PROTOLON (SB)
PROTOLON (SB) with Copper Core Shield
Flexible Cables for Trailing Operation

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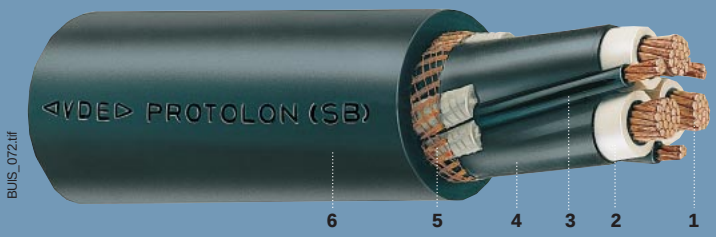
Selection and dimensioning criteria				Refer to Section 4 for further details	➜
	Type	**PROTOLON (SB)**	**PROTOLON (SB)** with copper core shield	Page	4/2
	Type designation	NTSCGEWÖU	NTSCGECEWÖU	Page	4/3
	Approvals/standards	DIN VDE 0250, Part 813 MSHA P-189-4 WUG/GE-83/98	DIN VDE 0250, Part 813 MSHA P-189-4 WUG/GE-83/98	Page	4/4
	Application (refer also to DIN VDE 0298, Part 3)	As power supply or connection cables for large material handling machines, e.g. excavators in open-cast mines subject to extremely high mechanical stresses. Particularly suitable for applications in which abrasion and chaffing stresses are to be expected in trailing operation.		Page	4/6
Electrical parameters	Rated voltage	U_0/U = 1.8/3 kV to 18/30 kV	U_0/U = 1.8/3 kV to 18/30 kV	Pages	4/14
	Maximum permissible operating voltage in AC systems	U_0/U = 2.1/3.6 kV to 20.8/36 kV	U_0/U = 2.1/3.6 kV to 20.8/36 kV	to	4/17
	Maximum permissible operating voltage in DC systems	U_0/U = 2.7/5.4 kV to 27/54 kV	U_0/U = 2.7/5.4 kV to 27/54 kV		
	AC test voltage	6 kV to 43 kV according to DIN VDE 0250, Part 813	6 kV to 43 kV according to DIN VDE 0250, Part 813		
	Current-carrying capacity	According to DIN VDE 0298, Part 4	According to DIN VDE 0298, Part 4		
Thermal parameters	Ambient temperature			Pages	4/18
	• Fully flexible operation	- 20 °C to + 60 °C	- 20 °C to + 60 °C	to	4/19
	• Fixed installation	- 40 °C to + 80 °C	- 40 °C to + 80 °C		
	Maximum permissible operating temperature of the conductor	90 °C	90 °C		
	Short-circuit temperature of the conductor	200 °C	200 °C		
Mechanical parameters	Tensile load	Up to 15 N/mm²	Up to 15 N/mm²	Page	4/20
	Torsional stresses	± 100 °/m	± 25 °/m	Page	4/21
	Minimum bending radii	According to DIN VDE 0298, Part 3	According to DIN VDE 0298, Part 3	Page	4/22
	Additional tests	Sheath shifting test	Sheath shifting test	Page	4/25
Chemical parameters	Resistance to oil	Given to DIN VDE 0473, Part 811-2-1, Para. 10	Given to DIN VDE 0473, Part 811-2-1, Para. 10	Page	4/28
	Behaviour in case of fire	Given to DIN VDE 0482, Part 265-2-1	Given to DIN VDE 0482, Part 265-2-1		
	Weather resistance	Unrestricted use outdoors and indoors, resistant to ozone and moisture	Unrestricted use outdoors and indoors, resistant to ozone and moisture		
Note on installation	Termination with sealing ends	Suitable material sets for self-assembly		Page	3/13
		Termination at the manufacturer's works		Page	3/15

1	Conductor
2	Insulation
3	Protective-earth conductor
4	Outer semiconductive layer
5	Reinforcing tape
6	Complete sheath (inner and outer sheath)



