

CABLES FOR A MOVING WORLD

# TRATOS VDE MTO<sup>®</sup>

for Mining and Tunnelling Applications



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## SELECTION OF CABLE TYPE IN RELATION TO USE

In relation to the type of application the cable designs shall adopt construction characteristics required to give the cable the best performance in relation to its application.

CABLE TYPE	Cylindrical reels	Mono spiral reels	Pumps	Dredgers	Excavators/ Dragline trailing operation	Belt conveyor, fixed installation	Cable booms
<b>OPEN CAST MINING</b>							
TRATOSFLEX MTO-M	MA	MA	x	x	x	S	S
TRATOSFLEX MTO-ST	x	x	MA	MA	x	S	S
TRATOSFLEX MTO-SB	x	x	x	x	MA	S	S
TRATOS FIX MTO-M	x	x	MA	x	x	MA	MA
TRATOSFLEX MTO-OCS	x	x	x	x	x	MA	MA
TRATOS FESTOON MTO-M	x	x	MA	MA	x	MA	MA
TRATOSFLEX MTO-MSR	x	x	x	x	x	MA	MA
TRATOSFIBRE-DB	x	x	x	x	x	MA	MA
CABLE TYPE	Cylindrical reels	Mono spiral reels	Underground lifts	Cable protection chain	Free trailing	Fixed installation e.g. festoon	
<b>UNDERGROUND MINING</b>							
TRATOS MTO-Z	x	x	x	x	MA	S	
TRATOS MTO-V	x	x	x	MA	x	S	
TRATOS MTO-F.../3E	x	x	x	x	x	MA	
TRATOS MTO-MH-FU	x	x	x	x	x	MA	
TRATOS MTO-FU	x	x	MA	x	x	S	
TRATOSMART MTO	MA	MA	x	x	x	S	
TRATOS MTO-TDM	MA	MA	x	x	x	S	
TRATOSFLEX MTO-MSR	x	x	x	x	x	MA	
TRATOSFIBRE-DB	x	x	x	x	x	MA	

MA = Main application

S = Suitable

x = Not suitable

## STANDARDS AND QUALITY SYSTEM

### APPLICATION AND INSTALLATION GUIDELINES

- DIN VDE 0298, Part 3 Application** .....of cables and flexible cords in power installations. General information on cables
- DIN VDE 0298, Part 4 Application** ..of cables and flexible cords in power installations. Recommended values for current-carrying capacity of cables
- DIN VDE 0101** ..... Erection of power installations with rated voltages above 1 kV
- DIN VDE 0118** ..... Specification for the erection of electrical installations in underground mines
- DIN VDE 0168** ..... Specification for the erection of electrical installations in open-cast mines, quarries and similar works

### DESIGN REGULATIONS

**DIN VDE** (DIN = German Standards Institute; VDE = Association of German Electrical Engineers)

Germany is the only country which has issued special design regulations for flexible electric cables for mining applications. The 1 kV tough rubber-sheathed flexible reeling cables TRATOSMART MTO NSHTÖU, the trailing cables TRATOS MTO NTS..WÖU and the rubber-sheathed flexible cables NSSHÖU are described and standardized in DIN VDE 0250. This set of standards has found recognition in Europe and in many countries outside Europe and is accepted as or specified as “state of the art”. No such design regulations exist for the MSR Mining and TRATOSFIBRE cables. These are Tratos special cables, the design of which is based on existing design regulations or general regulations of DIN VDE.

### QUALITY SYSTEM

Tratos aim to work closely with customers to find better, more environmentally friendly solutions to their challenges. We are committed to our vision and strategy to serve all our internal and external customers by providing high quality services and products. Tratos is an established industry leader in the design, manufacture and supply of cables and products and to maintain this leading position we are committed at every level to providing our customers with quality services and products at a competitive price. As a commercial enterprise we are aware of the importance of satisfying our customers and of the financial impact of which nonconformities may have on our profitability. For these reasons we are committed to complying with all customer requirements and specifications both legal and statutory requirements. Our Quality Management System has been audited and approved by two independent, Internationally recognized and accepted authorities: BASEC (UK) and AENOR-IQNET (E), in accordance to ISO 9001:2000 covering the production, purchasing of raw materials design and final test including various document types. The Tratos Quality Management system is under frequent regular surveillance by inspectors working for the Certification Authorities.



### ENVIRONMENTAL SYSTEM

Our Environmental Management System has been audited and approved by two independent, Internationally recognized and accepted authorities: BASEC (UK) and AENOR-IQNET (E), in accordance to ISO 14001:2000 covering the production, purchasing of raw materials design and final test including various document types. The Tratos Quality Management system is under frequent regular surveillance by inspectors working for the Certification Authorities.



## STANDARDS AND QUALITY SYSTEM

### REACH, WEEE & ROHS



Tratos is fully compliant with the **REACH**. This is a European Union regulation concerning the **Registration, Evaluation, Authorisation and restriction of Chemicals**. It came into force on 1st June 2007 and replaced a number of European Directives and Regulations with a single system. REACH applies to substances manufactured or imported into the EU in quantities of 1 tonne or more per year. Generally, it applies to all individual chemical substances on their own, in preparations or in articles. To summarise, REACH makes the cable industry directly responsible for assessing and managing the risks posed by chemicals and providing safety information to their users.



Tratos fully subscribes to The **Waste Electrical and Electronic Equipment Directive (WEEE Directive)**, introduced into UK law in January 2007 by the Waste Electrical and Electrical Equipment Regulations 2006. The WEEE Directive aims to reduce the amount of electrical and electronic equipment being produced and to encourage everyone to reuse, recycle and recover it. The WEEE Directive also aims to improve the environmental performance of businesses that manufacture, supply, use, recycle and recover electrical and electronic equipment. TRATOS has enlisted the services of the UK's leading producer compliance scheme, Valpak, whom manage our recycling obligations and also ensure our compliance to the WEEE Regulations and the Waste Batteries and Accumulators Regulations.



Tratos is fully compliant with the **Restriction of Hazardous Substances (RoHS) Regulations**. These Regulations implement EU Directive 2002/95 which bans the placing on the EU market of new electrical and electronic equipment containing more than agreed levels of lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyl (PBB) and polybrominated diphenyl ether (PBDE) flame retardants. Tratos fully understands the requirements of the RoHS Directive and ensures that our products, and their components, comply.

### CORPORATE SOCIAL RESPONSABILITY

Tratos adopts a Code of Ethics which adheres to the United Nations Global Compact on human rights, labour standards, protection of the environment and anti corruption measures.

Under this self regulatory code, Tratos will carry out initiatives in the environmental and social fields with special reference to environmental policies and social policies regarding child labour, compulsory labour, health and security, freedom of association and the right to collective bargaining, discrimination, disciplinary procedures, working hours and wages.



# TRATOS VDE MTO<sup>®</sup>

MEDIUM VOLTAGE REELING CABLES / R-(N)TSCGEWÖU

## TRATOS MTO<sup>®</sup>-M TRATOS MTO<sup>®</sup>-M (FO)

For connection of large material handling machines such as excavators, dumpers, mobile crushers in open-cast mines.  
Flexible MV reeling cable suitable for high mechanical stresses in conjunction with mono spiral reels and cylindrical reels.

### FEATURES AND PERFORMANCES



#### CONSTRUCTION

- **Conductor:** Electrolytic tinned copper, very finely stranded, Class "FS" (refer also to DIN VDE 0295)
- **Insulation:** TRATOS MTO, basic material EPR, compound type: special compound (refer also to DIN VDE 0207, Part 20)
- **Electrical Field Control:** Inner and outer semiconductive layer of semiconductive rubber
- **Core arrangement:** Three main conductors laid-up, with protective earth conductor split into three in the outer interstices
- **Inner Sheath:** Basic material: EPR, compound type: special compound (refer also to DIN VDE 0207, Part 21)
- **Outer sheath:** Basic material PCP, compound type: special compound, colour red (refer also to DIN VDE 0207, Part 21)
- **Marking:** (Year of manufacture) (serial number) TRATOS MTO-M R-(N)TSCGEWÖU (number of cores) x (cross-section)(rated voltage)
- **Core Identification:** Natural colouring with black semiconductive rubber on which white digits 1 to 3 are printed

#### FIBRE OPTICS <sup>(1)</sup>

- **Fibre:** Inner core diameter of fibre 9 µm, 62.5 µm or 50 µm; Diameter over cladding 125 µm; Diameter over coating 250 µm
- **Fibre covering:** Buffering tube with filling compound, basic material: ETFE compound 7YI 1
- **Identification of the fibres:** Colour coding of the fibres and buffering tube for identification of the fibre type
- **Core arrangement:** Six cores in one layer, especially laid-up around the GFK supporting element
- **Sheath over the laid-up cores:** Special material

#### STANDARDS

- DIN VDE 0250, Part 813

(1) Apply only on TRATOS FIX MTO<sup>®</sup>-M (FO)

<b>Electrical parameters</b>			
<b>Rated voltage</b>	U <sub>0</sub> /U = 3.6/6 kV to 18/30 kV		
<b>Maximum permissible operating voltage in AC systems</b>	U <sub>0</sub> /U = 4.2/7.2 kV to 20.8/36 kV		
<b>Maximum permissible operating voltage in DC systems</b>	U <sub>0</sub> /U = 5.4/10.8 kV to 27/54 kV		
<b>AC test voltage</b>	11 kV to 43 kV according to DIN VDE 0250, Part 813		
<b>Current-carrying capacity</b>	According to DIN VDE 0298, Part 4		
<b>Thermal parameters</b>			<b>Type K</b>
<b>Ambient temperature</b>	<ul style="list-style-type: none"> <li>• Fully flexible operation</li> <li>• Fixed installation</li> </ul>	-30 °C to + 80 °C -40 °C to + 80 °C	-60 °C to + 60 °C -60 °C to + 60 °C
<b>Maximum permissible operating temperature of the conductor</b>	90 °C		
<b>Short-circuit temperature of the conductor</b>	250 °C		
<b>Mechanical parameters</b>			
<b>Tensile load</b>	Up to 20 N/mm <sup>2</sup>		
<b>Torsional stresses</b>	±100 °/m		
<b>Minimum bending radii</b>	According to DIN VDE 0298, Part 3		
<b>Minimum distance with S-type directional changes</b>	20 x D		
<b>Travel speed</b>	<ul style="list-style-type: none"> <li>• In operation</li> <li>• On rewinding</li> </ul>	Up to 60 m/min Up to 100 m/min	
<b>Additional tests</b>	Reversed bending test, torsional stress test, roller bending test (type C)		
<b>Chemical parameters</b>			
<b>Resistance to oil and brine</b>	Given to DIN VDE 0473, Part 811-2-1, Para. 10		
<b>Behaviour in case of fire</b>	Given to DIN VDE 0482, Part 265-2-1, Para. 10		
<b>Weather resistance</b>	Unrestricted use outdoors and indoors, resistant to ozone and moisture		

<b>Optical parameters <sup>(1)</sup></b>			
<b>Transmission data of the fibre-optics</b>	G50/125	G62.5/125	E9/125
<b>Attenuation at wavelength 850 nm</b>	≤2.8 dB/km	≤3.3 dB/km	-
<b>Attenuation at wavelength 1300 nm</b>	≤0.8 dB/km	≤0.9 dB/km	≤0.4 dB/km
<b>Attenuation at wavelength 1550 nm</b>	-	-	≤0.3 dB/km
<b>Bandwidth at 850 nm and 1300 nm</b>	≥400 MHz	≥400 MHz	
<b>Numerical aperture</b>	0.20 ± 0.02	0.275 ± 0.02	

