



**PROTOLON(SMK) LWL**  
(N)TSKCGEWOEU  
Medium Voltage Reeling Cable  
with integrated Fibre Optics

**ENERGY**



## Technical Data

	Type	PROTOLON (SMK) LWL		
	Type designation	(N)TSKCGEWÖU		
	Approvals/ standards	DIN VDE 0250, Part 813, MSHA P-189-4; GOST R		
	Application	Flexible H.V. flexible reeling cable, also suitable for festoon systems, for 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, cranes, large mobile equipment and excavators. Also for application to which DIN VDE 0168 and 0118 apply: Open-cast and underground mining.		
<b>Electrical parameters</b>	Rated voltage	U <sub>0</sub> /U = 1.8/3 kV to 18/30 kV		
	Maximum permissible operating voltage in AC systems	U <sub>0</sub> /U = 2.1/3.6 kV to 20.8/36 kV		
	Maximum permissible operating voltage in DC systems	U <sub>0</sub> /U = 2.7/5.4 kV to 27/54 kV		
	AC test voltage	6.0 kV to 43.0 kV according to DIN VDE 0250, Part 813		
	Current-carrying capacity	According to DIN VDE 0298, Part 4 Higher values are permissible in specific cases. Please consult the manufacturer.		
	Data transmission	Special design with fibre-optics for trouble free data transmission at high data rates.		
	EMC	This design exhibits an extremely low interference level as a result of use a symmetrical three-core design with very narrow manufacturing rates.		
<b>Optical parameters</b>	Transmission data of the fibre-optics	Graded-index fibre 50/125	Graded-index fibre 62.5/125	Monomode fibre E9/125
	Max. attenuation at wavelength 850 nm	2.8 dB/km	3.3 dB/km	-
	Max. attenuation at wavelength 1300 nm	0.8 dB/km	0.4 dB/km	0.9 dB/km
	Max. attenuation at wavelength 1550 nm	-	-	0,3 dB/km
	Bandwidth at 850 nm	> 400 MHz	> 400 MHz	-
	Bandwidth at 1300 nm	> 1200 MHz	> 600 MHz	-
	Numerical aperture	0,200+/-0,200	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

## Technical Data

<b>Thermal parameters</b>	Ambient temperature	
	- Fully flexible operation	-35°C to +80°C
	- Fixed installation	-50°C to +80°C
	Maximum permissible operating temperature of the conductor	90°C
	Short-circuit temperature of the conductor	250°C
<b>Mechanical parameters</b>	dynamical tensile load at acceleration processes	up to 30 N/mm <sup>2</sup> (acc. to: DIN VDE 0298 part 3: 15 N/mm <sup>2</sup> )
	max. permanent tensile load	up to 20 N/mm <sup>2</sup>
	Torsional stresses	+/-25°/m
	Minimum bending radii	According to DIN VDE 0298, Part 3
	Minimum distance with S-type directional changes	20xD (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
<b>Chemical parameters</b>	Resistance to oil	DIN VDE 0473, Part 811-2-1 Para. 10
	Weather resistance	Unrestricted use outdoors and indoors, resistant to ozone, UV and moisture
	Water compatibility	According to HD 2216
<b>Note on installation</b>		Preparation of fibre-optics requires special skills and use of elaborate tools. It is therefore recommended that performance of this work be entrusted to our customer service. (Assembly at works) Please give the connection dimensions.



## Design features

Type	PROTOLON (SMK) LWL
Conductor and protective-earth conductor (refer also to DIN VDE 0295)	Electrolytic copper tinned, very finely stranded, class FS
Insulation (refer also to DIN VDE 0207, Part 20)	PROTOLON HS High grade special compound based on high-quality EPR (at least 3GI3); improved mechanical and electrical characteristics.
Field control	For designs from 3 to 30 kV: 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	From 3.6/6 kV: natural coloured insulation with black semiconductive layer
Centre element (cradle separator)	special designed centre element for additional stabilizing purposes for the core arrangement (always at FO-cables)
Core	Standard for reeling fibre-optic cables: Conductive EPR shaped core for additional stability
Fibre-optics	Fibre core diameter 62.5, 50 or 9µm; diameter across the cladding 125µm, diameter over the coating 250µm
Fibre covering	Specially developed color code for identification of the individual fibres
Fibre optic tubes	Tubes filled with special gel, compound based on ETFE
Fibre optic arrangement	six tubes, lay up in one layer, with one, two or three FO´s each and special support element into the centre
Core arrangement	three core design with cradle separator in the centre, earth conductor splitted into 3 parts
Sheath system	<ul style="list-style-type: none"> <li>- PROTOFIRM Sandwich: double layer inner sheath High grade special compound based on EPR, quality at least 5GM3, also served as water barrier, color: red</li> <li>- Anti-torsion braid: reinforced braid made of polyester threads, in a vulcanized bond between the sheaths. Resulting in high strength of the sheath system.</li> <li>- 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 special rubber compounds based on PCP, quality at least 5GM5 color: bright red/red</li> </ul>
Marking	PROTOLON (SMK) LWL (N)TSKCGEWÖU (number of cores)x(cross-section) (rated voltage) (year of manufacture) (serial number)

