

CABLES

Selection guide

This guide is applicable to cables used for cathodic protection systems. It is intended to give guidance in the selection of conductor size, insulation level and construction of cable to be used on AC and DC current systems operating at low voltages. It also summarises the information needed to select the appropriate materials.



		CABLES					
		NYN	XLPE / PVC	XLPE / SWA / PVC	NSSHÖU	HYDROFIRM	PVDF
INSTALLATION GENERAL	AIR	■	■	■			
	UNDERGROUND	■	■	■			
	WATER	■	■	■		■	
DEEP GROUNDBED	OPEN HOLE	CHLORIDE-FREE WATER	■	■			
		WATER CONTAINING CHLORIDE					■
	CLOSED HOLE	CHLORIDE-FREE SOIL	■	■			
		SOIL CONTAINING CHLORIDE					■
SHALLOW GROUNDBED	CHLORIDE-FREE SOIL	■	■				
	SOIL CONTAINING CHLORIDE					■	
OFFSHORE ANODES	WATER CONTAINING CHLORIDE				■	■	
INTERNAL ANODES	CHLORIDE-FREE WATER	■	■	■	■		
	WATER CONTAINING CHLORIDE				■	■	

CABLES

Type: NYY 0.6/1 kV

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German Cathodic Protection



Conductors: Plain annealed copper conductors
 Insulation: PVC (Polyvinylchloride)
 Sheath/Jacket: PVC (Polyvinylchloride)
 Colour: Black
 Operating temperature: Maximum 70°C
 Short circuit temperature: Maximum 160°C
 Types: O - without protective earth conductor
 J - with protective earth conductor
 Standard: VDE0271 / IEC60502



Core identification:

RE - Circular solid conductor
 RM - Circular stranded conductor

Core colour code NYY-J

3 cores (green-yellow, black, blue)
 4 cores (green-yellow, black, blue, brown)
 5 cores (green-yellow, black, blue, brown, black)

Core colour code NYY-O

1 core (black)
 2 cores (black, blue)
 3 cores (black, blue, brown)
 4 cores (black, blue, brown, black)
 5 cores (black, blue, brown, black, black)

Voltage rating:

Cables are classified by the rated voltages U_0/U .

U_0 is the voltage between the conductor and earth or earthed metallic cover (concentric conductor screen, armouring, metal sheath).

U is the voltage between the phase conductors.

Cables are insulated against voltage stress in three-phase systems, the rated voltage $U=1$ kV being laid down in accordance with the VDE Standard voltage insulation levels (1,6,10, 20 kV).

The rated voltage U_0 , by which the conductor insulation to earth is measured, is calculated from the equation

$$U_0 = U / 1.73$$

The standard, rounded-off rated voltages employed in three-phase systems in compliance with VDE and IEC are accordingly :

$$U_0/U = 0.6/1; 3.6/6; 6/10; 12/20$$

The maximum continuous permissible operating voltage

(U_m) during undisturbed operation in DC systems is 1.8 kV for cables in which $U_0=0.6$ kV

In single and three-phase systems the following maximum continuous permissible operating voltages (U_m) apply:

$$U_0 = 0.6$$

$U_m = 1.2$ kV in three-phase systems

$U_m = 1.4$ kV in single-phase systems both conductors insulated.

$U_m = 0.7$ kV in single-phase systems one conductor earthed.

