



Quality Through Experience

TUNNELING CABLES



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Tunneling Cables

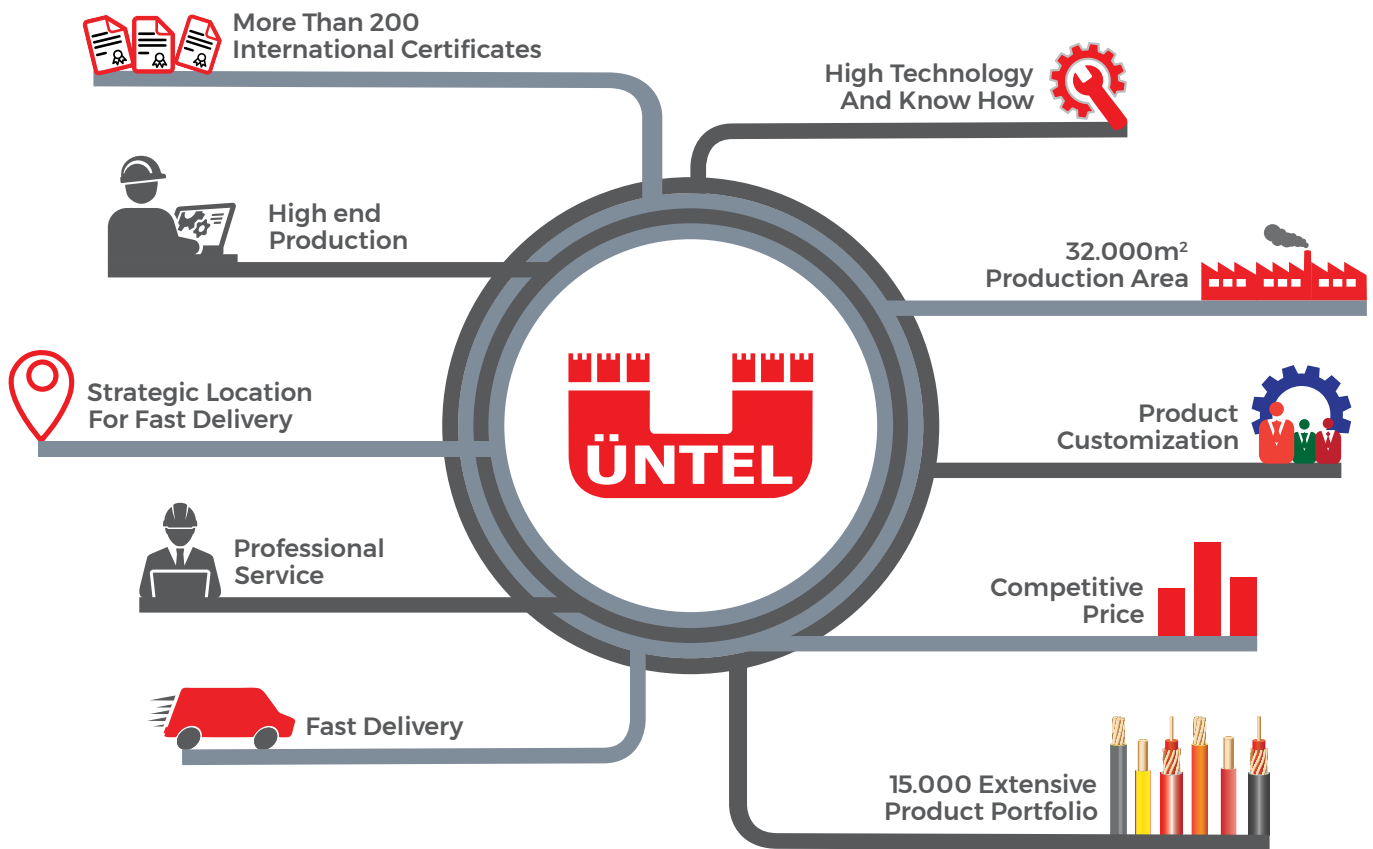


Quality Through Experience

HALF A CENTURY OF EXPERIENCE

HALF A CENTURY OF EXPERIENCE

Exporting Over 70 Countries on 6 Continents



INDUSTRIAL
CABLES

MARINE
CABLES

OFFSHORE
CABLES

MINING & TUNNELING
CABLES

AIRPORT
CABLES

RAILWAY
CABLES

CRANE
CABLES

DEFENSE INDUSTRY
CABLES

INSTRUMENTATION
CABLES



ABOUT US

ÜNTEL KABLO, one of leading cable manufacturers in the world was established in 1972, Turkey. With almost 50 years of experience, continuously develops and optimize her product range with the help of advanced technology and well trained staff.

Product range consists over 15.000 different types of cables, covers both rubber and thermoplastic cables up to Medium Voltage (MV) range. ÜNTEL's power and instrumentation cables supplies energy for industries which requires experience like marine, offshore, mines and tunnels, airports, railways and have been used in industrial ways such as heavy-duty rubber drum reeling cables, welding cables, control cables and fire resistant cables. ÜNTEL is also able to produce tailor made products for special purposes. Today these products are exported over 70 countries on six continents.

By the end of 2009, ÜNTEL finalized the investment of a new high-tech plant near Istanbul. Now continues her operations on 43.000 m2 land space with 32.000 m2 closed area. By having 3.000 tons copper drawing and 4.000 tons different type of

compound processing capacity, ÜNTEL produces 30.000 tones of cable per year. By means of new factory building, state of the art machines and unique ERP system investments ÜNTEL aimed absolute customer satisfaction.

Üntel's laboratories which are approved by organisations that specify the standards are equipped with advanced technology test and measurement devices. Within the scope of Quality System Certificates there is a quality management system presents in Üntel according to ISO, IQnet and TSE quality standards.. Around 200 different types of cables are certified by global organisations like VDE, KEMA, ABS, UL, BV, DNV-GL, RINA and TSE.

Üntel Kablo evaluate customer needs and expectations in a sectoral wiew and provide effective solutions with hundred percent customer satisfaction and qualified production philisopy. Üntel's biggest value is well trained and experienced staff and believe that exceptional quality comes through this experience.



Your Reliable Solution Partner for Mining and Tunneling Cables



TUNNELING CABLES

TUNNELING CABLES

Üntel Kablo is one of the leading manufacturer of mining and tunnelling cables in Europe and has been producing tunnelling cables according to many international standards with approved quality more than 45+ years

We have many production rubber continuous vulcanisation lines that are capable of extruding three layers of rubber in a single operation, and are equipped with instruments to control the whole production process.

Drilling, Tunnelling & TBM Cables are designed to perform in demanding environments and mainly they are used in applications from energy supply to heavy mobile MV equipment.

We offer these cables with durability to high tensile and bending stresses for mines and tunnel installation.

For this kind of cables we stick to specific cable design principles developed through years of experience. This decades of experience allows us to use only the highest quality of materials and compounds to achieve a cable which is suitable to each specific application. Drawing on over 45 years' experience and continuously investing in Research

& Development and Innovation, we apply excellence, understanding and integrity to everything we do, meeting and exceeding the precise needs of our customers.

Tunnelling projects have been mainly for road, railway traffics or watering supply projects. These long tunnels are bored with tunneling machines and powering is ensured by heavy-duty flexible similar to the dynamic mining cables. For this reason they are considered as being part of the same product range. Mainly there are two main cable types used in tunnelling processes. Static cables can be installed in a fixed manner from the feeding end of the tunnel to the interconnection point with the heavy duty trailing or reeling dynamic cable. Dynamic cables are connected to the tunneling machine - TBM.



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CABLE STRUCTURE

Conductor	Electrolytic, stranded, plain copper wire DIN VDE 0295 Class 5
Insulation	All cores are insulated with 3GI3 compound
Lay Up	All cores are laid up in contact with each other and intersitial ground cores.
Inner Sheath	Special extruded elastomeric compound
Outer Sheath	Heavy-duty elastomer outer sheath 5GM5. Yellow or black.

PRODUCTION AND TEST STANDARDS

Construction	DIN VDE 0250-812
General Requirements	DIN VDE 0250-1
Guide to Use	DIN VDE 0298-3
Electrical Tests	DIN VDE 0472-501, 503, 508
Non-Electrical Tests	DIN VDE 0472-401, 402, 602, 303, 615
Under Fire Conditions Tests	DIN VDE 0472-803, 804
Flame Retardant	VDE 0482-332-1-2, DIN EN 60332-1-2, IEC 60332-1
Oil Resistant	HD/EN/IEC 60811-2-1, DIN VDE 0473-811-2-1

OPERATING CHARACTERISTICS

Rated Voltage	0,6 / 1 kV
Max. Permissible	
Operating Voltage AC	0,7 / 1,2 kV
Max. Permissible	
Operating Voltage DC	0,9 / 1,8 kV
AC Test Voltage	3 kV
Min Bending Radius	Acc. to DIN VDE 0298 part 3
Current Carrying Capacity	According to DIN VDE 0298, Part 4
Working Temperature	
Fixed	-40°C ... +80°C
Mobile	-25°C ... +80°C
Max. Tensile Load of cable	15 N / mm ²

Application

For use in open-cast mining and quarries and similar plants. Also suitable for laying alongside conveyor belts, on material handling equipment, It can be used for tunneling sites and similar applications.



Ozone
Resistant



Cold
Resistant



Tear
Resistant



Uv Resistant



Weather
Resistant



Moisture
Resistant



Ex-Proof

Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Approximate weight (kg / km)
3 x 1,5	9,7 - 10,3	145
3 x 2,5	11,2 - 12,8	220
3 x 4	12,5 - 14,1	300
3 x 6	13,2 - 15,0	380
3 x 10	16,6 - 18,6	590
3 x 16	19,5 - 21,0	797
3 x 25	22,9 - 24,9	1206
3 x 35	24,9 - 27,9	1670
3 x 50	29,4 - 33,0	2195
3 x 70	34,8 - 37,8	3124
3 x 95	40,9 - 43,9	4100
3 x 120	43,4 - 47,7	4730
3 x 150	47,8 - 54,0	5916
3 x 185	53,1 - 58,6	7270
4 x 1,5	10,5 - 12,6	200
4 x 2,5	12,0 - 13,7	260
4 x 4	13,5 - 15,1	360
4 x 6	15,7 - 17,7	458
4 x 10	17,4 - 20,2	670
4 x 16	21,4 - 23,1	1038
4 x 25	24,5 - 28,1	1576
4 x 35	28,4 - 31,4	1978
4 x 50	33,6 - 36,6	2765
4 x 70	38,8 - 42,5	3930
4 x 95	44,8 - 47,8	5165
4 x 120	50,0 - 53,9	6200

Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Approximate weight (kg / km)
4 x 150	55,0 - 58,9	7537
4 x 185	59,0 - 63,3	9420
5 x 1.5	11,4 - 13,5	234
5 x 2.5	12,9 - 1,6	318
5 x 4	14,7 - 16,7	434
5 x 6	16,1 - 18,6	594
5 x 10	19,0 - 22,0	820
5 x 16	23,2 - 25,2	1285
5 x 25	28,0 - 31,0	1864
5 x 35	34,0 - 37,5	2675
7 x 1,5	12,9 - 14,5	300
7 x 2,5	14,9 - 17,4	458
12 x 1.5	15,8 - 17,8	420
12 x 2.5	17,3 - 19,6	580
18 x 1.5	18,5 - 20,5	610
18 x 2.5	21,2 - 23,4	900
24 x 1.5	20,9 - 23,1	760
24 x 2.5	22,8 - 24,8	1140
3 x 50/25	29,0 - 33,5	2510
3 x 70/35	34,8 - 37,8	3500
3 x 95/50	44,0 - 49,0	4300
3 x 120/70	44,7 - 47,7	5470
3 x 150/70	49,5 - 54,8	7000
3 x 185/95	54,5 - 58,5	8300
3 x 240/120	60,9 - 66,2	10500





CABLE STRUCTURE

Conductor	Electrolytic, stranded, tinned copper wire DIN VDE 0295 Class 5
Insulation	All cores are insulated with 3GI3 compound (acc. to DIN VDE 0207 Part 20).
Screen	...3/E coded types has individual screens made by laying up tinned copper wires over the insulation.
Lay Up	All cores are laid up in contact with each other and intersitial ground cores.
Inner Sheath	Special elastomeric compound GM1b (acc. to DIN VDE 0207 Part 21)
Screen	...kon coded types has a concentric overall screen made of tinned copper wires in between inner and outer sheaths
Outer Sheath	Heavy-duty elastomer outer sheath 5GM5 (acc. to DIN VDE 0207 Part 21)

PRODUCTION AND TEST STANDARDS

Construction	DIN VDE 0250-812
General Requirements	DIN VDE 0250-1
Guide to Use	DIN VDE 0298-3
Electrical Tests	DIN VDE 0472-501, 503, 508
Non-Electrical Tests	DIN VDE 0472-401, 402, 602, 303, 615
Under Fire Conditions Tests	DIN VDE 0472-803, 804
Flame Retardant	VDE 0482-332-1-2, DIN EN 60332-1-2, IEC 60332-1
Oil Resistant	HD/EN/IEC 60811-2-1, DIN VDE 0473-811-2-1

OPERATING CHARACTERISTICS

Rated Voltage	0,6 / 1 kV
Max. Permissible Operating Voltage AC	0,7 / 1,2 kV
Max. Permissible Operating Voltage DC	0,9 / 1,8 kV
AC Test Voltage	3 kV
Min Bending Radius	VDE 0298-3 Tab. 3
Current Carrying Capacities	VDE 0298-4
Working Temperature	
Fixed	-40°C ... +80°C
Mobile	-25°C ... +80°C
Max. Tensile Load of Cable	15N/mm ²

Application

For use in mines, quarries, industrial areas, construction sites, agricultural operations and as trailing cable. The cables are also suitable for fixed application as power supply cable for underground mining and open-cast mining applications, for tunnelling applications and similar applications.