### Selection and ordering data

Number of cores and nominal cross-section	Order No.	Earth conductor diameter [mm]	Overall diameter of cable Min. value [mm]	Overall diameter of cable Max. value [mm]	Approx. net weight for 1000 m [kg/km]	Maximum permissible tensile force (dyn. value) [N]
<b>3.6/6 kV (N)TSKCGEWOEU LWL: 6 G 62,5/125µm</b>						
3x25+2x25/2+6LWL	5DK3 081	7,1/4,2	39,9	42,9	2570	1500 (2250)
3x35+2x25/2+6LWL	5DK3 082	8,3/4,2	42,0	45,0	3000	2100 (3150)
3x50+2x25/2+6LWL	5DK3 083	9,9/4,2	44,8	47,8	3610	3000 (4500)
3x70+2x35/2+6LWL	5DK3 ***	11,8/5,0	48,8	52,8	4900	4200 (6300)
3x95+2x50/2+6LWL	5DK3 ***	13,8/5,9	54,8	58,8	5930	5700 (8550)
3x120+2x70/2+6LWL	5DK3 086	15,4/7,0	58,2	62,2	7110	7200 (10800)
<b>6/10 kV (N)TSKCGEWOEU LWL: 6 G 62,5/125µm</b>						
3x25+2x25/2+6LWL	5DK4 081	7,1/4,2	40,7	43,7	2610	1500 (2250)
3x35+2x25/2+6LWL	5DK4 082	8,3/4,2	42,7	45,7	3010	2100 (3150)
3x50+2x25/2+6LWL	5DK4 083	9,9/4,2	46,1	49,1	3680	3000 (4500)
3x70+2x35/2+6LWL	5DK4 084	11,8/5,0	51,1	55,1	4810	4200 (6300)
3x95+2x50/2+6LWL	5DK4 085	13,8/5,9	56,1	60,1	6000	5700 (8550)
3x120+2x70/2+6LWL	5DK4 086	15,4/7,0	60,9	64,9	7410	7200 (10800)
3x150+3x70/2+6LWL	5DK4 087	17,2/7,0	64,8	68,8	8570	9000 (13500)
3x185+2x95/2+6LWL	5DK4 088	19,1/8,0	69,3	73,3	10160	11100 (16650)
3x240+2x120/2+6LWL	5DK4 090	21,8/9,0	76,7	80,7	12880	14400 (21600)
3x300+2x150/2+6LWL	5DK4 091	24,4/10,0	84,2	89,2	15880	18000 (27000)
-	-	-	-	-	-	-
<b>8,7/15 kV (N)TSKCGEWOEU LWL: 6 G 62,5/125µm</b>						
3x25+2x25/2+6LWL	-	7,1/4,2	43,5	46,5	2860	1500 (2250)
3x35+2x25/2+6LWL	5DK5 082	8,3/4,2	46,1	49,1	3330	2100 (3150)
3x50+2x25/2+6LWL	5DK5 083	9,9/4,2	50,5	54,5	4210	3000 (4500)
3x70+2x35/2+6LWL	5DK5 084	11,8/5,0	55,2	59,2	5270	4200 (6300)
3x95+2x50/2+6LWL	-	13,8/5,9	60,9	64,9	6640	5700 (8550)
3x120+2x70/2+6LWL	-	15,4/7,0	64,4	68,4	7870	7200 (10800)
3x150+3x70/2+6LWL	-	17,2/7,0	68,8	72,8	9130	9000 (13500)
3x185+2x95/2+6LWL	-	19,0/8,0	74,1	78,1	10920	11100 (16650)
3x240+2x120/2+6LWL	-	21,8/9,0	80,8	84,8	13560	14400 (21600)
3x300+2x150/2+6LWL	-	24,4/10,0	87,7	92,7	16510	18000 (27000)
<b>12/20 kV (N)TSKCGEWOEU LWL: 6 G 62,5/125µm</b>						
3x25+2x25/2+6LWL	5DK5 531	7,1/4,2	46,6	49,6	3150	1500 (2250)
3x35+2x25/2+6LWL	5DK5 533	8,3/4,2	50,1	54,1	3810	2100 (3150)
3x50+2x25/2+6LWL	-	9,9/4,2	54,1	58,1	4610	3000 (4500)
3x70+2x35/2+6LWL	-	11,8/5,0	58,2	62,2	5640	4200 (6300)
3x95+2x50/2+6LWL	-	13,8/5,9	64,0	68,0	7050	5700 (8550)
3x120+2x70/2+6LWL	-	15,4/7,0	68,0	72,0	8360	7200 (10800)
3x150+3x70/2+6LWL	-	17,2/7,0	73,3	77,3	9840	9000 (13500)
3x185+2x95/2+6LWL	-	19,0/8,0	77,2	81,2	11410	11100 (16650)
3x240+2x120/2+6LWL	-	21,8/9,0	85,1	90,1	14440	14400 (21600)
3x300+2x150/2+6LWL	-	24,4/10,0	91,3	96,3	17810	18000 (27000)