CORES x CROSS SECTIONAL AREA	SHEATH		RESISTANCE		WEIGHT	NOMINAL DELIVERY LENGTH
	THICKNESS	OUTER DIAMETER	DC 20° C	INDUCTIVE PER CORE AT 50 Hz		
mm ²	mm	mm	Ohm/km	Ohm/km	kg/km	m
1 x 10 RE	1.8	12	1.830	-	190	2 000
1 x 16 RE	1.8	13	1.150	0.254	260	2 000
1 x 25 RM	1.8	15	0.727	0.240	390	1 000
1 x 35 RM	1.8	16	0.524	0.228	490	1 000
1 x 50 RM	1.8	18	0.387	0.219	640	1 000
1 x 70 RM	1.8	19	0.268	0.210	850	1 000
1 x 95 RM	1.8	21	0.193	0.203	1 150	1 000
1 x 120 RM	1.8	23	0.153	0.196	1 400	1 000
1 x 150 RM	1.8	26	0.124	0.192	1 700	1 000
1 x 185 RM	1.8	28	0.099	0.184	2 100	1 000
2 x 1.5 RE	1.8	11	12.10	0.108	175	1 000
2 x 2.5 RE	1.8	13	7.410	0.104	230	1 000
2 x 4 RE	1.8	14	4.610	0.100	295	1 000
2 x 6 RE	1.8	15	3.080	0.094	360	1 000
2 x 10 RE	1.8	17	1.830	0.088	480	1 000
2 x 16 RE	1.8	19	1.150	0.083	650	1 000
3 x 1.5 RE	1.8	12	12.10	0.108	200	1 000
3 x 2.5 RE	1.8	13	7.410	0.104	260	1 000
3 x 4 RE	1.8	15	4.610	0.100	345	1 000
3 x 6 RE	1.8	16	3.080	0.094	425	1 000
3 x 10 RE	1.8	19	1.830	0.088	580	1 000
3 x 25 RM	1.8	24	0.727	0.080	1 270	1 000
4 x 1.5 RE	1.8	13	12.10	0.115	235	1 000
4 x 2.5 RE	1.8	14	7.410	0.110	310	1 000
4 x 4 RE	1.8	16	4.610	0.107	410	1 000
4 x 6 RE	1.8	17	3.080	0.100	520	1 000
4 x 10 RE	1.8	19	1.830	0.094	710	1 000
4 x 16 RE	1.8	22	1.150	0.090	1 020	1 000
4 x 25 RM	1.8	27	0.727	0.086	1 590	1 000
4 x 35 RM	1.8	29	0.524	0.083	1 650	1 000
4 x 50 RM	1.9	33	0.387	0.083	2 200	1 000
4 x 70 RM	2.1	37	0.268	0.082	3 000	1 000
5 x 1.5 RE	1.8	14	12.10	0.115	350	1 500
5 x 2.5 RE	1.8	15	7.410	0.110	450	1 000
5 x 4 RE	1.8	17	4.610	0.107	600	1 000
5 x 6 RE	1.8	20	3.080	0.100	750	1 000
5 x 10 RE	1.8	22	1.830	0.094	1 000	1 000
5 x 16 RE	1.8	24	1.150	0.090	1 400	1 000
5 x 25 RM	1.8	30	0.727	0.086	2 100	1 000
5 x 35 RM	1.9	34	0.524	0.083	2 750	1 000

CABLES

Type: XLPE / PVC 0.6/1 kV

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German Cathodic Protection



SINGLE CORE (Cu/XLPE/PVC) Cables 0.6/1 kV



Conductors: Copper circular stranded
 Insulation: XLPE
 Sheath/Jacket: PVC (Polyvinylchloride)
 Colour: Black
 Operating temperature: Maximum 90°C
 Short circuit temperature: Maximum 250°C
 Standard: Cables up to and including 35 mm²
 IEC 502 -1994
 All cables other conform generally to
 BS 5467 - 1997 and IEC 60502

Cores and Cross-sectional area	Thickness of Insulation	Thickness of Outer sheath	Approx. Overall Diameter	DC Resistance at 20° C	Current Capacity at 20° C	Approx. Cable Weight
mm ²	mm	mm	mm	Ohm/km	A	kg/km
1 x 16	0.7	1.4	9.5	1.150	105	215
1 x 25	0.9	1.4	11.0	0.727	140	310
1 x 35	0.9	1.4	12.0	0.524	174	410
1 x 50	1.0	1.4	13.5	0.387	212	540
1 x 70	1.1	1.4	15.5	0.268	269	745
1 x 95	1.1	1.4	17.5	0.193	331	1 010
1 x 120	1.2	1.5	19.0	0.153	386	1 250
1 x 150	1.4	1.6	21.0	0.124	442	1 535
1 x 185	1.6	1.6	23.5	0.099	511	1 910
1 x 240	1.7	1.7	26.0	0.074	612	2 470
1 x 300	1.8	1.8	28.5	0.059	707	3 080