Ozone
Resistant



Cold
Resistant



Tear
Resistant



Uv Resistant



Weather
Resistant



Moisture
Resistant



Ex-Proof

Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Approximate weight (kg / km)
1 x 1,5	6,0 - 6,6	56
1 x 2,5	6,7 - 7,4	73
1 x 4	7,3 - 8,1	95
1 x 6	7,8 - 8,6	117
1 x 10	9,2 - 10,2	174
1 x 16	10,2 - 11,2	236
1 x 25	13,1 - 14,1	372
1 x 35	14,0 - 15,4	470
1 x 50	15,8 - 17,4	626
1 x 70	18,0 - 19,8	866
1 x 95	19,0 - 21,9	1906
1 x 120	22,0 - 24,4	1382
1 x 150	23,8 - 26,3	1675
1 x 185	26,9 - 29,7	2072
1 x 240	30,0 - 33,2	2710
1 x 300	33,6 - 37,2	3372
1 x 400	38,3 - 42,3	4320
1 x 500*	41,0 - 45,4	5582
2 x 1,5	10,8 - 12,0	170
2 x 2,5	12,1 - 13,3	217
2 x 4	14,5 - 16,10	321
2 x 6	15,6 - 17,2	386
2 x 10	19,2 - 21,2	597
2 x 16	21,1 - 23,3	770
2 x 25	26,4 - 29,2	1186
2 x 35	28,1 - 31,1	1440
2 x 50	33,1 - 36,5	2001
2 x 70	38,0 - 42,0	2753
2 x 95	41,8 - 46,2	3414
2 x 120	46,7 - 51,7	4315

Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Approximate weight (kg / km)
3 x 1,5	11,3 - 12,5	192
3 x 2,5	12,7 - 14,1	254
3 x 4	15,3 - 16,9	377
3 x 6	16,3 - 18,1	456
3 x 10	20,2 - 22,4	715
3 x 16	22,2 - 24,6	937
3 x 25	27,9 - 30,9	1444
3 x 35	31,1 - 34,3	1885
3 x 50	36,3 - 40,1	2600
3 x 70	40,2 - 44,4	3416
3 x 95	46,0 - 50,8	4466
3 x 120	49,5 - 54,7	5397
3 x 150	53,1 - 58,7	6451
3 x 185	59,6 - 65,8	7953
4 x 1,5	12,2 - 13,4	224
4 x 2,5	14,7 - 16,3	337
4 x 4	16,3 - 18,1	440
4 x 6	17,6 - 19,4	542
4 x 10	21,9 - 24,2	852
4 x 16	25,1 - 27,7	1216
4 x 25	31,3 - 34,5	1853
4 x 35	33,5 - 37,1	2324
4 x 50	39,2 - 43,2	3210
4 x 70	43,6 - 48,2	4240
4 x 95	50,0 - 55,2	5540
4 x 120	55,6 - 61,4	6985
4 x 150	60,0 - 66,3	8385
4 x 185	67,0 - 74,0	10285
4 x 240 *	74,5 - 82,3	13130
4 x 300*	81,0 - 89,6	16155



Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Approximate weight (kg / km)
5x1,5	13,0 - 14,4	262
5x2,5	15,8 - 17,4	394
5x4	17,7 - 19,5	525
5x6	19,8 - 21,8	697
5x10	23,7 - 26,1	1030
5x16	27,2 - 30,0	1446
5x25	34,5 - 38,1	2256
5x35	38,2 - 42,2	2938
5x50	43,0 - 47,6	3878
5x70	49,7 - 54,9	5385
5x95	55,6 - 61,4	6856
5x120*	61,2 - 67,6	8595
5x150*	65,4 - 72,2	10717
6x1,5	15,0 - 16,6	352
6x2,5	16,3 - 18,6	466
6x4	19,6 - 21,6	620
6x6	21,1 - 23,3	768
6x10	25,4 - 28,0	1157
6x16	29,2 - 32,2	1633
6x25	36,5 - 40,3	2502
6x35	40,4 - 44,6	3275
6x50	47,5 - 52,5	4555
7x1,5	16,0 - 17,6	392
7x2,5	18,1 - 20,0	523
7x4	21,1 - 23,3	707
7x6	22,8 - 25,2	880
7x10	28,5 - 31,5	1400
7x16	33,1 - 36,5	1995
7x25	41,0 - 45,4	3025

Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Approximate weight (kg / km)
7 x 35	43,9 - 48,5	3778
7 x 50	51,7 - 57,1	5257
8 x 1,5*	16,2 - 18,0	420
10 x 1,5*	18,0 - 19,8	474
10 x 2,5*	21,1 - 23,3	672
12 x 1,5	19,1 - 21,1	551
12 x 2,5	21,7 - 23,9	748
12 x 4	25,5 - 28,1	1103
14 x 2,5*	22,6 - 25,0	850
14 x 4*	26,5 - 29,3	1232
15 x 1,5*	20,7 - 22,9	655
15 x 2,5*	23,7 - 26,1	916
16 x 2,5*	23,7 - 26,1	948
18 x 1,5	22,0 - 24,4	777
18 x 2,5	25,7 - 28,4	1103
18 x 4	30,3 - 33,5	1605
19 x 1,5*	21,7 - 23,9	763
19 x 2,5*	25,7 - 28,4	1154
20 x 2,5*	26,8 - 29,6	1220
20 x 4*	30,4 - 33,6	1687
21 x 1,5*	22,6 - 25,0	826
24 x 1,5*	24,6 - 27,2	911
24 x 2,5*	30,3 - 33,5	1476
24 x 4*	34,5 - 38,1	2052
27 x 1,5*	25,0 - 27,6	982
30 x 2,5*	33,3 - 36,8	1844
36 x 1,5*	28,5 - 31,5	1295
37 x 1,5*	28,5 - 31,5	1315
37 x 2,5*	31,4 - 34,8	1753

Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Approximate weight (kg / km)
48 x 1,5*	28,5 - 31,5	1547
3 x 10 + 1 x 6*	21,0 - 23,2	800
3 x 25 + 1 x 16*	30,0 - 33,2	1715
3 x 35 + 1 x 16*	33,7 - 37,3	2207
3 x 50 + 1 x 25*	40,0 - 44,2	3062
3 x 70 + 1 x 35*	43,2 - 47,8	3950
3 x 95 + 1 x 50*	48,0 - 53,0	4921
3 x 120 + 1 x 70*	53,7 - 59,3	6402
3 x 185 + 1 x 95*	64,6 - 71,4	9330
3 x 240 + 1 x 120*	73,5 - 81,3	12264
3 x 25 + 3 x 16 / 3*	28,8 - 31,8	1470
3 x 35 + 3 x 25 / 3*	34,1 - 37,7	2320
3 x 50 + 3 x 25 / 3*	36,5 - 40,3	2787
3 x 70 + 3 x 35 / 3*	41,5 - 46,0	3786
3 x 95 + 3 x 50 / 3*	46,0 - 50,8	4775
3 x 120 + 3 x 70 / 3*	51,2 - 56,6	6068
3 x 150 + 3 x 70 / 3*	53,5 - 59,1	6910
3 x 185 + 3 x 95 / 3*	61,7 - 68,1	8814
3 x 240 + 3 x 120 / 3*	67,5 - 74,5	11181
3 x 300 + 3 x 150 / 3*	74,2 - 82,0	13652
3 x 2,5 + 3 x 2,5 / 3E	16,0 - 19,0	350
3 x 4 + 3 x 4 / 3E	19,0 - 22,0	500
3 x 6 + 3 x 6 / 3E	20,0 - 23,0	600
3 x 10 + 3 x 10 / 3E	24,0 - 28,0	950
3 x 16 + 3 x 16 / 3E	27,0 - 30,0	1200
3 x 25 + 3 x 16 / 3E	29,0 - 33,0	1800
3 x 35 + 3 x 16 / 3E	34,0 - 38,0	2300
3 x 50 + 3 x 25 / 3E	40,0 - 44,0	3300
3 x 70 + 3 x 35 / 3E	44,0 - 48,0	4100

Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Approximate weight (kg / km)
3 x 95 + 3 x 50 / 3E	50,0 - 55,0	5500
3 x 120 + 3 x 70 / 3E	55,0 - 60,0	6800
3 x 150 + 3 x 70 / 3E	59,0 - 64,0	8000
3 x 2,5 + 3 x 2,5 / 3E + 3 x 1,5 St	18,0 - 20,0	500
3 x 4 + 3 x 4 / 3E + 3 x 1,5 St	19,0 - 22,0	550
3 x 6 + 3 x 6 / 3E + 3 x 1,5 St	20,0 - 24,0	650
3 x 10 + 3 x 10 / 3E + 3 x 2,5 St	24,0 - 28,0	1000
3 x 16 + 3 x 16 / 3E + 3 x 2,5 St	27,0 - 30,0	1300
3 x 25 + 3 x 16 / 3E + 3 x 2,5 St	30,0 - 34,0	1800
3 x 35 + 3 x 16 / 3E + 3 x 2,5 St	34,0 - 38,0	2400
3 x 50 + 3 x 25 / 3E + 3 x 2,5 St	40,0 - 44,0	3200
3 x 70 + 3 x 35 / 3E + 3 x 2,5 St	44,0 - 48,0	4200
3 x 95 + 3 x 50 / 3E + 3 x 2,5 St	48,0 - 53,0	5600
3 x 120 + 3 x 70 / 3E + 3 x 2,5 St	51,0 - 56,0	6800
3 x 150 + 3 x 70 / 3E + 3 x 2,5 St	59,0 - 64,0	8100
3 x 2,5 / 2,5 kon	15,0 - 18,0	350
5 x 2,5 / 2,5 kon	19,0 - 23,0	500
5 x 4 / 4 kon	20,0 - 23,0	650
5 x 6 / 6 kon	21,0 - 24,0	800
10 x 1,5 / 1,5 kon	20,0 - 24,0	800
10 x 2,5 / 2,5 kon	26,0 - 29,0	1100

* Based on standart DIN VDE 0250 - 812 as (N)SSHOU



CABLE STRUCTURE

Conductor	Electrolytic, stranded, tinned copper wire DIN VDE 0295 Class 5
Insulation	All cores are insulated with 3GI3 compound
Lay Up	Three power cores laid up with the protective earth conductors split into three in the outer interstices
Screen	.Concentric tinned copper wire braiding
Inner Sheath	Special extruded elastomeric compound GM1b
Outer Sheath	Heavy-duty elastomer outer sheath 5GM5. Yellow or black

PRODUCTION AND TEST STANDARDS

Construction	DIN VDE 0250-811
General Requirements	DIN VDE 0250-1
Guide to Use	DIN VDE 0298-3
Electrical Tests	DIN VDE 0472-501, 503, 508
Non-Electrical Tests	DIN VDE 0472-401, 402, 602, 303, 615
Under Fire Conditions Tests	DIN VDE 0472-803, 804
Flame Retardant	VDE 0482-332-1-2, DIN EN 60332-1-2, IEC 60332-1
Oil Resistant	HD/EN/IEC 60811-2-1, DIN VDE 0473-811-2-1

OPERATING CHARACTERISTICS

Rated Voltage	0,6 / 1 kV
Max. Permissible	
Operating Voltage AC	0,7/1,2 kV
Max. Permissible	
Operating Voltage DC	0,9/1,8 kV
AC Test Voltage	: 3 kV
Min Bending Radius	Acc. to DIN VDE 0298 part 3
Current Carrying Capacity	According to DIN VDE 0298, Part 4
Working Temperature	
Fixed	-40°C ... +80°C
Mobile	-25°C ... +80°C
Max. Tensile Load of Cable	15 N/mm ²
Max. Torsion	25°/m

Application

The cables are suitable for fixed installation and flexible operation as motor power supply cables for frequency converter controlled drives in the mining and tunneling



Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Approximate weight (kg / km)
3 x 16 + 3 x 2.5	24,4 - 27,4	1200
3 x 25 + 3 x 4	28,2 - 31,2	1700
3 x 35 + 3 x 16/3	30,5 - 33,5	2200
3 x 50 + 3 x 25/3	36,0 - 39,0	2800
3 x 70 + 3 x 35/3	41,2 - 44,2	3850
3 x 95 + 3 x 50/3	45,7 - 48,7	4650
3 x 120 + 3x70/3	48,7 - 52,7	5800
3 x 150 + 3x70/3	55,7 - 59,7	7150
3 x 185 + 3x95/3	60,4 - 64,4	8500
3 x 240 + 3x120/3	68,2 - 72,2	10100



CABLE STRUCTURE

CONDUCTOR & INSULATION

Power Cores

Conductor	Tinned copper conductor DIN VDE 0295 class 5.
Insulation	Based on 3GI3 - EPR rubber and semi conductive rubber compound.

