ROUND MEDIUM VOLTAGE REELING CABLES

	PROTOLON (SMK)	PROTOLON (SMK) LWL	TENAX-TTS	TENAX-TTS LWL
Designation	(N)TSCGEWOEU	(N)TSKCGEWOEU	(N)TSCGEWOEU	(N)TSCGEWOEU
Dimension	Optimized based on DIN VDE 0250 part 813	Optimized based on DIN VDE 0250 part 813	Optimized based on DIN VDE 0250 part 813	Optimized based on DIN VDE 0250 part 813
Cores	3C+3G (also + control or BUS)	3C+2G+FO (also + control or BUS)	3C+3G	3C+2G+FO
Outer Sheath	Rubber RED	Rubber RED	Rubber RED or BLACK with yellow stripes	Rubber RED or BLACK with yellow stripes
Approvals	GOST-R	GOST-R		
Tensile Load	30 N/mm²	30 N/mm²	25 N/mm²	25 Nmm²
Speed	240 m/min	240 m/min	180m/min	180 m/min
Temp. (moving)	-35°C/+80°C (special to -45°C on request)	-35°C/+80°C (special to -45°C on request)	-25°C/+80°C	-25°C/+80°C

PROTOLON(SMK) (N)TSCGEWOEU

Medium voltage reeling cable

Application

Flexible medium voltage reeling cable for application under high to extreme mechanical stresses, e.g. high travel speeds, dynamic tensile loads, multiple changes of direction into different planes, churning on running over rollers and torsional stresses.
Mainly for mobile equipment, e.g. fast-moving container cranes and large moving equipment.

Global data

Brand	PROTOLON(SMK)
Type designation	(N)TSCGEWOEU
Standard	Based on DIN VDE 0250-813
Certifications / Approvals	GOST-R

Design features

Conductor	Conductor and earth conductor made of electrolytic copper tinned, very finely stranded, class FS (refer also to DIN VDE 0295)
Insulation	PROTOLON HS High grade special compound based on high-quality EPR (at least 3GI3); improved mechanical and electrical characteristics (refer also to DIN VDE 0207, Part 20)
Electrical field control	Inner semiconductive layer of EPR, outer semiconductive layer of modified NBR, capable of being stripped when cold and thus extremely easy to prepare (Easy Strip design)
Core identification	Natural coloured insulation with black semiconductive layer
Core arrangement	Three-core design, with earth conductor split into 3 parts positioned in the interstices
Sheath system	- PROTOFIRM Sandwich - double layer inner sheath: Special compound based on EPR, quality at least 5GM3, also served as water barrier, color: red; - Anti-torsion braid: Reinforced braid made of polyester threads, in a vulcanized bond between the sheaths, resulting in high strength of the sheath system; - PROTOFIRM Sandwich - double layer outer sheath: A sheath system with a unique combination of flexibility and robustness has been achieved through the use of a new sandwich structure. Abrasion and tear-proof high grade rubber compounds based on PCP, quality at least 5GM5, colour: bright red/red.
Marking	PROTOLON (SMK) (N)TSCGEWOEU (number of cores)x(cross-section) (rated voltage) (year of manufacture) (serial number)

Electrical parameters

Rated voltage	1.8/3 kV	3.6/6 kV	6/10 kV	8.7/15 kV	12/20 kV
Max. permissible operating voltage AC	2.1/3.6 kV	4.2/7.2 kV	6.9/12 kV	10.4/18 kV	13.9/24 kV
Max. permissible operating voltage DC	2.7/5.4 kV	5.4/10.8 kV	9/18 kV	13.5/27 kV	18/36 kV
AC test voltage	6 kV	11 kV	17 kV	24 kV	29 kV

EMC	This design exhibits an extremely low interference level as a result of use of a symmetrical three-core design with very narrow manufacturing tolerances.
Data transmission	Special designs with Twisted Shielded Pairs or Individually Screened control elements available on request. A special cable design with fibre optics can be found in the product range PROTOLON(SMK)-LWL.
Current Carrying Capacity description	According to DIN VDE 0298, Part 4. Higher values are permissible in specific cases (please consult the manufacturer)

Chemical parameters

Resistance to oil	Acc. to DIN EN 60811-404 and DIN VDE 0473-811-404, paragraph 10
Weather resistance	Unrestricted use outdoors and indoors, resistant to ozone, UV and moisture
Water resistance	According to HD 2216

Thermal parameters

Max. permissible temperature at conductor	90 °C
Max. short circuit temperature of the conductor	250 °C
Ambient temperature for fixed installation	min -50 °C ; max +80 °C
Ambient temperature in fully flexible operation	min -35 °C ; max +80 °C

Mechanical parameters

Max. tensile load on the conductor	20 N/mm²
Max. tensile load on the conductor during acceleration	Up to 30 (acc. to DIN VDE 0298 part 3: 15 N/mm²) N/mm²
Torsional stress	± 25 °/m
Min. bending radius	Acc. to DIN VDE 0298 part 3
Min. distance with S-type directional changes	20 x D (D = cable diameter)
Travel speed	- Gantry (reeling operation): no restriction. For speeds beyond 240 m/min it is recommended to consult the cable manufacturer.
Additional tests	Reversed bending test, torsional stress test

