDENTIFICATION

Fibres colour code inside tube

1 · Green	2 · Red	3 · Blue	4 · Yellow
5 · Grey	6 · Violet	7 · Brown	8 · Orange

Colour of filling elements

Black

Tubes colour code

6 tubes			
2 White	2 Red	2 Blue	

8 tubes			
2 White	2 Red	2 Blue	2 Green

12 tubes			
3 White	3 Red	3 Blue	3 Green

Tubes colour code

18 tubes

1st jacket	2 White	2 Red	2 Blue	
2nd jacket	3 White	3 Red	3 Blue	3 Green

GENERAL CHARACTERISTICS

Construction standards	ADIF TE-038.003 • Telefonica ER.f6.210:Dec.2006
Flame retardant	IEC 60332-1-2 • EN 60332-1-2 (cable vertically mounted, length of charred cable ≤ 540 mm)
Fire retardant	IEC 60332-3-24 • EN 60332-3-24 (bunch of cables vertically mounted on a ladder, length of charred cable ≤ 2,5 m)
Halogen free	
Low smoke	IEC 61034-2 • EN 61034-2 (cable light transmittance ≥ 50%)
Low toxicity	IEC 60754-1 • EN 50267-2-1 (LSHF sheaths: halogen acid gas content ≤ 0,5%)
Low corrosivity	IEC 60754-2 • EN 50267-2-3 (LSHF sheaths: pH ≥4,3 • conductivity ≤ 10µS/mm)

MECHANICAL AND DIMENSIONAL CHARACTERISTICS – ADIF CONSTRUCTION

Fibres count per cable	N.º of elements	Fibres per tube	Cable diameter (mm)	Cable weight (kg/km)	Max. pulling force (N)	Mechanical resistance		Minimum bending radius	
						Crush (N/cm)	Impact (J)	Installed (mm)	In service (mm)
32	6	8	14,5	210	3 200	260	5	290	220
64	6	5(12)+1(4)	14,5	210	3 200	260	5	290	220
96	12	8	19,0	340	3 200	260	5	380	285
128	18	8	20,5	365	3 200	260	5	410	310

MECHANICAL AND DIMENSIONAL CHARACTERISTICS – TELEFÓNICA CONSTRUCTION

Fibres count per cable	N.º of elements	Fibres per tube	Cable diameter (mm)	Cable weight (kg/km)	Max. pulling force (N)	Mechanical resistance		Minimum bending radius	
						Crush (N/cm)	Impact (J)	Installed (mm)	In service (mm)
6	6	2	13,0	180	4 200	260	5	290	220
8	6	2	13,0	180	4 200	260	5	290	220
12	6	2	13,0	180	4 200	260	5	290	220
16	6	4	13,0	180	4 200	260	5	290	220
24	6	4	13,0	180	4 200	260	5	290	220
32	6	8	13,0	180	4 200	260	5	290	220
48	6	8	13,0	180	4 200	260	5	290	220
64	8	8	15,0	220	4 200	260	5	310	310
96	12	8	18,0	300	4 200	260	5	370	280
128	18	8	18,5	315	4 200	260	5	390	295
144	18	8	18,5	315	4 200	260	5	390	295
256	18	16	20,0	350	4 200	260	5	400	300

Temperature: Storage and transport: - 10°C up to 60°C.
Temperature: Operation: - 20°C up to 60°C.

APPLICATION

Superior fibre protection by the use of a double jacket and an armour. Unitube cable, loose type, low dimensions and lightweight, design for outdoor applications, in ducts or directly buried and in environments with presence of rodents. Easy handling and installation.

CONSTRUCTION CHARACTERISTICS

Optical fibres (at choice)

Single-mode (Dispersion unshifted) – IEC 60793-2 and ITU-T Rec. G.652.
Single-mode NZD – ITU-T Rec. G.655.
Multi-mode type 50/125 µm – IEC 60793-2 (A1.a) and ITU-T Rec. G.651.
Multi-mode type 62,5/125 µm – IEC 60793-2 (A1.b).

Loose Tube

PBT – tube with optical fibres and filled with gel.

Mechanical reinforcement

Glass fibre yarns.

Inner jacket

Polyethylene.

Ripcord

Metallic protection

Corrugated coated steel tape.

Oversheath

Polyethylene.