CONTROL CORES + MONITORING PE CORE(S)

Conductor	Tinned copper conductor DIN VDE 0295 class 5.
Insulation	3GI3 type EPR compound and semi conductive rubber compound.

Lay Up

Three power cores laid-up, with double concentric control cores and monitoring core in the outer interstices. If there are 3 control cores, the monitoring core is concentrically wrapped over insulation of control cores

Inner Sheath

GM1b type EPR compound

Screen / Armour

Flexible - pliable armour in helix of tinned copper and galvanised steel wires

Outer Sheath

Heavy duty elastomer 5GM5 type rubber compound. Yellow or Red.

PRODUCTION AND TEST STANDARDS

Construction	DIN VDE 0250-812
General Requirements	DIN VDE 0250-1
Guide to Use	DIN VDE 0298-3
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Flame Retardant	VDE 0482-332-1-2, DIN EN 60332-1-2, IEC 60332-1
Oil Resistant	HD/EN/IEC 60811-2-1, DIN VDE 0473-811-2-1

OPERATING CHARACTERISTICS

Rated Voltage	0,6/1 kV
Max. Permissible Operating Voltage AC	0,7/1,2 kV
Max. Permissible Operating Voltage DC	0,9/1,8 kV
AC Test Voltage	3 kV
AC Test Voltage (For Control Cores)	2 kV
Min Bending Radius	Acc. to DIN VDE 0298 part 3
Min. Distance With S-Type Directional Changes	20 x D
Current Carrying Capacity	According to DIN VDE 0298, Part 4
Working Temperature	
Fixed	-40°C ... +80°C
Mobile	-25°C ... +80°C
Max. Tensile Load of cable	15 N/mm ²



Application

It is used for connection of mobile machines with very high mechanical load, especially in mines for coal cutting and loading machines as well as for supplying appliances and devices and auxiliary electrical circuits. Concentric phase monitoring screen and overall concentric earth conductor facilitate in connection with a suitable monitoring equipment monitoring of the cable from standpoint of insulation faults and damages that are caused by external effects.

Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Approximate weight (kg / km)
3 x 16/16 KON + (2x1,5 St+1,5 ÜL)	35,0 - 38,0	2150
3 x 25/16 KON + (2x1,5 St+1,5 ÜL)	41,0 - 46,0	3000
3 x 35/16 KON + (2x1,5 St+1,5 ÜL)	42,0 - 47,0	3400
3 x 70/35 KON + (2x1,5 St+1,5 ÜL)	46,0 - 51,0	4300
3 x 70/35 KON + (2x1,5 St+1,5 ÜL)	52,0 - 56,0	5600
3 x 95/50 KON + (2x1,5 St+1,5 ÜL)	58,0 - 62,0	7100
3 x 25/16 KON + 3 x (1,5 ST KON/1,5 ÜL KON)	42,0 - 46,0	3130
3 x 35/16 KON + 3 x (1,5 ST KON/1,5 ÜL KON)	43,0 - 47,0	3610
3 x 50/35 KON + 3 x (1,5 ST KON/1,5 ÜL KON)	49,0 - 53,0	4580
3 x 70/35 KON + 3 x (1,5 ST KON/1,5 ÜL KON)	52,0 - 56,0	5920
3 x 95/50 KON + 3 x (1,5 ST KON/1,5 ÜL KON)	60,0 - 64,0	7400



CABLE STRUCTURE

Conductor	Electrolytic, stranded, tinned copper wire DIN VDE 0295 Class 5
Insulation	All cores are insulated with 3GI3 compound (acc. to DIN VDE 0207 part 20).
Lay Up	All cores are laid up in contact with each other and interstitial ground cores.
Inner Sheath	Special elastomeric compound GM1b (acc. to DIN VDE 0207 Teil 21)
Outer Sheath	Heavy duty elastomer outer sheath 5GM5 (acc. to DIN VDE 0207 Teil 21) Yellow or black

PRODUCTION AND TEST STANDARDS

Construction	DIN VDE 0250-813
General Requirements	DIN VDE 0250-1
Guide to Use	DIN VDE 0298-3
Electrical Tests	DIN VDE 0472-501, 503, 508
Non-Electrical Tests	DIN VDE 0472-401, 402, 602, 303, 615
Under Fire Conditions Tests	DIN VDE 0472-803, 804
Flame Retardant	VDE 0482-332-1-2, DIN EN 60332-1-2, IEC 60332-1
Oil Resistant	HD/EN/IEC 60811-2-1, DIN VDE 0473-811-2-1

OPERATING CHARACTERISTICS

Rated Voltage	0,6 / 1 kV
Ac Test Voltage	3 kV
Operating Temperature	Max. 90°C
Short-Circuit Temperature	Max. 250°C
Working Temperature:	
Fixed	-40°C ... +80°C
Mobile	-25°C ... +80°C
Min Bending Radius	VDE 0298-3 Tab. 3
Current Carrying Capacities	VDE 0298-4

Application

Used in dry, damp and wet places where there are mechanical effects, in mines, in trolley, systems, in cranes, in tunnelling applications as trailing and cable power supply



Ozone
Resistant



Cold
Resistant



Tear
Resistant



Uv Resistant



Weather
Resistant



Moisture
Resistant



Ex-Proof

Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Approximate weight (kg / km)
3 x 25 + 3 x 25/3	40,0 - 44,0	2470
3 x 35 + 3 x 25/3	44,4 - 48,4	3150
3 x 50 + 3 x 25/3	47,7 - 51,7	3750
3 x 70 + 3 x 35/3	52,3 - 56,3	4690
3 x 95 + 3 x 50/3	59,9 - 63,9	6210
3 x 120 + 3 x 70/3	63,8 - 67,8	7430
3 x 150 + 3 x 70/3	69,2 - 73,2	8900
3 x 185 + 3 x 95/3	73,1 - 77,1	10330



CABLE STRUCTURE

Conductor	Electrolytic, stranded, tinned copper wire DIN VDE 0295 Class 5
Insulation	3GI3 Type EPR Compound
Electrical Field Control	Inner and Outer Semiconductive layer of semiconductive rubber
Protective-Earth Conductor Lay Up	Tinned Copper conductor with semiconductive layer Three main conductors laid-up with three control cores in the outer interstice
Inner Sheath	GM1b Type EPR Compound
Reinforcement	Embedded braid made of anti torsion synthetic threads
Outer Sheath	5GM5 Type elastomer compound, Red

PRODUCTION AND TEST STANDARDS

Construction	DIN VDE 0250-813
General Requirements	DIN VDE 0250-1
Guide to Use	DIN VDE 0298-3
Electrical Tests	DIN VDE 0472-501, 503, 508
Non-Electrical Tests	DIN VDE 0472-401, 402, 602, 303, 615
Under Fire Conditions Tests	DIN VDE 0472-803, 804
Flame Retardant	VDE 0482-332-1-2, DIN EN 60332-1-2, IEC 60332-1
Oil Resistant	HD/EN/IEC 60811-2-1, DIN VDE 0473-811-2-1

OPERATING CHARACTERISTICS

Rated Voltage	3,6/6 kV 6/10 kV 8,7/15 kV 12/20 kV 18/30 kV
AC Test Voltage	11 kV 17 kV 24 kV 29 kV 43 kV
Max. Permissible Operating Voltage AC	4,2/7,2 kV 6,9/12 kV 10,4/18 kV 13,9/24 kV 20,8/36 kV Acc. to DIN VDE 0298 part 3
Min Bending Radius	According to DIN VDE 0298, Part 4
Current Carrying Capacity	
Working Temperature	
Fixed	-40°C ... +80°C
Mobile	-25°C ... +80°C
Max. Tensile Load of cable	15 N/mm ²
Max. Torsion	25°/m
Travel Speed for tunnelling app.	max. 30 m/min.
Minimum distance for change of direction	20 X D

Application

For the connection of electrical equipment, large material handling machines such as excavators, cranes, dumpers in mining and tunnelling applications. The flexible cable design allows for movement of the equipment during operation.



Ozone Resistant



Cold Resistant



Tear Resistant



UV Resistant



Weather Resistant



Moisture Resistant



Ex-Proof

3,6/6 kV

Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Approximate weight (kg / km)
3 x 25 + 3 x 25/3	41,8 - 45,0	2530
3 x 35 + 3 x 25/3	44,2 - 48,9	2900
3 x 50 + 3 x 25/3	48,5 - 51,4	3600
3 x 70 + 3 x 35/3	52,6 - 55,6	4400
3 x 95 + 3 x 50/3	55,7 - 58,8	5630
3 x 120 + 3 x 70/3	59,6 - 65,9	6200

6/10 kV

Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Approximate weight (kg / km)
3 x 25 + 3 x 25/3	43,6 - 48,1	2600
3 x 35 + 3 x 25/3	45,6 - 50,4	2980
3 x 50 + 3 x 25/3	48,3 - 51,4	3720
3 x 70 + 3 x 35/3	53,4 - 59,1	4510
3 x 95 + 3 x 50/3	57,1 - 63,2	5720
3 x 120 + 3 x 70/3	63,0 - 69,7	6300

8,7/15 kV

Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Approximate weight (kg / km)
3 x 25 + 3 x 25/3	48,1 - 53,2	3675
3 x 35 + 3 x 25/3	51,8 - 57,3	4415
3 x 50 + 3 x 25/3	55,5 - 61,4	5135
3 x 70 + 3 x 35/3	58,0 - 64,1	6005
3 x 95 + 3 x 50/3	63,4 - 70,1	7200
3 x 120 + 3 x 70/3	67,5 - 74,6	8700

12/20 kV

Cross Section (mm²)	Overall Diameter Min - Max (mm)	Approximate weight (kg / km)
3 x 25 + 3 x 25/3	51,1 - 55,3	4460
3 x 35 + 3 x 25/3	54,0 - 58,2	4990
3 x 50 + 3 x 25/3	59,4 - 63,6	5740
3 x 70 + 3 x 35/3	64,2 - 68,4	6950
3 x 95 + 3 x 50/3	69,6 - 73,8	7870
3 x 120 + 3 x 70/3	73,6 - 77,8	9425

18/30 kV

Cross Section (mm²)	Overall Diameter Min - Max (mm)	Approximate weight (kg / km)
3 x 25 + 3 x 25/3	66,0 - 72,8	6360
3 x 35 + 3 x 25/3	68,0 - 75,0	6925
3 x 50 + 3 x 25/3	71,6 - 79,1	7800
3 x 70 + 3 x 35/3	75,8 - 83,7	9140
3 x 95 + 3 x 50/3	79,4 - 87,7	10100
3 x 120 + 3 x 70/3	85,3 - 94,2	12260

20/35 kV

Cross Section (mm²)	Overall Diameter Min - Max (mm)	Approximate weight (kg / km)
3 x 35 + 3 x 25/3	75,7 - 83,6	8400
3 x 50 + 3 x 25/3	79,5 - 87,8	9360
3 x 70 + 3 x 35/3	82,0 - 90,6	10400
3 x 95 + 3 x 50/3	87,3 - 96,4	11770
3 x 120 + 3 x 70/3	91,4 - 101,1	13680





CABLE STRUCTURE

Conductors	Flexible Tinned Electrolytic Copper Conductor DIN VDE 0295 Class 5
Insulation	3GI3 type EPR Compound
Electrical Field Control	Inner and Outer Semiconductive layer of semiconductive rubber
Control Core	Tinned Copper Conductor with semiconductive layer.
Protective - Earth Conductor	Tinner Copper / Textile braiding combined cores laying concentric around each power core.
Core Identification	Main Cores: Natural coloring with black semiconductive rubber, Control cores: Black
Lay Up	Three main conductors laid-up with three control cores in the outer interstice
Inner Sheath Monitoring	GM1b Type EPR Compound
Conductor	Overall concentric lay of copper wire spinning
Outer Sheath	5GM5 Type elastomer compound, Red