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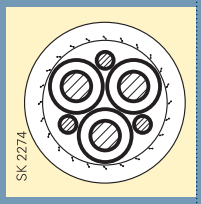
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Design features			Refer to Section 4 for further details	➜
Type	**PROTOLON (SB)**	**PROTOLON (SB)** with copper core shield	Page	4/2
Conductor (refer also to DIN VDE 0295)	Electrolytic copper, tinned, finely stranded, Class 5 (Protective-earth conductor: electrolytic copper, tinned, very finely stranded, Class “FS”)	Electrolytic copper, tinned, finely stranded, Class 5 (Protective-earth conductor: electrolytic copper, tinned, very finely stranded, Class “FS”)	Page	4/29
Insulation (refer also to DIN VDE 0207, Part 20)	PROTOLON, basic material EPR, compound type: 3GI3	PROTOLON. basic material EPR, compound type: 3GI3	Page	4/32
Arrangement of protective-earth conductor	With protective-earth conductor split into three in the outer interstices	Individual concentric protective-earth conductor, split over each core		
Electrical field control	Inner and outer semiconductive layer of semiconductive rubber	Inner and outer semiconductive layer of semiconductive rubber and additional individual concentric metallic protective-earth conductor	Page	4/36
Core identification	Natural colouring with black semiconductive rubber	Natural colouring with black semiconductive rubber		
Core arrangement	Three main conductors laid-up, with protective-earth conductor split into three in the outer interstices	Three main conductors laid-up		
Reinforcing tape	Extremely tear-resistant reinforcing tape which prevents sheath movement	Extremely tear-resistant reinforcing tape which prevents sheath movement		
Inner sheath und outer sheath (refer also to DIN VDE 0207, Part 21)	Complete sheath (inner and outer sheath) of special extremely abrasion-resistant and tear-proof chloroprene rubber compound, inner and outer sheath inseparably bonded compound type: 5GM5	Complete sheath (inner and outer sheath) of special extremely abrasion-resistant and tear-proof chloroprene rubber compound, inner and outer sheath inseparably bonded compound type: 5GM5	Page	4/32
Marking	(Year of manufacture) (serial number) <VDE> PROTOLON (SB) NTSCGEWÖU (number of cores) x (cross-section) (rated voltage)	(Year of manufacture) (serial number) <VDE> PROTOLON (SB) NTSCGECEWÖU (number of cores) x (cross-section) (rated voltage)	Page	4/40