Rated voltage 1.8/3 kV

Number of cores x cross section	Part number	MLFB Number	Conductor diameter max. mm	Earth conductor diameter max. mm	Outer diameter min. mm	Outer diameter max. mm	Bending radius free moving min. mm	Weight (ca.) kg/km	Permissible tensile force max. N	Dynamic tensile force max. N	Conductor resistance at 20°C max. Ω/km	Current carrying capacity (1) A	Short Circuit Current (conductor) kA
3x25+3x25/3	20004456	5DK2101	7.1	4.2	34.3	37.3	373	2110	1500	2250	0.8	131	3.58
3x35+3x25/3		5DK2102	8.3	4.2	43	46	460	3150	2100	3150	0.57	162	5.01
3x50+3x25/3	20143217	5DK2103	9.9	4.2	46.4	49.4	494	3840	3000	4500	0.39	202	7.15
3x70+3x35/3	20004457	5DK2104	11.8	5	45.9	48.9	489	4230	4200	6300	0.28	250	10.01
3x95+3x50/3	20004458	5DK2105	13.8	5.9	50.3	54.3	543	5440	5700	8550	0.21	301	13.59
3x120+3x70/3		5DK2106	15.4	7	63.8	67.8	678	8010	7200	10800	0.16	352	17.16
3x150+3x70/3		5DK2107	17.2	7	67.7	71.7	717	9240	9000	13500	0.13	404	21.45
3x185+3x95/3		5DK2108	19	8	71.6	75.6	756	10750	11100	16650	0.11	461	26.46
3x240+3x120/3		5DK2110	21.8	9	79.4	83.4	834	13640	14400	21600	0.08	540	34.32
3x300+3x150/3		5DK2111	24.4	10	84.7	89.7	897	16230	18000	27000	0.07	620	42.9

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
Special designs upon request!

Rated voltage 3.6/6 kV

Number of cores x cross section	Part number	MLFB Number	Conductor diameter max. mm	Earth conductor diameter max. mm	Outer diameter min. mm	Outer diameter max. mm	Bending radius free moving min. mm	Weight (ca.) kg/km	Permissible tensile force max. N	Dynamic tensile force max. N	Conductor resistance at 20°C max. Ω/km	Current carrying capacity (1) A	Short Circuit Current (conductor) kA
3x25+3x25/3	20004476	5DK3101	7.1	4.2	35.5	38.5	385	2210	1500	2250	0.8	131	3.58
3x35+3x25/3	20004477	5DK3102	8.3	4.2	39	42	420	2720	2100	3150	0.57	162	5.01
3x50+3x25/3	20004478	5DK3103	9.9	4.2	42.4	45.4	454	3380	3000	4500	0.39	202	7.15
3x70+3x35/3	20004479	5DK3104	11.8	5	46.4	49.4	494	4310	4200	6300	0.28	250	10.01
3x95+3x50/3	20004480	5DK3105	13.8	5.9	51.4	55.5	555	5570	5700	8550	0.21	301	13.59
3x120+3x70/3	20024335	5DK3106	15.4	7	55	59	590	6700	7200	10800	0.16	352	17.16
3x150+3x70/3	20004481	5DK3107	17.2	7	58.8	62.8	628	7820	9000	13500	0.13	404	21.45
3x185+3x95/3	20006940	5DK3108	19	8	64	68	680	9530	11100	16650	0.11	461	26.46
3x240+3x120/3		5DK3110	21.8	9	72.5	76.5	765	12120	14400	21600	0.08	540	34.32
3x300+3x150/3		5DK3111	24.4	10	78.2	82.2	822	14580	18000	27000	0.07	620	42.9

Special designs upon request!
(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).

Rated voltage 6/10 kV

Number of cores x cross section	Part number	MLFB Number	Conductor diameter max. mm	Earth conductor diameter max. mm	Outer diameter min. mm	Outer diameter max. mm	Bending radius free moving min. mm	Weight (ca.) kg/km	Permissible tensile force max. N	Dynamic tensile force max. N	Conductor resistance at 20°C max. Ω/km	Current carrying capacity (1) A	Short Circuit Current (conductor) kA
3x25+3x25/3	20004539	5DK4061	7.1	4.2	37.8	40.8	408	2400	1500	2250	0.8	131	3.58
3x35+3x25/3	20001443	5DK4062	8.3	4.2	40.2	43.2	432	2830	2100	3150	0.57	162	5.01
3x35+3x35/3	20004545	5DK4072	8.3	5	40.2	43.2	432	2920	2100	3150	0.57	162	5.01
3x35+3x50/3	20008105	5DK4802	8.3	5.9	42.7	45.7	457	3280	2100	3150	0.57	162	5.01
3x50+3x25/3	20004540	5DK4063	9.9	4.2	43.7	46.7	467	3570	3000	4500	0.39	202	7.15
3x70+3x50/3	20004546	5DK4074	11.8	5.9	47.7	50.7	507	4570	4200	6300	0.28	250	10.01
3x95+3x50/3	20004541	5DK4065	13.8	5.9	52.8	56.8	568	5710	5700	8550	0.21	301	13.59
3x120+3x70/3	20004542	5DK4066	15.4	7	56.2	60.2	602	6840	7200	10800	0.16	352	17.16
3x150+3x70/3	20004543	5DK4067	17.2	7	61.5	65.5	655	8200	9000	13500	0.13	404	21.45
3x185+3x95/3	20004544	5DK4068	19	8	65.3	69.3	693	9690	11100	16650	0.11	461	26.46
3x240+3x120/3	20113369	5DK4070	21.8	9	73.8	77.8	778	12310	14400	21600	0.08	540	34.32
3x300+3x150/3	20154762	5DK4071	24.4	10	79.5	83.5	835	14780	18000	27000	0.07	620	42.9

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
Special designs upon request!

Rated voltage 8.7/15 kV

Number of cores x cross section	Part number	MLFB Number	Conductor diameter max. mm	Earth conductor diameter max. mm	Outer diameter min. mm	Outer diameter max. mm	Bending radius free moving min. mm	Weight (ca.) kg/km	Permissible tensile force max. N	Dynamic tensile force max. N	Conductor resistance at 20°C max. Ω/km	Current carrying capacity (1) A	Short Circuit Current (conductor) kA
3x25+3x25/3	20004658	5DK5061	7.1	4.2	41.1	44.1	441	2680	1500	2250	0.8	139	3.58
3x35+3x25/3	20004659	5DK5062	8.3	4.2	43.7	46.7	467	3150	2100	3150	0.57	172	5.01
3x50+3x25/3	20004660	5DK5063	9.9	4.2	47.1	50.1	501	3840	3000	4500	0.39	215	7.15
3x70+3x35/3	20004661	5DK5064	11.8	5	52	56	560	5010	4200	6300	0.28	265	10.01
3x95+3x50/3	20148256	5DK5065	13.8	5.9	57.2	61.2	612	6070	5700	8550	0.21	319	13.59
3x120+3x70/3		5DK5066	15.4	7	62.1	66.1	661	7480	7200	10800	0.16	371	17.16
3x150+3x70/3		5DK5067	17.2	7	65.9	69.9	699	8630	9000	13500	0.13	428	21.45
3x185+3x95/3		5DK5068	19	8	69.8	73.8	738	10140	11100	16650	0.11	488	26.46
3x240+3x120/3		5DK5070	21.8	9	77.3	81.3	813	12860	14400	21600	0.08	574	34.32
3x300+3x150/3		5DK5071	24.4	10	84.2	89.2	892	15730	18000	27000	0.07	660	42.9

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
Special designs upon request!