TWO CORE (Cu/XLPE/PVC) Cables 0.6/1 kV



Conductors: Copper circular stranded
 Insulation: XLPE
 Sheath/Jacket: PVC (Polyvinylchloride)
 Colour: Black
 Operating temperature: Maximum 90°C
 Short circuit temperature: Maximum 250°C
 Standard: BS 5467 - 1997 and IEC 60502

Cores and Cross-sectional area	Thickness of Insulation	Thickness of Outer sheath	Approx. Overall Diameter	DC Resistance at 20° C	Current Capacity at 20° C	Approx. Cable Weight
mm ²	mm	mm	mm	Ohm/km	A	kg/km
2 x 4	0.7	1.8	13.0	4.610	34	240
2 x 6	0.7	1.8	14.2	3.080	43	300
2 x 10	0.7	1.8	15.6	1.830	105	405
2 x 16	0.7	1.8	17.8	1.150	120	565
2 x 25	0.9	1.8	21.0	0.727	160	825
2 x 35	0.9	1.8	23.2	0.524	200	1 070
2 x 50	1.0	1.8	26.3	0.387	240	1 240
2 x 70	1.1	1.8	29.3	0.268	260	1 700
2 x 95	1.1	1.9	33.9	0.193	320	2 280
2 x 120	1.2	2.0	37.5	0.153	370	2 830
2 x 150	1.4	2.2	41.5	0.099	430	3 510

THREE CORE (Cu/XLPE/PVC) Cables 0.6/1 kV



Conductors: Copper circular stranded
 Insulation: XLPE
 Sheath/Jacket: PVC (Polyvinylchloride)
 Colour: Black
 Operating temperature: Maximum 90°C
 Short circuit temperature: Maximum 250°C
 Standard: Cables up to and including 10 mm²
 IEC 502 -1994
 All cables other conform generally to
 BS 5467 - 1997 and IEC 60502

Cores and Cross-sectional area	Thickness of Insulation	Thickness of Outer sheath	Approx. Overall Diameter	DC Resistance at 20° C	Current Capacity at 20° C	Approx. Cable Weight
mm ²	mm	mm	mm	Ohm/km	A	kg/km
3 x 10	0.7	1.8	16.5	1.830	74	500
3 x 16	0.7	1.8	18.9	1.150	105	705
3 x 25	0.9	1.8	19.9	0.727	140	955
3 x 35	0.9	1.8	22.3	0.524	174	1 250
3 x 50	1.0	1.8	25.5	0.387	212	1 610
3 x 70	1.1	1.9	28.2	0.268	269	2 230
3 x 95	1.1	2.0	32.2	0.193	331	3 000
3 x 120	1.2	2.1	35.8	0.153	386	3 750
3 x 150	1.4	2.2	39.0	0.124	442	4 640
3 x 185	1.6	2.4	43.6	0.099	511	5 730
3 x 240	1.7	2.6	49.6	0.075	612	7 360

FOUR CORE (Cu/XLPE/PVC) Cables 0.6/1 kV



Conductors: Copper circular stranded
 Insulation: XLPE
 Sheath/Jacket: PVC (Polyvinylchloride)
 Colour: Black
 Operating temperature: Maximum 90°C
 Short circuit temperature: Maximum 250°C
 Standard: Cables up to and including 16 mm²
 IEC 502 -1994
 All cables other conform generally to
 BS 5467 - 1997 and IEC 60502

Cores and Cross-sectional area	Thickness of Insulation	Thickness of Outer sheath	Approx. Overall Diameter	DC Resistance at 20° C	Current Capacity at 20° C	Approx. Cable Weight
mm ²	mm	mm	mm	Ohm/km	A	kg/km
4 x 10	0.7	1.8	17.9	1.830	74	615
4 x 16	0.7	1.8	20.6	1.150	105	880
4 x 25	0.9	1.8	22.0	0.727	140	1 220
4 x 35	0.9	1.8	25.4	0.524	174	1 620
4 x 50	1.0	1.8	28.3	0.387	212	2 100
4 x 70	1.1	1.9	32.1	0.268	269	2 930
4 x 95	1.1	2.0	36.3	0.193	331	3 950
4 x 120	1.2	2.1	39.7	0.153	386	4 920
4 x 150	1.4	2.2	44.8	0.124	442	6 150
4 x 185	1.6	2.4	49.7	0.099	511	7 600
4 x 240	1.7	2.6	54.8	0.075	612	9 730