COLOUR AND CABLE MARKING

Black.
Oversheath marked at regular intervals with the following information:
<CABELTE> <type of cable> <composition> <year of manufacture> <metric marking>

FIBRES IDENTIFICATION

Fibres colour code inside tube

1 · White	2 · Red	3 · Green	4 · Blue
5 · Black	6 · Yellow	7 · Orange	8 · Grey
9 · Brown	10 · Rose	11 · Violet	12 · Turquoise
13 · White / Black	14 · Yellow / Black	15 · Orange / Black	16 · Red / Black

MECHANICAL AND DIMENSIONAL CHARACTERISTICS

Fibres count per cable	Fibres per tube	Cable diameter	Cable weight	Max. Pulling force		Mechanical resistance		Minimum bending radius	
				Installed	In service	Crush	Impact	Installed	In service
		(mm)	(kg/km)	(N)	(N)	(N/cm)	(J)	(mm)	(mm)
4	4	10,0	115	1 100	350	200	1	200	160
6	6	10,0	115	1 100	350	200	1	200	160
8	8	10,0	115	1 100	350	200	1	200	160
12	12	10,0	115	1 100	350	200	1	200	160
16	16	11,0	130	1 350	450	200	1	220	175

Temperature: Storage and transport: - 10°C up to 60°C.
Temperature: Operation: - 20°C up to 60°C.

TOU ZvZ12AZ1

Unitube

Armoured • Fire retardant

APPLICATION

Superior fibre protection by the use of a double jacket and an armour. Unitube cable, loose type, flame retardant and halogen free, low dimensions and lightweight, design for outdoor applications, in ducts or directly buried and in environments with presence of rodents. Easy handling and installation.

CONSTRUCTION CHARACTERISTICS

Optical fibres (at choice)

Single-mode (Dispersion unshifted) – IEC 60793-2 and ITU-T Rec. G.652
Single-mode NZD – ITU-T Rec. G.655
Multi-mode type 50/125 µm – IEC 60793-2 (A1.a) and ITU-T Rec. G.651
Multi-mode type 62,5/125 µm – IEC 60793-2 (A1.b)

Loose Tubes

PBT – tube with optical fibres and filled with gel.

Mechanical reinforcement

Glass fibre yarns.

Ripcord

Inner jacket

LSHF – Low Smoke Halogen Free thermoplastic compound, flame retardant.

Metallic protection

Corrugated coated steel tape.

Oversheath

LSHF – Low Smoke Halogen Free thermoplastic compound, fire retardant.

COLOUR AND CABLE MARKING

Black
Oversheath marked at regular intervals with the following information:
<CABELTE> <type of cable> <composition> <year of manufacture> <metric marking>

FIBRES IDENTIFICATION

Fibres colour code inside tube

1 · White	2 · Red	3 · Green	4 · Blue
5 · Black	6 · Yellow	7 · Orange	8 · Grey
9 · Brown	10 · Rose	11 · Violet	12 · Turquoise
13 · White / Black	14 · Yellow / Black	15 · Orange / Black	16 · Red / Black

GENERAL CHARACTERISTICS

Flame retardant	IEC 60332-1-2 • EN 60332-1-2 (cable vertically mounted, length of charred cable ≤ 540 mm)
Fire retardant	IEC 60332-3-24 • EN 60332-3-24 (bunch of cables vertically mounted on a ladder, length of charred cable ≤ 2,5 m)
Halogen free	
Low smoke	IEC 61034-2 • EN 61034-2 (cable light transmittance ≥ 50%)
Low toxicity	IEC 60754-1 • EN 50267-2-1 (LSHF sheaths: halogen acid gas content ≤ 0,5%)
Low corrosivity	IEC 60754-2 • EN 50267-2-2 (LSHF sheaths: pH ≥4,3 • conductivity ≤ 10µS/mm)

MECHANICAL AND DIMENSIONAL CHARACTERISTICS

Fibres count per cable	Fibres per tube	Cable diameter	Cable weight	Max. Pulling force		Mechanical resistance		Minimum bending radius	
				Installed	In service	Crush	Impact	Installed	In service
		(mm)	(kg/km)	(N)	(N)	(N/cm)	(J)	(mm)	(mm)
4	4	10,0	140	1 400	350	200	1	200	160
6	6	10,0	140	1 400	350	200	1	200	160
8	8	10,0	140	1 400	350	200	1	200	160
12	12	10,0	140	1 400	350	200	1	200	160
16	16	11,0	155	1 550	450	200	1	220	175

Temperature: Storage and transport: - 10°C up to 60°C.
Temperature: Operation: - 20°C up to 60°C.