Rated voltage 12/20 kV

Number of cores x cross section	Part number	MLFB Number	Conductor diameter max. mm	Earth conductor diameter max. mm	Outer diameter min. mm	Outer diameter max. mm	Bending radius free moving min. mm	Weight (ca.) kg/km	Permissible tensile force max. N	Dynamic tensile force max. N	Conductor resistance at 20°C max. Ω/km	Current carrying capacity (1) A	Short Circuit Current (conductor) kA
3x25+3x25/3	20004698	5DK5521	7.1	4.2	44.1	47.1	471	2950	1500	2250	0.8	139	3.58
3x35+3x25/3	20004699	5DK5522	8.3	4.2	46.6	49.6	496	3440	2100	3150	0.57	172	5.01
3x50+3x25/3	20119477	5DK5523	9.9	4.2	51.8	55.8	558	4300	3000	4500	0.39	215	7.15
3x70+3x35/3	20025103	5DK5524	11.8	5	55	59	590	5350	4200	6300	0.28	265	10.01
3x95+3x50/3	20004700	5DK5525	13.8	5.9	61.6	65.6	656	6660	5700	8550	0.21	319	13.59
3x120+3x70/3	20168895	5DK5526	15.4	7	65.1	69.1	691	7870	7200	10800	0.16	371	17.16
3x150+3x70/3		5DK5527	17.2	7	69	73	730	9060	9000	13500	0.13	428	21.45
3x185+3x95/3		5DK5528	19	8	74.3	78.3	783	10850	11100	16650	0.11	488	26.46
3x240+3x120/3		5DK5530	21.8	9	80.3	84.3	843	13340	14400	21600	0.08	574	34.32
3x300+3x150/3		5DK5532	24.4	10	87.2	92.2	922	16250	18000	27000	0.07	660	42.9

Special designs upon request!
(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).

PROTOLON(SMK)-LWL (N)TSKCGEWOEU

Medium voltage reeling cable with fiber optics

Application

Flexible medium voltage reeling cable with integrated fibre-optics for the combined transmission of energy and data, for application under high or extreme mechanical stresses, e.g. high travel speeds, dynamic tensile loads, multiple changes of direction into different planes, churning on running over rollers and torsional stresses.
Mainly for mobile equipment, e.g. fast-moving container cranes and large moving equipment.

Global data

Brand	PROTOLON(SMK)-LWL
Type designation	(N)TSKCGEWOEU
Standard	Based on DIN VDE 0250-813
Certifications / Approvals	GOST-R

Notes on installation

Notes on installation	Preparation of fibre-optics requires special skills and use of elaborate tools. It is therefore recommended that performance of this work is entrusted to our customer service (Factory assembly). Please provide the connection dimensions.

Design features

Conductor	Conductor and earth conductor made of electrolytic copper tinned, very finely stranded, class FS (refer also to DIN VDE 0295)
Insulation	PROTOLON HS High grade special compound based on high-quality EPR (at least 3GI3); improved mechanical and electrical characteristics (refer also to DIN VDE 0207, Part 20).
Electrical field control	Inner semiconductive layer of EPR, outer semiconductive layer of modified NBR, capable of being stripped when cold and thus extremely easy to prepare (Easy Strip design)
Core identification	Natural coloured insulation with black semiconductive layer
Optical Fiber	Fibre core diameter: 62.5, 50 or 9µm; diameter across the cladding: 125µm; diameter over the coating: 250µm. Design available with 6,12, 18 or 24 fibres.

Fibre class:	G50/125µm	G62,5/125µm	E9/125µm
Type:	Graded-index fibre	Graded-index fibre	Monomode fibre
- Attenuation at 850 nm:	<2,8 dB/km	<3,3 dB/km	-
- Attenuation at 1310 nm:	<0,8 dB/km	<0,9 dB/km	<0,4 dB/km
- Attenuation at 1550 nm:	-	-	<0,3 dB/km
- Bandwidth at 850 nm:	>400 MHz	>400 MHz	-
- Bandwidth at 1300 nm:	>1200 MHz	>600 MHz	-
- Numerical aperture:	0,2 ± 0,02	0,275 ± 0,02	0,14 ± 0,02
- Chromatic dispersion at 1300 nm:	-	-	<3,5 ps/nm km
- Chromatic dispersion at 1550 nm:	-	-	<3,5 ps/nm km

Fiber coding	Specially developed color code for identification of the individual fibres
Fiber covering	Hollow core with filling compound, Basic material: ETFE, Compound: 7YI 1, Natural color
Core arrangement	Three core design with cradle separator in the centre, earth conductor splitted into 2 parts positioned in two interstices. Optical element: six tubes, laid up around a central support element, with one, two or three optical fibers in each, positioned in the third interstice.
Sheath system	- PROTOFIRM Sandwich - double layer inner sheath: Special compound based on EPR, quality at least 5GM3, also served as water barrier, color: red; - Anti-torsion braid: Reinforced braid made of polyester threads, in a vulcanized bond between the sheaths, resulting in high strength of the sheath system; - PROTOFIRM Sandwich - double layer outer sheath: A sheath system with a unique combination of flexibility and robustness has been achieved through the use of a new sandwich structure. Abrasion and tear-proof high grade rubber compounds based on PCP, quality at least 5GM5, colour: bright red/red.
Marking	PROTOLON (SMK) LWL (N)TSKCGEWOEU (number of cores)x(cross-section) (rated voltage) (year of manufacture) (serial number)