CABLES

Type: XLPE / (AWA) SWA / PVC 0.6/1 kV

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German Cathodic Protection



SINGLE CORE (Cu/XLPE/AWA/PVC) Cables 0.6/1 kV



Conductors: Copper circular stranded
 Insulation: XLPE
 Armour: Aluminium wire
 Sheath/Jacket: PVC (Polyvinylchloride)
 Colour: Black
 Operating temperature: Maximum 90°C
 Short circuit temperature: Maximum 250°C
 Standard: Cables up to and including 120 mm²
 IEC 502 -1994
 All cables other conform generally to BS 5467 - 1997 and IEC 60502

Cores and Cross-sectional area	Thickness of Insulation	Thickness of Extruded Bedding	Thickness of Outer sheath	Diameter of Armour wire	Approx. Overall Diameter	DC Resistance at 20° C	Approx. Cable Weight
mm ²	mm	mm	mm	mm	mm	Ohm/km	kg/km
1 x 50	1.0	0.8	1.5	1.6	18.8	0.387	765
1 x 70	1.1	0.8	1.5	1.6	20.6	0.268	1000
1 x 95	1.1	0.8	1.6	1.6	22.7	0.193	1300
1 x 120	1.2	0.8	1.6	1.6	24.4	0.153	1560
1 x 150	1.4	1.0	1.7	1.6	26.8	0.124	1920
1 x 185	1.6	1.0	1.8	1.6	29.0	0.099	2300
1 x 240	1.7	1.0	1.8	1.6	31.7	0.075	2890
1 x 300	1.8	1.0	1.9	1.6	34.1	0.060	3530
1 x 400	2.0	1.2	2.0	2.0	38.8	0.047	4590
1 x 500	2.2	1.2	2.1	2.0	42.4	0.037	5660
1 x 630	2.4	1.2	2.2	2.0	48.6	0.028	7100

TWO CORE (Cu/XLPE/SWA/PVC) Cables 0.6/1 kV



Conductors: Copper circular stranded
 Insulation: XLPE
 Armour: Steel wire
 Sheath/Jacket: PVC (Polyvinylchloride)
 Colour: Black
 Operating temperature: Maximum 90°C
 Short circuit temperature: Maximum 250°C
 Standard: All cables conform to BS 5467 - 1997 and IEC 60502

Cores and Cross-sectional area	Thickness of Insulation	Thickness of Extruded Bedding	Thickness of Outer sheath	Diameter of Armour wire	Approx. Overall Diameter	DC Resistance at 20° C	Approx. Cable Weight
mm ²	mm	mm	mm	mm	mm	Ohm/km	kg/km
2 x 4	0.7	0.8	1.4	0.9	15.2	4.610	440
2 x 6	0.7	0.8	1.4	0.9	16.4	3.080	520
2 x 10	0.7	0.8	1.5	0.9	18.0	1.830	670
2 x 16	0.7	0.8	1.5	1.25	20.9	1.150	965
2 x 25	0.9	0.8	1.6	1.25	24.3	0.727	1310
2 x 35	0.9	1.0	1.7	1.6	27.8	0.524	1810
2 x 50	1.0	1.0	1.8	1.6	30.9	0.387	2070
2 x 70	1.1	1.0	1.9	2.0	34.7	0.268	2650
2 x 95	1.1	1.2	2.0	2.0	39.9	0.193	3640
2 x 120	1.2	1.2	2.1	2.0	43.5	0.153	4330
2 x 150	1.4	1.2	2.2	2.0	47.3	0.124	5140