Selection data

Number of cores and nominal cross-section	Conductor diameter	Overall diameter of cable (guidance value)		Conductor resistance at 20 °C	Inductance per unit length	Operating capacitance per unit length	Current-carrying capacity at 30 °C	Permissible short-circuit current (1s)	Approx. net weight for 1000 m	Maximum permissible tensile force
	Max. value	Min. value	Max. value							
mm^2	mm	mm	mm	Ω/km	mH/km	µF/km	A	kA	kg	N
1.8/3 kV NTSCGEWÖU										
3 x 25 + 3 x 25/3[1)]	6.9	38.5	41.5	0.795	0.33	0.41	131	3.05	2470	1125
3 x 35 + 3 x 25/3[1)]	8.3	42.9	45.9	0.565	0.31	0.47	162	4.27	3080	1575
3 x 50 + 3 x 25/3[1)]	9.8	46.1	49.1	0.393	0.29	0.54	202	6.10	3750	2250
3 x 70 + 3 x 35/3[1)]	11.6	49.7	53.7	0.277	0.28	0.61	250	8.54	4690	3150
3 x 95 + 3 x 50/3	13.3	57.4	61.4	0.210	0.28	0.66	301	11.59	6210	4275
3 x 120 + 3 x 70/3	15.1	61.2	65.2	0.164	0.27	0.72	352	14.64	7430	5400
3 x 150 + 3 x 70/3	16.8	66.7	70.7	0.132	0.26	0.79	404	18.30	8900	6750
3 x 185 + 3 x 95/3	18.6	70.6	74.6	0.108	0.26	0.86	461	22.57	10330	8325
3.6/6 kV NTSCGEWÖU										
3 x 25 + 3 x 25/3[1)]	6.9	44.6	47.6	0.795	0.36	0.34	131	3.05	3080	1125
3 x 35 + 3 x 25/3[1)]	8.3	47.6	50.6	0.565	0.34	0.39	162	4.27	3590	1575
3 x 50 + 3 x 25/3[1)]	9.8	52.4	56.4	0.393	0.32	0.43	202	6.10	4520	2250
3 x 70 + 3 x 35/3[1)]	11.6	56.3	60.3	0.277	0.30	0.49	250	8.54	5520	3150
3 x 95 + 3 x 50/3	13.3	59.9	63.9	0.210	0.29	0.54	301	11.59	6580	4275
3 x 120 + 3 x 70/3	15.1	65.6	69.6	0.164	0.28	0.60	352	14.64	8110	5400
3 x 150 + 3 x 70/3	16.8	69.3	73.3	0.132	0.27	0.65	404	18.30	9320	6750
3 x 185 + 3 x 95/3	18.6	73.2	77.2	0.108	0.27	0.70	461	22.57	10780	8352
6/10 kV NTSCGEWÖU										
3 x 25 + 3 x 25/3[1)]	6.9	46.4	49.4	0.795	0.37	0.31	131	3.05	3270	1125
3 x 35 + 3 x 25/3[1)]	8.3	49.1	53.1	0.565	0.34	0.35	162	4.27	3800	1575
3 x 50 + 3 x 25/3[1)]	9.8	54.1	58.1	0.393	0.33	0.39	202	6.10	4750	2250
3 x 70 + 3 x 35/3[1)]	11.6	58.0	62.0	0.277	0.31	0.44	250	8.54	5750	3150
3 x 95 + 3 x 50/3	13.3	61.7	65.7	0.210	0.30	0.49	301	11.59	6830	4275
3 x 120 + 3 x 70/3	15.1	67.4	71.4	0.164	0.29	0.54	352	14.64	8380	5400
3 x 150 + 3 x 70/3	16.8	71.0	75.0	0.132	0.28	0.58	404	18.30	9620	6750
3 x 185 + 3 x 95/3	18.6	76.7	80.7	0.108	0.27	0.63	461	22.57	11430	8325
8.7/15 kV NTSCGEWÖU										
3 x 25 + 3 x 25/3[1)]	6.9	52.6	56.6	0.795	0.39	0.25	139	3.05	4040	1125
3 x 35 + 3 x 25/3[1)]	8.3	55.6	59.6	0.565	0.37	0.28	172	4.27	4630	1575
3 x 50 + 3 x 25/3[1)]	9.8	58.9	62.9	0.393	0.35	0.31	215	6.10	5370	2250
3 x 70 + 3 x 35/3[1)]	11.6	64.5	68.5	0.277	0.33	0.35	265	8.54	6720	3150
3 x 95 + 3 x 50/3	13.3	68.2	72.2	0.210	0.32	0.39	319	11.59	7850	4275
3 x 120 + 3 x 70/3	15.1	72.1	76.1	0.164	0.31	0.42	371	14.64	9130	5400
3 x 150 + 3 x 70/3	16.8	77.6	81.6	0.132	0.30	0.46	428	18.30	10750	6750
3 x 185 + 3 x 95/3	18.6	81.5	85.5	0.108	0.29	0.50	488	22.57	12290	8325

1) A protective-earth conductor design … 50/3 is also possible for applications according to DIN VDE 0168.