Electrical parameters

Rated voltage	3.6/6 kV	6/10 kV	8.7/15 kV	12/20 kV
Max. permissible operating voltage AC	4.2/7.2 kV	6.9/12 kV	10.4/18 kV	13.9/24 kV
Max. permissible operating voltage DC	5.4/10.8 kV	9/18 kV	13.5/27 kV	18/36 kV
AC test voltage	11 kV	17 kV	24 kV	29 kV
EMC	This design exhibits an extremely low interference level as a result of use a symmetrical three-core design with very narrow manufacturing rates.			
Data transmission	Special design with fibre-optics for trouble free data transmission at high data rates.			
Current Carrying Capacity description	According to DIN VDE 0298, Part 4. Higher values are permissible in specific cases (please consult the manufacturer).			

Chemical parameters

Resistance to oil	Acc. to DIN EN 60811-404 and DIN VDE 0473-811-404, paragraph 10
Weather resistance	Unrestricted use outdoors and indoors, resistant to ozone, UV and moisture.
Water resistance	According to HD 2216

Thermal parameters

Max. permissible temperature at conductor	90 °C
Max. short circuit temperature of the conductor	250 °C
Ambient temperature for fixed installation	min -50 °C ; max +80 °C
Ambient temperature in fully flexible operation	min -35 °C ; max +80 °C

Mechanical parameters

Max. tensile load on the conductor	20 N/mm²
Max. tensile load on the conductor during acceleration	Up to 30 (acc. to DIN VDE 0298 part 3: 15 N/mm²) N/mm²
Torsional stress	± 25 °/m
Min. bending radius	Acc. to DIN VDE 0298 part 3
Min. distance with S-type directional changes	20 x D (cable diameter)
Travel speed	- Gantry (reeling operation): no restriction. For speeds beyond 240 m/min it is recommended to consult the cable manufacturer
Additional tests	Reversed bending test, torsional stress test

Rated voltage 3.6/6 kV

Number of cores x cross section	Part number	MLFB Number	Conductor diameter max. mm	Earth conductor diameter max. mm	Outer diameter min. mm	Outer diameter max. mm	Bending radius free moving min. mm	Weight (ca.) kg/km	Permissible tensile force max. N	Dynamic tensile force max. N	Conductor resistance at 20°C max. Ω/km	Current carrying capacity (1) A	Short Circuit Current (conductor) kA
3x25 + 2x25/2 + 1x(6G62,5)		5DK3081	7.1	5	39.9	42.9	429	2570	1500	2250	0.8	131	3.58
3x35 + 2x25/2 + 1x(6G62,5)	20004468	5DK3082	8.3	5	42	45	450	2990	2100	3150	0.57	162	5.01
3x50 + 2x25/2 + 1x(6G62,5)	20004469	5DK3083	9.9	5	44.8	47.8	478	3660	3000	4500	0.39	202	7.15
3x70 + 2x35/2 + 1x(6G62,5)	20004470	5DK3084	11.8	5.9	49.9	53.9	539	4740	4200	6300	0.28	250	10.01
3x95 + 2x50/2 + 1x(6G62,5)	20004471	5DK3085	13.8	7.2	54.8	58.8	588	5920	5700	8550	0.21	301	13.59
3x120 + 2x70/2 + 1x(6G62,5)	20008293	5DK3086	15.4	8.3	58.2	62.2	622	7130	7200	10800	0.16	352	17.16
3x150 + 2x70/2 + 1x(6G62,5)	20007743	5DK3100	17.2	8.3	63.5	67.5	675	8500	9000	13500	0.13	404	21.45

Design with 12,18 or 24 fibers and/or G50 or E9 types available upon request.
(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).

Rated voltage 6/10 kV

Number of cores x cross section	Part number	MLFB Number	Conductor diameter max. mm	Earth conductor diameter max. mm	Outer diameter min. mm	Outer diameter max. mm	Bending radius free moving min. mm	Weight (ca.) kg/km	Permissible tensile force max. N	Dynamic tensile force max. N	Conductor resistance at 20°C max. Ω/km	Current carrying capacity (1) A	Short Circuit Current (conductor) kA
3x25 + 2x25/2 + 1x(6G62,5)	20004548	5DK4081	7.1	5	40.7	43.7	437	2640	1500	2250	0.8	131	3.58
3x35 + 2x25/2 + 1x(6G62,5)	20004549	5DK4082	8.3	5	42.7	45.7	457	3060	2100	3150	0.57	162	5.01
3x50 + 2x25/2 + 1x(6G62,5)	20004550	5DK4083	9.9	5	46.1	49.1	491	3730	3000	4500	0.39	202	7.15
3x70 + 2x35/2 + 1x(6G62,5)	20004551	5DK4084	11.8	5.9	51.1	55.1	551	4870	4200	6300	0.28	250	10.01
3x95 + 2x50/2 + 1x(6G62,5)	20004552	5DK4085	13.8	7.2	56.1	60.1	601	6070	5700	8550	0.21	301	13.59
3x120 + 2x70/2 + 1x(6G62,5)	20006945	5DK4086	15.4	8.3	60.9	64.9	649	7500	7200	10800	0.16	352	17.16
3x150 + 2x70/2 + 1x(6G62,5)	20004553	5DK4087	17.2	8.3	64.8	68.8	688	8670	9000	13500	0.13	404	21.45
3x185 + 2x95/2 + 1x(6G62,5)	20007673	5DK4088	19	9.8	69.3	73.3	733	10290	11100	16650	0.11	461	26.46
3x240 + 2x120/2 + 1x(6G62,5)	20035801	5DK4090	21.8	11	76.7	80.7	807	12960	14400	21600	0.08	540	34.32
3x300 + 2x150/2 + 1x(6G62,5)		5DK4091	24.4	12	84.2	89.2	892	15880	18000	27000	0.07	620	42.9

Design with 12,18 or 24 fibers and/or G50 or E9 types available upon request.
(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).