THREE CORE (Cu/XLPE/SWA/PVC) Cables 0.6/1 kV



Conductors: Copper circular stranded
 Insulation: XLPE
 Armour: Steel wire
 Sheath/Jacket: PVC (Polyvinylchloride)
 Colour: Black
 Operating temperature: Maximum 90°C
 Short circuit temperature: Maximum 250°C
 Standard: All cables conform to BS 5467 - 1997 and IEC 60502

Cores and Cross-sectional area	Thickness of Insulation	Thickness of Extruded Bedding	Thickness of Outer sheath	Diameter of Armour wire	Approx. Overall Diameter	DC Resistance at 20° C	Approx. Cable Weight
mm ²	mm	mm	mm	mm	mm	Ohm/km	kg/km
3 x 2.5	0.7	0.8	1.4	0.9	14.8	7.410	415
3 x 4	0.7	0.8	1.4	0.9	15.9	4.610	490
3 x 6	0.7	0.8	1.4	0.9	17.2	3.080	580
3 x 10	0.7	0.8	1.5	1.25	19.6	1.830	850
3 x 16	0.7	0.8	1.6	1.25	22.2	1.150	1110
3 x 25	0.9	1.0	1.7	1.6	24.3	0.727	1520
3 x 35	0.9	1.0	1.8	1.6	26.9	0.524	1910
3 x 50	1.0	1.0	1.8	1.6	30.1	0.387	2400
3 x 70	1.1	1.0	1.9	1.6	32.8	0.268	3100
3 x 95	1.1	1.2	2.1	2.0	38.2	0.193	4310
3 x 120	1.2	1.2	2.2	2.0	41.8	0.153	5170

FOUR CORE (Cu/XLPE/SWA/PVC) Cables 0.6/1 kV



Conductors: Copper circular stranded
 Insulation: XLPE
 Armour: Steel wire
 Sheath/Jacket: PVC (Polyvinylchloride)
 Colour: Black
 Operating temperature: Maximum 90°C
 Short circuit temperature: Maximum 250°C
 Standard: All cables conform to BS 5467 - 1997 and IEC 60502

Cores and Cross-sectional area	Thickness of Insulation	Thickness of Extruded Bedding	Thickness of Outer sheath	Diameter of Armour wire	Approx. Overall Diameter	DC Resistance at 20° C	Approx. Cable Weight
mm ²	mm	mm	mm	mm	mm	Ohm/km	kg/km
4 x 2.5	0.7	0.8	1.4	0.9	15.8	7.410	470
4 x 4	0.7	0.8	1.4	0.9	17.0	4.610	570
4 x 6	0.7	0.8	1.5	1.25	18.3	3.080	790
4 x 10	0.7	0.8	1.5	1.25	21.0	1.830	1020
4 x 16	0.7	0.8	1.6	1.25	23.9	1.150	1350
4 x 25	0.9	1.0	1.7	1.6	26.4	0.727	1850
4 x 35	0.9	1.0	1.8	1.6	30.0	0.524	2360
4 x 50	1.0	1.0	1.9	1.6	33.1	0.387	2970
4 x 70	1.1	1.2	2.1	2.0	38.1	0.268	4190
4 x 95	1.1	1.2	2.2	2.0	42.3	0.193	5370
4 x 120	1.2	1.4	2.3	2.5	47.1	0.153	6910

CABLES

Type: NSSHÖU 0.6/1 kV

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German Cathodic Protection



Ethylene Propylene Rubber (EPR) has excellent physical and ageing properties and a high maximum permissible operating temperature. Therefore, EPR insulated cables are generally used in heavy-duty equipment subject to high mechanical stresses such as in mines and quarries, and also in areas with a risk of explosion.