Selection data

Number of cores and nominal cross-section	Conductor diameter	Overall diameter of cable (guidance value)		Conductor resistance at 20 °C	Induc-tance per unit length	Operating capaci-tance per unit length	Current-carrying capacity at 30 °C	Permissi-ble short-circuit current (1s)	Approx. net weight for 1000 m	Maximum permissi-ble tensile force
	Max. value	Min. value	Max. value							
mm^2	mm	mm	mm	Ω/km	mH/km	µF/km	A	kA	kg	N
12/20 kV NTSCGEWÖU										
3 x 25 + 3 x 25/3[1)]	6.9	56.9	60.9	0.795	0.41	0.22	139	3.05	4620	1125
3 x 35 + 3 x 25/3[1)]	8.3	59.9	63.9	0.565	0.39	0.25	172	4.27	5220	1575
3 x 50 + 3 x 25/3[1)]	9.8	65.0	69.0	0.393	0.37	0.27	215	6.10	6300	2250
3 x 70 + 3 x 35/3[1)]	11.6	68.9	72.9	0.277	0.35	0.30	265	8.54	7410	3150
3 x 95 + 3 x 50/3	13.3	72.5	76.5	0.210	0.33	0.33	319	11.59	8560	4275
3 x 120 + 3 x 70/3	15.1	78.2	82.2	0.164	0.32	0.36	371	14.64	10260	5400
3 x 150 + 3 x 70/3	16.8	81.9	85.9	0.132	0.31	0.39	428	18.30	11570	6750
3 x 185 + 3 x 95/3	18.6	87.4	92.4	0.108	0.30	0.42	488	22.57	13530	8325
18/30 kV NTSCGEWÖU										
3 x 25 + 3 x 25/3[1)]	6.9	69.5	73.5	0.795	0.45	0.17	139	3.05	6680	1125
3 x 35 + 3 x 25/3[1)]	8.3	72.5	76.5	0.565	0.43	0.19	172	4.27	7380	1575
3 x 50 + 3 x 25/3[1)]	9.8	77.6	81.6	0.393	0.40	0.21	215	6.10	8460	2250
3 x 70 + 3 x 35/3[1)]	11.6	81.5	85.5	0.277	0.38	0.23	265	8.54	9690	3150
3 x 95 + 3 x 50/3	13.3	84.9	89.9	0.210	0.37	0.25	319	11.59	10960	4275
3 x 120 + 3 x 70/3	15.1	90.6	95.6	0.164	0.35	0.27	371	14.64	12830	5400
3 x 150 + 3 x 70/3	16.8	94.3	99.3	0.132	0.34	0.29	428	18.30	14250	6750
3 x 185 + 3 x 95/3	18.6	100.0	105.0	0.108	0.33	0.31	488	22.57	16390	8325

1) A protective-earth conductor design … 50/3 is also possible for applications according to DIN VDE 0168.