Rated voltage 8.7/15 kV

Number of cores x cross section	Part number	MLFB Number	Conductor diameter max. mm	Earth conductor diameter max. mm	Outer diameter min. mm	Outer diameter max. mm	Bending radius free moving min. mm	Weight (ca.) kg/km	Permissible tensile force max. N	Dynamic tensile force max. N	Conductor resistance at 20°C max. Ω/km	Current carrying capacity (1) A	Short Circuit Current (conductor) kA
3x25 + 2x25/2 + 1x(6G62,5)	20004664	5DK5078	7.1	5	43.5	46.5	465	2890	1500	2250	0.8	139	3.58
3x35 + 2x25/2 + 1x(6G62,5)	20004667	5DK5082	8.3	5	46.1	49.1	491	3380	2100	3150	0.57	172	5.01
3x50 + 2x25/2 + 1x(6G62,5)	20004668	5DK5083	9.9	5	50.5	54.5	545	4260	3000	4500	0.39	215	7.15
3x70 + 2x35/2 + 1x(6G62,5)	20004669	5DK5084	11.8	5.9	55.2	59.2	592	5350	4200	6300	0.28	265	10.01
3x95 + 2x50/2 + 1x(6G62,5)		5DK5***	13.8	7.2	60.9	64.9	649	6700	5700	8550	0.21	319	13.59
3x120 + 2x70/2 + 1x(6G62,5)		5DK5***	15.4	8.3	64.4	68.4	684	7870	7200	10800	0.16	371	17.16
3x150 + 2x70/2 + 1x(6G62,5)		5DK5***	17.2	8.3	68.8	72.8	728	9130	9000	13500	0.13	428	21.45
3x185 + 2x95/2 + 1x(6G62,5)		5DK5***	19	9.8	74.1	78.1	781	10920	11100	16650	0.11	488	26.46
3x240 + 2x120/2 + 1x(6G62,5)		5DK5***	21.8	11	80.8	84.8	848	13560	14400	21600	0.08	574	34.32
3x300 + 2x150/2 + 1x(6G62,5)		5DK5***	24.4	12	87.7	92.7	927	16510	18000	27000	0.07	660	42.9

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
Design with 12,18 or 24 fibers and/or G50 or E9 types available upon request.

Rated voltage 12/20 kV

Number of cores x cross section	Part number	MLFB Number	Conductor diameter max. mm	Earth conductor diameter max. mm	Outer diameter min. mm	Outer diameter max. mm	Bending radius free moving min. mm	Weight (ca.) kg/km	Permissible tensile force max. N	Dynamic tensile force max. N	Conductor resistance at 20°C max. Ω/km	Current carrying capacity (1) A	Short Circuit Current (conductor) kA
3x25 + 2x25/2 + 1x(6G62,5)	20004701	5DK5531	7.1	5	46.6	49.6	496	3200	1500	2250	0.8	139	3.58
3x35 + 2x25/2 + 1x(6G62,5)	20004702	5DK5533	8.3	5	50.1	54.1	541	3880	2100	3150	0.57	172	5.01
3x50 + 2x25/2 + 1x(6G62,5)		5DK5***	9.9	5	54.1	58.1	581	4670	3000	4500	0.39	215	7.15
3x70 + 2x35/2 + 1x(6G62,5)	20168072	5DK5***	11.8	5.9	58.2	62.2	622	5640	4200	6300	0.28	265	10.01
3x95 + 2x50/2 + 1x(6G62,5)		5DK5***	13.8	7.2	64	68	680	7050	5700	8550	0.21	319	13.59
3x120 + 2x70/2 + 1x(6G62,5)		5DK5***	15.4	8.3	68	72	720	8360	7200	10800	0.16	371	17.16
3x150 + 2x70/2 + 1x(6G62,5)	20161633	5DK5***	17.2	8.3	73.3	77.3	773	9840	9000	13500	0.13	428	21.45
3x185 + 2x95/2 + 1x(6G62,5)		5DK5***	19	9.8	77.2	81.2	812	11410	11100	16650	0.11	488	26.46
3x240 + 2x120/2 + 1x(6G62,5)		5DK5***	21.8	11	85.1	90.1	901	14440	14400	21600	0.08	574	34.32
3x300 + 2x150/2 + 1x(6G62,5)		5DK5***	24.4	12	91.3	96.3	963	17810	18000	27000	0.07	660	42.9

Design with 12,18 or 24 fibers and/or G50 or E9 types available upon request.
(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).

(N)TSCGEWOEU TENAX TTS

Medium voltage reeling cable

Application

Flexible medium voltage reeling cable for application under high mechanical stresses, e.g. high travel speeds, dynamic tensile loads, multiple changes of direction into different planes, churning on running over rollers and torsional stresses.
Mainly for mobile equipment, e.g. fast-moving container cranes and large moving equipment.

Global data

Brand	TENAX-TTS
Type designation	(N)TSCGEWOEU
Standard	Based on DIN VDE 0250-813

Design features

Conductor	Plain copper, fine stranded class 5 according to DIN EN 60228 / VDE 0295
Insulation	Rubber, compound type EPR-SHS EI6, super-clean
Electrical field control	Inner and outer layer of semiconductive rubber compound
Core arrangement	Cores layed up around conductive filler with aramid rope in the center, earth conductor split into the interstices.
Inner sheath	Rubber, special compound, mechanical properties acc. to 5GM3
Reinforcement	Polyester anti-torsion braid
Outer sheath	Abrasion and tear proof special rubber compound, quality at least 5GM5 acc. to DIN VDE 0207 part 21, resistance to ozone, UV and oil. Sheath colour: red or black with yellow stripe
Marking	Embossed: (N)TSCGEWOEU (number of cores) x (cross-section) (rated voltage) DRAKA DE VDE (Year of manufacture) TENAX TTS