Conductors: Finely-stranded copper conductor of tinned copper wires. Class 5 according to DIN VDE 0295 and IEC 228

Insulation: EPR insulation (Ozone and weather resistant)

Inner sheath: Rubber for all multi-core cables

Outer sheath: Synthetic vulcanised rubber, oil-resistant according to DIN VDE 0473 Part 811-2-1, EN/IEC 60811-2-1

Colour: Colour of outer sheath: yellow

Operating temperature: 90° C

Short circuit temperature: 200° C

Special application: Multicore cables marked with (*) can be used for equipment in waste water process, cooling, surface and rain water.
* Tested as flame retardant cables and accepted by US Mine Safety and Health Administration (MSHA)

Standard: DIN VDE 0298 Part 3, Minimum bending radii
VDE 0482 Part 332-1-2, Behaviour in case of fire, EN/IEC 60332-1-2
VDE 0250, Cables, wires and flexible cords for power insulation.
Rubber insulated flexible cable NS-SHÖU
VDE 0298 Part 4, Current carrying capacity



Types: J - with protective earth conductor
O - without protective earth conductor

Core identification:

Core colour code NSSHÖU-J

3 cores (green-yellow, black, blue)
4 cores (green-yellow, black, blue, brown)
5 cores (green-yellow, black, blue, brown, black)

Core colour code NSSHÖU-O

1 core (black)
2 cores (black, blue)
3 cores (black, blue, brown)
4 cores (black, blue, brown, black)
5 cores (black, blue, brown, black, black)

Voltage rating:

Rated voltage : $U_0/U = 0.6/1$ kV

Maximum permissible voltage

- DC System : $U_m = 1.8$ kV

- AC single-phase system

Phase-to-Phase : $U_m = 1.4$ kV

Phase-to-Earth : $U_m = 0.7$ kV

- AC three-phase system : $U_m = 1.2$ kV

CORES x CROSS SECTIONAL AREA	CONDUCTOR		SHEATH		RESISTANCE DC 20° C	CURRENT CAPACITY AMBIENT TEMP 30° C	WEIGHT	NOMINAL DELIVERY LENGTH
	DIAMETER	INSULATION THICKNESS	OUTER DIAMETER	THICKNESS				
mm ²	mm	mm	mm	mm	Ohm/km	A	kg/km	m
1 x 16	6.3	1.2	12.5	1.6	1.240	99	255	1 000
1 x 25	7.8	1.4	15.0	2.0	0.795	131	283	1 000
1 x 35	9.2	1.4	16.5	2.0	0.565	162	493	1 000
1 x 50	11.0	1.6	18.5	2.0	0.393	202	670	1 000
1 x 70	13.1	1.6	20.5	2.2	0.277	250	900	1 000
1 x 95	15.1	1.8	23.5	2.2	0.210	301	1 140	1 000
1 x 120	17.0	1.8	25.5	2.5	0.164	352	1 430	1 000
1 x 150	19.0	2.0	27.5	2.5	0.132	404	1 740	1 000
1 x 185	21.0	2.2	31.0	3.0	0.108	461	2 150	500
1 x 240	24.0	2.4	34.5	3.0	0.082	633	2 760	500
2 x 1.5*	1.6	0.8	13.0	1.6	13.70	23	187	1 000
2 x 2.5*	2.6	0.9	14.0	1.6	8.210	30	239	1 000
2 x 4*	3.2	1.0	17.0	2.0	5.090	41	356	1 000
3 x 1.5*	1.6	0.8	13.5	1.6	13.70	23	210	1 000
3 x 2.5*	2.6	0.9	15.0	1.6	8.210	30	273	1 000
3 x 4*	3.2	1.0	1.0	2.0	5.090	41	408	1 000
3 x 6*	3.9	1.0	19.5	2.0	3.390	53	510	1 000
3 x 10*	5.1	1.2	23.0	2.2	1.950	74	770	1 000
4 x 1.5*	1.6	0.8	14.0	1.6	13.70	23	239	1 000
4 x 2.5*	2.6	0.9	17.0	2.0	8.210	30	364	1 000
4 x 4*	3.2	1.0	19.0	2.0	5.090	41	477	1 000
4 x 6*	3.9	1.0	20.5	2.0	3.390	53	600	1 000
4 x 10*	5.1	1.2	25.0	2.2	1.950	74	920	1 000
4 x 16*	6.3	1.2	30.0	2.5	1.240	99	1 370	1 000
4 x 25*	7.8	1.4	35.5	3.0	0.795	131	2 010	1 000
4 x 35*	9.2	1.4	38.5	3.0	0.565	162	2 530	1 000
4 x 50*	11.0	1.8	45.0	3.5	0.393	202	3 520	1 000
5 x 1.5	1.6	0.8	15.0	1.6	13.70	23	266	1 000
5 x 2.5	2.6	0.9	18.0	2.0	8.210	30	403	1 000
5 x 4	3.2	1.0	20.5	2.0	5.090	41	540	1 000
5 x 6	3.9	1.0	23.0	2.2	3.390	53	720	1 000
5 x 10	5.1	1.2	27.0	2.2	1.950	74	1 050	1 000
5 x 16	6.3	1.2	32.5	2.5	1.240	99	1 580	500
5 x 25	7.8	1.4	38.5	3.0	0.795	131	2 320	500