APPLICATION

Superior fibre protection by the use of a double jacket and an armour. Multitube cable, loose type, low dimensions and lightweight, design for outdoor applications, in ducts or directly buried and in environments with presence of rodents. Easy handling and installation.

CONSTRUCTION CHARACTERISTICS

Optical fibres (at choice)

Single-mode (Dispersion unshifted) – IEC 60793-2 and ITU-T Rec. G.652.
Single-mode NZD – ITU-T Rec. G.655.
Multi-mode type 50/125 µm – IEC 60793-2 (A1.a) and ITU-T Rec. G.651.
Multi-mode type 62,5/125 µm – IEC 60793-2 (A1.b).

Central strength member

Glass fibre reinforced plastic rod (FRP).

Loose Tubes

PBT – tube with optical fibres and filled with gel.

Core watertightness

Dry – waterblocking swelling tape and yarns.

Mechanical reinforcement

Glass fibre yarns.

Inner jacket

Polyethylene.

Ripcord

Metallic protection

Corrugated coated steel tape.

Oversheath

Polyethylene.

COLOUR AND CABLE MARKING

Black.
Oversheath marked at regular intervals with the following information:
<CABELTE> <type of cable> <composition> <year of manufacture> <metric marking>

Fibres colour code inside tube

1 · White	2 · Red	3 · Green	4 · Blue
5 · Black	6 · Yellow	7 · Orange	8 · Grey
9 · Brown	10 · Rose	11 · Violet	12 · Turquoise

Colour of filling elements

Black.

Tubes colour code

Up to 12 tubes

1 · Red	2 up to 11 · Natural	12 · Green

16 tubes

1st jacket	White	Red	Blue	Green
2nd jacket	3 White	3 Red	3 Blue	3 Green

Tubes colour code

18 tubes

1st jacket	2 White	2 Red	2 Blue	
2nd jacket	3 Black	3 Red	3 Blue	3 Green

MECHANICAL AND DIMENSIONAL CHARACTERISTICS

Fibres count per cable	N.º of elements	Fibres per tube	Cable diameter (mm)	Cable weight (kg/km)	Max. Pulling force		Mechanical resistance		Minimum bending radius	
					Installed (N)	In service (N)	Crush (N/cm)	Impact (J)	Installed (mm)	In service (mm)
24	5	6	14,5	180	1 950	1 050	450	5	350	275
24	5	8	14,5	180	1 950	1 050	450	5	350	275
24	5	12	14,5	190	1 950	1 050	450	5	350	275
32	5	8	14,5	180	1 950	1 050	450	5	350	275
36	6	6	14,5	200	2 050	950	450	5	350	275
36	5	12	14,5	190	1 950	1 050	450	5	350	275
48	6	8	14,5	200	2 050	950	450	5	350	275
48	5	12	14,5	190	1 950	1 050	450	5	350	275
60	5	12	14,5	190	1 950	1 050	450	5	350	275
64	8	8	16,5	240	2 450	1 250	450	5	400	315
72	9	8	16,5	250	2 550	1 200	450	5	400	315
72	6	12	15,5	215	2 200	1 100	450	5	375	300
96	12	8	18,5	315	3 150	1 400	450	5	450	350
96	8	12	16,5	250	2 550	1 400	450	5	400	315
120	10	12	18,5	300	3 000	1 500	450	5	450	350
128	16	8	19,5	330	3 350	1 400	450	5	470	370
144	18	8	19,5	330	3 350	1 400	450	5	470	370
144	12	12	19,5	340	3 450	1 700	450	5	470	370

Temperature: Storage and transport: - 10°C up to 60°C.
Temperature: Operation: - 20°C up to 60°C.

TON ZvZ12AZ1

Multitube
Armoured • Fire retardant

APPLICATION

Superior fibre protection by the use of a double jacket and an armour. Multitube cable, loose type, fire retardant and halogen free, design for outdoor applications, in ducts or directly buried and in environments with presence of rodents. Easy handling and installation.

CONSTRUCTION CHARACTERISTICS

Optical fibres (at choice)

Single-mode (Dispersion unshifted) – IEC 60793-2 and ITU-T Rec. G.652.
Single-mode NZD – ITU-T Rec. G.655.
Multi-mode type 50/125 µm – IEC 60793-2 (A1.a) and ITU-T Rec. G.651.
Multi-mode type 62,5/125 µm – IEC 60793-2 (A1.b).