(1) Apply only on TRATOS FIX MTO®-M (FO)®

## TRATOS MTO®-M

Nominal Cross Sectional Area mm <sup>2</sup>	Conductor diameter (guidance value) mm	Overall diameter of cable (guidance value)		Conductor resistance at 20 °C Ω/km	Inductance per unit length mH/km	Operating capacitance per unit length μF/km	Current carrying capacity at 30 °C A	Permissible shortcircuit current (1s) kA	Approx. net weight kg/km	Maximum permissible tensile force N
		Min. value mm	Max. value mm							
3.6/6 kV R-(N)TSCGEWÖU										
3 x 25 + 3 x 25/3	7.15	36.3	39.3	0.780	0.31	0.44	131	3.58	2215	1500
3 x 25 + 3 x 50/3	7.15	40.2	43.2	0.780	0.35	0.44	131	3.58	2763	1500
3 x 35 + 3 x 25/3	8.50	40.1	43.1	0.554	0.30	0.50	162	5.01	2767	2100
3 x 35 + 3 x 50/3	8.50	42.4	45.4	0.554	0.32	0.50	162	5.01	3169	2100
3 x 50 + 3 x 25/3	10.20	43.8	46.8	0.386	0.28	0.58	202	7.15	3439	3000
3 x 50 + 3 x 50/3	10.20	45.5	48.5	0.386	0.30	0.58	202	7.15	3805	3000
3 x 70 + 3 x 35/3	11.90	47.5	50.5	0.272	0.27	0.65	250	10.01	4382	4200
3 x 70 + 3 x 50/3	11.90	47.5	50.5	0.272	0.27	0.65	250	10.01	4495	4200
3 x 95 + 3 x 50/3	13.90	52.7	56.7	0.206	0.26	0.74	301	13.60	5635	5700
3 x 120 + 3 x 70/3	15.80	56.8	60.8	0.161	0.25	0.82	352	17.16	6879	7200
3 x 150 + 3 x 70/3	17.50	61.9	65.9	0.129	0.25	0.90	404	21.45	8222	9000
3 x 185 + 3 x 95/3	19.30	65.8	69.8	0.106	0.24	0.97	462	26.46	9658	11100
3 x 240 + 3 x 120/3	22.10	73.2	77.2	0.080	0.24	1.10	540	34.32	12374	14400
3 x 300 + 3 x 150/3	24.70	78.9	82.9	0.064	0.23	1.21	620	42.90	14901	18000
6/10 kV R-(N)TSCGEWÖU										
3 x 25 + 3 x 25/3	7.15	38.6	41.6	0.780	0.32	0.39	131	3.58	2416	1500
3 x 25 + 3 x 50/3	7.15	41.5	44.5	0.780	0.32	0.39	131	3.58	2854	1500
3 x 35 + 3 x 25/3	8.50	41.4	44.4	0.554	0.31	0.45	162	5.01	2881	2100
3 x 35 + 3 x 50/3	8.50	43.1	46.1	0.554	0.31	0.45	162	5.01	3234	2100
3 x 50 + 3 x 25/3	10.20	45.1	48.1	0.386	0.29	0.51	202	7.15	3560	3000
3 x 50 + 3 x 50/3	10.20	45.1	48.1	0.386	0.29	0.51	202	7.15	3745	3000
3 x 70 + 3 x 35/3	11.90	49.7	53.7	0.272	0.28	0.58	250	10.01	4667	4200
3 x 70 + 3 x 50/3	11.90	51.4	55.4	0.272	0.28	0.58	250	10.01	5139	4200
3 x 95 + 3 x 50/3	13.90	54.0	58.0	0.206	0.27	0.66	301	13.60	5780	5700
3 x 120 + 3 x 70/3	15.80	58.1	62.1	0.161	0.26	0.73	352	17.16	7037	7200
3 x 150 + 3 x 70/3	17.50	63.2	67.2	0.129	0.25	0.79	404	21.45	8389	9000
3 x 185 + 3 x 95/3	19.30	67.1	71.1	0.106	0.25	0.86	462	26.46	9864	11100
3 x 240 + 3 x 120/3	22.10	74.6	78.6	0.080	0.24	0.97	540	34.32	12570	14400
3 x 300 + 3 x 150/3	24.70	80.2	84.2	0.064	0.24	1.07	620	42.90	15114	18000
8.7/15 kV R-(N)TSCGEWÖU										
3 x 25 + 3 x 25/3	7.15	42.1	45.1	0.780	0.34	0.31	139	3.58	2707	1500
3 x 25 + 3 x 50/3	7.15	43.8	46.8	0.780	0.34	0.31	139	3.58	3062	1500
3 x 35 + 3 x 25/3	8.50	44.9	47.9	0.554	0.33	0.36	172	5.01	3198	2100
3 x 35 + 3 x 50/3	8.50	44.9	47.9	0.554	0.33	0.36	172	5.01	3382	2100
3 x 50 + 3 x 25/3	10.20	49.5	53.5	0.386	0.31	0.41	215	7.15	4083	3000
3 x 50 + 3 x 50/3	10.20	49.5	53.5	0.386	0.31	0.41	215	7.15	4267	3000
3 x 70 + 3 x 35/3	11.90	53.1	57.1	0.272	0.30	0.45	265	10.01	5028	4200
3 x 70 + 3 x 50/3	11.90	53.1	57.1	0.272	0.30	0.45	265	10.01	5303	4200
3 x 95 + 3 x 50/3	13.90	57.3	61.3	0.206	0.28	0.51	319	13.60	6216	5700
3 x 120 + 3 x 70/3	15.80	63.0	67.0	0.161	0.27	0.57	371	17.16	7673	7200
3 x 150 + 3 x 70/3	17.50	66.6	70.6	0.129	0.27	0.62	428	21.45	8852	9000
3 x 185 + 3 x 95/3	19.30	70.5	74.5	0.106	0.26	0.67	488	26.46	10351	11100
3 x 240 + 3 x 120/3	22.10	78.0	82.0	0.080	0.25	0.75	574	34.32	13125	14400
3 x 300 + 3 x 150/3	24.70	84.9	89.9	0.064	0.25	0.82	665	42.90	16020	18000



**TRATOS MTO<sup>®</sup>-M**

Nominal Cross Sectional Area	Conductor diameter (guidance value)	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 shortcircuit current (1s)	Approx. net weight	Maximum permissible tensile force
		Min. value	Max. value							
mm <sup>2</sup>	mm	mm	mm	Ω/km	mH/km	μF/km	A	kA	kg/km	N
12/20 kV R-(N)TSCGEWÖU										
3 x 25 + 3 x 25/3	7.15	45.1	48.1	0.780	0.36	0.27	139	3.58	2982	1500
3 x 25 + 3 x 50/3	7.15	45.1	48.1	0.780	0.36	0.27	139	3.58	3167	1500
3 x 35 + 3 x 25/3	8.50	47.9	50.9	0.554	0.34	0.31	172	5.01	3511	2100
3 x 35 + 3 x 50/3	8.50	47.9	50.9	0.554	0.34	0.31	172	5.01	3694	2100
3 x 50 + 3 x 25/3	10.20	52.5	56.5	0.386	0.32	0.35	215	7.15	4399	3000
3 x 50 + 3 x 50/3	10.20	52.5	56.5	0.386	0.32	0.35	215	7.15	4583	3000
3 x 70 + 3 x 35/3	11.90	56.2	60.2	0.272	0.31	0.39	265	10.01	5411	4200
3 x 70 + 3 x 50/3	11.90	56.2	60.2	0.272	0.31	0.39	265	10.01	5684	4200
3 x 95 + 3 x 50/3	13.90	61.9	65.9	0.206	0.30	0.44	319	13.60	6783	5700
3 x 120 + 3 x 70/3	15.80	66.0	70.0	0.161	0.29	0.48	371	17.16	8068	7200
3 x 150 + 3 x 70/3	17.50	69.7	73.7	0.129	0.28	0.52	428	21.45	9323	9000
3 x 185 + 3 x 95/3	19.30	75.0	79.0	0.106	0.27	0.56	488	26.46	11025	11100
3 x 240 + 3 x 120/3	22.10	81.0	85.0	0.080	0.26	0.63	574	34.32	13657	14400
3 x 300 + 3 x 150/3	24.70	87.9	92.9	0.064	0.26	0.69	665	42.90	16571	18000
14/25 kV R-(N)TSCGEWÖU										
3 x 25 + 3 x 25/3	7.15	49.9	53.9	0.780	0.38	0.23	139	3.58	3542	1500
3 x 25 + 3 x 50/3	7.15	49.9	53.9	0.780	0.38	0.23	139	3.58	3726	1500
3 x 35 + 3 x 25/3	8.50	52.7	56.7	0.554	0.36	0.26	172	5.01	4075	2100
3 x 35 + 3 x 50/3	8.50	52.7	56.7	0.554	0.36	0.26	172	5.01	4258	2100
3 x 50 + 3 x 25/3	10.20	56.4	60.4	0.386	0.34	0.30	215	7.15	4872	3000
3 x 50 + 3 x 50/3	10.20	56.4	60.4	0.386	0.34	0.30	215	7.15	5054	3000
3 x 70 + 3 x 35/3	11.90	61.5	65.5	0.272	0.32	0.33	265	10.01	6083	4200
3 x 70 + 3 x 50/3	11.90	61.5	65.5	0.272	0.32	0.33	265	10.01	6356	4200
3 x 95 + 3 x 50/3	13.90	65.8	69.8	0.206	0.31	0.37	319	13.60	7303	5700
3 x 120 + 3 x 70/3	15.80	69.9	73.9	0.161	0.30	0.41	371	17.16	8652	7200
3 x 150 + 3 x 70/3	17.50	75.0	79.0	0.129	0.29	0.44	428	21.45	10139	9000
3 x 185 + 3 x 95/3	19.30	78.9	82.9	0.106	0.28	0.47	488	26.46	11705	11100
3 x 240 + 3 x 120/3	22.10	86.2	91.2	0.080	0.27	0.53	574	34.32	14670	14400
3 x 300 + 3 x 150/3	24.70	91.8	96.8	0.064	0.27	0.58	665	42.90	17332	18000
18/30 kV R-(N)TSCGEWÖU										
3 x 25 + 3 x 25/3	7.15	53.4	57.4	0.780	0.40	0.21	139	3.58	3919	1500
3 x 25 + 3 x 50/3	7.15	53.4	57.4	0.780	0.40	0.21	139	3.58	4101	1500
3 x 35 + 3 x 25/3	8.50	56.2	60.2	0.554	0.38	0.24	172	5.01	4503	2100
3 x 35 + 3 x 50/3	8.50	56.2	60.2	0.554	0.38	0.24	172	5.01	4684	2100
3 x 50 + 3 x 25/3	10.20	61.2	65.2	0.386	0.35	0.26	215	7.15	5482	3000
3 x 50 + 3 x 50/3	10.20	61.2	65.2	0.386	0.35	0.26	215	7.15	5662	3000
3 x 70 + 3 x 35/3	11.90	64.9	68.9	0.272	0.34	0.29	265	10.01	6531	4200
3 x 70 + 3 x 50/3	11.90	64.9	68.9	0.272	0.34	0.29	265	10.01	6802	4200
3 x 95 + 3 x 50/3	13.90	69.2	73.2	0.206	0.32	0.33	319	13.60	7807	5700
3 x 120 + 3 x 70/3	15.80	74.7	78.7	0.161	0.31	0.36	371	17.16	9364	7200
3 x 150 + 3 x 70/3	17.50	78.4	82.4	0.129	0.30	0.39	428	21.45	10710	9000
3 x 185 + 3 x 95/3	19.30	83.6	88.6	0.106	0.29	0.42	488	26.46	12609	11100
3 x 240 + 3 x 120/3	22.10	89.7	94.7	0.080	0.28	0.46	574	34.32	15344	14400
3 x 300 + 3 x 150/3	24.70	96.3	101.3	0.064	0.27	0.51	665	42.90	18241	18000

## TRATOS MTO®-M (FO)

Nominal Cross Sectional Area	Conductor diameter (guidance value)	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 shortcircuit current (1s)	Approx. net weight	Maximum permissible tensile force
		Min. value	Max. value							
mm <sup>2</sup>	mm	mm	mm	Ω/km	mH/km	μF/km	A	kA	kg/km	N
3.6/6 kV R-(N)TSCGEWÖU										
3x25+2x25/2+1x(FO)	7.15	40.2	43.2	0.780	0.35	0.44	131	3.58	2570	1500
3x25+2x50/2+1x(FO)	7.15	43.1	46.1	0.780	0.38	0.44	131	3.58	3020	1500
3x35+2x25/2+1x(FO)	8.50	41.8	44.8	0.554	0.32	0.50	162	5.01	2940	2100
3x35+2x50/2+1x(FO)	8.50	44.7	47.7	0.554	0.35	0.50	162	5.01	3400	2100
3x50+2x25/2+1x(FO)	10.20	43.8	46.8	0.386	0.28	0.58	202	7.15	3450	3000
3x50+2x50/2+1x(FO)	10.20	46.6	49.6	0.386	0.31	0.58	202	7.15	3930	3000
3x70+2x35/2+1x(FO)	11.90	47.4	50.4	0.272	0.27	0.65	250	10.01	4370	4200
3x70+2x50/2+1x(FO)	11.90	52.4	56.4	0.272	0.29	0.65	250	10.01	5290	4200
3x95+2x50/2+1x(FO)	13.90	52.7	56.7	0.206	0.26	0.74	301	13.60	5660	5700
3x120+2x70/2+1x(FO)	15.80	56.1	60.1	0.161	0.25	0.82	352	17.16	6810	7200
3x150+2x70/2+1x(FO)	17.50	61.8	65.8	0.129	0.25	0.90	404	21.45	8240	9000
3x185+2x95/2+1x(FO)	19.30	65.7	69.7	0.106	0.24	0.97	462	26.46	9670	11100
3x240+2x120/2+1x(FO)	22.10	73.2	77.2	0.080	0.24	1.10	540	34.32	12410	14400
3x300+2x150/2+1x(FO)	24.70	78.2	82.2	0.064	0.23	1.21	620	42.90	14890	18000
6/10 kV R-(N)TSCGEWÖU										
3x25+2x25/2+1x(FO)	7.15	40.9	43.9	0.780	0.35	0.39	131	3.58	2630	1500
3x25+2x50/2+1x(FO)	7.15	43.8	46.8	0.780	0.38	0.39	131	3.58	3090	1500
3x35+2x25/2+1x(FO)	8.50	43.1	46.1	0.554	0.33	0.45	162	5.01	3060	2100
3x35+2x50/2+1x(FO)	8.50	45.4	48.4	0.554	0.35	0.45	162	5.01	3470	2100
3x50+2x25/2+1x(FO)	10.20	45.1	48.1	0.386	0.29	0.51	202	7.15	3570	3000
3x50+2x50/2+1x(FO)	10.20	47.9	50.9	0.386	0.32	0.51	202	7.15	4060	3000
3x70+2x35/2+1x(FO)	11.90	49.6	53.6	0.272	0.28	0.58	250	10.01	4670	4200
3x70+2x50/2+1x(FO)	11.90	53.1	57.1	0.272	0.30	0.58	250	10.01	5370	4200
3x95+2x50/2+1x(FO)	13.90	54.0	58.0	0.206	0.27	0.66	301	13.60	5800	5700
3x120+2x70/2+1x(FO)	15.80	58.1	62.1	0.161	0.25	0.73	352	17.16	7040	7200
3x150+2x70/2+1x(FO)	17.50	63.1	67.1	0.129	0.25	0.79	404	21.45	8410	9000
3x185+2x95/2+1x(FO)	19.30	67.0	71.0	0.106	0.24	0.86	462	26.46	9850	11100
3x240+2x120/2+1x(FO)	22.10	74.5	78.5	0.080	0.24	0.97	540	34.32	12610	14400
3x300+2x150/2+1x(FO)	24.70	80.1	84.1	0.064	0.23	1.07	620	42.90	15100	18000
8.7/15 kV R-(N)TSCGEWÖU										
3x25+2x25/2+1x(FO)	7.15	43.8	46.8	0.780	0.36	0.31	139	3.58	2890	1500
3x25+2x50/2+1x(FO)	7.15	45.5	48.5	0.780	0.38	0.31	139	3.58	3240	1500
3x35+2x25/2+1x(FO)	8.50	44.8	47.4	0.554	0.33	0.36	172	5.01	3200	2100
3x35+2x50/2+1x(FO)	8.50	47.7	50.7	0.554	0.35	0.36	172	5.01	3700	2100
3x50+2x25/2+1x(FO)	10.20	49.4	53.4	0.386	0.31	0.41	215	7.15	4090	3000
3x50+2x50/2+1x(FO)	10.20	51.1	55.1	0.386	0.32	0.41	215	7.15	4470	3000
3x70+2x35/2+1x(FO)	11.90	53.1	57.1	0.272	0.30	0.45	265	10.01	5040	4200
3x70+2x50/2+1x(FO)	11.90	55.4	59.4	0.272	0.30	0.45	265	10.01	5630	4200
3x95+2x50/2+1x(FO)	13.90	57.4	61.4	0.206	0.28	0.51	319	13.60	6200	5700
3x120+2x70/2+1x(FO)	15.80	62.9	66.9	0.161	0.27	0.57	371	17.16	7690	7200
3x150+2x70/2+1x(FO)	17.50	66.6	70.6	0.129	0.27	0.62	428	21.45	8880	9000
3x185+2x95/2+1x(FO)	19.30	70.5	74.5	0.106	0.26	0.67	488	26.46	10350	11100
3x240+2x120/2+1x(FO)	22.10	77.9	81.9	0.080	0.25	0.75	574	34.32	13140	14400
3x300+2x150/2+1x(FO)	24.70	85.4	89.4	0.064	0.25	0.82	665	42.90	16060	18000