Electrical parameters

Rated voltage	3.6/6 kV	6/10 kV	8.7/15 kV	12/20 kV
Max. permissible operating voltage AC	4.2/7.2 kV	6.9/12 kV	10.4/18 kV	13.9/24 kV
Max. permissible operating voltage DC	5.4/10.8 kV	9/18 kV	13.5/27 kV	18/36 kV
AC test voltage	11 kV	17 kV	24 kV	29 kV
Current Carrying Capacity description	According to DIN VDE 0298 Part 4			

Thermal parameters

Max. permissible temperature at conductor	90 °C
Max. short circuit temperature of the conductor	250 °C
Ambient temperature for fixed installation	min -40 °C ; max +80 °C
Ambient temperature in fully flexible operation	min -25 °C ; max +80 °C

Mechanical parameters

Max. tensile load on the conductor	20 N/mm²
Max. tensile load on the conductor during acceleration	25 N/mm²
Torsional stress	± 50 °/m
Min. bending radius	Acc. to DIN VDE 0298 part 3
Min. distance with S-type directional changes	20 X D
Travel speed	- Reeling operation: up to 180 m/min

Rated voltage 3.6/6 kV

Number of cores x cross section	Part number	Conductor diameter max. mm	Outer diameter min. mm	Outer diameter max. mm	Bending radius free moving min. mm	Weight (ca.) kg/km	Permissible tensile force max. N	Dynamic tensile force max. N	Conductor resistance at 20°C max. Ω/km	Nom. operating capacitance µF/km	Inductive Reactance (at 50Hz) Ω/km	Current carrying capacity (1) A	Short Circuit Current (conductor) kA
3x16+3x16/3		5	36	39	390	1970	960	1200	1.21	0.3	0.121	99	2.29
3x25+3x25/3		6.2	38.5	41.5	415	2380	1500	1875	0.78	0.38	0.102	131	3.58
3x35+3x25/3	20074704	7.7	41.5	44.5	445	2830	2100	2625	0.55	0.43	0.097	162	5.01
3x50+3x25/3	20074720	9.3	44.5	47.5	475	3390	3000	3750	0.39	0.49	0.092	202	7.15
3x70+3x35/3		11.5	50	54	540	4400	4200	5250	0.27	0.55	0.088	250	10.01
3x95+3x50/3		12.8	54	58	580	5300	5700	7125	0.21	0.62	0.084	301	13.59
3x120+3x70/3		14.9	58	62	620	6400	7200	9000	0.16	0.67	0.082	352	17.16
3x150+3x70/3		16.5	63	67	670	7600	9000	11250	0.13	0.73	0.08	404	21.45
3x185+3x95/3		18.5	67	72	720	9200	11100	13875	0.11	0.79	0.078	461	26.46

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).

Rated voltage 6/10 kV

Number of cores x cross section	Part number	Conductor diameter max. mm	Outer diameter min. mm	Outer diameter max. mm	Bending radius free moving min. mm	Weight (ca.) kg/km	Permissible tensile force max. N	Dynamic tensile force max. N	Conductor resistance at 20°C max. Ω/km	Nom. operating capacitance µF/km	Inductive Reactance (at 50Hz) Ω/km	Current carrying capacity (1) A	Short Circuit Current (conductor) kA
3x16/16		5	37	41	410	2055	960	1200	1.21	0.26	0.118	99	2.29
3x16+3x16/3	20074723	5	36	39	390	1910	960	1200	1.21	0.26	0.118	99	2.29
3x25+3x25/3	20074717	6.2	40	43	430	2340	1500	1875	0.78	0.35	0.104	131	3.58
3x35+3x25/3	20119291	7.7	43	46	460	2890	2100	2625	0.55	0.39	0.099	162	5.01
3x50+3x25/3	20074713	9.3	45	48	480	3390	3000	3750	0.39	0.45	0.094	202	7.15
3x70+3x35/3	20126712	11.5	50.5	54.5	545	4480	4200	5250	0.27	0.51	0.09	250	10.01
3x95+3x50/3		12.8	54.5	58.5	585	5400	5700	7125	0.21	0.58	0.086	301	13.59
3x120+3x70/3		14.9	58.5	62.5	625	6700	7200	9000	0.16	0.63	0.084	352	17.16
3x150+3x70/3		16.5	63	67	670	7600	9000	11250	0.13	0.69	0.082	404	21.45
3x185+3x95/3		18.5	68	73	730	9350	11100	13875	0.11	0.75	0.08	461	26.46
3x240+3x120/3		21	73	78	780	11850	14400	18000	0.08	0.83	0.078	540	34.32

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).

Rated voltage 8.7/15 kV

Number of cores x cross section	Part number	Conductor diameter max. mm	Outer diameter min. mm	Outer diameter max. mm	Bending radius free moving min. mm	Weight (ca.) kg/km	Permissible tensile force max. N	Dynamic tensile force max. N	Conductor resistance at 20°C max. Ω/km	Nom. operating capacitance µF/km	Inductive Reactance (at 50Hz) Ω/km	Current carrying capacity (1) A	Short Circuit Current (conductor) kA
3x16+3x16/3		5	39	42	420	2210	960	1200	1.21	0.22	0.121	105	2.29
3x25+3x25/3	20121561	6.2	42	45	450	2550	1500	1875	0.78	0.3	0.11	139	3.58
3x35+3x25/3		7.7	45	49	490	3100	2100	2625	0.55	0.33	0.105	172	5.01
3x50+3x25/3	20100279	9.3	49	53	530	3720	3000	3750	0.39	0.37	0.099	215	7.15
3x70+3x35/3		11.5	53	57	570	5050	4200	5250	0.27	0.42	0.094	265	10.01
3x95+3x50/3	20101412	12.8	58	62	620	5900	5700	7125	0.21	0.48	0.089	319	13.59
3x120+3x70/3		14.9	63	67	670	7265	7200	9000	0.16	0.52	0.087	371	17.16
3x150+3x70/3		16.5	66	70	700	8500	9000	11250	0.13	0.57	0.085	428	21.45
3x185+3x95/3		18.5	70	74	740	9900	11100	13875	0.11	0.61	0.083	488	26.46

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).