Central strength member

Glass fibre reinforced plastic rod (FRP).

Loose Tubes

PBT – tube with optical fibres and filled with gel.

Core watertightness

Dry – waterblocking swelling tape and yarns.

Mechanical reinforcement

Glass fibre yarns.

Inner jacket

LSHF – Low Smoke Halogen Free thermoplastic compound, flame retardant.

Ripcord

Metallic protection

Corrugated coated steel tape.

Oversheath

LSHF – Low Smoke Halogen Free thermoplastic compound, fire retardant.

COLOUR AND CABLE MARKING

Black.
Oversheath marked at regular intervals with the following information:
<CABELTE> <type of cable> <composition> <year of manufacture> <metric marking>

FIBRES IDENTIFICATION

Fibres colour code inside tube

1 · White	2 · Red	3 · Green	4 · Blue
5 · Black	6 · Yellow	7 · Orange	8 · Grey
9 · Brown	10 · Rose	11 · Violet	12 · Turquoise

Colour of filling elements

Black.

Tubes colour code

Up to 12 tubes

1 · Red	2 up to 11 · Natural	12 · Green

Tubes colour code

16 tubes

1st jacket	White	Red	Blue	Green
2nd jacket	3 White	3 Red	3 Blue	3 Green

18 tubes

1st jacket	2 White	2 Red	2 Blue	
2nd jacket	3 White	3 Red	3 Blue	3 Green

GENERAL CHARACTERISTICS

Flame retardant	IEC 60332-1-2 • EN 60332-1-2 (cable vertically mounted, length of charred cable ≤ 540 mm)
Fire retardant (frt)	IEC 60332-3-24 • EN 60332-3-24 (bunch of cables vertically mounted on a ladder, length of charred cable ≤ 2,5 m)
Halogen free	
Low smoke	IEC 61034-2 • EN 61034-2 (cable light transmittance ≥ 50%)
Low toxicity	IEC 60754-1 • EN 50267-2-1 (halogen acid gas content ≤ 0,5%)
Low corrosivity	IEC 60754-2 • EN 50267-2-3 (pH ≥4,3 • conductivity ≤ 10µS/mm)

MECHANICAL AND DIMENSIONAL CHARACTERISTICS

Fibres count per cable	N.º of elements	Fibres per tube	Cable diameter (mm)	Cable weight (kg/km)	Max. Pulling force		Mechanical resistance		Minimum bending radius	
					Installed (N)	In service (N)	Crush (N/cm)	Impact (J)	Installed (mm)	In service (mm)
24	5	6	14,5	240	2 450	1 300	450	5	350	275
24	5	8	14,5	240	2 450	1 300	450	5	350	275
24	5	12	14,5	245	2 500	1 400	450	5	350	275
32	5	8	14,5	240	2 450	1 300	450	5	350	275
36	6	6	14,5	250	2 500	1 200	450	5	350	275
36	5	12	14,5	245	2 500	1 400	450	5	350	275
48	6	8	14,5	250	2 500	1 200	450	5	350	275
48	5	12	14,5	245	2 500	1 400	450	5	350	275
60	5	12	14,5	245	2 500	1 400	450	5	350	275
64	8	8	16,5	300	3 050	1 550	450	5	400	315
72	9	8	16,5	315	3 200	1 500	450	5	400	315
72	6	12	15,5	275	2 800	1 400	450	5	375	300
96	12	8	18,5	385	3 850	1 800	450	5	450	350
96	8	12	16,5	315	3 200	1 750	450	5	400	315
120	10	12	18,5	370	3 750	1 900	450	5	450	350
128	16	8	19,5	405	4 050	2 050	450	5	470	370
144	18	8	19,5	405	4 050	2 050	450	5	470	370
144	12	12	19,5	420	4 200	2 100	450	5	470	370

Temperature: Storage and transport: - 10°C up to 60°C.
Temperature: Operation: - 20°C up to 60°C.

APPLICATION

Multitube cable, loose type, armoured, small diameter, design for outdoor applications, in ducts or directly buried and in environments with presence of rodents. Easy handling and installation.

CONSTRUCTION CHARACTERISTICS

Optical fibres (at choice)

Single-mode (Dispersion unshifted) – IEC 60793-2 and ITU-T Rec. G.652.
Single-mode NZD – ITU-T Rec. G.655.
Multi-mode type 50/125 µm – IEC 60793-2 (A1.a) and ITU-T Rec. G.651.
Multi-mode type 62,5/125 µm – IEC 60793-2 (A1.b)

Central strength member

Glass fibre reinforced plastic rod (FRP).