**TRATOS MTO<sup>®</sup>-M (FO)**

Nominal Cross Sectional Area mm <sup>2</sup>	Conductor diameter (guidance value) mm	Overall diameter of cable (guidance value)		Conductor resistance at 20 °C Ω/km	Inductance per unit length mH/km	Operating capacitance per unit length µF/km	Current carrying capacity at 30 °C A	Permissible shortcircuit current (1s) kA	Approx. net weight kg/km	Maximum permissible tensile force N
		Min. value mm	Max. value mm							
12/20 kV R-(N)TSCGEWÖU										
3x25+2x25/2+1x(FO)	7.15	45.1	48.1	0.780	0.36	0.27	139	3.58	3000	1500
3x25+2x50/2+1x(FO)	7.15	47.4	50.4	0.780	0.39	0.27	139	3.58	3430	1500
3x35+2x25/2+1x(FO)	8.50	47.9	50.9	0.554	0.34	0.31	172	5.01	3500	2100
3x35+2x50/2+1x(FO)	8.50	50.5	54.5	0.554	0.36	0.31	172	5.01	4060	2100
3x50+2x25/2+1x(FO)	10.20	52.4	56.4	0.386	0.32	0.35	215	7.15	4400	3000
3x50+2x50/2+1x(FO)	10.20	52.4	56.4	0.386	0.32	0.35	215	7.15	4590	3000
3x70+2x35/2+1x(FO)	11.90	56.1	60.1	0.272	0.31	0.39	265	10.01	5390	4200
3x70+2x50/2+1x(FO)	11.90	58.4	62.4	0.272	0.31	0.39	265	10.01	5990	4200
3x95+2x50/2+1x(FO)	13.90	61.8	65.8	0.206	0.30	0.44	319	13.60	6780	5700
3x120+2x70/2+1x(FO)	15.80	65.9	69.9	0.161	0.29	0.48	371	17.16	8080	7200
3x150+2x70/2+1x(FO)	17.50	69.6	73.6	0.129	0.28	0.52	428	21.45	9310	9000
3x185+2x95/2+1x(FO)	19.30	74.9	78.9	0.106	0.27	0.56	488	26.46	11060	11100
3x240+2x120/2+1x(FO)	22.10	81.0	85.0	0.080	0.26	0.63	574	34.32	13660	14400
3x300+2x150/2+1x(FO)	24.70	88.4	92.4	0.064	0.26	0.69	665	42.90	16600	18000
14/25 kV R-(N)TSCGEWÖU										
3x25+2x25/2+1x(FO)	7.15	49.8	53.8	0.780	0.38	0.23	139	3.58	3540	1500
3x25+2x50/2+1x(FO)	7.15	51.6	55.6	0.780	0.40	0.23	139	3.58	3950	1500
3x35+2x25/2+1x(FO)	8.50	52.7	56.7	0.554	0.36	0.26	172	5.01	4090	2100
3x35+2x50/2+1x(FO)	8.50	52.7	56.7	0.554	0.36	0.26	172	5.01	4280	2100
3x50+2x25/2+1x(FO)	10.20	56.3	60.3	0.386	0.34	0.30	215	7.15	4850	3000
3x50+2x50/2+1x(FO)	10.20	56.3	60.3	0.386	0.34	0.30	215	7.15	5030	3000
3x70+2x35/2+1x(FO)	11.90	61.4	65.4	0.272	0.32	0.33	265	10.01	6090	4200
3x70+2x50/2+1x(FO)	11.90	61.4	65.4	0.272	0.32	0.33	265	10.01	6380	4200
3x95+2x50/2+1x(FO)	13.90	65.7	69.7	0.206	0.31	0.37	319	13.60	7300	5700
3x120+2x70/2+1x(FO)	15.80	69.8	73.8	0.161	0.30	0.41	371	17.16	8940	7200
3x150+2x70/2+1x(FO)	17.50	74.9	78.9	0.129	0.29	0.44	428	21.45	10150	9000
3x185+2x95/2+1x(FO)	19.30	78.8	82.8	0.106	0.28	0.47	488	26.46	11680	11100
3x240+2x120/2+1x(FO)	22.10	86.2	91.2	0.080	0.27	0.53	574	34.32	14700	14400
3x300+2x150/2+1x(FO)	24.70	91.8	96.8	0.064	0.27	0.58	665	42.90	17330	18000
18/30 kV R-(N)TSCGEWÖU										
3x25+2x25/2+1x(FO)	7.15	53.3	57.3	0.780	0.40	0.21	139	3.58	3920	1500
3x25+2x50/2+1x(FO)	7.15	53.3	57.3	0.780	0.40	0.21	139	3.58	4110	1500
3x35+2x25/2+1x(FO)	8.50	56.1	60.1	0.554	0.38	0.24	172	5.01	4480	2100
3x35+2x50/2+1x(FO)	8.50	56.1	60.1	0.554	0.38	0.24	172	5.01	4670	2100
3x50+2x25/2+1x(FO)	10.20	61.2	65.2	0.386	0.35	0.26	215	7.15	5490	3000
3x50+2x50/2+1x(FO)	10.20	61.2	65.2	0.386	0.35	0.26	215	7.15	5680	3000
3x70+2x35/2+1x(FO)	11.90	64.9	68.9	0.272	0.34	0.29	265	10.01	6540	4200
3x70+2x50/2+1x(FO)	11.90	64.9	68.9	0.272	0.34	0.29	265	10.01	6830	4200
3x95+2x50/2+1x(FO)	13.90	69.2	73.2	0.206	0.32	0.33	319	13.60	7800	5700
3x120+2x70/2+1x(FO)	15.80	74.7	78.7	0.161	0.31	0.36	371	17.16	9420	7200
3x150+2x70/2+1x(FO)	17.50	78.4	82.4	0.129	0.30	0.39	428	21.45	10700	9000
3x185+2x95/2+1x(FO)	19.30	83.6	88.6	0.106	0.29	0.42	488	26.46	12630	11100
3x240+2x120/2+1x(FO)	22.10	89.6	94.6	0.080	0.28	0.46	574	34.32	15320	14400
3x300+2x150/2+1x(FO)	24.70	96.2	101.2	0.064	0.27	0.51	665	42.90	18240	18000

### TRATOSFLEX MTO<sup>®</sup>-ST TRATOSFLEX MTO<sup>®</sup>-ST.../3E

Power supply cable for use in water, e.g. for connection to dredgers, floating docks, pumps, etc., in applications where high mechanical stresses are to be expected. Also suitable for use in sewage, salt water and brackish water at water depths of up to 500 m.

## FEATURES AND PERFORMANCES



### CONSTRUCTION

- **Conductor:** Electrolytic copper, tinned, finely stranded, Class 5 (refer also to DIN VDE 0295)
- **Insulation:** Basic material EPR, compound type: 3GI3 (refer also to DIN VDE 0207, Part 20)
- **Arrangement of protective-earth conductor<sup>(1)</sup>:** With protective earth conductor split into three in the outer interstices
- **Electrical Field Control<sup>(2)</sup>:** Inner and outer semiconductive layer of semiconductive rubber
- **Core arrangement<sup>(3)</sup>:** Three main conductors laid up with protective-earth conductor split into three in the outer interstices
- **Inner sheath:** EPR inner sheath with special characteristics with respect to water proofing and prevention of formation of water bubbles. Compound type: GM1b (refer also to DIN VDE 0207, Part 21)
- **Outer sheath:** Outer sheath, basic material CM, particularly water-proof, compound type: 5GM3, colour red (refer also to DIN VDE 0207, Part 21)
- **Marking:** (Year of manufacture) (serial number) TRATOSFLEX MTO-ST (N)TSCGEWÖU (number of cores) x (cross-section) (rated voltage)
- **Core Identification:** Natural colouring with black semiconductive rubber

### STANDARDS

- DIN VDE 0250, Part 813

(1) For **TRATOSFLEX MTO<sup>®</sup>-ST.../3E**: Individual concentric protective-earth conductors distributed over the insulation of the three main cores (NTSCGEWOU)

(2) For **TRATOSFLEX MTO<sup>®</sup>-ST.../3E**: Inner and outer semiconductive layer of semiconductive rubber and individual concentric metallic protective-earth conductor (NTSCWOU)

(3) For **TRATOS MTO<sup>®</sup>-ST.../3E**: Three main conductors laid-up (NTSCGEWOU)

<b>Electrical parameters</b>			
<b>Rated voltage</b>		U <sub>0</sub> /U = 1.8/3 kV to 18/30 kV	
<b>Maximum permissible operating voltage in AC systems</b>		U <sub>0</sub> /U = 2.1/3.6 kV to 20.8/36 kV	
<b>Maximum permissible operating voltage in DC systems</b>		U <sub>0</sub> /U = 2.7/5.4 kV to 27/54 kV	
<b>AC test voltage</b>		6 kV to 43 kV according to DIN VDE 0250, Part 813	
<b>Current-carrying capacity</b>		According to DIN VDE 0298, Part 4	
<b>Thermal parameters</b>			<b>Type K</b>
<b>Ambient temperature</b>	<ul style="list-style-type: none"> <li>• Fully flexible operation</li> <li>• Fixed installation</li> </ul>	-30 °C to + 80 °C -40 °C to + 80 °C	-60 °C to + 60 °C -60 °C to + 60 °C
<b>Maximum permissible water temperature</b>		+40 °C	
<b>Maximum permissible operating temperature of the conductor</b>		90 °C	
<b>Short-circuit temperature of the conductor</b>		200 °C	
<b>Mechanical parameters</b>			
<b>Tensile load</b>		Up to 15 N/mm <sup>2</sup>	
<b>Torsional stresses</b>		±100 %/m (for <b>TRATOS MTO-ST.../3E</b> ±25 %/m)	
<b>Minimum bending radii</b>		According to DIN VDE 0298, Part 3	
<b>Chemical parameters</b>			
<b>Resistance to oil</b>		Given to DIN VDE 0473, Part 811-2-1, Para. 10	
<b>Behaviour in case of fire</b>		Given to DIN VDE 0482 Part 811-2-1, Para. 10	
<b>Water compatibility</b>		Given to HD 22.16	
<b>Weather resistance</b>		Unrestricted use outdoors and indoors, resistant to UV and ozone	