PRODUCTION AND TEST STANDARDS

Construction	Based on DIN VDE 0250-813
General Requirements	DIN VDE 0250-1
Guide to Use	DIN VDE 0298-3
Electrical Tests	DIN VDE 0472-501, 503, 508
Non-Electrical Tests	DIN VDE 0472-401, 402, 602, 303, 615
Under Fire Conditions Tests	DIN VDE 0472-803, 804
Flame Retardant	VDE 0482-332-1-2, DIN EN 60332-1-2, IEC 60332-1
Oil Resistant	HD/EN/IEC 60811-2-1, DIN VDE 0473-811-2-1

OPERATING CHARACTERISTICS

Rated Voltage	3,6/6 kV	6/10 kV	8,7/15 kV	12/20 kV	18/30 kV
AC Test Voltage	11 kV	17 kV	24 kV	29 kV	43 kV
Max. Permissible Operating Voltage AC	4,2/7,2 kV	6,9/12 kV	10,4/18 kV	13,9/24 kV	20,8/36 kV
Max. Permissible Operating Voltage DC	5,4/10,8 kV	9/18 kV	13,5/27 kV	18/36 kV	27/54 kV
Min. Bending Radius	Acc. to DIN VDE 0298 part 3				
Current Carrying Capacity	According to DIN VDE 0298, Part 4				
Working Temperature					
Fixed	-40°C ... +80°C				
Mobile	-25°C ... +80°C				
Max. Tensile Load of cable	15 N/mm ²				
Max. Torsion	25°/m				
Travel Speed for TBM application	max. 30 m/min.				
Minimum distance for change of direction	20 X D				



Ozone
Resistant



Cold
Resistant



Tear
Resistant



Uv Resistant



Weather
Resistant



Moisture
Resistant



Ex-Proof

Application

The cables are suitable for reeling power supply cables for TBM's machines and in underground mines for tunnel constructions

3,6/6 kV

Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Approximate weight (kg / km)
3 x 25 + 3 x 16/3E + 3 x 2,5 ST + 6ÜL KON	42,2 - 45,4	2770
3 x 35 + 3 x 25/3E + 3 x 2,5 ST + 6ÜL KON	46,8 - 50,0	3200
3 x 50 + 3 x 25/3E + 3 x 2,5 ST + 6ÜL KON	50,1 - 53,2	4040
3 x 70 + 3 x 35/3E + 3 x 2,5 ST + 6ÜL KON	54,6 - 57,7	5035
3 x 95 + 3 x 50/3E + 3 x 2,5 ST + 6ÜL KON	56,4 - 60,5	6270
3 x 120 + 3 x 70/3E + 3 x 2,5 ST + 6ÜL KON	64,0 - 68,0	7400

6/10 kV

Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Approximate weight (kg / km)
3 x 25 + 3 x 16/3E + 3 x 2,5 ST + 6ÜL KON	45,5 - 48,2	2975
3 x 35 + 3 x 25/3E + 3 x 2,5 ST + 6ÜL KON	47,8 - 51,0	3420
3 x 50 + 3 x 25/3E + 3 x 2,5 ST + 6ÜL KON	50,7 - 54,9	4260
3 x 70 + 3 x 35/3E + 3 x 2,5 ST + 6ÜL KON	57,2 - 61,4	5270
3 x 95 + 3 x 50/3E + 3 x 2,5 ST + 6ÜL KON	61,1 - 65,3	6540
3 x 120 + 3 x 70/3E + 3 x 2,5 ST + 6ÜL KON	65,1 - 69,3	7840

12/20 kV

Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Approximate weight (kg / km)
3 x 25 + 3 x 16/3E + 3 x 2,5 ST + 6ÜL KON	51,1 - 55,3	3600
3 x 35 + 3 x 25/3E + 3 x 2,5 ST + 6ÜL KON	54,0 - 58,2	4140
3 x 50 + 3 x 25/3E + 3 x 2,5 ST + 6ÜL KON	59,4 - 63,6	5030
3 x 70 + 3 x 35/3E + 3 x 2,5 ST + 6ÜL KON	64,2 - 68,4	6200
3 x 95 + 3 x 50/3E + 3 x 2,5 ST + 6ÜL KON	69,2 - 73,8	7520
3 x 120 + 3 x 70/3E + 3 x 2,5 ST + 6ÜL KON	73,6 - 77,8	8740



CABLE STRUCTURE

Conductors	Electrolytic, stranded, tinned copper wire DIN VDE 0295 Class 5
Insulation	3GI3 Type EPR Compound
Electrical Field Control	Inner and Outer Semiconductive layer of semiconductive rubber
Protective - Earth Conductor	Tinned Copper conductor with semiconductive layer
Optical Fiber	Fibre core diameter of fiber 9 µm, 62.5 µm or 50 µm; Diameter over cladding 125 µm; diameter over coating 250 µm; designs up to 24 fibers available.
Fiber Coating	Color coding of the fibers and buffering tube for identification of the fiber type.
Fiber Covering	Hollow core with filling compound, basic material ETFE
Arrangement Of Fiber Cores	Six cores in one layer and specially laid-up around the central support element.
Lay Up	Three main conductors laid-up with two control cores and fiber optic element in the outer interstice
Inner Sheath	GM1b type EPR compound
Reinforcement	Embedded braid made of anti torsion synthetic threads
Outer Sheath	5GM5 type elastomer compound, Red

PRODUCTION AND TEST STANDARDS

Construction	Based on DIN VDE 0250-812
General Requirements	DIN VDE 0250-1
Guide to Use	DIN VDE 0298-3
Electrical Tests	DIN VDE 0472-501, 503, 508
Non-Electrical Tests	DIN VDE 0472-401, 402, 602, 303, 615
Under Fire Conditions Tests	DIN VDE 0472-803, 804
Flame Retardant	VDE 0482-332-1-2, DIN EN 60332-1-2, IEC 60332-1
Oil Resistant	HD/EN/IEC 60811-2-1, DIN VDE 0473-811-2-1



Ozone
Resistant



Cold
Resistant



Tear
Resistant



Uv Resistant



Weather
Resistant



Moisture
Resistant



Ex-Proof

OPERATING CHARACTERISTICS

Rated Voltage	3,6/6 kV	6/10 kV	8,7/15 kV	12/20 kV	18/30 kV
AC Test Voltage	11 kV	17 kV	24 kV	29 kV	43 kV
Max. Permissible Operating Voltage AC	4,2/7,2 kV	6,9/12 kV	10,4/18 kV	13,9/24 kV	20,8/36 kV
Max. Permissible Operating Voltage DC	5,4/10,8 kV	9/18 kV	13,5/27 kV	18/36 kV	27/54 kV
Min. Bending Radius	Acc. to DIN VDE 0298 part 3				
Current Carrying Capacity	According to DIN VDE 0298, Part 4				
Working Temperature					
Fixed	-40°C ... +80°C				
Mobile	-25°C ... +80°C				
Max. Tensile Load of cable	20 N/mm ²				
Max. Torsion	25°/m				
Travel Speed for tunnelling app.	max.30 m/min.				
Minimum distance for change of direction	20 X D				

Application

For the connection of electrical equipment, large material handling machines such as excavators, cranes, dumpers in mining and tunnelling applications in combination of power and data transmission. The flexible cable design allows for movement of the equipment during operation. Suitable also as flex MV reeling cable and also for festoon systems



Ozone
Resistant



Cold
Resistant



Tear
Resistant



UV Resistant



Weather
Resistant



Moisture
Resistant



Ex-Proof

3,6/6 kV

Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Permissible Tensile Force Max. (N)	Conductor Resistance At 20 °C (Ω/km)	Approximate weight (kg / km)
3 x 25 + 2 x 25/2 + FO	42,2 - 45,2	1500	0,78	2660
3 x 25 + 2 x 50/2 + FO	45,0 - 48,0	1500	0,78	2990
3 x 35 + 2 x 25/2 + FO	43,8 - 46,8	2100	0,554	3050
3 x 35 + 2 x 50/2 + FO	45,9 - 48,9	2100	0,554	3400
3 x 50 + 2 x 25/2 + FO	45,1 - 48,1	3000	0,386	3540
3 x 50 + 2 x 50/2 + FO	48,8 - 51,8	3000	0,386	4070
3 x 70 + 2 x 35/2 + FO	48,8 - 51,8	4200	0,272	4480
3 x 70 + 2 x 50/2 + FO	52,5 - 56,5	4200	0,272	4840
3 x 95 + 2 x 50/2 + FO	54,3 - 58,3	5700	0,206	5800
3 x 120 + 2 x 70/2 + FO	58,2 - 62,2	7200	0,16 1	7010
3 x 150 + 2 x 70/2 + FO	62,4 - 66,4	9000	0,129	8210
3 x 185 + 2 x 95/2 + FO	67,8 - 71,8	11100	0,106	9920
3 x 240 + 2 x 120/2 + FO	74,4 - 78,4	14400	0,08	12530
3 x 300 + 2 x 150/2 + FO	80,6 - 85,6	18000	0,064	15330

6/10 kV

Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Permissible Tensile Force Max. (N)	Conductor Resistance At 20 °C (Ω/km)	Approximate weight (kg / km)
3 x 25 + 2 x 25/2 + FO	42,7 - 45,7	1500	0,78	2740
3 x 25 + 2 x 50/2 + FO	46,0 - 49,0	1500	0,78	2980
3 x 35 + 2 x 25/2 + FO	45,2 - 48,2	2100	0,554	3160
3 x 35 + 2 x 50/2 + FO	47,6 - 50,6	2100	0,554	3610
3 x 50 + 2 x 25/2 + FO	46,5 - 49,5	3000	0,386	3670
3 x 50 + 2 x 50/2 + FO	50,4 - 53,4	3000	0,386	4020
3 x 70 + 2 x 35/2 + FO	50,3 - 53,3	4200	0,272	4610
3 x 70 + 2 x 50/2 + FO	53,8 - 56,8	4200	0,272	5160
3 x 95 + 2 x 50/2 + FO	55,6 - 59,6	5700	0,206	5940
3 x 120 + 2 x 70/2 + FO	60,4 - 63,4	7200	0,161	7150
3 x 150 + 2 x 70/2 + FO	65,2 - 69,2	9000	0,129	8600
3 x 185 + 2 x 95/2 + FO	69,2 - 73,2	11100	0,106	10110
3 x 240 + 2 x 120/2 + FO	77,2 - 81,2	14400	0,08	12980
3 x 300 + 2 x 150/2 + FO	81,8 - 86,8	18000	0,064	15550

8.7/15 kV

Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Permissible Tensile Force Max. (N)	Conductor Resistance At 20 °C (Ω/km)	Approximate weight (kg / km)
3 x 25 + 2 x 25/2 + FO	46,0 - 49,0	1500	0,78	3000
3 x 25 + 2 x 50/2 + FO	47,4 - 51,4	1500	0,78	3350
3 x 35 + 2 x 25/2 + FO	46,3 - 49,3	2100	0,554	3550
3 x 35 + 2 x 50/2 + FO	50,1 - 53,1	2100	0,554	3710
3 x 50 + 2 x 25/2 + FO	50,1 - 53,1	3000	0,386	4020
3 x 50 + 2 x 50/2 + FO	53,8 - 57,8	3000	0,386	4640
3 x 70 + 2 x 35/2 + FO	54,8 - 58,8	4200	0,272	5170
3 x 70 + 2 x 50/2 + FO	54,8 - 58,8	4200	0,272	5280
3 x 95 + 2 x 50/2 + FO	59,2 - 63,2	5700	0,206	6370
3 x 120 + 2 x 70/2 + FO	64,6 - 68,6	7200	0,161	7830
3 x 150 + 2 x 70/2 + FO	68,8 - 72,8	9000	0,129	9090
3 x 185 + 2 x 95/2 + FO	72,8 - 76,8	11100	0,106	10610
3 x 240 + 2 x 120/2 + FO	79,7 - 84,7	14400	0,08	13540
3 x 300 + 2 x 150/2 + FO	87,9 - 92,9	18000	0,064	16530

12/20 kV

Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Permissible Tensile Force Max. (N)	Conductor Resistance At 20 °C (Ω/km)	Approximate weight (kg / km)
3 x 25 + 2 x 25/2 + FO	46,5 - 49,5	1500	0,78	3070
3 x 25 + 2 x 50/2 + FO	49,5 - 52,5	1500	0,78	3400
3 x 35 + 2 x 25/2 + FO	49,3 - 52,3	2100	0,554	3590
3 x 35 + 2 x 50/2 + FO	53,1 - 57,1	2100	0,554	4200
3 x 50 + 2 x 25/2 + FO	54,1 - 58,1	3000	0,386	4500
3 x 50 + 2 x 50/2 + FO	54,1 - 58,1	3000	0,386	4590
3 x 70 + 2 x 35/2 + FO	58,0 - 62,0	4200	0,272	5540
3 x 70 + 2 x 50/2 + FO	58,0 - 62,0	4200	0,272	5650
3 x 95 + 2 x 50/2 + FO	62,4 - 66,4	5700	0,206	6750
3 x 120 + 2 x 70/2 + FO	67,7 - 71,7	7200	0,161	8400
3 x 150 + 2 x 70/2 + FO	71,9 - 75,9	9000	0,129	9520
3 x 185 + 2 x 95/2 + FO	77,3 - 81,3	11100	0,106	11340
3 x 240 + 2 x 120/2 + FO	83,8 - 87,8	14400	0,08	14060
3 x 300 + 2 x 150/2 + FO	91,0 - 96,0	18000	0,064	17090