Selection data

Number of cores and nominal cross-section	Conductor diameter	Overall diameter of cable (guidance value)		Conductor resistance at 20 °C	Inductance per unit length	Operating capacitance per unit length	Current-carrying capacity at 30 °C	Permissible short-circuit current (1s)	Approx. net weight for 1000 m	Maximum permissible tensile force
	Max. value	Min. value	Max. value							
mm^2	mm	mm	mm	Ω/km	mH/km	µF/km	A	kA	kg	N
1.8/3 kV NTSCGECEWÖU										
3 x 25 + 2 x 25/2 + 1 x 10 ST	6.9	40.3	44.3	0.795	0.34	0.41	131	3.05	2470	1125
3 x 35 + 2 x 25/2 + 1 x 10 ST	8.3	42.9	46.9	0.565	0.32	0.47	162	4.27	3080	1575
3 x 50 + 2 x 25/2 + 1 x 10 ST	9.8	46.8	50.8	0.393	0.3	0.54	202	6.1	3750	2250
3 x 70 + 2 x 35/2 + 1 x 10 ST	11.6	51.5	55.5	0.277	0.29	0.61	250	8.54	4690	3150
3 x 95 + 2 x 50/2 + 1 x 10 ST	13.3	57.4	62.4	0.21	0.29	0.66	301	11.59	6210	4275
3 x 120 + 2 x 70/2 + 1 x 10 ST	15.1	63.6	68.6	0.164	0.28	0.72	352	14.64	7430	5400
3 x 150 + 2 x 70/2 + 1 x 10 ST	16.8	67.2	72.2	0.132	0.27	0.79	404	18.3	8900	6750
3 x 185 + 2 x 95/2 + 1 x 10 ST	18.6	70.2	75.2	0.108	0.27	0.86	461	22.57	10330	8325
3.6/6 kV NTSCGECEWÖU										
3 x 25 + 2 x 25/2 + 1 x 10 ST	6.9	45.0	49.0	0.795	0.37	0.34	131	3.05	3200	1125
3 x 35 + 2 x 25/2 + 1 x 10 ST	8.3	47.6	51.6	0.565	0.35	0.39	162	4.27	3680	1575
3 x 50 + 2 x 25/2 + 1 x 10 ST	9.8	53.0	57.0	0.393	0.33	0.43	202	6.1	4640	2250
3 x 70 + 2 x 35/2 + 1 x 10 ST	11.6	56.2	60.2	0.277	0.31	0.49	250	8.54	5550	3150
3 x 95 + 2 x 50/2 + 1 x 10 ST	13.3	61.8	66.8	0.21	0.3	0.54	301	11.59	6650	4275
3 x 120 + 2 x 70/2 + 1 x 10 ST	15.1	66.1	71.1	0.164	0.29	0.6	352	14.64	8160	5400
3 x 150 + 2 x 70/2 + 1 x 10 ST	16.6	69.8	74.8	0.132	0.28	0.65	404	18.3	9340	6750
3 x 185 + 2 x 95/2 + 1 x 10 ST	18.6	74.6	79.6	0.108	0.28	0.7	461	22.57	10890	8325
6/10 kV NTSCGECEWÖU										
3 x 25 + 2 x 25/2 + 1 x 10 ST	6.9	46.8	50.8	0.795	0.38	0.31	131	3.05	3410	1125
3 x 35 + 2 x 25/2 + 1 x 10 ST	8.3	50.9	54.9	0.565	0.35	0.35	162	4.27	3890	1575
3 x 50 + 2 x 25/2 + 1 x 10 ST	9.8	54.5	58.9	0.393	0.34	0.39	202	6.1	4860	2250
3 x 70 + 2 x 35/2 + 1 x 10 ST	11.6	58.0	62.0	0.277	0.32	0.44	250	8.54	5780	3150
3 x 95 + 2 x 50/2 + 1 x 10 ST	13.3	63.5	68.5	0.21	0.31	0.49	301	11.59	6920	4275
3 x 120 + 2 x 70/2 + 1 x 10 ST	15.1	67.8	72.8	0.164	0.3	0.54	352	14.64	8450	5400
3 x 150 + 2 x 70/2 + 1 x 10 ST	16.6	71.5	76.5	0.132	0.29	0.58	404	18.3	9620	6750
3 x 185 + 2 x 95/2 + 1 x 10 ST	18.6	76.3	81.3	0.108	0.28	0.63	461	22.57	10980	8325
8.7/15 kV NTSCGECEWÖU										
3 x 25 + 2 x 25/2 + 1 x 10 ST	6.9	53.0	57.0	0.795	0.4	0.25	139	3.05	4130	1125
3 x 35 + 2 x 25/2 + 1 x 10 ST	8.3	55.6	59.6	0.565	0.38	0.28	172	4.27	4740	1575
3 x 50 + 2 x 25/2 + 1 x 10 ST	9.8	59.3	63.3	0.393	0.36	0.31	215	6.1	5470	2250
3 x 70 + 2 x 35/2 + 1 x 10 ST	11.6	64.6	68.6	0.277	0.34	0.35	265	8.54	6820	3150
3 x 95 + 2 x 50/2 + 1 x 10 ST	13.3	68.3	73.3	0.21	0.33	0.39	319	11.59	7950	4275
3 x 120 + 2 x 70/2 + 1 x 10 ST	15.1	74.4	79.4	0.164	0.32	0.42	371	14.64	9240	5400
3 x 150 + 2 x 70/2 + 1 x 10 ST	16.6	78.1	83.1	0.132	0.31	0.46	428	18.3	10860	6750
3 x 185 + 2 x 95/2 + 1 x 10 ST	18.6	81.1	86.1	0.108	0.3	0.5	488	22.57	12400	8325
12/20 kV NTSCGECEWÖU										
3 x 25 + 2 x 25/2 + 1 x 10 ST	6.9	57.3	61.3	0.795	0.42	0.22	139	3.05	4770	1125
3 x 35 + 2 x 25/2 + 1 x 10 ST	8.3	59.9	63.9	0.565	0.4	0.25	172	4.27	5340	1575
3 x 50 + 2 x 25/2 + 1 x 10 ST	9.8	65.4	69.4	0.393	0.38	0.27	215	6.1	6460	2250
3 x 70 + 2 x 35/2 + 1 x 10 ST	11.6	68.8	72.8	0.277	0.36	0.3	265	8.54	7450	3150
3 x 95 + 2 x 50/2 + 1 x 10 ST	13.3	74.4	79.4	0.21	0.34	0.33	319	11.59	8680	4275
3 x 120 + 2 x 70/2 + 1 x 10 ST	15.1	78.7	83.7	0.164	0.33	0.36	371	14.64	10370	5400
3 x 150 + 2 x 70/2 + 1 x 10 ST	16.6	82.2	87.2	0.132	0.32	0.39	428	18.3	11650	6750
3 x 185 + 2 x 95/2 + 1 x 10 ST	18.6	87.0	92.0	0.108	0.31	0.42	488	22.57	13090	8325