## TRATOSFLEX MTO®-ST

Nominal Cross Sectional Area  mm <sup>2</sup>	Conductor diameter Max.  mm	Overall diameter of cable (guidance value)		Conductor resistance at 20 °C  Ω/km	Inductance per unit length  mH/km	Operating capacitance per unit length  μF/km	Current carrying capacity at 30 °C  A	Permissible shortcircuit current (1s)  kA	Approx. net weight  kg/km	Maximum permissible tensile force  N
		Min. value  mm	Max. value  mm							
1.8/3 kV NTSCGEWÖU										
3 x 25 + 3 x 25/3	6.9	38.6	41.6	0.795	0.33	0.41	131	3.05	2480	1125
3 x 35 + 3 x 25/3	8.3	42.5	45.5	0.565	0.31	0.46	162	4.27	3090	1575
3 x 50 + 3 x 25/3	9.7	46.0	49.0	0.393	0.29	0.53	202	6.10	3750	2250
3 x 70 + 3 x 35/3	11.2	49.2	52.2	0.277	0.28	0.59	250	8.54	4620	3150
3 x 95 + 3 x 50/3	13.2	57.2	61.2	0.210	0.28	0.65	301	11.59	6200	4275
3 x 120 + 3 x 70/3	14.9	60.9	64.9	0.164	0.27	0.72	352	14.64	7390	5400
3 x 150 + 3 x 70/3	16.6	66.3	70.3	0.132	0.27	0.78	404	18.30	8830	6750
3 x 185 + 3 x 95/3	18.0	69.4	73.4	0.108	0.26	0.84	461	22.57	10170	8325
3.6/6 kV NTSCGEWÖU										
3 x 25 + 3 x 25/3	6.9	44.7	47.7	0.795	0.36	0.34	131	3.05	3120	1125
3 x 35 + 3 x 25/3	8.3	47.3	50.3	0.565	0.34	0.38	162	4.27	3600	1575
3 x 50 + 3 x 25/3	9.7	52.2	56.2	0.393	0.32	0.44	202	6.10	4560	2250
3 x 70 + 3 x 35/3	11.2	55.5	59.5	0.277	0.31	0.48	250	8.54	5470	3150
3 x 95 + 3 x 50/3	13.2	59.8	63.8	0.210	0.29	0.54	301	11.59	6570	4275
3 x 120 + 3 x 70/3	14.9	65.3	69.3	0.164	0.28	0.59	352	14.64	8090	5400
3 x 150 + 3 x 70/3	16.6	68.9	72.9	0.132	0.28	0.64	404	18.30	9250	6750
	18.0	72.0	76.0	0.108	0.27	0.69	461	22.57	10600	8325
6/10 kV NTSCGEWÖU										
3 x 25 + 3 x 25/3	6.9	46.4	49.4	0.795	0.37	0.31	131	3.05	3320	1125
3 x 35 + 3 x 25/3	8.3	49.0	52.0	0.565	0.35	0.35	162	4.27	3810	1575
3 x 50 + 3 x 25/3	9.7	54.0	58.0	0.393	0.33	0.39	202	6.10	4780	2250
3 x 70 + 3 x 35/3	11.2	57.2	61.2	0.277	0.31	0.43	250	8.54	5700	3150
3 x 95 + 3 x 50/3	13.2	61.5	65.5	0.210	0.30	0.49	301	11.59	6830	4275
3 x 120 + 3 x 70/3	14.9	67.0	71.0	0.164	0.29	0.53	352	14.64	8360	5400
3 x 150 + 3 x 70/3	16.6	70.7	74.7	0.132	0.28	0.58	404	18.30	9530	6750
3 x 185 + 3 x 95/3	18.0	73.7	77.7	0.108	0.28	0.62	461	22.57	10890	8325
8.7/15 kV NTSCGEWÖU										
3 x 25 + 3 x 25/3	6.9	52.7	56.7	0.795	0.39	0.25	139	3.05	4050	1125
3 x 35 + 3 x 25/3	8.3	55.3	59.3	0.565	0.37	0.28	172	4.27	4650	1575
3 x 50 + 3 x 25/3	9.7	58.7	62.7	0.393	0.35	0.31	215	6.10	5390	2250
3 x 70 + 3 x 35/3	11.2	63.8	67.8	0.277	0.33	0.34	265	8.54	6740	3150
3 x 95 + 3 x 50/3	13.2	68.1	72.1	0.210	0.32	0.39	319	11.59	7870	4275
3 x 120 + 3 x 70/3	14.9	71.7	75.7	0.164	0.31	0.42	371	14.64	9150	5400
3 x 150 + 3 x 70/3	16.6	77.2	81.2	0.132	0.30	0.46	428	18.30	10770	6750
3 x 185 + 3 x 95/3	18.0	80.2	84.2	0.108	0.29	0.48	488	22.57	12310	8325
12/20 kV NTSCGEWÖU										
3 x 25 + 3 x 25/3	6.9	57.0	61.0	0.795	0.41	0.22	139	3.05	4690	1125
3 x 35 + 3 x 25/3	8.3	59.6	63.6	0.565	0.39	0.24	172	4.27	5260	1575
3 x 50 + 3 x 25/3	9.7	64.8	68.8	0.393	0.37	0.27	215	6.10	6380	2250
3 x 70 + 3 x 35/3	11.2	68.1	72.1	0.277	0.35	0.30	265	8.54	7370	3150
3 x 95 + 3 x 50/3	13.2	72.4	76.4	0.210	0.33	0.33	319	11.59	8600	4275
3 x 120 + 3 x 70/3	14.9	77.9	81.9	0.164	0.32	0.36	371	14.64	10290	5400
3 x 150 + 3 x 70/3	16.6	81.5	85.5	0.132	0.31	0.39	428	18.30	11560	6750
3 x 185 + 3 x 95/3	18.0	84.3	89.3	0.108	0.30	0.41	488	22.57	13000	8325
14/25 kV NTSCGEWÖU										
3 x 25 + 3 x 25/3	6.9	64.4	68.4	0.795	0.43	0.19	139	3.05	5860	1125
3 x 35 + 3 x 25/3	8.3	67.0	71.0	0.565	0.41	0.21	172	4.27	8390	1575
3 x 50 + 3 x 25/3	9.7	70.4	74.4	0.393	0.39	0.23	215	6.10	7220	2250
3 x 70 + 3 x 35/3	11.2	73.7	77.7	0.277	0.37	0.25	265	8.54	8720	3150
3 x 95 + 3 x 50/3	13.2	79.8	83.8	0.210	0.35	0.28	319	11.59	9950	4275
3 x 120 + 3 x 70/3	14.9	83.5	87.5	0.164	0.34	0.30	371	14.64	11380	5400
3 x 150 + 3 x 70/3	16.6	88.7	93.7	0.132	0.33	0.33	428	18.30	13120	6750
3 x 185 + 3 x 95/3	18.0	91.8	96.8	0.108	0.32	0.35	488	22.57	14770	8325



**TRATOSFLEX MTO®-ST**

Nominal Cross Sectional Area	Conductor diameter Max.	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 shortcircuit current (1s)	Approx. net weight	Maximum permissible tensile force
		Min. value	Max. value							
mm <sup>2</sup>	mm	mm	mm	Ω/km	mH/km	μF/km	A	kA	kg/km	N
18/30 kV NTSCGEWÖU										
3 x 50 + 3 x 25/3	9.7	77.4	81.4	0.393	0.41	0.21	215	6.10	8590	2250
3 x 70 + 3 x 35/3	11.2	80.7	84.7	0.277	0.39	0.23	265	8.54	9670	3150
3 x 95 + 3 x 50/3	13.2	84.8	89.8	0.210	0.37	0.25	319	11.59	11010	4275
3 x 120 + 3 x 70/3	14.9	90.2	95.2	0.164	0.35	0.27	371	14.64	12890	5400
3 x 150 + 3 x 70/3	16.6	93.9	98.9	0.132	0.34	0.29	428	18.30	14260	6750
3 x 185 + 3 x 95/3	18.0	96.8	102.0	0.108	0.33	0.31	488	22.57	15780	8325

## TRATOSFLEX MTO®-ST.../3E

Nominal Cross Sectional Area  mm <sup>2</sup>	Conductor diameter Max.  mm	Overall diameter of cable (guidance value)		Conductor resistance at 20 °C  Ω/km	Inductance per unit length  mH/km	Operating capacitance per unit length  μF/km	Current carrying capacity at 30 °C  A	Permissible shortcircuit current (1s)  kA	Approx. net weight  kg/km	Maximum permissible tensile force  N
		Min. value  mm	Max. value  mm							
1.8/3 kV NTSCGEWÖU										
3 x 25 + 3 x 16/3E	6.9	41.3	44.3	0.795	0.33	0.41	131	3.05	1180	1125
3 x 35 + 3 x 16/3E	8.1	43.9	46.9	0.565	0.31	0.46	162	4.27	1650	1575
3 x 50 + 3 x 25/3E	9.7	47.8	50.8	0.393	0.29	0.53	202	6.10	2310	2250
3 x 70 + 3 x 35/3E	11.2	52.5	56.5	0.277	0.28	0.59	250	8.54	3220	3150
3 x 95 + 3 x 50/3E	13.2	59.4	63.4	0.210	0.28	0.65	301	11.59	4335	4275
3 x 120 + 3 x 70/3E	14.9	65.5	69.5	0.164	0.27	0.72	352	14.64	5480	5400
3 x 150 + 3 x 70/3E	16.6	69.2	73.2	0.132	0.27	0.78	404	18.30	6800	6750
3 x 185 + 3 x 95/3E	18.0	72.2	76.2	0.108	0.26	0.84	461	22.57	8375	8325
3.6/6 kV NTSCGEWÖU										
3 x 25 + 3 x 16/3E	6.9	46.0	49.0	0.795	0.36	0.34	131	3.05	3160	1125
3 x 35 + 3 x 16/3E	8.1	48.6	51.6	0.565	0.34	0.38	162	4.27	3640	1575
3 x 50 + 3 x 25/3E	9.7	54.0	58.0	0.393	0.32	0.43	202	6.10	4600	2250
3 x 70 + 3 x 35/3E	11.2	57.2	61.2	0.277	0.31	0.48	250	8.54	5510	3150
3 x 95 + 3 x 50/3E	13.2	63.8	67.8	0.210	0.29	0.54	301	11.59	6610	4275
3 x 120 + 3 x 70/3E	14.9	68.1	72.1	0.164	0.28	0.59	352	14.64	8130	5400
3 x 150 + 3 x 70/3E	16.6	71.8	75.8	0.132	0.28	0.64	404	18.30	9290	6750
3 x 185 + 3 x 95/3E	18.0	76.6	80.6	0.108	0.27	0.69	461	22.57	10840	8325
6/10 kV NTSCGEWÖU										
3 x 25 + 3 x 16/3E	6.9	47.8	50.8	0.795	0.37	0.31	131	3.05	3360	1125
3 x 35 + 3 x 16/3E	8.1	51.9	55.9	0.565	0.35	0.34	162	4.27	3850	1575
3 x 50 + 3 x 25/3E	9.7	55.5	59.5	0.393	0.33	0.39	202	6.10	4820	2250
3 x 70 + 3 x 35/3E	11.2	59.0	63.0	0.277	0.31	0.43	250	8.54	5740	3150
3 x 95 + 3 x 50/3E	13.2	65.5	69.5	0.210	0.30	0.48	301	11.59	6870	4275
3 x 120 + 3 x 70/3E	14.9	69.8	73.8	0.164	0.29	0.53	352	14.64	8400	5400
3 x 150 + 3 x 70/3E	16.6	73.5	77.5	0.132	0.28	0.58	404	18.30	9570	6750
3 x 185 + 3 x 95/3E	18.0	78.3	82.3	0.108	0.28	0.61	461	22.57	10930	8325
8.7/15 kV NTSCGEWÖU										
3 x 25 + 3 x 16/3E	6.9	54.0	58.0	0.795	0.39	0.25	139	3.05	4090	1125
3 x 35 + 3 x 16/3E	8.1	56.6	60.6	0.565	0.37	0.28	172	4.27	4690	1575
3 x 50 + 3 x 25/3E	9.7	60.3	64.3	0.393	0.35	0.31	215	6.10	5430	2250
3 x 70 + 3 x 35/3E	11.2	65.5	69.5	0.277	0.33	0.34	265	8.54	6780	3150
3 x 95 + 3 x 50/3E	13.2	70.3	74.3	0.210	0.32	0.39	319	11.59	7910	4275
3 x 120 + 3 x 70/3E	14.9	76.4	80.4	0.164	0.31	0.42	371	14.64	9190	5400
3 x 150 + 3 x 70/3E	16.6	80.1	84.1	0.132	0.30	0.46	428	18.30	10810	6750
3 x 185 + 3 x 95/3E	18.0	83.1	87.1	0.108	0.29	0.48	488	22.57	12350	8325
12/20 kV NTSCGEWÖU										
3 x 25 + 3 x 16/3E	6.9	58.3	62.3	0.795	0.41	0.22	139	3.05	4730	1125
3 x 35 + 3 x 16/3E	8.1	60.9	64.9	0.565	0.39	0.24	172	4.27	5300	1575
3 x 50 + 3 x 25/3E	9.7	66.4	70.4	0.393	0.37	0.27	215	6.10	6420	2250
3 x 70 + 3 x 35/3E	11.2	69.8	73.8	0.277	0.35	0.30	265	8.54	7410	3150
3 x 95 + 3 x 50/3E	13.2	76.4	80.4	0.210	0.33	0.33	319	11.59	8640	4275
3 x 120 + 3 x 70/3E	14.9	80.7	84.7	0.164	0.32	0.36	371	14.64	10330	5400
3 x 150 + 3 x 70/3E	16.6	84.2	89.2	0.132	0.31	0.39	428	18.30	11600	6750
3 x 185 + 3 x 95/3E	18.0	89.0	94.0	0.108	0.30	0.41	488	22.57	13040	8325
14/25 kV NTSCGEWÖU										
3 x 25 + 3 x 16/3E	6.9	65.7	69.7	0.795	0.43	0.19	139	3.05	5900	1125
3 x 35 + 3 x 16/3E	8.1	68.3	72.3	0.565	0.41	0.21	172	4.27	8430	1575
3 x 50 + 3 x 25/3E	9.7	72.0	76.0	0.393	0.39	0.23	215	6.10	7260	2250
3 x 70 + 3 x 35/3E	11.2	77.2	81.2	0.277	0.37	0.25	265	8.54	8760	3150
3 x 95 + 3 x 50/3E	13.2	82.0	86.0	0.210	0.35	0.28	319	11.59	9990	4275
3 x 120 + 3 x 70/3E	14.9	87.9	92.9	0.164	0.34	0.30	371	14.64	11420	5400
3 x 150 + 3 x 70/3E	16.6	91.6	96.6	0.132	0.33	0.33	428	18.30	13160	6750
3 x 185 + 3 x 95/3E	18.0	94.6	99.6	0.108	0.32	0.35	488	22.57	14810	8325