Loose Tubes

PBT – tube with optical fibres and filled with gel.

Core watertightness

Dry – waterblocking swelling tape and yarns.

Mechanical reinforcement

Glassfibres yarns.

Ripcord

Metallic protection

Corrugated coated steel tape.

Oversheath

Polyethylene.

COLOUR AND CABLE MARKING

Black.
Oversheath will be marked, at regular intervals, with the following information:
<CABELTE> <type of cable> <composition> <year of manufacture> <metric marking>

FIBRES IDENTIFICATION

Fibres colour code inside tube

1 · White	2 · Red	3 · Green	4 · Blue
5 · Black	6 · Yellow	7 · Orange	8 · Grey
9 · Brown	10 · Rose	11 · Violet	12 · Turquoise

Colour of filling elements

Black.

Tubes colour code

Up to 12 tubes

1 · Red	2 up to 11 · Natural	12 · Green

MECHANICAL AND DIMENSIONAL CHARACTERISTICS

Fibres count per cable	N.º of elements	Fibres per tube	Cable diameter (mm)	Cable weight (kg/km)	Max. pulling force		Mechanical resistance		Minimum bending radius	
					Installation (N)	Permanent (N)	Crush (N/cm)	Impact (J)	Installation (mm)	Permanent (mm)
12	5	6	12,5	160	1 600	550	200	5	300	240
24	5	6	12,5	160	1 600	550	300	5	300	240
36	5	12	13,5	180	1 800	600	300	5	325	255
48	5	12	13,5	180	1 800	600	300	5	325	255
72	6	12	14,5	190	2 000	700	300	5	350	275
96	8	12	15,5	230	2 300	800	300	5	370	295
144	12	12	18,5	320	3 200	1 100	300	5	445	350

Temperature: Storage and transport: - 10°C up to 60°C.
Temperature: Operation: - 20°C up to + 60°C.

APPLICATION

Superior fibre protection by the use of a double jacket and an armour. Multitube cable, loose type, design for outdoor applications, in ducts or directly buried and in environments with presence of rodents.
PESP-DR – Polyethylene oversheath.
TEST-DR – LSZH oversheath, flame retardant and halogen free.

CONSTRUCTION CHARACTERISTICS

Optical fibres (at choice)

Single-mode (Dispersion unshifted) – IEC 60793-2 and ITU-T Rec. G.652.
Single-mode NZD – ITU-T Rec. G.655.
Multi-mode type 50/125 µm – IEC 60793-2 (A1.a) and ITU-T Rec. G.651.
Multi-mode type 62,5/125 µm – IEC 60793-2 (A1.b).

Central strength member

Glass fibre reinforced plastic rod (FRP).

Loose Tubes

PBT – tube with optical fibres and filled with gel.

Core watertightness

Dry – waterblocking swelling tape and yarns.

Inner Sheath

Polyethylene or LSHF – Low smoke halogen free thermoplastic compound – flame retardant.

Ripcord

Metallic protection

Corrugated coated steel tape.

Oversheath

Polyethylene or LSHF – Low smoke halogen free thermoplastic compound – fire retardant.

COLOUR AND CABLE MARKING

PESP-DR: Black.
TEST-DR: Black or Yellow.
Oversheath marked at regular intervals with the following information:
<CABELTE> <type of cable> <composition> <year of manufacture> <metric marking>

FIBRES IDENTIFICATION

Fibres colour code inside tube

1 · Green	2 · Red	3 · Blue	4 · Yellow
5 · Grey	6 · Violet	7 · Brown	8 · Orange
9 · White	10 · Rose	11 · Black	12 · Turquoise

Colour of filling elements

Black.