CABLES**Type: HYDROFIRM (T)**

Document No.: 08-500-R1

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German Cathodic Protection**Application**

HYDROFIRM (T) cables are intended for continuous immersion in drinking or ground water at depths up to 500 m, for use under medium mechanical stresses, and for use as a connection cable for electrical equipment. They may also be submerged in rain, sea, or surface water, as well as in industrial process or cooling water. However, these cables have limited suitability for mixed water types as defined by DIN 4045 and 4046.

They are not suitable for use in water containing more than 0.5 mg/l of chlorine.

Suitability for continuous immersion in water is verified by a certificate that includes manufacturing supervision from the VDE Test and Certification Institute (German Institute of Electrical Engineers).

Whereas tests conducted by the Federal Authority of Materials Testing (BAM), based on the KTW recommendations (Area C, "Installation Materials"), prove the suitability of this cable's use in drinking water.

HYDROFIRM (T) cables may be used indoors and outdoors, but not in areas exposed to explosion hazards. For protected, fixed installation within equipment, pipes or wells, these cables may be operated with an AC voltage to 1000V or a DC voltage to 750V dependent on earthing.

Technical details

The design is based on DIN VDE 0282 Part 810. HYDROFIRM (T) cables are at least equivalent to type 07RN rubber-insulated flexible cables with respect to their electrical and mechanical properties.

Finely stranded conductor of bare copper wires, Class 5 to DIN VDE 0295 and IEC 228

Insulation and sheath consist of special EPR-based materials, adapted for use in ground water and drinking water.

Insulation: Special rubber compound, at least equivalent to compound type 3G13 in DIN VDE 0207, colour coding to DIN VDE 0293.

Inner sheath (for sizes >16mm² or more than 5 conductors): Special rubber compound at least equivalent to compound type GM1b to DIN VDE 0207.

Outer sheath: Special rubber compound, mechanical and thermal properties equivalent/identical to compound type 5GM3 to DIN VDE 0207 coloured blue.

Tensile strength: The maximum allowable tensile stress is 15N/mm².