**TRATOSFLEX MTO®-ST.../3E**

Nominal Cross Sectional Area	Conductor diameter Max.	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 shortcircuit current (1s)	Approx. net weight	Maximum permissible tensile force
		Min. value	Max. value							
mm <sup>2</sup>	mm	mm	mm	Ω/km	mH/km	μF/km	A	kA	kg/km	N
18/30 kV NTSCGEWÖU										
3 x 25 + 3 x 16/3E	6.9	70.9	74.9	0.795	0.45	0.17	139	3.05	7050	1125
3 x 35 + 3 x 16/3E	8.1	73.5	77.5	0.565	0.43	0.19	172	4.27	7490	1575
3 x 50 + 3 x 25/3E	9.7	79.0	83.0	0.393	0.41	0.21	215	6.10	8630	2250
3 x 70 + 3 x 35/3E	11.2	82.4	86.4	0.277	0.39	0.23	265	8.54	9710	3150
3 x 95 + 3 x 50/3E	13.2	88.8	93.8	0.210	0.37	0.25	319	11.59	11050	4275
3 x 120 + 3 x 70/3E	14.9	93.1	98.1	0.164	0.35	0.27	371	14.64	12930	5400
3 x 150 + 3 x 70/3E	16.6	96.8	101.8	0.132	0.34	0.29	428	18.30	14300	6750
3 x 185 + 3 x 95/3E	18.0	101.6	106.6	0.108	0.33	0.31	488	22.57	15820	8325

# TRATOS VDE MTO<sup>®</sup>

MEDIUM VOLTAGE FLEXIBLE CABLES FOR TRAILING OPERATIONS / NTSCGEWÖU & NTSCWOU

## TRATOSFLEX MTO<sup>®</sup>-SB TRATOSFLEX MTO<sup>®</sup>-SB (CSS) with Copper Core Shield

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.

### FEATURES AND PERFORMANCES



#### CONSTRUCTION

- **Conductor:** Electrolytic copper, tinned, finely stranded, Class 5 (Protective-earth conductor: electrolytic copper, tinned, very finely stranded, Class "FS" (refer also to DIN VDE 0295)
- **Insulation:** TRATOS MTO, basic material EPR, compound type: 3GI3 (refer also to DIN VDE 0207, Part 20)
- **Arrangement of protective-earth conductor<sup>(1)</sup>:** With protective-earth conductor split into three in the outer interstices
- **Electrical Field Control<sup>(2)</sup>:** Inner and outer semiconductive layer of semiconductive rubber
- **Core arrangement<sup>(3)</sup>:** Three main conductors laid-up, with protective-earth conductor split into three in the outer interstices
- **Tape:** Extremely tear-resistant reinforcing tape which prevents sheath movement
- **Inner & Outer sheath:** 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 (refer also to DIN VDE 0207, Part 21)
- **Marking:** (Year of manufacture) (serial number) <VDE> TRATOSFLEX MTO-SB NTSCGEWÖU (number of cores) x (cross-section) (rated voltage)
- **Core Identification:** Natural colouring with black semiconductive rubber

#### STANDARDS

- DIN VDE 0250, Part 813

(1) For **TRATOSFLEX MTO<sup>®</sup>-SB (CSS)**: Individual concentric protective-earth conductor, split over each core (NTSCGEWOU)

(2) For **TRATOSFLEX MTO<sup>®</sup>-SB (CSS)**: Inner and outer semiconductive layer of semiconductive rubber and additional individual concentric metallic protective-earth conductor (NTSCWOU)

(3) For **TRATOSFLEX MTO<sup>®</sup>-SB (CSS)**: Three main conductors laid-up (NTSCGEWOU)

<b>Electrical parameters</b>			
<b>Rated voltage</b>		U <sub>0</sub> /U = 1.8/3 kV to 18/30 kV	
<b>Maximum permissible operating voltage in AC systems</b>		U <sub>0</sub> /U = 2.1/3.6 kV to 20.8/36 kV	
<b>Maximum permissible operating voltage in DC systems</b>		U <sub>0</sub> /U = 2.7/5.4 kV to 27/54 kV	
<b>AC test voltage</b>		6 kV to 43 kV according to DIN VDE 0250, Part 813	
<b>Current-carrying capacity</b>		According to DIN VDE 0298, Part 4	
<b>Thermal parameters</b>			<b>Type K</b>
<b>Ambient temperature</b>	<ul style="list-style-type: none"> <li>• Fully flexible operation</li> <li>• Fixed installation</li> </ul>	-30 °C to + 80 °C -40 °C to + 80 °C	-60 °C to + 60 °C -60 °C to + 60 °C
<b>Maximum permissible operating temperature of the conductor</b>		90 °C	
<b>Short-circuit temperature of the conductor</b>		200 °C	
<b>Mechanical parameters</b>			
<b>Tensile load</b>		Up to 15 N/mm <sup>2</sup>	
<b>Torsional stresses</b>		±100 °/m (for <b>TRATOS MTO-SB (CSS)</b> ±25 °/m)	
<b>Minimum bending radii</b>		According to DIN VDE 0298, Part 3	
<b>Additional tests</b>		Sheath shifting test	
<b>Chemical parameters</b>			
<b>Resistance to oil</b>		Given to DIN VDE 0473, Part 811-2-1, Para. 10	
<b>Behaviour in case of fire</b>		Given to DIN VDE 0482, Part 265-2-1	
<b>Weather resistance</b>		Unrestricted use outdoors and indoors, resistant to UV and ozone and moisture	

## TRATOSFLEX MTO®-SB

Nominal Cross Sectional Area  mm <sup>2</sup>	Conductor diameter Max.  mm	Overall diameter of cable (guidance value)		Conductor resistance at 20 °C  Ω/km	Inductance per unit length  mH/km	Operating capacitance per unit length  µF/km	Current carrying capacity at 30 °C  A	Permissible shortcircuit current (1s)  kA	Approx. net weight  kg/km	Maximum permissible tensile force  N
		Min. value  mm	Max. value  mm							
1.8/3 kV NTSCGEWÖU										
3 x 25 + 3 x 25/3*	6.9	38.5	41.5	0.795	0.33	0.41	131	3.05	2470	1125
3 x 35 + 3 x 25/3*	8.3	42.9	45.9	0.565	0.31	0.47	162	4.27	3080	1575
3 x 50 + 3 x 25/3*	9.8	46.1	49.1	0.393	0.29	0.54	202	6.10	3750	2250
3 x 70 + 3 x 35/3*	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*	6.9	44.6	47.6	0.795	0.36	0.34	131	3.05	3080	1125
3 x 35 + 3 x 25/3*	8.3	47.6	50.6	0.565	0.34	0.39	162	4.27	3590	1575
3 x 50 + 3 x 25/3*	9.8	52.4	56.4	0.393	0.32	0.43	202	6.10	4520	2250
3 x 70 + 3 x 35/3*	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*	6.9	46.4	49.4	0.795	0.37	0.31	131	3.05	3270	1125
3 x 35 + 3 x 25/3*	8.3	49.1	53.1	0.565	0.34	0.35	162	4.27	3800	1575
3 x 50 + 3 x 25/3*	9.8	54.1	58.1	0.393	0.33	0.39	202	6.10	4750	2250
3 x 70 + 3 x 35/3*	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*	6.9	52.6	56.6	0.795	0.39	0.25	139	3.05	4040	1125
3 x 35 + 3 x 25/3*	8.3	55.6	59.6	0.565	0.37	0.28	172	4.27	4630	1575
3 x 50 + 3 x 25/3*	9.8	58.9	62.9	0.393	0.35	0.31	215	6.10	5370	2250
3 x 70 + 3 x 35/3*	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
12/20 kV NTSCGEWÖU										
3 x 25 + 3 x 25/3*	6.9	56.9	60.9	0.795	0.41	0.22	139	3.05	4620	1125
3 x 35 + 3 x 25/3*	8.3	59.9	63.9	0.565	0.39	0.25	172	4.27	5220	1575
3 x 50 + 3 x 25/3*	9.8	65.0	69.0	0.393	0.37	0.27	215	6.10	6300	2250
3 x 70 + 3 x 35/3*	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*	6.9	69.5	73.5	0.795	0.45	0.17	139	3.05	6680	1125
3 x 35 + 3 x 25/3*	8.3	72.5	76.5	0.565	0.43	0.19	172	4.27	7380	1575
3 x 50 + 3 x 25/3*	9.8	77.6	81.6	0.393	0.40	0.21	215	6.10	8460	2250
3 x 70 + 3 x 35/3*	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