Tubes colour code
1 tube – White
2 tubes – White-Red
3 tubes – White-Red-Green
4 tubes – 1st jacket White-White-Red-Green
n tubes – White-...-White-Red-Green

GENERAL CHARACTERISTICS FOR TON GZ12AZ1 · TEST-DR

Flame retardant	IEC 60332-1-2 • EN 60332-1-2 (cable vertically mounted, length of charred cable ≤ 540 mm)
Fire retardant	IEC 60332-3-24 • EN 60332-3-24 (bunch of cables vertically mounted on a ladder, length of charred cable ≤ 2,5 m)
Halogen free	
Low smoke	IEC 61034-2 • EN 61034-2 (cable light transmittance ≥ 60%)
Low toxicity	IEC 60754-1 • EN 50267-2-1 (LSHF sheaths: halogen acid gas content ≤ 0,5%)
Low corrosivity	IEC 60754-2 • EN 50267-2-3 (LSHF sheaths: pH ≥4,3 • conductivity ≤ 10µS/mm)

MECHANICAL AND DIMENSIONAL CHARACTERISTICS

Fibres count per cable	N.º of elements	Fibres per tube	Cable diameter	Cable weight (kg/km)		Max. pulling force	Mechanical resistance		Minimum bending radius	
				PESP-DR	TEST-DR		Crush	Impact	Installed	In service
			(mm)			(N)	(N/cm)	(J)	(mm)	(mm)
8	6	4	14,5	240	270	2 350	450	5	350	275
12	6	6	14,5	240	270	2 350	450	5	350	275
16	6	4	14,5	240	270	2 350	450	5	350	275
18	6	6	14,5	240	270	2 350	450	5	350	275
24	6	8	14,5	240	270	2 350	450	5	350	275
32	6	8	14,5	240	270	2 350	450	5	350	275
36	6	6	14,5	240	270	2 350	450	5	350	275
48	6	8	14,5	240	270	2 350	450	5	350	275
64	8	8	17,0	275	310	2 450	450	5	410	325
80	10	8	18,0	330	370	2 450	450	5	435	345
96	8	12	18,0	330	370	2 050	450	5	435	345

Temperature: Storage and transport: - 10°C up to 60°C.
Temperature: Operation: - 20°C up to 60°C.
Maximum pulling force 2600N (LASE 1%).

APPLICATION

Superior fibre protection by the use of a double jacket and an armour. Multitube cable, loose type, design for outdoor applications when it necessary high tensile strengh for cable pulling into ducts. Suitable also for directed buried and in environments with presence of rodents.

PKESP – polyethylene oversheath.

TKEST – LSZH oversheath, flame retardant, halogen free.

CONSTRUCTION CHARACTERISTICS

Optical fibres (at choice)

Single-mode (Dispersion unshifted) – IEC 60793-2 and ITU-T Rec. G.652

Single-mode NZD – ITU-T Rec. G.655

Multi-mode type 50/125 µm – IEC 60793-2 (A1.a) and ITU-T Rec. G.651

Multi-mode type 62,5/125 µm – IEC 60793-2 (A1.b)

Central strength member

PBT – tube with optical fibres and filled with a water tightness compound.

Core watertightness

Dry – waterblocking swelling tape and yarns.

Inner Sheath

Polyethylene or LSHF – Low smoke halogen free thermoplastic compound – flame retardant.

Peripheral strength member

Aramid yarns around cable core.

Ripcord

Metallic protection

Corrugated coated steel tape.

Oversheath

Polyethylene or LSHF – Low smoke halogen free thermoplastic compound – fire retardant.

COLOUR AND CABLE MARKING

PKESP: Black.

TKEST: Black or Yellow.

Oversheath marked at regular intervals with the following information:

<CABELTE> <type of cable> <composition> <year of manufacture> <metric marking>

FIBRES IDENTIFICATION

Fibres colour code inside tube

1 · Red	2 · Green	3 · Blue	4 · Yellow
5 · Violet	6 · Orange	7 · Brown	8 · Grey
9 · Black	10 · Rose	11 · Turquoise	12 · White

Colour of filling elements

Black.

Tubes colour code

6 tubes		
2 White	2 Red	2 Blue

Tubes colour code

8 tubes

2 White	2 Red	2 Blue	2 Green

12 tubes

3 White	3 Red	3 Blue	3 Green

18 tubes

1st jacket	2 White	2 Red	2 Blue	
2nd jacket	3 White	3 Red	3 Blue	3 Green

GENERAL CHARACTERISTICS FOR TON Z1Za2AZ1 · TEST-DR

Construction standards	ADIF TE-038.003
Flame retardant	IEC 60332-1-2 • EN 60332-1-2 (cable vertically mounted, length of charred cable ≤ 540 mm)
Fire retardant	IEC 60332-3-24 • EN 60332-3-24 (bunch of cables vertically mounted on a ladder, length of charred cable ≤ 2,5 m)
Halogen free	
Low smoke	IEC 61034-2 • EN 61034-2 (cable light transmittance ≥ 50%)
Low toxicity	IEC 60754-1 • EN 50267-2-1 (LSHF sheaths: halogen acid gas content ≤ 0,5%)
Low corrosivity	IEC 60754-2 • EN 50267-2-2 (LSHF sheaths: pH ≥4,3 • conductivity ≤ 10µS/mm)