14/25 kV

Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Permissible Tensile Force Max. (N)	Conductor Resistance At 20 °C (Ω/km)	Approximate weight (kg / km)
03 x 25 + 2 x 25/2 + FO	50,5 - 53,5	1500	0,78	3460
3 x 25 + 2 x 50/2 + FO	50,5 - 53,5	1500	0,78	3550
3 x 35 + 2 x 25/2 + FO	54,2 - 57,2	2100	0,554	4180
3 x 35 + 2 x 50/2 + FO	54,2 - 57,2	2100	0,554	4260
3 x 50 + 2 x 25/2 + FO	57,0 - 61,0	3000	0,386	4980
3 x 50 + 2 x 50/2 + FO	57,0 - 61,0	3000	0,386	5050
3 x 70 + 2 x 35/2 + FO	62,0 - 66,0	4200	0,272	6020
3 x 70 + 2 x 50/2 + FO	62,0 - 66,0	4200	0,272	6130
3 x 95 + 2 x 50/2 + FO	67,9 - 71,9	5700	0,206	7500
3 x 120 + 2 x 70/2 + FO	71,6 - 75,6	7200	0,161	8790
3 x 150 + 2 x 70/2 + FO	77,3 - 81,3	9000	0,129	10390
3 x 185 + 2 x 95/2 + FO	81,4 - 85,4	11100	0,106	11980
3 x 240 + 2 x 120/2 + FO	89,2 - 94,2	14400	0,08	15130
3 x 300 + 2 x 150/2 + FO	95,0 - 100,0	18000	0,064	17830

18/30 kV

Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Permissible Tensile Force Max. (N)	Conductor Resistance At 20 °C (Ω/km)	Approximate weight (kg / km)
03 x 25 + 2 x 25/2 + FO	55,1 - 59,1	1500	0,78	4020
3 x 25 + 2 x 50/2 + FO	55,1 - 59,1	1500	0,78	4100
3 x 35 + 2 x 25/2 + FO	58,0 - 62,0	2100	0,554	4590
3 x 35 + 2 x 50/2 + FO	58,0 - 62,0	2100	0,554	4670
3 x 50 + 2 x 25/2 + FO	61,8 - 65,8	3000	0,386	5410
3 x 50 + 2 x 50/2 + FO	61,8 - 65,8	3000	0,386	5480
3 x 70 + 2 x 35/2 + FO	67,0 - 71,0	4200	0,272	6710
3 x 70 + 2 x 50/2 + FO	67,0 - 71,0	4200	0,272	6810
3 x 95 + 2 x 50/2 + FO	71,4 - 75,4	5700	0,206	7960
3 x 120 + 2 x 70/2 + FO	76,7 - 80,7	7200	0,161	9510
3 x 150 + 2 x 70/2 + FO	81,0 - 85,0	9000	0,129	10950
3 x 185 + 2 x 95/2 + FO	83,9 - 88,9	11100	0,106	12560
3 x 240 + 2 x 120/2 + FO	92,8 - 97,8	14400	0,08	15770
3 x 300 + 2 x 150/2 + FO	99,6 - 104,6	18000	0,064	18770

20/35 kV

Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Permissible Tensile Force Max. (N)	Conductor Resistance At 20 °C (Ω/km)	Approximate weight (kg / km)
3 x 25 + 2 x 25/2 + FO	59,8 - 63,8	1500	0,78	4580
3 x 35 + 2 x 25/2 + FO	64,4 - 68,4	2100	0,554	5410
3 x 50 + 2 x 25/2 + FO	68,1 - 72,1	3000	0,386	6270
3 x 50 + 2 x 35/2 + FO	68,1 - 72,1	3000	0,386	6350
3 x 70 + 2 x 35/2 + FO	71,8 - 75,8	4200	0,272	7350



CABLE STRUCTURE

CONDUCTOR & INSULATION

Power Cores

Conductors

Tinned copper conductor DIN VDE 0295 class 5.

Insulation

Based on 3GI3 - EPR rubber and semi conductive rubber compound.

CONTROL CORES + MONITORING PE CORE(S)

Conductors

Tinned copper conductor DIN VDE 0295 class 5.

Insulation

3GI3 type EPR compound and semi conductive rubber compound.

Cradle Separator

A shaped section of elastomeric material, semi conductive, with control wire in the center, designed to support the core assembly, fill the center interstice and provide a specified separation between individual power cores

Electrical

Field Control

Inner and outer semiconductive layer of semiconductive rubber

Core Identification

Lay Up

Power cores naturally colored, Control cores blue colored

Three main conductors laid-up with three control cores & PE conductors in interstice over a cradle separator.

Inner Sheath

Screen / Armour

GM1b type EPR Compound

Flexible - pliable armour in helix of tinned copper and galvanised steel wires

Outer Sheath

5GM5 type elastomer compound, Red

PRODUCTION AND TEST STANDARDS

Construction

DIN VDE 0250-813

General Requirements

DIN VDE 0250-1

Guide to Use

DIN VDE 0298-3

Electrical Tests

DIN VDE 0472-501, 503, 508

Non-Electrical Tests

DIN VDE 0472-401, 402, 602, 303, 615

Under Fire Conditions Tests

DIN VDE 0472-803, 804

Flame Retardant

VDE 0482-332-1-2, DIN EN 60332-1-2, IEC 60332-1

Oil Resistant

HD/EN/IEC 60811-2-1, DIN VDE 0473-811-2-1



Ozone
Resistant



Cold
Resistant



Tear
Resistant



Uv Resistant



Weather
Resistant



Moisture
Resistant



Ex-Proof

OPERATING CHARACTERISTICS

Rated Voltage	1,8/3 kV	3,6/6 kV
AC Test Voltage	6 kV	11 kV
Max. Permissible Operating Voltage AC	2,1/3,6 kV	4,2/7,2 kV
Max. Permissible Operating Voltage DC	2,7/5,4 kV	5,4/10,8 kV
Min. Bending Radius	Acc. to DIN VDE 0298 part 3	
Current Carrying Capacity	According to DIN VDE 0298, Part 4	
Working Temperature		
Fixed	-40°C ... +80°C	
Mobile	-25°C ... +80°C	
Min. Bending Radius	VDE 0298-3 Tab. 3	
Current Carrying Capacities	VDE 0298-4	

Application

For the connection of mobile electrical equipment in mines and tunnels. Suitable also for coal cutting machines, particularly for extreme bending loads inside of steel or plastic track chains.

1,8/3 kV

Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Conductor Resistance At 20 °C (Ω/km)	Approximate weight (kg / km)
3 x 25 + 3 x (1,5 ST KON+ 16/3 KON)	42,1 - 45,3	0,795	3190
3 x 35 + 3 x (1,5 ST KON+ 16/3 KON)	46,5 - 49,7	0,565	3920
3 x 50 + 3 x (1,5 ST KON+ 25/3 KON)	50,4 - 53,5	0,393	4730
3 x 70 + 3 x (1,5 ST KON+ 35/3 KON)	55,8 - 60,0	0,277	6070
3 x 95 + 3 x (1,5 ST KON+ 50/3 KON)	61,5 - 65,7	0,21	7620
3 x 120 + 3 x (1,5 ST KON+ 70/3 KON)	66,0 - 70,3	0,164	9270
3 x 150 + 3 x (1,5 ST KON+ 70/3 KON)	71,8 - 76,0	0,132	10920
3 x 185 + 3 x (1,5 ST KON+ 95/3 KON)	76,2 - 80,3	0,108	12770
3 x 240 + 3 x (1,5 ST KON+ 120/3 KON)	84,1 - 89,4	0,0817	15860

1,8/3 kV

Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Conductor Resistance At 20 °C (Ω/km)	Approximate weight (kg / km)
3 x 35 + 3 x (1,5 ST KON + 25/3 KON) + ÜL KON	46,0 - 51,0	0,554	3960
3 x 50 + 3 x (1,5 ST KON + 25/3 KON) + ÜL KON	51,0 - 55,0	0,368	4980
3 x 70 + 3 x (1,5 ST KON + 35/3 KON) + ÜL KON	57,0 - 62,0	0,272	6360
3 x 95 + 3 x (1,5 ST KON + 50/3 KON) + ÜL KON	64,0 - 69,0	0,206	8150
3 x 50 + 3 x (35 + 35/3 KON) + 2 x (0,75 ST KON) + 1 x (2 x 0,75 ÜL KON)	66,0 - 71,0	0,368	8390
3 x 70 + 3 x (50 + 50/3 KON) + 2 x (0,75 ST KON) + 1 x (2 x 0,75 ÜL KON)	74,0 - 79,0	0,272	10350
3 x 95 + 3 x (70 + 70/3 KON) + 2 x (0,75 ST KON) + 1 x (2 x 0,75 ÜL KON)	85,0 - 90,0	0,206	13340

3,6/6 kV

Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Conductor Resistance At 20 °C (Ω/km)	Approximate weight (kg / km)
3 x 25 + 3 x (1,5 ST KON + 16/3 KON)	47,3 - 50,4	0,795	3710
3 x 35 + 3 x (1,5 ST KON + 16/3 KON)	50,2 - 53,4	0,565	4320
3 x 50 + 3 x (1,5 ST KON + 25/3 KON)	53,5 - 57,7	0,393	5250
3 x 70 + 3 x (1,5 ST KON + 35/3 KON)	59,6 - 63,8	0,277	6600
3 x 95 + 3 x (1,5 ST KON + 50/3 KON)	64,3 - 68,5	0,21	8030
3 x 120 + 3 x (1,5 ST KON + 70/3 KON)	70,7 - 74,8	0,164	9990
3 x 150 + 3 x (1,5 ST KON + 70/3 KON)	74,5 - 78,8	0,132	11330
3 x 185 + 3 x (1,5 ST KON + 95/3 KON)	78,5 - 83,0	0,108	13280
3 x 240 + 3 x (1,5 ST KON + 120/3 KON)	86,8 - 92,10	0,0817	16380

3,6/6 kV

Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Conductor Resistance At 20 °C (Ω/km)	Approximate weight (kg / km)
3 x 35 + 3 x (1,5 ST KON + 25/3 KON) + ÜL KON	46,0 - 51,0	0,554	3960
3 x 50 + 3 x (1,5 ST KON + 25/3 KON) + ÜL KON	51,0 - 55,0	0,368	4980
3 x 70 + 3 x (1,5 ST KON + 35/3 KON) + ÜL KON	57,0 - 62,0	0,272	6360
3 x 95 + 3 x (1,5 ST KON + 50/3 KON) + ÜL KON	64,0 - 69,0	0,206	8150
3 x 35 + 3 x (35 + 35/3 KON) + 2 x (0,75ST KON) + 1 x (2 x 0,75ÜL KON)	69,0 - 74,0	0,554	7800
3 x 50 + 3 x (50 + 50/3 KON) + 2 x (0,75ST KON) + 1 x (2 x 0,75 ÜL KON)	73,0 - 78,0	0,368	9340
3 x 70 + 3 x (70 + 70/3 KON) + 2 x (0,75ST KON) + 1 x (2 x 0,75 ÜL KON)	80,0 - 85,0	0,272	11580
3 x 95 + 3 x (95 + 95/3 KON) + 2 x (0,75ST KON) + 1 x (2 x 0,75 ÜL KON)	89,0 - 94,0	0,206	13930



CABLE STRUCTURE

Conductors	Flexible electrolytic copper wire acc. to DIN VDE 0295 - Class 5
Insulation	
Main Cores	3GI3 type EPR compound
Pilot Control Cores	3GI3 type EPR compound
Protective Conductor	Made of plain copper wires or copper wire braiding laid-up concentrically around each main core
Electrical Field Control	Extruded inner and outer rubber semiconductive layer For 3,6/6 kV cables outer semiconductive layer only
Core Identification	
Main Cores	Natural coloring, design acc. to DIN VDE 0250 Part.1
Pilot Cores	Black colored and number coded
Lay Up	Three main conductors laid-up with three pilot control cores in the outer interstice Protective cores are concentrically wrapped over insulation of power cores YM5 type PVC Compound
Inner Sheath Monitoring Conductor	Semiconductive tape + overall concentric lay of copper wires and syntetic tape over wires
Inner Sheath Armour	PVC compound type DMV6 acc. to DIN VDE 0276-603 Galvanized steel wire braiding, coverage minimum 75 % ST2 Type to IEC 60502
Outer Sheath	PVC compound type DMV6 acc. to DIN VDE 0276-603, Red or Black

PRODUCTION AND TEST STANDARDS

Construction	DIN VDE 0250-605 & IEC 60502-2
General Requirements	DIN VDE 0250-1
Guide to Use	DIN VDE 0298-3
Electrical Tests	DIN VDE 0472-501, 503, 508
Non-Electrical Tests	DIN VDE 0472-401, 402, 602, 303, 615
Flame Retardant	VDE 0482-332-1-2, DIN EN 60332-1-2, IEC 60332-1



Ozone
Resistant



Cold
Resistant



Tear
Resistant



Uv Resistant



Weather
Resistant



Moisture
Resistant



Ex-Proof

OPERATING CHARACTERISTICS

Rated Voltage	3,6/6 kV	6/10 kV	8,7/15 kV	12/20 kV	18/30 kV
AC Test Voltage	11 kV	17 kV	24 kV	29 kV	43 kV
Max. Permissible Operating Voltage AC	4,2/7,2 kV	6,9/12 kV	10,4/18 kV	13,9/24 kV	20,8/36 kV
Max. Permissible Operating Voltage DC	5,4/10,8 kV	9/18 kV	13,5/27 kV	18/36 kV	27/54 kV
Min. Bending Radius	Acc. to DIN VDE 0298 part 3				
Current Carrying Capacity	According to DIN VDE 0298, Part 4				
Working Temperature	-40°C ... +80°C				
Fixed	+5°C ... +80°C				
Mobile	20 N/mm ²				
Max. Tensile Load of cable	25°/m				
Max. Torsion	max. 30 m/min.				
Travel Speed					
Minimum distance for change of direction	20 X D				

Application

These cables are used for the connection of mobile operating equipments, in mines and underground excavations with hazardous environments, in stationary operation, e.g. high-voltage transformers in mining and tunnelling.