## TRATOSFLEX MTO®-SB (CSS)

Nominal Cross Sectional Area  mm <sup>2</sup>	Conductor diameter Max.  mm	Overall diameter of cable (guidance value)		Conductor resistance at 20 °C  Ω/km	Inductance per unit length  mH/km	Operating capacitance per unit length  µF/km	Current carrying capacity at 30 °C  A	Permissible shortcircuit current (1s)  kA	Approx. net weight  kg/km	Maximum permissible tensile force  N
		Min. value  mm	Max. value  mm							
1.8/3 kV NTSCGEWÖU										
3x25+2x25/2+1x10ST	6.9	40.3	44.3	0.795	0.34	0.41	131	3.05	2470	1125
3x35+2x25/2+1x10ST	8.3	42.9	46.9	0.565	0.32	0.47	162	4.27	3080	1575
3x50+2x25/2+1x10ST	9.8	46.8	50.8	0.393	0.3	0.54	202	6.1	3750	2250
3x70+2x35/2+1x10ST	11.6	51.5	55.5	0.277	0.29	0.61	250	8.54	4690	3150
3x95+2x50/2+1x10ST	13.3	57.4	62.4	0.21	0.29	0.66	301	11.59	6210	4275
3x120+2x70/2+1x10ST	15.1	63.6	68.6	0.164	0.28	0.72	352	14.64	7430	5400
3x150+2x70/2+1x10ST	16.8	67.2	72.2	0.132	0.27	0.79	404	18.3	8900	6750
3x185+2x95/2+1x10ST	18.6	70.2	75.2	0.108	0.27	0.86	461	22.57	10330	8325
3.6/6 kV NTSCGEWÖU										
3x25+2x25/2+1x10ST	6.9	45.0	49.0	0.795	0.37	0.34	131	3.05	3200	1125
3x35+2x25/2+1x10ST	8.3	47.6	51.6	0.565	0.35	0.39	162	4.27	3680	1575
3x50+2x25/2+1x10ST	9.8	53.0	57.0	0.393	0.33	0.43	202	6.1	4640	2250
3x70+2x35/2+1x10ST	11.6	56.2	60.2	0.277	0.31	0.49	250	8.54	5550	3150
3x95+2x50/2+1x10ST	13.3	61.8	66.8	0.21	0.3	0.54	301	11.59	6650	4275
3x120+2x70/2+1x10ST	15.1	66.1	71.1	0.164	0.29	0.6	352	14.64	8160	5400
3x150+2x70/2+1x10ST	16.6	69.8	74.8	0.132	0.28	0.65	404	18.3	9340	6750
3x185+2x95/2+1x10ST	18.6	74.6	79.6	0.108	0.28	0.7	461	22.57	10890	8325
6/10 kV NTSCGEWÖU										
3x25+2x25/2+1x10ST	6.9	46.8	50.8	0.795	0.38	0.31	131	3.05	3410	1125
3x35+2x25/2+1x10ST	8.3	50.9	54.9	0.565	0.35	0.35	162	4.27	3890	1575
3x50+2x25/2+1x10ST	9.8	54.5	58.9	0.393	0.34	0.39	202	6.1	4860	2250
3x70+2x35/2+1x10ST	11.6	58.0	62.0	0.277	0.32	0.44	250	8.54	5780	3150
3x95+2x50/2+1x10ST	13.3	63.5	68.5	0.21	0.31	0.49	301	11.59	6920	4275
3x120+2x70/2+1x10ST	15.1	67.8	72.8	0.164	0.3	0.54	352	14.64	8450	5400
3x150+2x70/2+1x10ST	16.6	71.5	76.5	0.132	0.29	0.58	404	18.3	9620	6750
3x185+2x95/2+1x10ST	18.6	76.3	81.3	0.108	0.28	0.63	461	22.57	10980	8325
8.7/15 kV NTSCGEWÖU										
3x25+2x25/2+1x10ST	6.9	53.0	57.0	0.795	0.4	0.25	139	3.05	4130	1125
3x35+2x25/2+1x10ST	8.3	55.6	59.6	0.565	0.38	0.28	172	4.27	4740	1575
3x50+2x25/2+1x10ST	9.8	59.3	63.3	0.393	0.36	0.31	215	6.1	5470	2250
3x70+2x35/2+1x10ST	11.6	64.6	68.6	0.277	0.34	0.35	265	8.54	6820	3150
3x95+2x50/2+1x10ST	13.3	68.3	73.3	0.21	0.33	0.39	319	11.59	7950	4275
3x120+2x70/2+1x10ST	15.1	74.4	79.4	0.164	0.32	0.42	371	14.64	9240	5400
3x150+2x70/2+1x10ST	16.6	78.1	83.1	0.132	0.31	0.46	428	18.3	10860	6750
3x185+2x95/2+1x10ST	18.6	81.1	86.1	0.108	0.3	0.5	488	22.57	12400	8325
12/20 kV NTSCGEWÖU										
3x25+2x25/2+1x10ST	6.9	57.3	61.3	0.795	0.42	0.22	139	3.05	4770	1125
3x35+2x25/2+1x10ST	8.3	59.9	63.9	0.565	0.4	0.25	172	4.27	5340	1575
3x50+2x25/2+1x10ST	9.8	65.4	69.4	0.393	0.38	0.27	215	6.1	6460	2250
3x70+2x35/2+1x10ST	11.6	68.8	72.8	0.277	0.36	0.3	265	8.54	7450	3150
3x95+2x50/2+1x10ST	13.3	74.4	79.4	0.21	0.34	0.33	319	11.59	8680	4275
3x120+2x70/2+1x10ST	15.1	78.7	83.7	0.164	0.33	0.36	371	14.64	10370	5400
3x150+2x70/2+1x10ST	16.6	82.2	87.2	0.132	0.32	0.39	428	18.3	11650	6750
3x185+2x95/2+1x10ST	18.6	87.0	92.0	0.108	0.31	0.42	488	22.57	13090	8325
14/25 kV NTSCGEWÖU										
3x25+2x25/2+1x10ST	6.9	64.7	68.7	0.795	0.44	0.19	139	3.05	5940	1125
3x35+2x25/2+1x10ST	8.3	67.3	71.3	0.565	0.42	0.22	172	4.27	6470	1575
3x50+2x25/2+1x10ST	9.8	71	75	0.393	0.4	0.24	215	6.1	7300	2250
3x70+2x35/2+1x10ST	11.6	75.2	80.2	0.277	0.38	0.26	265	8.54	8800	3150
3x95+2x50/2+1x10ST	13.3	80	85	0.21	0.36	0.29	319	11.59	10050	4275
3x120+2x70/2+1x10ST	15.1	85.9	90.9	0.164	0.34	0.31	371	14.64	11470	5400
3x150+2x70/2+1x10ST	16.8	89.6	94.6	0.132	0.32	0.34	428	18.3	13210	6750
3x185+2x95/2+1x10ST	18.6	92.6	97.6	0.108	0.32	0.36	488	22.57	14860	8325

**TRATOSFLEX MTO®-SB (CSS)**

Nominal Cross Sectional Area	Conductor diameter Max.	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 shortcircuit current (1s)	Approx. net weight	Maximum permissible tensile force
		Min. value	Max. value							
mm <sup>2</sup>	mm	mm	mm	Ω/km	mH/km	μF/km	A	kA	kg/km	N
18/30 kV NTSCGEWÖU										
3x25+2x25/2+1x10ST	6.9	69.9	73.9	0.795	0.46	0.17	139	3.05	7100	1125
3x35+2x25/2+1x10ST	8.3	72.6	76.6	0.565	0.44	0.19	172	4.27	7540	1575
3x50+2x25/2+1x10ST	9.8	78	82	0.393	0.41	0.21	215	6.1	8680	2250
3x70+2x35/2+1x10ST	11.6	80.4	85.4	0.277	0.39	0.23	265	8.54	9760	3150
3x95+2x50/2+1x10ST	13.3	86.8	91.8	0.21	0.38	0.25	319	11.59	11100	4275
3x120+2x70/2+1x10ST	15.1	91.1	96.1	0.164	0.36	0.27	371	14.64	12980	5400
3x150+2x70/2+1x10ST	16.8	94.8	99.8	0.132	0.35	0.29	428	18.3	14350	6750
3x185+2x95/2+1x10ST	18.6	99.6	104.6	0.108	0.34	0.31	488	22.57	15870	8325



# TRATOS VDE MTO<sup>®</sup>

MEDIUM VOLTAGE FLEXIBLE CABLES FOR FIXED INSTALLATION / F-(N)TSCGEWÖU

## TRATOS FIX MTO<sup>®</sup>-M TRATOS FIX MTO<sup>®</sup>-M (FO)

For laying alongside the conveyor belts (also for shiftable units) and on material handling equipment (even with continuous movement such as in cable booms or as connection between upper and lower car) and for connection of submersible pump units

### FEATURES AND PERFORMANCES



#### CONSTRUCTION

- **Conductor:** Electrolytic copper, not tinned, finely stranded, Class 5 (refer also to DIN VDE 0295)
- **Insulation:** TRATOS MTO, basic material EPR, compound type: special compound (refer also to DIN VDE 0207, Part 20)
- **Electrical Field Control:** Inner and outer semiconductive layer of semiconductive rubber
- **Core arrangement:** Three main conductors laid-up, with protective earth conductor split into three in the outer interstices
- **Inner Sheath:** Basic material: EPR, compound type: special compound (refer also to DIN VDE 0207, Part 21)
- **Outer sheath:** Basic material CM, compound type: special compound, colour red (refer also to DIN VDE 0207, Part 21)
- **Marking:** (Year of manufacture) (serial number) TRATOS FIX MTO-M F-(N)TSCGEWÖU (number of cores) x (cross-section) (rated voltage)
- **Core Identification:** Natural colouring with black semiconductive rubber on which white digits 1 to 3 are printed

#### FIBRE OPTICS <sup>(1)</sup>

- **Fibre:** Inner core diameter of fibre 9 µm, 62.5 µm or 50 µm; Diameter over cladding 125 µm; Diameter over coating 250 µm
- **Fibre covering:** Buffering tube with filling compound, basic material: ETFE compound 7YI 1
- **Identification of the fibres:** Colour coding of the fibres and buffering tube for identification of the fibre type
- **Core arrangement:** Six cores in one layer, especially laid-up around the GFK supporting element
- **Sheath over the laid-up cores:** Special material

#### STANDARDS

- DIN VDE 0250, Part 813

(1) Apply only on TRATOS FIX MTO<sup>®</sup>-M (FO)

Electrical parameters			
Rated voltage	U <sub>0</sub> /U = 3.6/6 kV to 18/30 kV		
Maximum permissible operating voltage in AC systems	U <sub>0</sub> /U = 4.2/7.2 kV to 20.8/36 kV		
Maximum permissible operating voltage in DC systems	U <sub>0</sub> /U = 5.4/10.8 kV to 27/54 kV		
AC test voltage	11 kV to 43 kV according to DIN VDE 0250, Part 813		
Current-carrying capacity	According to DIN VDE 0298, Part 4		
Thermal parameters			Type K
Ambient temperature	<ul style="list-style-type: none"> <li>• Fully flexible operation</li> <li>• Fixed installation</li> </ul>	-30 °C to + 80 °C -40 °C to + 80 °C	-60 °C to + 60 °C -60 °C to + 60 °C
Maximum permissible operating temperature of the conductor	90 °C		
Short-circuit temperature of the conductor	250 °C		
Mechanical parameters			
Tensile load	Up to 15 N/mm <sup>2</sup>		
Torsional stresses	±100 °/m		
Minimum bending radii	According to DIN VDE 0298, Part 3		
Speed on rewinding with drum car	Up to 100 m/min		
Additional tests	Torsional stress test, reversed bending test, roller bending test (type C), water compatibility according to HD 22.16		
Chemical parameters			
Resistance to oil and brine	Given to DIN VDE 0473, Part 811-2-1, Para. 10		
Behaviour in case of fire	Given to DIN VDE 0482, Part 265-2-1		
Weather resistance	Unrestricted use outdoors and indoors, resistant to ozone and moisture		

Optical parameters <sup>(1)</sup>			
Transmission data of the fibre-optics	G50/125	G62.5/125	E9/125
Attenuation at wavelength 850 nm	≤2.8 dB/km	≤3.3 dB/km	-
Attenuation at wavelength 1300 nm	≤0.8 dB/km	≤0.9 dB/km	≤0.4 dB/km
Attenuation at wavelength 1550 nm	-	-	≤0.3 dB/km
Bandwidth at 850 nm and 1300 nm	≥400 MHz	≥400 MHz	
Numerical aperture	0.20 ± 0.02	0.275 ± 0.02	

(1) Apply only on TRATOS FIX MTO<sup>®</sup>-M (FO)

## TRATOS FIX MTO®-M

Nominal Cross Sectional Area  mm <sup>2</sup>	Conductor diameter (guidance value)  mm	Overall diameter of cable (guidance value)		Conductor resistance at 20 °C  Ω/km	Inductance per unit length  mH/km	Operating capacitance per unit length  µF/km	Current carrying capacity at 30 °C  A	Permissible shortcircuit current (1s)  kA	Approx. net weight  kg/km	Maximum permissible tensile force  N
		Min. value  mm	Max. value  mm							
3.6/6 kV F-(N)TSCGEWÖU										
3 x 25 + 3 x 25/3	6.75	36.7	39.7	0.780	0.33	0.45	131	3.58	2320	1125
3 x 25 + 3 x 50/3	6.75	40.6	43.6	0.780	0.36	0.45	131	3.58	2860	1125
3 x 35 + 3 x 25/3	8.05	40.5	43.5	0.554	0.31	0.50	162	5.01	2860	1575
3 x 35 + 3 x 50/3	8.05	42.3	45.3	0.554	0.33	0.50	162	5.01	3220	1575
3 x 50 + 3 x 25/3	9.55	43.8	46.8	0.386	0.30	0.58	202	7.15	3500	2250
3 x 50 + 3 x 50/3	9.55	43.8	46.8	0.386	0.30	0.58	202	7.15	3650	2250
3 x 70 + 3 x 35/3	11.05	47.0	50.0	0.272	0.29	0.64	250	10.01	4360	3150
3 x 70 + 3 x 50/3	11.05	49.7	53.7	0.272	0.29	0.64	250	10.01	5010	3150
3 x 95 + 3 x 50/3	13.10	52.2	56.2	0.206	0.27	0.73	301	13.60	5550	4275
3 x 120 + 3 x 70/3	14.80	55.9	59.9	0.161	0.26	0.80	352	17.16	6690	5400
3 x 150 + 3 x 70/3	16.50	61.0	65.0	0.129	0.26	0.88	404	21.45	8030	6750
3 x 185 + 3 x 95/3	17.90	64.0	68.0	0.106	0.25	0.94	462	26.46	9320	8325
3 x 240 + 3 x 120/3	21.00	72.1	76.1	0.080	0.24	1.07	540	34.32	11960	10800
3 x 300 + 3 x 150/3	23.40	77.3	81.3	0.004	0.24	1.18	620	42.90	14260	13500
6/10 kV F-(N)TSCGEWÖU										
3 x 25 + 3 x 25/3	6.75	39.0	42.0	0.780	0.34	0.40	131	3.58	2520	1125
3 x 25 + 3 x 50/3	6.75	41.4	44.4	0.780	0.36	0.40	131	3.58	2930	1125
3 x 35 + 3 x 25/3	8.05	41.8	44.8	0.554	0.32	0.45	162	5.01	2980	1575
3 x 35 + 3 x 50/3	8.05	43.6	46.6	0.554	0.34	0.45	162	5.01	3350	1575
3 x 50 + 3 x 25/3	9.55	45.1	48.1	0.386	0.30	0.51	202	7.15	3640	2250
3 x 50 + 3 x 50/3	9.55	45.1	48.1	0.386	0.30	0.51	202	7.15	3780	2250
3 x 70 + 3 x 35/3	11.05	48.3	51.3	0.272	0.29	0.57	250	10.01	4500	3150
3 x 70 + 3 x 50/3	11.05	48.3	51.3	0.272	0.29	0.57	250	10.01	4730	3150
3 x 95 + 3 x 50/3	13.10	53.5	57.5	0.206	0.28	0.65	301	13.60	5710	4275
3 x 120 + 3 x 70/3	14.80	57.2	61.2	0.161	0.27	0.71	352	17.16	6860	5400
3 x 150 + 3 x 70/3	16.50	62.3	66.3	0.129	0.26	0.78	404	21.45	8210	6750
3 x 185 + 3 x 95/3	17.90	65.3	69.3	0.106	0.26	0.83	462	26.46	9510	8325
3 x 240 + 3 x 120/3	21.00	73.4	77.4	0.080	0.25	0.95	540	34.32	12170	10800
3 x 300 + 3 x 150/3	23.40	78.6	82.6	0.004	0.24	1.04	620	42.90	14500	13500
8.7/15 kV F-(N)TSCGEWÖU										
3 x 25 + 3 x 25/3	6.75	42.5	45.5	0.780	0.36	0.32	139	3.58	2850	1125
3 x 25 + 3 x 50/3	6.75	44.2	47.2	0.780	0.38	0.32	139	3.58	3210	1125
3 x 35 + 3 x 25/3	8.05	45.3	48.3	0.554	0.34	0.36	172	5.01	3340	1575
3 x 35 + 3 x 50/3	8.05	45.3	48.3	0.554	0.34	0.36	172	5.01	3480	1575
3 x 50 + 3 x 25/3	9.55	49.4	53.4	0.386	0.32	0.41	215	7.15	4180	2250
3 x 50 + 3 x 50/3	9.55	49.4	53.4	0.386	0.32	0.41	215	7.15	4320	2250
3 x 70 + 3 x 35/3	11.05	52.7	56.7	0.272	0.31	0.45	265	10.01	5090	3150
3 x 70 + 3 x 50/3	11.05	52.7	56.7	0.272	0.31	0.45	265	10.01	5310	3150
3 x 95 + 3 x 50/3	13.10	57.0	61.0	0.206	0.29	0.51	319	13.60	6160	4275
3 x 120 + 3 x 70/3	14.80	62.1	66.1	0.161	0.28	0.56	371	17.16	7550	5400
3 x 150 + 3 x 70/3	16.50	65.7	69.7	0.129	0.28	0.60	428	21.45	8710	6750
3 x 185 + 3 x 95/3	17.90	68.7	72.7	0.106	0.27	0.65	488	26.46	10020	8325
3 x 240 + 3 x 120/3	21.00	76.8	80.8	0.080	0.26	0.73	574	34.32	12750	10800
3 x 300 + 3 x 150/3	23.40	82.0	86.0	0.004	0.25	0.80	665	42.90	15110	13500