MECHANICAL AND DIMENSIONAL CHARACTERISTICS

Fibres count per cable	N.º of elements	Fibres per tube	Cable diameter	Cable weight (kg/km)		Max. pulling force	Mechanical resistance		Minimum bending radius	
							Crush	Impact	Installed	In service
				PKESP	TKEST					
			(mm)			(N)	(N/cm)	(J)	(mm)	(mm)
32	6	8	16,5	235	290	3 200	260	5	415	330
64	6	5(12)+1(4)	16,5	235	290	3 200	260	5	415	330
96	12	8	22,0	370	460	3 200	260	5	550	440
128	18	8	22,5	400	485	3 200	260	5	565	450

Temperature: Storage and transport: - 10°C up to 60°C.
Temperature: Operation: - 20°C up to 60°C.

TON ES-8

Multitube

Aerial • 8 figure • Short span

APPLICATION

Multitube loose tube cable, low dimensions and lightweight, watertight. Suitable to for aerial installations, in figure-8.

CONSTRUCTION CHARACTERISTICS

Optical fibres (at choice)

Single-mode (Dispersion unshifted) – IEC 60793-2 and ITU-T Rec. G.652.
Single-mode NZD – ITU-T Rec. G.655.
Multi-mode type 50/125 µm – IEC 60793-2 (A1.a) and ITU-T Rec. G.651.
Multi-mode type 62,5/125 µm – IEC 60793-2 (A1.b).

Central strength member

Glass fibre reinforced plastic rod (FRP).

Loose Tubes

PBT – tube with optical fibres and filled with gel.

Core watertightness

Dry – waterblocking swelling tape and yarns.

Messenger wire

Metallic messenger of galvanized steel.
7 wires with 1mm diameter/each.

Oversheath

Polyethylene.

COLOUR AND CABLE MARKING

Black.
Oversheath marked at regular intervals with the following information:
CABELTE <tipo de cable> <composición> <año de fabricación> <marcado métrico>

FIBRES IDENTIFICATION

Fibres colour code inside tube

1 · White	2 · Red	3 · Green	4 · Blue
5 · Black	6 · Yellow	7 · Orange	8 · Grey
9 · Brown	10 · Rose	11 · Violet	12 · Turquoise

Colour of filling elements

Black.

Tubes colour code

1 · Red	2 · Natural	3 · Natural	4 · Natural	5 · Green

MECHANICAL AND DIMENSIONAL CHARACTERISTICS

Fibres count per cable	N.º of elements	Fibres per tube	Optical cable diameter (mm)	Cable total height (mm)	Cable weight (Kg/Km)	Maximum pulling force (N)	Mechanical resistance		Minimum bending radius	
							Crush (N/cm)	Impact (J)	Installed (mm)	In service (mm)
12	5	12	11	19	160	2 350	300	1	265	210
24										
36										
48										
60										

Temperature: Storage and transport: - 10°C up to 60°C.
Temperature: Operation: - 20°C up to 60°C.
Minimum breaking load of steel messenger 7 x 1: 6 600 N.

ADSS · TON ZaE1S

Unitube

Aerial • Short span

APPLICATION

All dielectric self-supported cable, suitable to be installed aerially in short spans. Loose tube design, dry core.

CONSTRUCTION CHARACTERISTICS

Optical fibres (at choice)

Single-mode (Dispersion unshifted) – IEC 60793-2 and ITU-T Rec. G.652.
Single-mode NZD – ITU-T Rec. G.655.
Multi-mode type 50/125 µm – IEC 60793-2 (A1.a) and ITU-T Rec. G.651.
Multi-mode type 62,5/125 µm – IEC 60793-2 (A1.b).

Central strength member

Glass fibre reinforced plastic rod (FRP).

Loose Tubes

PBT – tube with optical fibres and filled with gel.

Core watertightness

Dry – waterblocking swelling tape and yarns.

Mechanical reinforcement

Aramid yarns lay around cable core.
If anti-shotgun (antiballistic) protection is required, an aramid tape is applied.

Oversheath

Polyethylene.