3,6/6 kV

Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Conductor Resistance At 20 °C (Ω/km)	Approximate weight (kg / km)
3x25 + 3x16/3E + 3x2,5st + ÜL	47,0 - 51,0	0,780	3600
3x35 + 3x16/3E + 3x2,5st + ÜL	49,0 - 54,0	0,554	4170
3x50 + 3x25/3E + 3x2,5st + ÜL	52,0 - 57,8	0,386	4850
3x70 + 3x35/3E + 3x2,5st + ÜL	56,1 - 61,2	0,272	5900
3x95 + 3x50/3E + 3x2,5st + ÜL	60,3 - 66,2	0,206	5900
3x120 + 3x70/3E + 3x2,5st + ÜL	63,8 - 70,2	0,161	8620
3x150 + 3x70/3E + 3x2,5st + ÜL	66,0 - 72,0	0,129	9860
3x185 + 3x95/3E + 3x2,5st + ÜL	70,0 - 74,0	0,106	11300

6/10 kV

Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Conductor Resistance At 20 °C (Ω/km)	Approximate weight (kg / km)
3x25 + 3x16/3E + 3x2,5st + ÜL	54,0 - 57,0	0,780	4200
3x35 + 3x16/3E + 3x2,5st + ÜL	57,1 - 60,2	0,554	4650
3x50 + 3x25/3E + 3x2,5st + ÜL	60,4 - 63,6	0,386	5380
3x70 + 3x35/3E + 3x2,5st + ÜL	65,2 - 68,8	0,272	6450
3x95 + 3x50/3E + 3x2,5st + ÜL	68,0 - 71,9	0,206	7700
3x120 + 3x70/3E + 3x2,5st + ÜL	70,1 - 76,1	0,161	9260
3x150 + 3x70/3E + 3x2,5st + ÜL	73,0 - 78,0	0,129	10840
3x185 + 3x95/3E + 3x2,5st + ÜL	74,0 - 79,2	0,106	12400

8,7/15 kV

Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Conductor Resistance At 20 °C (Ω/km)	Approximate weight (kg / km)
3x25 + 3x16/3E + 3x2,5st + ÜL	54,2 - 58,0	0,780	4530
3x35 + 3x16/3E + 3x2,5st + ÜL	55,0 - 60,0	0,554	5100
3x50 + 3x25/3E + 3x2,5st + ÜL	58,0 - 61,0	0,386	5840
3x70 + 3x35/3E + 3x2,5st + ÜL	65,2 - 67,0	0,272	7840
3x95 + 3x50/3E + 3x2,5st + ÜL	66,0 - 69,0	0,206	9120

12/20 kV

Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Conductor Resistance At 20 °C (Ω/km)	Approximate weight (kg / km)
3x25 + 3x16/3E + 3x2,5st + ÜL	54,4 - 58,2	0,780	4920
3x35 + 3x16/3E + 3x2,5st + ÜL	55,4 - 60,0	0,554	5400
3x50 + 3x25/3E + 3x2,5st + ÜL	58,0 - 61,0	0,386	6200
3x70 + 3x35/3E + 3x2,5st + ÜL	65,2 - 67,0	0,272	7320
3x95 + 3x50/3E + 3x2,5st + ÜL	66,0 - 69,0	0,206	8630
3x120 + 3x70/3E + 3x2,5st + ÜL	68,7 - 74,0	0,161	9260
3x150 + 3x70/3E + 3x2,5st + ÜL	74,0 - 78,0	0,129	10460
3x185 + 3x95/3E + 3x2,5st + ÜL	78,0 - 82,0	0,106	11870





CABLE STRUCTURE

Conductors	Flexible electrolytic copper wire acc. to DIN VDE 0295 - Class 5
Insulation	
Main Cores	3GI3 type EPR compound
Pilot Control Cores	3GI3 type EPR compound
Protective Conductor	Made of plain copper wires or copper wire braiding laid-up concentrically around each main core
Electrical Field Control	Extruded inner and outer rubber semiconductive layer For 3,6/6 kV cables outer semiconductive layer only
Core Identification	
Main Cores	Natural coloring, design acc. to DIN VDE 0250 Part.1
Pilot Cores	Black colored and number coded
Lay Up	Three main conductors laid-up with three pilot control cores in the outer interstice Protective cores are concentrically wrapped over insulation of power cores
Inner Sheath	Special Halogen free and flame retardant HFFR compound
Monitoring Conductor	Semiconductive tape + overall concentric lay of copper wires and syntetic tape over wires
Inner Sheath	Special Halogen free and flame retardant HFFR compound
Armour	Galvanized steel wire braiding, coverage minimum 75 %
Outer Sheath	Special Halogen free and flame retardant HFFR compound , Red or Black

PRODUCTION AND TEST STANDARDS

Construction	DIN VDE 0250-605 & IEC 60502-2
General Requirements	DIN VDE 0250-1
Guide to Use	DIN VDE 0298-3
Electrical Tests	DIN VDE 0472-501, 503, 508
Non-Electrical Tests	DIN VDE 0472-401, 402, 602, 303, 615
Under Fire Conditions Test	DIN VDE 0472-803, 804
Flame Retardant	VDE 0482-332-1-2, DIN EN 60332-1-2, IEC 60332-1



Ozone
Resistant



Cold
Resistant



Tear
Resistant



Uv Resistant



Weather
Resistant



Moisture
Resistant



Ex-Proof

OPERATING CHARACTERISTICS

Rated Voltage	3,6/6 kV	6/10 kV	8,7/15 kV	2/20 kV	18/30 kV
AC Test Voltage	11 kV	17 kV	24 kV	29 kV	43 kV
Max. Permissible Operating Voltage AC	4,2/7,2 kV	6,9/12 kV	10,4/18 kV	13,9/24 kV	20,8/36 kV
Max. Permissible Operating Voltage DC	5,4/10,8 kV	9/18 kV	13,5/27 kV	18/36 kV	27/54 kV
Min. Bending Radius	Acc. to DIN VDE 0298 part 3				
Current Carrying Capacity	According to DIN VDE 0298, Part 4				
Working Temperature	-40°C ... +80°C				
Fixed	+5°C ... +80°C				
Mobile	15 N/mm ²				
Max. Tensile Load of cable	25°/m				
Max. Torsion	max. 30m/min				
Travel Speed	20 X D				
Minimum distance for change of direction					

Application

These cables are used for the connection of mobile operating equipments, in mines and underground excavations with hazardous environments, in stationary operation, e.g. high-voltage transformers in mining and tunnelling.

3,6/6 kV

Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Conductor Resistance At 20 °C (Ω/km)	Approximate weight (kg / km)
3x25 + 3x16/3E + 3x2,5st + ÜL	47,0 - 51,0	0,780	3600
3x35 + 3x16/3E + 3x2,5st + ÜL	49,0 - 54,0	0,554	4170
3x50 + 3x25/3E + 3x2,5st + ÜL	52,0 - 57,8	0,386	4850
3x70 + 3x35/3E + 3x2,5st + ÜL	56,1 - 61,2	0,272	5900
3x95 + 3x50/3E + 3x2,5st + ÜL	60,3 - 66,2	0,206	5900
3x120 + 3x70/3E + 3x2,5st + ÜL	63,8 - 70,2	0,161	8620
3x150 + 3x70/3E + 3x2,5st + ÜL	66,0 - 72,0	0,129	9860
3x185 + 3x95/3E + 3x2,5st + ÜL	70,0 - 74,0	0,106	11300

6/10 kV

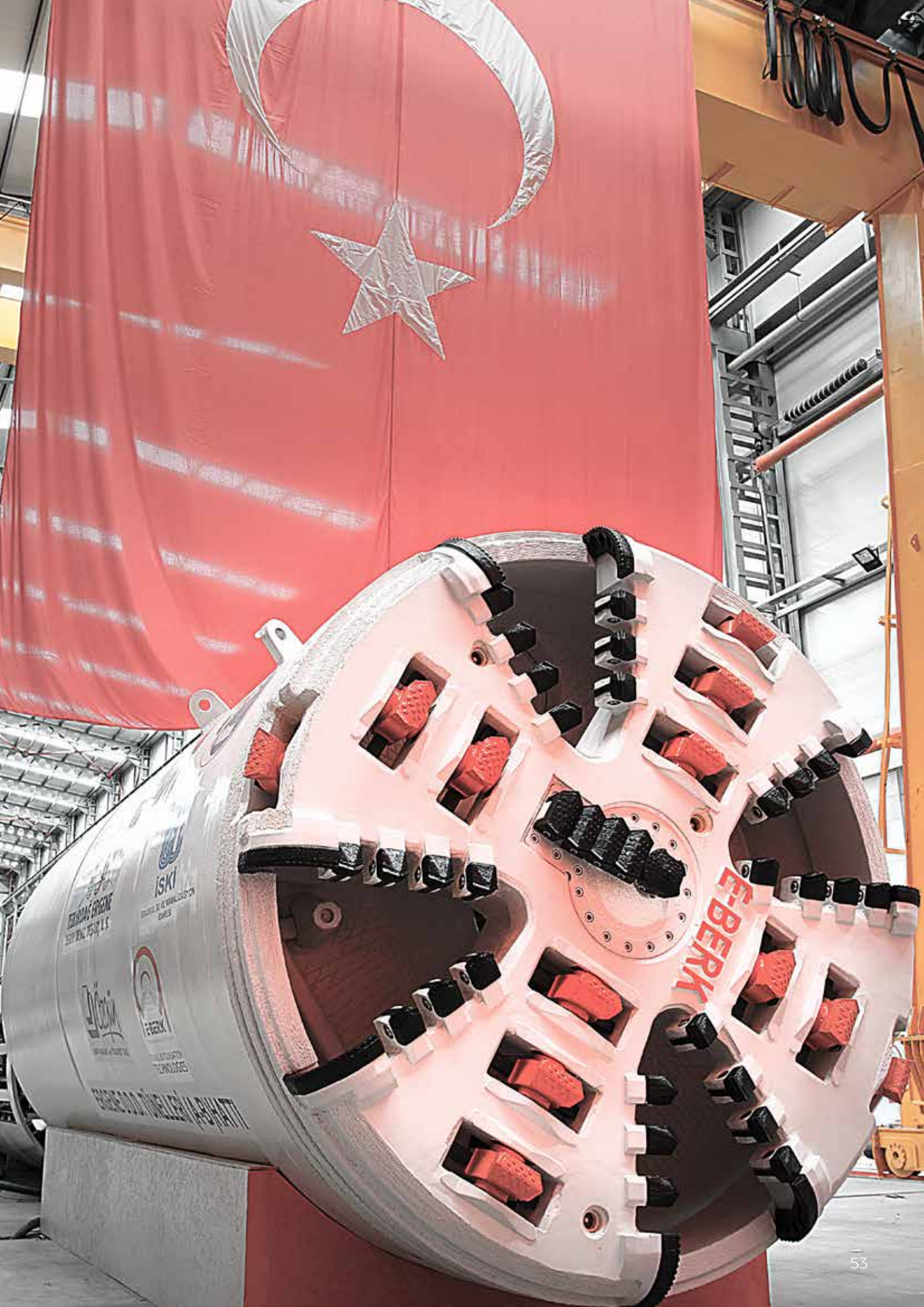
Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Conductor Resistance At 20 °C (Ω/km)	Approximate weight (kg / km)
3x25 + 3x16/3E + 3x2,5st + ÜL	54,0 - 57,0	0,780	4200
3x35 + 3x16/3E + 3x2,5st + ÜL	57,1 - 60,2	0,554	4650
3x50 + 3x25/3E + 3x2,5st + ÜL	60,4 - 63,6	0,386	5380
3x70 + 3x35/3E + 3x2,5st + ÜL	65,2 - 68,8	0,272	6450
3x95 + 3x50/3E + 3x2,5st + ÜL	68,0 - 71,9	0,206	7700
3x120 + 3x70/3E + 3x2,5st + ÜL	70,1 - 76,1	0,161	9260
3x150 + 3x70/3E + 3x2,5st + ÜL	73,0 - 78,0	0,129	10840
3x185 + 3x95/3E + 3x2,5st + ÜL	74,0 - 79,2	0,106	12400