**TRATOS FIX MTO<sup>®</sup>-M**

Nominal Cross Sectional Area  mm <sup>2</sup>	Conductor diameter (guidance value)  mm	Overall diameter of cable (guidance value)		Conductor resistance at 20 °C  Ω/km	Inductance per unit length  mH/km	Operating capacitance per unit length  μF/km	Current carrying capacity at 30 °C  A	Permissible shortcircuit current (1s)  kA	Approx. net weight  kg/km	Maximum permissible tensile force  N
		Min. value  mm	Max. value  mm							
12/20 kV F-(N)TSCGEWÖU										
3 x 25 + 3 x 25/3	6.75	45.5	48.5	0.780	0.38	0.28	139	3.58	3150	1125
3 x 25 + 3 x 50/3	6.75	45.5	48.5	0.780	0.38	0.28	139	3.58	3300	1125
3 x 35 + 3 x 25/3	8.05	48.3	51.3	0.554	0.36	0.31	172	5.01	3660	1575
3 x 35 + 3 x 50/3	8.05	48.3	51.3	0.554	0.36	0.31	172	5.01	3800	1575
3 x 50 + 3 x 25/3	9.55	52.5	56.5	0.386	0.34	0.35	215	7.15	4540	2250
3 x 50 + 3 x 50/3	9.55	52.5	56.5	0.386	0.34	0.35	215	7.15	4680	2250
3 x 70 + 3 x 35/3	11.05	55.7	59.7	0.272	0.32	0.38	265	10.01	5460	3150
3 x 70 + 3 x 50/3	11.05	55.7	59.7	0.272	0.32	0.38	265	10.01	5690	3150
3 x 95 + 3 x 50/3	13.10	61.4	65.4	0.206	0.31	0.43	319	13.60	6770	4275
3 x 120 + 3 x 70/3	14.80	65.1	69.1	0.161	0.30	0.47	371	17.16	7980	5400
3 x 150 + 3 x 70/3	16.50	68.7	72.7	0.129	0.29	0.51	428	21.45	9170	6750
3 x 185 + 3 x 95/3	17.90	73.2	77.2	0.106	0.28	0.54	488	26.46	10780	8325
3 x 240 + 3 x 120/3	21.00	79.8	83.8	0.080	0.27	0.62	574	34.32	13280	10800
3 x 300 + 3 x 150/3	23.40	86.3	91.3	0.004	0.26	0.67	665	42.90	16070	13500
14/25 kV F-(N)TSCGEWÖU										
3 x 25 + 3 x 25/3	6.75	50.3	54.3	0.780	0.40	0.24	139	3.58	3750	1125
3 x 25 + 3 x 50/3	6.75	50.3	54.3	0.780	0.40	0.24	139	3.58	3900	1125
3 x 35 + 3 x 25/3	8.05	53.1	57.1	0.554	0.37	0.26	172	5.01	4290	1575
3 x 35 + 3 x 50/3	8.05	53.1	57.1	0.554	0.37	0.26	172	5.01	4430	1575
3 x 50 + 3 x 25/3	9.55	56.3	60.3	0.386	0.35	0.30	215	7.15	5020	2250
3 x 50 + 3 x 50/3	9.55	56.3	60.3	0.386	0.35	0.30	215	7.15	5160	2250
3 x 70 + 3 x 35/3	11.05	61.0	65.0	0.272	0.34	0.33	265	10.01	6190	3150
3 x 70 + 3 x 50/3	11.05	61.0	65.0	0.272	0.34	0.33	265	10.01	6410	3150
3 x 95 + 3 x 50/3	13.10	65.3	69.3	0.206	0.32	0.36	319	13.60	7340	4275
3 x 120 + 3 x 70/3	14.80	69.0	73.0	0.161	0.31	0.40	371	17.16	8580	5400
3 x 150 + 3 x 70/3	16.50	74.0	78.0	0.129	0.30	0.43	428	21.45	10050	6750
3 x 185 + 3 x 95/3	17.90	77.0	81.0	0.106	0.29	0.46	488	26.46	11430	8325
3 x 240 + 3 x 120/3	21.00	85.0	90.0	0.080	0.28	0.52	574	34.32	14400	10800
3 x 300 + 3 x 150/3	23.40	90.2	95.2	0.004	0.27	0.56	665	42.90	16860	13500
18/30 kV F-(N)TSCGEWÖU										
3 x 25 + 3 x 25/3	6.75	53.7	57.7	0.780	0.41	0.21	139	3.58	4160	1125
3 x 25 + 3 x 50/3	6.75	53.7	57.7	0.780	0.41	0.21	139	3.58	4300	1125
3 x 35 + 3 x 25/3	8.05	56.6	60.6	0.554	0.39	0.24	172	5.01	4730	1575
3 x 35 + 3 x 50/3	8.05	56.6	60.6	0.554	0.39	0.24	172	5.01	4870	1575
3 x 50 + 3 x 25/3	9.55	61.2	65.2	0.386	0.37	0.26	215	7.15	5700	2250
3 x 50 + 3 x 50/3	9.55	61.2	65.2	0.386	0.37	0.26	215	7.15	5840	2250
3 x 70 + 3 x 35/3	11.05	64.4	68.4	0.272	0.35	0.29	265	10.01	6680	3150
3 x 70 + 3 x 50/3	11.05	64.4	68.4	0.272	0.35	0.29	265	10.01	6900	3150
3 x 95 + 3 x 50/3	13.10	68.7	72.7	0.206	0.33	0.32	319	13.60	7860	4275
3 x 120 + 3 x 70/3	14.80	73.8	77.8	0.161	0.32	0.35	371	17.16	9390	5400
3 x 150 + 3 x 70/3	16.50	77.5	81.5	0.129	0.31	0.38	428	21.45	10660	6750
3 x 185 + 3 x 95/3	17.90	80.5	84.5	0.106	0.30	0.40	488	26.46	12060	8325
3 x 240 + 3 x 120/3	21.00	88.5	93.5	0.080	0.29	0.46	574	34.32	15090	10800
3 x 300 + 3 x 150/3	23.40	94.7	99.7	0.004	0.28	0.49	665	42.90	17820	13500

## TRATOS FIX MTO®-M (FO)

Nominal Cross Sectional Area	Conductor diameter (guidance value)	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 shortcircuit current (1s)	Approx. net weight	Maximum permissible tensile force
		Min. value	Max. value							
mm <sup>2</sup>	mm	mm	mm	Ω/km	mH/km	μF/km	A	kA	kg/km	N
3.6/6 kV F-(N)TSCGEWÖU										
3x25+2x25/2+1x(FO)	6.75	40.1	43.1	0.780	0.36	0.45	131	3.58	2650	1125
3x25+2x50/2+1x(FO)	6.75	42.4	45.4	0.780	0.38	0.45	131	3.58	3060	1125
3x35+2x25/2+1x(FO)	8.05	42.3	45.3	0.554	0.31	0.50	162	5.01	3060	1575
3x35+2x50/2+1x(FO)	8.05	44.0	47.0	0.554	0.35	0.50	162	5.01	3410	1575
3x50+2x25/2+1x(FO)	9.55	43.8	46.8	0.386	0.30	0.58	202	7.15	3490	2250
3x50+2x50/2+1x(FO)	9.55	46.1	49.1	0.386	0.32	0.58	202	7.15	3640	2250
3x70+2x35/2+1x(FO)	11.05	47.0	50.0	0.272	0.29	0.64	250	10.01	4350	3150
3x70+2x50/2+1x(FO)	11.05	52.0	56.0	0.272	0.30	0.64	250	10.01	5280	3150
3x95+2x50/2+1x(FO)	13.10	52.2	56.2	0.206	0.27	0.73	301	13.60	5550	4275
3x120+2x70/2+1x(FO)	14.80	49.6	50.9	0.161	0.28	0.80	352	17.16	7040	5400
3x150+2x70/2+1x(FO)	16.50	48.4	52.3	0.129	0.26	0.88	404	21.45	8000	6750
3x185+2x95/2+1x(FO)	17.90	51.3	55.3	0.106	0.25	0.94	462	26.46	9310	8325
3x240+2x120/2+1x(FO)	21.00	58.0	62.0	0.080	0.24	1.07	540	34.32	11940	10800
3x300+2x150/2+1x(FO)	23.40	63.2	67.2	0.004	0.24	1.18	620	42.90	14230	13500
6/10 kV F-(N)TSCGEWÖU										
3x25+2x25/2+1x(FO)	6.75	41.4	44.4	0.780	0.36	0.40	131	3.58	2770	1125
3x25+2x50/2+1x(FO)	6.75	43.1	46.1	0.780	0.38	0.40	131	3.58	3120	1125
3x35+2x25/2+1x(FO)	8.05	43.6	46.6	0.554	0.32	0.45	162	5.01	3190	1575
3x35+2x50/2+1x(FO)	8.05	44.7	47.7	0.554	0.35	0.45	162	5.01	3470	1575
3x50+2x25/2+1x(FO)	9.55	45.1	48.1	0.386	0.30	0.51	202	7.15	3620	2250
3x50+2x50/2+1x(FO)	9.55	46.8	49.8	0.386	0.32	0.51	202	7.15	4010	2250
3x70+2x35/2+1x(FO)	11.05	48.3	51.3	0.272	0.29	0.57	250	10.01	4500	3150
3x70+2x50/2+1x(FO)	11.05	52.7	56.7	0.272	0.31	0.57	250	10.01	5360	3150
3x95+2x50/2+1x(FO)	13.10	53.5	57.5	0.206	0.28	0.65	301	13.60	5710	4275
3x120+2x70/2+1x(FO)	14.80	57.2	61.2	0.161	0.27	0.71	352	17.16	6830	5400
3x150+2x70/2+1x(FO)	16.50	62.3	66.3	0.129	0.26	0.78	404	21.45	8180	6750
3x185+2x95/2+1x(FO)	17.90	65.3	69.3	0.106	0.26	0.83	462	26.46	9500	8325
3x240+2x120/2+1x(FO)	21.00	73.4	77.4	0.080	0.25	0.95	540	34.32	12160	10800
3x300+2x150/2+1x(FO)	23.40	78.6	82.6	0.004	0.24	1.04	620	42.90	14460	13500
8.7/15 kV F-(N)TSCGEWÖU										
3x25+2x25/2+1x(FO)	6.75	44.2	47.2	0.780	0.38	0.32	139	3.58	3050	1125
3x25+2x50/2+1x(FO)	6.75	45.4	48.4	0.780	0.39	0.32	139	3.58	3350	1125
3x35+2x25/2+1x(FO)	8.05	45.3	48.3	0.554	0.34	0.36	172	5.01	3320	1575
3x35+2x50/2+1x(FO)	8.05	47.0	50.0	0.554	0.36	0.36	172	5.01	3710	1575
3x50+2x25/2+1x(FO)	9.55	49.4	53.4	0.386	0.32	0.41	215	7.15	4160	2250
3x50+2x50/2+1x(FO)	9.55	51.2	55.2	0.386	0.34	0.41	215	7.15	4590	2250
3x70+2x35/2+1x(FO)	11.05	52.7	56.7	0.272	0.31	0.45	265	10.01	5080	3150
3x70+2x50/2+1x(FO)	11.05	55.0	59.0	0.272	0.31	0.45	265	10.01	5640	3150
3x95+2x50/2+1x(FO)	13.10	57.0	61.0	0.206	0.29	0.51	319	13.60	6160	4275
3x120+2x70/2+1x(FO)	14.80	62.1	66.1	0.161	0.28	0.47	371	17.16	7520	5400
3x150+2x70/2+1x(FO)	16.50	65.7	69.7	0.129	0.28	0.51	428	21.45	8670	6750
3x185+2x95/2+1x(FO)	17.90	68.7	72.7	0.106	0.27	0.55	488	26.46	10010	8325
3x240+2x120/2+1x(FO)	21.00	76.8	80.8	0.080	0.26	0.62	574	34.32	12730	10800
3x300+2x150/2+1x(FO)	23.40	82.0	86.0	0.004	0.25	0.68	665	42.90	15080	13500