Voltage rating

Rated Voltage: $U_0/U = 450/750$ V

Max. operating voltages in: 3 phase AC operation $U_0/U = 475/825$ V

DC operation $U_0/U = 619/1238$ V

AC test voltage = 2.5kV



Cores and Cross-sectional area	Approx. Number of strands	Max. Strand diameter	Approx. Core diameter	Overall diameter		Approx. Cable Weight
				min	max	
mm ²		mm	mm	mm	mm	kg/km
1 x 6	75	0.31	3.2	7.5	8.8	120
1 x 10	77	0.41	4.1	9.5	11.0	180
1 x 16	123	0.41	5.6	11.5	13.5	265
1 x 25	190	0.41	6.8	13.5	15.5	380
1 x 35	268	0.41	8.1	15.0	17.5	500
1 x 50	384	0.41	9.6	17.5	20.0	690
1 x 70	545	0.41	11.2	20.0	22.5	920
1 x 95	724	0.41	13.2	22.5	25.0	1180
1 x 120	926	0.41	14.9	24.0	26.0	1470
HYDROFIRM (T) round, without ground conductor						
3 x 1.5	28	0.26	1.5	9.5	11.0	137
3 x 2.5	45	0.26	1.9	11.0	13.0	197
3 x 4	51	0.31	2.5	13.0	15.0	280
3 x 6	75	0.31	3.2	14.5	16.0	370
3 x 10	77	0.41	4.1	19.0	21.5	665
3 x 16	123	0.41	5.6	23.5	26.0	1000
3 x 25	190	0.41	6.8	28.5	31.0	1440
3 x 35	268	0.41	8.1	32.0	35.5	1870
3 x 50	384	0.41	9.6	37.0	41.0	2560
3 x 70	545	0.41	11.2	42.0	45.5	3370
HYDROFIRM (T) round, with ground conductor						
3 G 1.5	28	0.26	1.5	9.5	11.0	137
3 G 2.5	45	0.26	1.9	11.0	13.0	197
3 G 4	51	0.31	2.5	13.0	15.0	280
HYDROFIRM (T) round, with ground conductor						
4 G 1.5	28	0.26	1.5	10.0	12.0	175
4 G 2.5	45	0.26	1.9	12.0	14.0	250
4 G 4	51	0.31	2.5	14.0	16.0	375
4 G 6	75	0.31	3.2	15.5	18.0	475
4 G 10	77	0.41	4.1	21.0	23.5	825
4 G 16	123	0.41	5.6	25.5	29.0	1250
4 G 25	190	0.41	6.8	31.0	34.0	1800
4 G 35	268	0.41	8.1	35.0	39.0	2360
4 G 50	384	0.41	9.6	41.0	45.0	3250
4 G 70	545	0.41	11.2	46.5	50.0	4300
4 G 95	724	0.41	13.2	51.6	55.6	5650
4 G 120	926	0.41	14.9	56.1	56.1	6950

Core colour code

1 core (black)

3 cores (green-yellow, brown, blue)

4 cores (green-yellow, brown, blue, black)

CABLES

Type: PVDF 1 x 10 mm²

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German Cathodic Protection



Polyvinylidenfluoride (PVDF) insulated cables are used in highly corrosive environments inside deep anode groundbeds of cathodic protection systems.

PVDF 1 x 10 mm² type has been specially developed for extremely corrosive environments of anodes/groundbeds, caused mainly due to the presence of chlorine gas or ions in water.

PVDF is rated for continuous use over a temperature range of -10° to +125°C. It has high resistance to corrosive chemicals and organic solvents. Although this material is very hard with high tensile strength, abrasion resistance and excellent cut-through, limitations of flexibility are evident. It is resistant against creeping and fatigue.

Design and tests

DIN 40 500

Copper for electrical purposes;
wires of copper; technical conditions of delivery

DIN VDE 0472 Part 501

Testing of cables, wires and flexible cords;
conductor resistance

DIN VDE 0472 Part 502

Testing of cables, wires and flexible cords;
insulation resistance and volume resistivity

DIN VDE 0472 Part 509

Testing of cables, wires and flexible cords;
dielectric strength on cables, wires and cords

Voltage rating

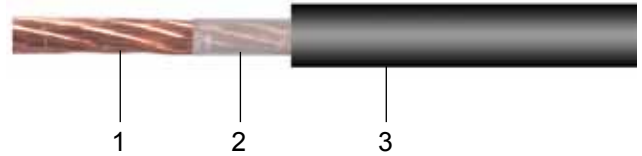
Rated voltage : 600 V

Electrical characteristics at 20° C

DC Resistance : 1.84 Ohm/km
Insulation resistance : 100 MOhm x km
Dielectric strength of insulation : 15 kV

Mechanical characteristics

Ambient temperature : -10 up to +125° C
Bending radius : 200 mm
Max. tension load : 800 N



Construction

- 1 Copper conductor, stranded
Strands 320 x 0.20 acc. to DIN 40 500
Cross-section 10 mm²
Diameter : approx. 4.8 mm
- 2 Separating tape 1 x 16 x 0.19 lapped
Material : PET (polyethyleneglycolterephthalate)
- 3 Outer sheath, black
Material: PVDF (polyvinylidene fluoride)
Thickness min. 1.8 mm
Outside diameter min. 8.4 mm
Weight approx. 193 kg/km

Typical application