Selection data

Number of cores and nominal cross-section	Conductor diameter	Overall diameter of cable (guidance value)		Conductor resistance at 20 °C	Inductance per unit length	Operating capacitance per unit length	Current-carrying capacity at 30 °C	Permissible short-circuit current (1s)	Approx. net weight for 1000 m	Maximum permissible tensile force
	Max. value	Min. value	Max. value							
mm^2	mm	mm	mm	Ω/km	mH/km	µF/km	A	kA	kg	N
14/25 kV NTSCGECEWÖU										
3 x 25 + 2 x 25/2 + 1 x 10 ST	6.9	64.7	68.7	0.795	0.44	0.19	139	3.05	5940	1125
3 x 35 + 2 x 25/2 + 1 x 10 ST	8.3	67.3	71.3	0.565	0.42	0.22	172	4.27	6470	1575
3 x 50 + 2 x 25/2 + 1 x 10 ST	9.8	71	75	0.393	0.4	0.24	215	6.1	7300	2250
3 x 70 + 2 x 35/2 + 1 x 10 ST	11.6	75.2	80.2	0.277	0.38	0.26	265	8.54	8800	3150
3 x 95 + 2 x 50/2 + 1 x 10 ST	13.3	80	85	0.21	0.36	0.29	319	11.59	10050	4275
3 x 120 + 2 x 70/2 + 1 x 10 ST	15.1	85.9	90.9	0.164	0.34	0.31	371	14.64	11470	5400
3 x 150 + 2 x 70/2 + 1 x 10 ST	16.8	89.6	94.6	0.132	0.32	0.34	428	18.3	13210	6750
3 x 185 + 2 x 95/2 + 1 x 10 ST	18.6	92.6	97.6	0.108	0.32	0.36	488	22.57	14860	8325
18/30 kV NTSCGECEWÖU										
3 x 25 + 2 x 25/2 + 1 x 10 ST	6.9	69.9	73.9	0.795	0.46	0.17	139	3.05	7100	1125
3 x 35 + 2 x 25/2 + 1 x 10 ST	8.3	72.6	76.6	0.565	0.44	0.19	172	4.27	7540	1575
3 x 50 + 2 x 25/2 + 1 x 10 ST	9.8	78	82	0.393	0.41	0.21	215	6.1	8680	2250
3 x 70 + 2 x 35/2 + 1 x 10 ST	11.6	80.4	85.4	0.277	0.39	0.23	265	8.54	9760	3150
3 x 95 + 2 x 50/2 + 1 x 10 ST	13.3	86.8	91.8	0.21	0.38	0.25	319	11.59	11100	4275
3 x 120 + 2 x 70/2 + 1 x 10 ST	15.1	91.1	96.1	0.164	0.36	0.27	371	14.64	12980	5400
3 x 150 + 2 x 70/2 + 1 x 10 ST	16.8	94.8	99.8	0.132	0.35	0.29	428	18.3	14350	6750
3 x 185 + 2 x 95/2 + 1 x 10 ST	18.6	99.6	104.6	0.108	0.34	0.31	488	22.57	15870	8325