COLOUR AND CABLE MARKING

Black.
Oversheath marked at regular intervals with the following information:
<CABELTE> <type of cable> <composition> <year of manufacture> <metric marking>

FIBRES IDENTIFICATION

Fibres colour code inside tube

1 · White	2 · Red	3 · Green	4 · Blue
5 · Black	6 · Yellow	7 · Orange	8 · Grey
9 · Brown	10 · Rose	11 · Violet	12 · Turquoise

Colour of filling elements

Natural.

Tubes colour code

1 · White	2 · Red	3 · Green	4 · Blue
5 · Black	6 · Yellow		

GENERAL CHARACTERISTICS

Mechanical characteristics	
Maximum load EDS	1150 N
Maximum allowable tension under worst conditions	1600 N
Resistant cross-sectional area	7,6 mm^2
Young's modulus	71 kN/mm^2
Coefficient of thermal expansion	9,4 x 10^{-6} $°C^{-1}$
Minimum cable sag at installation	2 %
Maximum span (depending on the installation conditions)	80 m

MECHANICAL AND DIMENSIONAL CHARACTERISTICS

Fibres count per cable	N.º of elements	Fibres per tube	Cable diameter (mm)	Cable weight (kg/km)	Breaking Load Minimum (N)	Mechanical resistance Crush (N/cm)	Mechanical resistance Impact (J)	Minimum bending radius Installed (mm)	Minimum bending radius In service (mm)
12	6	12	11	90	11 000	250	1,5	190	145
24									
36									
48									
60									
72									

Temperature: Storage and transport: - 10°C up to 60°C.
Temperature: Operation: - 20°C up to 60°C.

ADSS · TON EZaE1S

Unitube

Aerial • Medium span

APPLICATION

All dielectric self-supported cable, suitable to be installed aerially in middle spans.
Loose tube design, dry core.

CONSTRUCTION CHARACTERISTICS

Optical fibres (at choice)

Single-mode (Dispersion unshifted) – IEC 60793-2 and ITU-T Rec. G.652.
Single-mode NZD – ITU-T Rec. G.655.
Multi-mode type 50/125 µm – IEC 60793-2 (A1.a) and ITU-T Rec. G.651.
Multi-mode type 62,5/125 µm – IEC 60793-2 (A1.b).

Central strength member

Glass fibre reinforced plastic rod (FRP).

Loose Tubes

PBT – tube with optical fibres and filled with gel.

Core watertightness

Dry – waterblocking swelling tape and yarns.

Inner jacket

Polyethylene.

Mechanical reinforcement

Two layers of aramid yarns around cable core.
If anti-shotgun (antiballistic) protection is required, an aramid tape is applied.

Oversheath

Polyethylene.
In case of installation on HV transmission lines, the outer jacket provides antitracking protection.

COLOUR AND CABLE MARKING

Black.
Oversheath marked at regular intervals with the following information:
<CABELTE> <type of cable> <composition> <year of manufacture> <metric marking>

FIBRES IDENTIFICATION

Fibres colour code inside tube

1 · White	2 · Red	3 · Green	4 · Blue
5 · Black	6 · Yellow	7 · Orange	8 · Grey
9 · Brown	10 · Rose	11 · Violet	12 · Turquoise

Colour of filling elements

Natural.

Tubes colour code

1 · White	2 · Red	3 · Green	4 · Blue
5 · Black	6 · Yellow		

GENERAL CHARACTERISTICS

Mechanical characteristics	
Maximum load EDS	3 600 N
Maximum allowable tension under worst conditions	9 500 N
Resistant cross-sectional area	21,4 mm^2
Young's modulus	98 kN/mm^2
Coefficient of thermal expansion	2,14 x 10^{-6} $°C^{-1}$
Minimum cable sag at installation	2 %
Maximum span (depending on the installation conditions)	300 m

MECHANICAL AND DIMENSIONAL CHARACTERISTICS

Fibres count per cable	N.º of elements	Fibres per tube	Cable diameter (mm)	Cable weight (kg/km)	Breaking Load Minimum (N)	Mechanical resistance Crush (N/cm)	Mechanical resistance Impact (J)	Minimum bending radius Installed (mm)	Minimum bending radius In service (mm)
12	6	12	16	220	52 000	250	1,5	280	210
24									
36									
48									
60									
72									

Temperature: Storage and transport: - 10°C up to 60°C.
Temperature: Operation: - 20°C up to 60°C.