Rated voltage 12/20 kV

Number of cores x cross section	Part number	Conductor diameter max. mm	Outer diameter min. mm	Outer diameter max. mm	Bending radius free moving min. mm	Weight (ca.) kg/km	Permissible tensile force max. N	Dynamic tensile force max. N	Conductor resistance at 20°C max. Ω/km	Nom. operating capacitance µF/km	Inductive Reactance (at 50Hz) Ω/km	Current carrying capacity (1) A	Short Circuit Current (conductor) kA
3x25+3x25/3	20074721	6.2	45	48	480	2860	1500	1875	0.78	0.24	0.115	139	3.58
3x35+3x25/3		7.7	48	51	510	3250	2100	2625	0.55	0.27	0.109	172	5.01
3x50+3x25/3		9.3	51	55	550	4050	3000	3750	0.39	0.3	0.103	215	7.15
3x70+3x35/3	20074735	11.5	56	60	600	4800	4200	5250	0.27	0.34	0.098	265	10.01
3x95+3x50/3		12.8	60	64	640	6450	5700	7125	0.21	0.38	0.094	319	13.59
3x120+3x70/3		14.9	66	70	700	7700	7200	9000	0.16	0.41	0.091	371	17.16
3x150+3x70/3		16.5	69	73	730	8550	9000	11250	0.13	0.45	0.089	428	21.45
3x185+3x95/3		18.5	75	79	790	10600	11100	13875	0.11	0.49	0.086	488	26.46

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).

NOTES

(N)TSCGEWOEU TENAX TTS-LWL

Medium voltage reeling cable with fibre-optics

Application

Flexible medium voltage reeling cable with integrated fibre-optics for the combined transmission of energy and data, for application under high mechanical stresses, e.g. high travel speeds, dynamic tensile loads, multiple changes of direction into different planes, churning on running over rollers and torsional stresses.
Mainly for mobile equipment, e.g. fast-moving container cranes and large moving equipment.

Global data

Brand	TENAX-TTS
Type designation	(N)TSCGEWOEU
Standard	Based on DIN VDE 0250-813

Design features

Conductor	Plain copper, fine stranded class 5 according to DIN EN 60228 / VDE 0295
Insulation	Rubber, compound type EPR-SHS EI6, super-clean
Electrical field control	Inner and outer layer of semiconductive rubber compound
Optical Fiber	12 fibers, 50/125µ or 62.5/125µ or E9/125µ, within protection jacket.

Fibre class:	G50/125µm	G62,5/125µm	E9/125µm
Type:	Graded-index fibre	Graded-index fibre	Monomode fibre
- Attenuation at 850 nm:	<2,8 dB/km	<3,3 dB/km	-
- Attenuation at 1300 nm:	<0,8 dB/km	<0,9 dB/km	<0,4 dB/km
- Attenuation at 1550 nm:	-	-	<0,3 dB/km
- Bandwidth at 850 nm:	>400 MHz	>200 MHz	-
- Bandwidth at 1300 nm:	>1200 MHz	>500 MHz	-
- Numerical aperture:	0,2 ± 0,02	0,27 ± 0,02	-
- Chromatic dispersion at 1300 nm:	-	-	<3,5 ps/nm km
- Chromatic dispersion at 1550 nm:	-	-	<18 ps/nm km

Core arrangement	Cores layed up around conductive filler with aramid rope in the center
Inner sheath	Rubber, special compound, mechanical properties acc. to 5GM3
Reinforcement	Polyester anti-torsion braid
Outer sheath	Abrasion and tear proof special rubber compound, quality at least 5GM5 acc. to DIN VDE 0207 part 21, resistance to ozone, UV and oil. Sheath colour: red or black with yellow stripe
Marking	Embossed: (N)TSCGEWOEU (number of cores) x (cross-section) (rated voltage) DRAKA DE VDE (Year of manufacture) TENAX TTS

Electrical parameters

Rated voltage	3.6/6 kV	6/10 kV	8.7/15 kV	12/20 kV
Max. permissible operating voltage AC	4.2/7.2 kV	6.9/12 kV	10.4/18 kV	13.9/24 kV
Max. permissible operating voltage DC	5.4/10.8 kV	9/18 kV	13.5/27 kV	18/36 kV
AC test voltage	11 kV	17 kV	24 kV	29 kV
Current Carrying Capacity description	According to DIN VDE 0298 Part 4			

Thermal parameters

Max. permissible temperature at conductor	90 °C
Max. short circuit temperature of the conductor	250 °C
Ambient temperature for fixed installation	min -40 °C ; max +80 °C
Ambient temperature in fully flexible operation	min -25 °C ; max +80 °C

Mechanical parameters

Max. tensile load on the conductor	20 N/mm²
Max. tensile load on the conductor during acceleration	25 N/mm²
Torsional stress	± 50 °/m
Min. bending radius	Acc. to DIN VDE 0298 part 3
Min. distance with S-type directional changes	20 X D
Travel speed	- Reeling operation: up to 180 m/min

Rated voltage 3.6/6 kV

Number of cores x cross section	Conductor diameter max. mm	Outer diameter min. mm	Outer diameter max. mm	Bending radius free moving min. mm	Weight (ca.) kg/km	Permissible tensile force max. N	Dynamic tensile force max. N	Conductor resistance at 20°C max. Ω/km	Nom. operating capacitance µF/km	Inductive Reactance (at 50Hz) Ω/km	Current carrying capacity (1) A	Short Circuit Current (conductor) kA
3x25 + 2x25/2 + 1x(12G62,5)	6.2	38.5	41.5	415	2380	1500	1875	0.78	0.38	0.102	131	3.58
3x35 + 2x25/2 + 1x(12G62,5)	7.7	41.5	44.5	445	2750	2100	2625	0.55	0.49	0.092	202	5.01
3x50 + 2x25/2 + 1x(12G62,5)	9.3	44.5	47.5	475	3100	3000	3750	0.39	0.49	0.092	202	7.15
3x70 + 2x35/2 + 1x(12G62,5)	11.5	50	54	540	4400	4200	5250	0.27	0.55	0.088	250	10.01
3x95 + 2x50/2 + 1x(12G62,5)	12.8	54	58	580	5300	5700	7125	0.21	0.62	0.084	301	13.59
3x150 + 2x70/2 + 1x(12G62,5)	16.5	63	67	670	7600	9000	11250	0.13	0.73	0.08	404	21.45
3x185 + 2x95/2 + 1x(12G62,5)	18.5	67	72	720	9200	11100	13875	0.11	0.79	0.078	461	26.46

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).