8,7/15 kV

Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Conductor Resistance At 20 °C (Ω/km)	Approximate weight (kg / km)
3x25 + 3x16/3E + 3x2,5st + ÜL	54,2 - 58,0	0,780	4530
3x35 + 3x16/3E + 3x2,5st + ÜL	55,0 - 60,0	0,554	5100
3x50 + 3x25/3E + 3x2,5st + ÜL	58,0 - 61,0	0,386	5840
3x70 + 3x35/3E + 3x2,5st + ÜL	65,2 - 67,0	0,272	7840
3x95 + 3x50/3E + 3x2,5st + ÜL	66,0 - 69,0	0,206	9120

12/20 kV

Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Conductor Resistance At 20 °C (Ω/km)	Approximate weight (kg / km)
3x25 + 3x16/3E + 3x2,5st + ÜL	54,4 - 58,2	0,780	4920
3x35 + 3x16/3E + 3x2,5st + ÜL	55,4 - 60,0	0,554	5400
3x50 + 3x25/3E + 3x2,5st + ÜL	58,0 - 61,0	0,386	6200
3x70 + 3x35/3E + 3x2,5st + ÜL	65,2 - 67,0	0,272	7320
3x95 + 3x50/3E + 3x2,5st + ÜL	66,0 - 69,0	0,206	8630
3x120 + 3x70/3E + 3x2,5st + ÜL	68,7 - 74,0	0,161	9260
3x150 + 3x70/3E + 3x2,5st + ÜL	74,0 - 78,0	0,129	10460
3x185 + 3x95/3E + 3x2,5st + ÜL	78,0 - 82,0	0,106	11870





CABLE STRUCTURE

Conductors	Circular Stranded Plain Annealed Copper Conductor (class 2 acc. to IEC 60228)
Insulation	XLPE Insulation
Electrical Field Control	Extruded inner and outer rubber semiconductive layer
Core Identification	Natural coloring with black semiconductive layer
Screen	Copper tapes applied over each main core
Lay Up	3- Screened Cores will be laid up in concentrically
Bedding	PVC Filler
Armour	Galvanized Steel Wire Braid (GSWB) Min %90
Outer Sheath	Special PVC compound, flame retardant
Color	Red

PRODUCTION AND TEST STANDARDS

Construction	DIN VDE 0250-605 & IEC 60502-2
General Requirements	DIN VDE 0250-1
Guide to Use	DIN VDE 0298-3
Electrical Tests	DIN VDE 0472-501, 503, 508
Non-Electrical Tests	DIN VDE 0472-401, 402, 602, 303, 615
Under Fire Conditions Test	DIN VDE 0472-803, 804
Flame Retardant	VDE 0482-332-1-2, DIN EN 60332-1-2, IEC 60332-1

OPERATING CHARACTERISTICS

Rated Voltage	6/10 kV
AC Test Voltage	17 kV
Max. Permissible Operating Voltage AC	6,9/12 kV
Max. Permissible Operating Voltage DC	9/18 kV
Min Bending Radius	Acc. to DIN VDE 0298 part 3
Current Carrying Capacity	According to DIN VDE 0298, Part 4
Max Short Circuit Temperature	250°
Max Conductor Temperature	90°
Working Temperature	
Fixed	-25°C ... +80°C
Mobile	+5°C ... +80°C
Max. Tensile Load of cable	15 N/mm ²
Max. Torsion	25°/m

Application

These cables are used for the connection of mobile operating equipments, in mines and underground excavations with hazardous environments, in stationary operation, e.g. high-voltage transformers in mining and tunnelling. It can be used also for powering main pannels and switchboards in tunnelling applications



Ozone Resistant



Cold Resistant



Tear Resistant



Uv Resistant



Weather Resistant



Moisture Resistant



Ex-Proof

Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Max. DC Resistance (20 °C) (Ω/km)	Approximate weight (kg / km)
3 x 25 /16	45,0 - 49,6	0,727	3650
3 x 35 /16	47,7 - 52,8	0,524	4200
3 x 50 /16	50,6 - 56,0	0,387	4960
3 x 70 /16	54,5 - 60,2	0,268	6030
3 x 95 /16	58,8 - 65,0	0,193	7300
3 x 120 /16	62,0 - 68,5	0,153	8410



CABLE STRUCTURE

Conductors	Circular Stranded Plain Annealed Copper Conductor (class 2 acc. to IEC 60228)
Insulation	3GI3 type EPR Compound
Electrical Field Control	Extruded inner and outer rubber semiconductive layer
Core Identification	Natural coloring with black semiconductive layer
Screen	Copper tapes applied over each main core
Lay Up	3- Screened Cores will be laid up in concentrically
Bedding	PVC Filler
Armour	Galvanized Steel Wire Braid (GSWB) Min %90
Outer Sheath	Special PVC compound, flame retardant
Color	Red

PRODUCTION AND TEST STANDARDS

Construction	DIN VDE 0250-605 & IEC 60502-2
General Requirements	DIN VDE 0250-1
Guide to Use	DIN VDE 0298-3
Electrical Tests	DIN VDE 0472-501, 503, 508
Non-Electrical Tests	DIN VDE 0472-401, 402, 602, 303, 615
Under Fire Conditions Test	DIN VDE 0472-803, 804
Flame Retardant	VDE 0482-332-1-2, DIN EN 60332-1-2, IEC 60332-1

OPERATING CHARACTERISTICS

Rated Voltage	18/30 kV
AC Test Voltage	48 kV
Max. Permissible Operating Voltage AC	20,8/36 kV
Max. Permissible Operating Voltage DC	27/54 kV
Min Bending Radius	Acc. to DIN VDE 0298 part 3
Current Carrying Capacity	According to DIN VDE 0298, Part 4
Max Short Circuit Temperature	250°
Max Conductor Temperature	90°C
Working Temperature	
Fixed	-25°C ... +80°C
Mobile	+5°C ... +80°C
Max. Tensile Load of cable	15 N/mm ²
Max. Torsion	25°/m

Application

These cables are used for the connection of mobile operating equipments, in mines and underground excavations with hazardous environments, in stationary operation, e.g. high-voltage transformers in mining and tunnelling. It can be used also for powering main pannels and switchboards in tunnelling applications



Ozone Resistant



Cold Resistant



Tear Resistant



Uv Resistant



Weather Resistant



Moisture Resistant



Ex-Proof

Cross Section (mm ²)	Overall Diameter Min - Max (mm)	Max. DC Resistance (20 °C) (Ω/km)	Approximate weight (kg / km)
3 x 25 /16	65,1 - 72,0	0,727	6860
3 x 35 /16	68,0 - 75,1	0,524	7640
3 x 50 /16	70,8 - 78,3	0,387	8520
3 x 70 /16	74,5 - 82,4	0,268	9760
3 x 95 /16	79,0 - 87,2	0,193	11280
3 x 120 /16	82,2 - 90,9	0,153	12600



TECHNICAL DATA

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LETTER CODING OF CABLE TYPES

The type designation or coding is letter combination in conformity with DIN VDE that describes the type of cable coded.

N	Design according to the corresponding standard
(N)	Based on standard
C	Metallic screen over the stranded cores or between the inner and outer sheath (shield)
CE	Metallic screen over the insulation of the outer conductors
CG	Semiconductive (non-metallic) cover over the stranded cores or between the inner and outer sheath (shield)
CGE	Semiconductive (non metallic) cover over the insulation of the outer conductors
FM	Telecommunication lines within the cable
HSS	Heavy duty cable type, screened with protective conductors
K	Rubber cradle separator in the centre of the cables
KON	Concentric protective conductor between the inner and outer sheath or concentric control/monitoring conductor
LWL (FO)	Cable includes Fibre-optic (FO) cores
Ö (OE)	Oil-resistant outer sheath
R	Round wire reinforcement
SE	Protective conductor symmetrically split over cores
SH	Heavy tough rubber-sheathed flexible mining-type cable (Rough handling)
SSH	Heavy tough rubber-sheathed flexible mining-type cable (Rough handling)
SHT	1 kV reeling cable
SL	Control cable
ST	Control / Pilot cores within the cables
T	Reinforcement - Support element
TM	Trailing cable for medium mechanical stresses
TS	Trailing cables - Heavy duty rubber insulated flex cable
U	Flame-retardant outer sheath (according to EN 60332-1-2)
ÜL(UEL)	Monitoring conductor within the cable
W	Weather resistant
2Y	PE - Polyethylene Compound
2X	XLPE - Crosslinked polyethylene Compound
3G	Definition of the insulating material (3G = EPR)
Y	PVC compound
/3	Protective-earth conductor uniformly distributed in the three interstices
/3E	Protective-earth conductor uniformly distributed over the insulation of the outer conductor
-O	Without green/yellow core
-J	With green/yellow core

Mechanical properties of insulation and sheath materials

to DIN VDE 0207 (extract)	Insulation Compounds			Sheath Compounds				
Code for compound	Y14	Y15	3G13	YM1	YM3	YM5	GM1b	5GM5
Normally based on ¹⁾	PVC	PVC	EPR	PVC	PVC	PVC	SR	CR
Highest perm. Operating temp. ²⁾ At cand.°C	70	70	90	70	80	90	90	90
Tensile strength min. N/mm ²	12.5	12.5	4.2	12.5	12.5	12.5	4.2	15.0
Elongation at break min. %	175	125	200	125	150	150	200	300
Abrasion to vde 0472 part 613 max. Mm ³	–	–	–	–	–	–	–	300
Tear resistance ta vde 0472 part 613 min. N/mm ²	–	–	–	–	–	–	–	30
Flame retardancy to vde 0472 part 804	–	–	–	–	–	–	–	yes
Oil resistance to vde 0472 part 803	–	–	–	–	–	–	–	yes

- 1) PVC polyvinylchloride
 SR synthetic rubber
 EPR ethylene-propylene rubber
 CR chloroprene rubber

- 2) The cables are designed for these max. conductor temperatures. Installation regulations (e.g. DIN VDE 0118) have to be taken into consideration for individual applications, e.g. the current carrying capacities have to be reduced for ambient temperatures higher than 30 °C, as well as for different installation arrangements or cable groupings.

TECHNICAL DATA

Minimum allowed bending radii (in multiples of cable overall diameter) for DIN VDE

Cables situation	Voltage rating up to 1.1kV	Voltage rating 3kV and above
Fixed installation	4	6
Free flexing (not under tension)	6	10
Permanently repeating reeling	10	12
At deflection sheaves or rollers	15	20

Resistance and current carrying capacities of conductors of mining cables acc. to DIN VDE standards

Nominal conductor area (mm ²)	Maximum diameter of wires mm	Maximum resistance of tinned copper conductor ⁽¹⁾	Current carrying capacity on surface ⁽²⁾ A
1.5	0.26	13.7	23
2.5	0.26	8.21	30
4	0.31	5.09	41
6	0.31	3.39	53
10	0.41	1.95	74
16	0.41	1.24	99
25	0.41	0.795	131
35	0.41	0.565	162
50	0.41	0.393	202
70	0.51	0.277	250
95	0.51	0.21	301
120	0.51	0.164	352
150	0.51	0.132	404
185	0.51	0.108	461
240	0.51	0.0817	520

1. Figures are given according to 20°C conductor surface temperature

2. Figures are given according to 30°C ambient temperature. For different ambient temperatures, the correction factors below should be considered.

Ambient temp. (°C)	10	15	20	25	30	35	40	45	50
Correction factor*	1.18	1.14	1.10	1.05	1.00	0.95	0.89	0.84	0.71

* For DIN VDE types

TECHNICAL DATA

Why and How Tunnelling Cables Fail

Üntel cables are produced with best materials, machinery and care, to work trouble-free for the longest time. However there are some circumstances in which even the best cable can fail prematurely; when the construction limits of cables are exceeded during usage, their lifetime will decrease rapidly and breakdowns should be expected anytime. Almost without an exception, breakdowns are caused by one or more of the following misuses:

1. Excessive tension
2. Mechanical damage
3. Current overload
4. Improper splicing and termination techniques

Excessive Tension

A cable that has been “stretched” no longer has the balanced construction that is so vital to long life. Tension on the conductors subjects the individual wires in the strand to compression and shear. These thin wires are damaged and will break more easily when bent or flexed. Tension also elongates the conductor insulation. The elongated insulation is then vulnerable to compression cutting. It will rupture more easily when it is crushed against the stranded conductor during runovers.