**Selection and ordering data**

Number of cores and nominal cross-section	Order No.	Earth conductor diameter	Overall diameter of cable Min. value	Overall diameter of cable Max. value	Approx. net weight for 1000 m	Maximum permissible tensile force (dyn. value)
		[mm]	[mm]	[mm]	[kg/km]	[N]

14/25 kV (N)TSKCGEWOEU LWL: 6 G 62,5/125µm

3x25+2x25/2+6LWL	-	7,1/4,2	51,4	55,4	3730	1500 (2250)
3x35+2x25/2+6LWL	-	8,3/4,2	54,5	58,5	4300	2100 (3150)
3x50+2x25/2+6LWL	-	9,9/4,2	58,0	62,0	5070	3000 (4500)
3x70+2x35/2+6LWL	-	11,8/5,0	63,5	67,5	6350	4200 (6300)
3x95+2x50/2+6LWL	-	13,8/5,9	68,4	72,4	7650	5700 (8550)
3x120+2x70/2+6LWL	-	15,4/7,0	73,3	77,3	9190	7200 (10800)
3x150+3x70/2+6LWL	-	17,2/7,0	77,2	81,2	10450	9000 (13500)
3x185+2x95/2+6LWL	-	19,0/8,0	81,6	85,6	12140	11100 (16650)
3x240+2x120/2+6LWL	-	21,8/9,0	89,0	94,0	15150	14400 (21600)
3x300+2x150/2+6LWL	-	24,4/10,0	96,2	101,2	18190	18000 (27000)

18/30 kV (N)TSKCGEWOEU LWL: 6 G 62,5/125µm

3x25+2x25/2+6LWL	-	7,1/4,2	55,4	59,4	4180	1500 (2250)
3x35+2x25/2+6LWL	-	8,3/4,2	58,0	62,0	4720	2100 (3150)
3x50+2x25/2+6LWL	-	9,9/4,2	62,9	66,9	5730	3000 (4500)
3x70+2x35/2+6LWL	-	11,8/5,0	67,5	71,5	6900	4200 (6300)
3x95+2x50/2+6LWL	-	13,8/5,9	73,3	77,3	8420	5700 (8550)
3x120+2x70/2+6LWL	-	15,4/7,0	76,7	80,7	9720	7200 (10800)
3x150+3x70/2+6LWL	-	17,2/7,0	81,2	85,2	11120	9000 (13500)
3x185+2x95/2+6LWL	-	19,0/8,0	86,4	91,4	13120	11100 (16650)
3x240+2x120/2+6LWL	-	21,8/9,0	93,0	98,0	15910	14400 (21600)
3x300+2x150/2+6LWL	-	24,4/10,0	99,6	104,6	18890	18000 (27000)

Special designs on request!