Rated voltage 6/10 kV

Number of cores x cross section	Part number	Conductor diameter max. mm	Outer diameter min. mm	Outer diameter max. mm	Bending radius free moving min. mm	Weight (ca.) kg/km	Permissible tensile force max. N	Dynamic tensile force max. N	Conductor resistance at 20°C max. Ω/km	Nom. operating capacitance µF/km	Inductive Reactance (at 50Hz) Ω/km	Current carrying capacity (1) A	Short Circuit Current (conductor) kA
3x25 + 2x25/2 + 1x(12G62,5)	20091982	6.2	40	43	430	2480	1500	1875	0.78	0.35	0.104	131	3.58
3x35 + 2x25/2 + 1x(12G62,5)	20074719	7.7	42	45	450	2950	2100	2625	0.55	0.39	0.099	162	5.01
3x50 + 2x25/2 + 1x(12G62,5)	20096115	9.3	45	48	480	3480	3000	3750	0.39	0.45	0.094	202	7.15
3x70 + 2x35/2 + 1x(12G62,5)	20092017	11.5	51	55	550	4710	4200	5250	0.27	0.51	0.09	250	10.01
3x95 + 2x50/2 + 1x(12G62,5)	20086347	12.8	55	59	590	5550	5700	7125	0.21	0.58	0.086	301	13.59
3x120 + 2x70/2 + 1x(12G62,5)		14.9	58.5	62.5	625	6700	7200	9000	0.16	0.63	0.084	352	17.16
3x150 + 2x70/2 + 1x(12G62,5)		16.5	63	67	670	7600	9000	11250	0.13	0.69	0.082	404	21.45
3x240 + 2x120/2 + 1x(12G62,5)		21	73	78	780	12400	14400	18000	0.08	1.05	0.08	540	34.32

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).

Rated voltage 8.7/15 kV

Number of cores x cross section	Part number	Conductor diameter max. mm	Outer diameter min. mm	Outer diameter max. mm	Bending radius free moving min. mm	Weight (ca.) kg/km	Permissible tensile force max. N	Dynamic tensile force max. N	Conductor resistance at 20°C max. Ω/km	Nom. operating capacitance µF/km	Inductive Reactance (at 50Hz) Ω/km	Current carrying capacity (1) A	Short Circuit Current (conductor) kA
3x25 + 2x25/2 + 1x(12G62,5)		6.2	42	45	450	2700	1500	1875	0.78	0.3	0.11	139	3.58
3x35 + 2x25/2 + 1x(12G62,5)	20091668	7.7	45	49	490	2960	2100	2625	0.55	0.33	0.105	172	5.01
3x50 + 2x25/2 + 1x(12G62,5)		9.3	50	54	540	3960	3000	3750	0.39	0.37	0.099	215	7.15
3x70 + 2x35/2 + 1x(12G62,5)	20114426	11.5	53	57	570	4760	4200	5250	0.27	0.42	0.094	265	10.01
3x95 + 2x50/2 + 1x(12G62,5)	20153431	12.8	58	62	620	5760	5700	7125	0.21	0.48	0.089	319	13.59
3x120 + 2x70/2 + 1x(12G62,5)		14.9	64	68	680	7265	7200	9000	0.16	0.52	0.087	371	17.16
3x150 + 2x70/2 + 1x(12G62,5)		16.5	68	72	720	8500	9000	11250	0.13	0.57	0.085	428	21.45
3x185 + 2x95/2 + 1x(12G62,5)		18.5	72	77	770	9900	11100	13875	0.11	0.61	0.083	488	26.46

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).

Rated voltage 12/20 kV

Number of cores x cross section	Part number	Conductor diameter max. mm	Outer diameter min. mm	Outer diameter max. mm	Bending radius free moving min. mm	Weight (ca.) kg/km	Permissible tensile force max. N	Dynamic tensile force max. N	Conductor resistance at 20°C max. Ω/km	Nom. operating capacitance µF/km	Inductive Reactance (at 50Hz) Ω/km	Current carrying capacity (1) A	Short Circuit Current (conductor) kA
3x25 + 2x25/2 + 1x(12G62,5)	20076107	6.2	45	48	480	2890	1500	1875	0.78	0.24	0.115	139	3.58
3x35 + 2x25/2 + 1x(12G62,5)		7.7	47	50	500	3250	2100	2625	0.55	0.27	0.109	172	5.01
3x50 + 2x25/2 + 1x(12G62,5)		9.3	51	55	550	4050	3000	3750	0.39	0.3	0.103	215	7.15
3x70 + 2x35/2 + 1x(12G62,5)		11.5	56	60	600	4850	4200	5250	0.27	0.34	0.098	265	10.01
3x95 + 2x50/2 + 1x(12G62,5)		12.8	60	64	640	6450	5700	7125	0.21	0.38	0.094	319	13.59
3x120 + 2x70/2 + 1x(12G62,5)		14.9	66	70	700	7700	7200	9000	0.16	0.41	0.091	371	17.16
3x150 + 2x70/2 + 1x(12G62,5)		16.5	69	73	730	8550	9000	11250	0.13	0.45	0.089	428	21.45
3x185 + 2x95/2 + 1x(12G62,5)		18.5	75	79	790	10600	11100	13875	0.11	0.49	0.086	488	26.46

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).