A jacket under tension is much more likely to be cut or torn since it loses resistance to mechanical damage. Insulation and jacket will return to their original length when the tension is removed. However, the copper conductors take a permanent set when they are stretched. This difference in the properties of rubber and copper when subjected to tension will cause the conductors to be wavy and fail prematurely.

Mechanical Damage

Factors initiating mechanical damage include cutting, compression (crushing), punctures and abrasion. In only extreme cases of mechanical damage, the failure is instant, and the cause can be assigned on the spot. Many times, however, the cable components are merely “injured” and become latent failures. At that point, it may be more difficult to pinpoint the exact cause and to take remedial action.

Current Overload

The temperatures of the conductors, insulation and jacket are, of course, elevated when cables are subjected to an electrical load. The resistance of the copper is increased, voltage drop in the cable is increased, and therefore, a reduced voltage is supplied to the machine. As a result, the machine calls for more current, which adds further to cable heating. A trailing cable's insulation and jacket materials exhibit maximum resistance to physical abuse at the rated conductor temperature of 90°C or less. The ability of these components to withstand damage decreases as the temperature increases. Conditions which normally cause few cable failures suddenly become a problem. At elevated temperatures, the jacket has lost much of its resistance to cutting, crushing, tearing and abrasion. The section of the cable that remains on the reel is most likely to be damaged by electrical overload. Layering on the reel hinders ventilation and heat dissipation. Continued exposure to elevated temperatures will age the jacket, making it hard and brittle and causing crazing or cracking upon subsequent reeling.

Improper Splicing and Termination Techniques

Over the years, much work has been done to improve both splicing materials and techniques. The following items have been found to be primarily responsible for unsatisfactory splice service:

1. Ending up with a grounding or ground-check conductor which is shorter than the power conductors
2. Semi-conducting residue on the insulation surface was not removed
3. Gaps, voids or soft spots in insulating tape build-up
4. Improper termination of shielding system, leaving inward-pointing projections
5. Damage to factory insulation by improper removal of shielding systems
6. Excessive slack in one or more individual conductors
7. Splice has low tensile strength and is easily pulled in two
8. Individual wires are damaged during application of connector
9. Splice is too bulky – will not pass through cable guides or over sheaves
10. Improper application of the outer covering, allowing water to enter the cable interior

By choosing a cable with an adequate current rating, avoiding excessive tension and mechanical damage, and using proper splicing techniques, it is not unreasonable to reduce cable-related downtime by 50 percent or more. This will, of course, translate into increased production and profits.

TECHNICAL DATA

Conductor Resistance (IEC 60228, HD 383, DIN VDE 0295, BS 6360)

Conductor Resistance (mm ²)	Plain Copper Conductor (Ω/km)		Tinned Copper Conductor (Ω/km)	
	Class 1&2	Class 5&6	Class 1&2	Class 5&6
0,5	36	39	36,7	40,1
0,75	24,6	26	24,8	26,7
1	18,1	19,5	18,2	20
1,5	12,1	13,3	12,2	13,7
2,5	7,4	7,98	7,56	8,21
4	4,61	4,95	4,7	5,09
6	3,08	3,3	3,11	3,39
10	1,83	1,91	1,84	1,95
16	1,15	1,21	1,16	1,24
25	0,727	0,78	0,754	0,795
35	0,524	0,554	0,529	0,565
50	0,387	0,386	0,391	0,393
70	0,268	0,272	0,27	0,277
95	0,193	0,206	0,195	0,21
120	0,153	0,161	0,154	0,164
150	0,124	0,129	0,126	0,132
185	0,0991	0,106	0,1	0,108
240	0,0754	0,129	0,0762	0,0817
300	0,0601	0,106	0,0607	0,0654
400	0,047	0,0801	0,0475	0,0495
500	0,0366	0,0641	0,0369	0,0391
630	0,0283	0,0287	0,0286	0,0292

TECHNICAL DATA

CURRENT CARRYING CAPACITIES

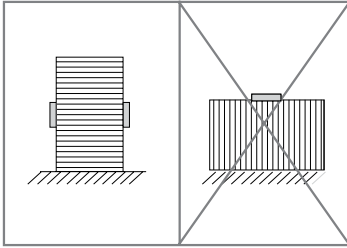
Installation	<1000V				1.8/3kV		3.6/6kV	6/10kV
	In open air	On surface			In open air		On surface	
Number of loaded conductors	1	2	3	2 or 3	1	1	3	3
Cross-section (mm ²)	Current Ratings in Ampere (A)							
0,5	-	3	3	-	-	-	-	-
0,75	15	6	6	12	-	-	-	-
1	19	10	10	15	-	-	-	-
1,5	24	16	16	18	30	32	-	-
2,5	32	25	20	26	41	43	30	-
4	42	32	25	34	55	56	41	-
6	54	40	-	44	70	71	53	-
10	73	63	-	61	98	99	74	-
16	98	-	-	82	132	133	99	105
25	129	-	-	108	176	174	131	139
35	158	-	-	135	218	215	162	172
50	198	-	-	168	276	270	202	216
70	245	-	-	207	347	338	250	265
95	292	-	-	250	416	403	301	319
120	344	-	-	292	488	473	352	371
150	391	-	-	335	566	546	404	428
185	448	-	-	382	644	622	461	488
240	528	-	-	453	775	-	-	-
300	608	-	-	523	898	-	-	-
400	726	-	-	-	-	-	-	-
500	830	-	-	-	-	-	-	-

TECHNICAL DATA

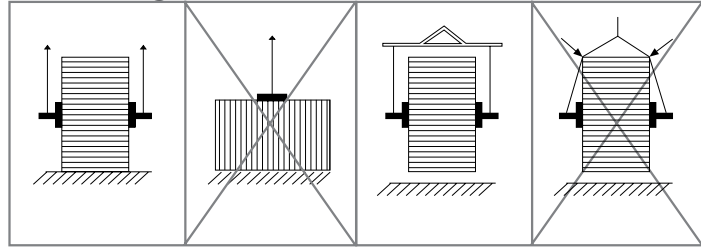
CABLES AND DRUMS USER GUIDE

Drums Handling

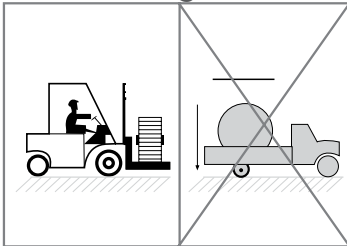
1.1.Position of Drums



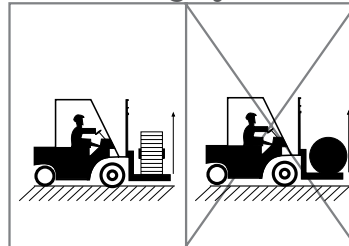
1.2.Loading



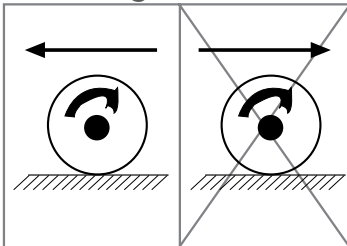
1.3.Unloading



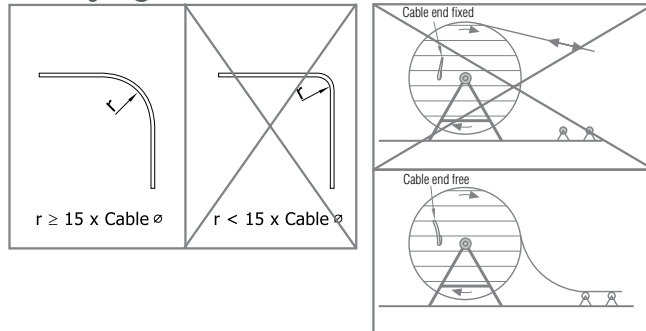
1.4.Handling by forklift



1.5.Rolling

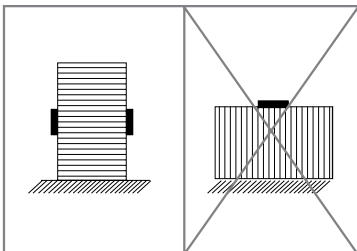


1.6.Paying-off the Cable

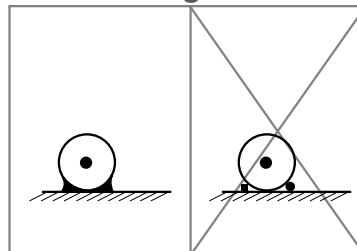


Transport Requirements

2.1.Position of the Drums

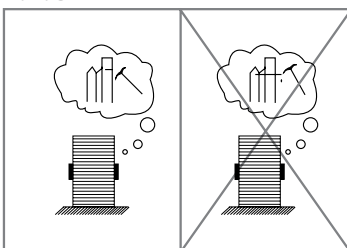


2.2.Fastening Drums

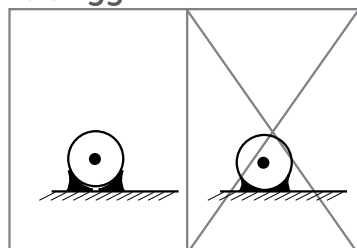


Cables and Drums User Guide

2.3.Use of nails

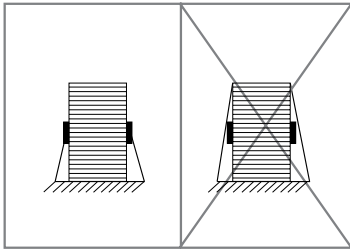


2.4.Bigger Drums

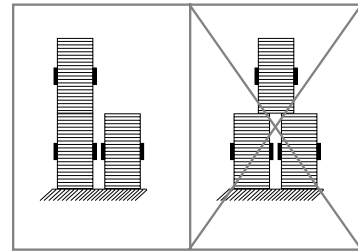


TECHNICAL DATA

2.5.Binding of the Drums

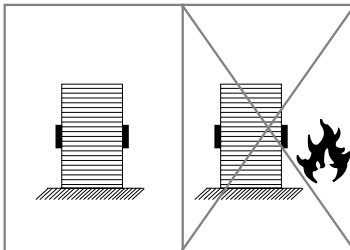


2.6.Multiple Drum Storage

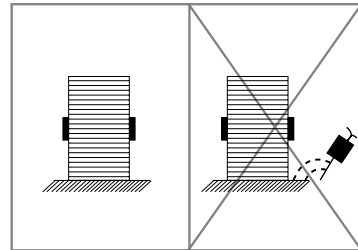


Storage Requirements

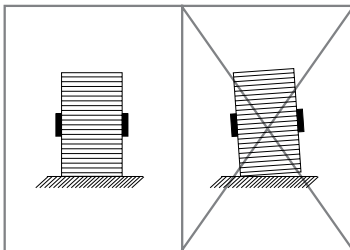
3.1.Do not store near heat sources



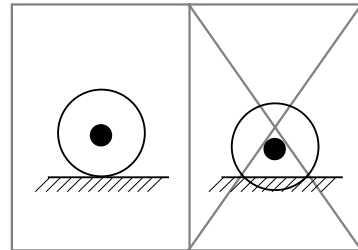
3.2. Do not store on vibrating surfaces. (Ship engine room etc.)



3.3.Do not store on irregular surfaces.



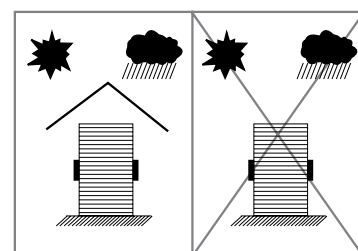
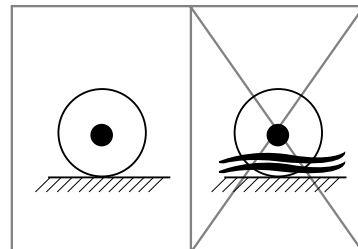
3.4.Do not store on soft surfaces



Cables and Drums User Guide

3.5. Do not store on areas liable of flooding. All cable ends must be fully sealed at all times to prevent the ingress of water. It is preferable to store reels off the ground on timbers or other supports. In damp locations, it is advisable to allow at least 3 inches between reels to permit circulation of air.

3.6. If storage is likely to last more than 6 months, drums should be stored in order to be protected from effects like rain, sunlight etc.



**OFFSHORE
CABLES**



**MARINE
CABLES**

**AIRPORT
CABLES**



**RAILWAY
CABLES**

**CRANE
CABLES**



**INDUSTRIAL
CABLES**

**MINING
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**TUNNELLING
CABLES**

**DEFENSE
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**INSTRUMENTATION
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