

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.
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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/mm ²
Max. tensile load on the conductor during acceleration	Up to 30 (acc. to DIN VDE 0298 part 3: 15 N/mm ²) N/mm ²
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).