**TRATOS FIX MTO<sup>®</sup>-M (FO)**

Nominal Cross Sectional Area	Conductor diameter (guidance value)	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 shortcircuit current (1s)	Approx. net weight	Maximum permissible tensile force
		Min. value	Max. value							
mm <sup>2</sup>	mm	mm	mm	Ω/km	mH/km	μF/km	A	kA	kg/km	N
12/20 kV F-(N)TSCGEWÖU										
3x25+2x25/2+1x(FO)	6.75	45.5	48.5	0.780	0.38	0.28	139	3.58	3140	1125
3x25+2x50/2+1x(FO)	6.75	47.2	50.2	0.780	0.39	0.28	139	3.58	3530	1125
3x35+2x25/2+1x(FO)	8.05	48.3	51.3	0.554	0.36	0.31	172	5.01	3640	1575
3x35+2x50/2+1x(FO)	8.05	51.0	55.0	0.554	0.37	0.31	172	5.01	4240	1575
3x50+2x25/2+1x(FO)	9.55	52.5	56.5	0.386	0.34	0.35	215	7.15	4530	2250
3x50+2x50/2+1x(FO)	9.55	52.5	56.5	0.386	0.34	0.35	215	7.15	4690	2250
3x70+2x35/2+1x(FO)	11.05	55.7	59.7	0.272	0.32	0.38	265	10.01	5460	3150
3x70+2x50/2+1x(FO)	11.05	58.0	62.0	0.272	0.32	0.38	265	10.01	6040	3150
3x95+2x50/2+1x(FO)	13.10	61.4	65.4	0.206	0.31	0.43	319	13.60	6770	4275
3x120+2x70/2+1x(FO)	14.80	65.1	69.1	0.161	0.30	0.47	371	17.16	7950	5400
3x150+2x70/2+1x(FO)	16.50	68.7	72.7	0.129	0.29	0.51	428	21.45	9130	6750
3x185+2x95/2+1x(FO)	17.90	73.2	77.2	0.106	0.28	0.54	488	26.46	10770	8325
3x240+2x120/2+1x(FO)	21.00	79.8	83.8	0.080	0.27	0.62	574	34.32	13260	10800
3x300+2x150/2+1x(FO)	23.40	86.3	91.3	0.004	0.26	0.67	665	42.90	16040	13500
14/25 kV F-(N)TSCGEWÖU										
3x25+2x25/2+1x(FO)	6.75	50.3	54.3	0.780	0.40	0.24	139	3.58	3740	1125
3x25+2x50/2+1x(FO)	6.75	50.3	54.3	0.780	0.40	0.24	139	3.58	3900	1125
3x35+2x25/2+1x(FO)	8.05	53.1	57.1	0.554	0.37	0.26	172	5.01	4270	1575
3x35+2x50/2+1x(FO)	8.05	53.1	57.1	0.554	0.37	0.26	172	5.01	4440	1575
3x50+2x25/2+1x(FO)	9.55	56.3	60.3	0.386	0.35	0.30	215	7.15	5000	2250
3x50+2x50/2+1x(FO)	9.55	56.3	60.3	0.386	0.35	0.30	215	7.15	5160	2250
3x70+2x35/2+1x(FO)	11.05	61.0	65.0	0.272	0.34	0.33	265	10.01	6190	3150
3x70+2x50/2+1x(FO)	11.05	61.0	65.0	0.272	0.34	0.33	265	10.01	6390	3150
3x95+2x50/2+1x(FO)	13.10	65.3	69.3	0.206	0.32	0.36	319	13.60	7340	4275
3x120+2x70/2+1x(FO)	14.80	69.0	73.0	0.161	0.31	0.40	371	17.16	8550	5400
3x150+2x70/2+1x(FO)	16.50	74.0	78.0	0.129	0.30	0.43	428	21.45	10020	6750
3x185+2x95/2+1x(FO)	17.90	77.0	81.0	0.106	0.29	0.46	488	26.46	11410	8325
3x240+2x120/2+1x(FO)	21.00	85.0	90.0	0.080	0.28	0.52	574	34.32	14380	10800
3x300+2x150/2+1x(FO)	23.40	90.2	95.2	0.004	0.27	0.56	665	42.90	16820	13500
18/30 kV F-(N)TSCGEWÖU										
3x25+2x25/2+1x(FO)	6.75	53.7	57.7	0.780	0.41	0.21	139	3.58	4140	1125
3x25+2x50/2+1x(FO)	6.75	53.7	57.7	0.780	0.41	0.21	139	3.58	4310	1125
3x35+2x25/2+1x(FO)	8.05	56.6	60.6	0.554	0.39	0.24	172	5.01	4720	1575
3x35+2x50/2+1x(FO)	8.05	56.6	60.6	0.554	0.39	0.24	172	5.01	4880	1575
3x50+2x25/2+1x(FO)	9.55	61.2	65.2	0.386	0.37	0.26	215	7.15	5680	2250
3x50+2x50/2+1x(FO)	9.55	61.2	65.2	0.386	0.37	0.26	215	7.15	5840	2250
3x70+2x35/2+1x(FO)	11.05	64.4	68.4	0.272	0.35	0.29	265	10.01	6670	3150
3x70+2x50/2+1x(FO)	11.05	64.4	68.4	0.272	0.35	0.29	265	10.01	6870	3150
3x95+2x50/2+1x(FO)	13.10	68.7	72.7	0.206	0.33	0.32	319	13.60	7860	4275
3x120+2x70/2+1x(FO)	14.80	73.8	77.8	0.161	0.32	0.35	371	17.16	9350	5400
3x150+2x70/2+1x(FO)	16.50	77.5	81.5	0.129	0.31	0.38	428	21.45	10630	6750
3x185+2x95/2+1x(FO)	17.90	80.5	84.5	0.106	0.30	0.40	488	26.46	12040	8325
3x240+2x120/2+1x(FO)	21.00	88.5	93.5	0.080	0.29	0.46	574	34.32	15070	10800
3x300+2x150/2+1x(FO)	23.40	94.7	99.7	0.004	0.28	0.49	665	42.90	17780	13500

# TRATOS VDE MTO®

MEDIUM VOLTAGE FLEXIBLE SINGLE CORE CABLES / NTMCGCWÖU

## TRATOSFLEX MTO®- OCS Single-Core

As a general rule, single-core cables are used in short lengths, e.g. for connection of switchgear cubicles and for connection of mobile transformer substations to the overhead line. When laying and during operation care should be taken to protect them against excessive mechanical stresses.

### FEATURES AND PERFORMANCES



#### CONSTRUCTION

- **Conductor:** Finely stranded copper conductor, tinned, Class 5 (refer also to DIN VDE 0295)
- **Insulation:** TRATOS MTO, basic material EPR, compound type: 3GI3 (refer also to DIN VDE 0207, Part 20)
- **Arrangement of protective-earth conductor<sup>(1)</sup>:** With protective-earth conductor applied concentrically
- **Electrical Field Control:** Inner and outer semiconductive layer of semiconductive rubber
- **Screen:** Cu wire braiding 16 mm<sup>2</sup> or 25 mm<sup>2</sup> (braid or spiral screen available)
- **Outer sheath:** TRATOS MTO, basic material PCP, compound type: 5GM5, colour red (refer also to DIN VDE 0207, Part 21)
- **Marking:** (Year of manufacture) (serial number) <VDE> TRATOSFLEX MTO-OCS NTMCGCWÖU (cross-section) (rated voltage)

#### STANDARDS

- DIN VDE 0250, Part 813

<b>Electrical parameters</b>			
<b>Rated voltage</b>		U <sub>0</sub> /U = 3.6/6 kV to 12/20 kV	
<b>Maximum permissible operating voltage in AC systems</b>		U <sub>0</sub> /U = 4.2/7.2 kV to 13.9/24 kV	
<b>Maximum permissible operating voltage in DC systems</b>		U <sub>0</sub> /U = 5.4/10.8 kV to 18/36 kV	
<b>AC test voltage</b>		11 kV to 29 kV	
<b>Current-carrying capacity</b>		According to DIN VDE 0298, Part 4	
<b>Thermal parameters</b>			<b>Type K</b>
<b>Ambient temperature</b>	<ul style="list-style-type: none"> <li>• Fully flexible operation</li> <li>• Fixed installation</li> </ul>	-30 °C to + 80 °C -40 °C to + 80 °C	-60 °C to + 60 °C -60 °C to + 60 °C
<b>Maximum permissible operating temperature of the conductor</b>		90 °C	
<b>Short-circuit temperature of the conductor</b>		200 °C	
<b>Mechanical parameters</b>			
<b>Tensile load</b>		Up to 15 N/mm <sup>2</sup>	
<b>Torsional stresses</b>		±25 °/m	
<b>Minimum bending radii</b>		According to DIN VDE 0298, Part 3	
<b>Chemical parameters</b>			
<b>Resistance to oil</b>		Given to DIN VDE 0473, Part 811-2-1, Para. 10	
<b>Behaviour in case of fire</b>		Given to DIN VDE 0482, Part 265-2-1	
<b>Weather resistance</b>		Unrestricted use outdoors and indoors, resistant to ozone and moisture	

## TRATOSFLEX MTO®-OCS Single-Core

Nominal Cross Sectional Area mm <sup>2</sup>	Conductor diameter (guidance value) mm	Overall diameter of cable (guidance value)		Conductor resistance at 20 °C Ω/km	Inductance per unit length mH/km	Operating capacitance per unit length μF/km	Current carrying capacity at 30 °C (1) A	Permissible shortcircuit current (1s) kA	Approx. net weight kg/km	Maximum permissible tensile force N
		Min. value mm	Max. value mm							
3.6/6 kV NTMCGCWÖU										
1 x 16/16KON	5.7	19.4	21.4	1.240	-	0.29	141	1.95	601	240
1 x 25/16KON	6.9	21.4	23.4	0.795	-	0.34	187	3.05	825	375
1 x 35/16KON	8.1	22.6	24.6	0.565	-	0.39	231	4.27	882	525
1 x 50/16KON	9.7	24.6	27.6	0.393	-	0.43	288	6.10	1104	750
1 x 70/16KON	11.2	26.5	29.5	0.277	-	0.49	357	8.54	1346	1050
1 x 95/16KON	13.2	28.5	31.5	0.210	-	0.54	430	11.59	1614	1425
1 x 120/16KON	14.9	31.2	34.2	0.164	-	0.60	503	14.64	1983	1800
1 x 150/16KON	16.6	32.9	35.9	0.132	-	0.65	577	18.30	2300	2250
1 x 185/16KON	18.0	34.3	37.3	0.108	-	0.70	658	22.57	2642	2775
1 x 240/16KON	21.3	38.6	41.6	0.0817	-	0.75	771	29.28	3371	3600
6/10 kV NTMCGCWÖU										
1 x 16/16KON	5.7	20.4	22.4	1.240	-	0.27	141	1.95	644	240
1 x 25/16KON	6.9	22.2	24.2	0.795	-	0.31	187	3.05	791	375
1 x 35/16KON	8.1	23.4	25.4	0.565	-	0.35	231	4.27	1050	525
1 x 50/16KON	9.7	25.4	28.4	0.393	-	0.39	288	6.10	1153	750
1 x 70/16KON	11.2	27.3	30.3	0.277	-	0.44	357	8.54	1399	1050
1 x 95/16KON	13.2	29.3	32.3	0.210	-	0.49	430	11.59	1910	1425
1 x 120/16KON	14.9	32.0	35.0	0.164	-	0.54	503	14.64	2044	1800
1 x 150/16KON	16.6	33.7	36.7	0.132	-	0.58	577	18.30	2364	2250
1 x 185/16KON	18.0	35.1	38.1	0.108	-	0.63	658	22.57	2709	2775
1 x 240/16KON	21.3	39.4	42.4	0.0817	-	0.69	771	29.28	3446	3600
8.7/15 kV NTMCGCWÖU										
1 x 16/16KON	5.7	22.6	24.6	1.240	-	0.22	150	1.95	760	240
1 x 25/16KON	6.9	24.8	27.8	0.795	-	0.25	198	3.05	954	375
1 x 35/16KON	8.1	26.4	29.4	0.565	-	0.28	245	4.27	1101	525
1 x 50/16KON	9.7	28.0	31.0	0.393	-	0.31	307	6.10	1304	750
1 x 70/16KON	11.2	30.5	33.5	0.277	-	0.35	378	8.54	1623	1050
1 x 95/16KON	13.2	32.5	35.5	0.210	-	0.39	455	11.59	1912	1425
1 x 120/16KON	14.9	34.2	37.2	0.164	-	0.42	530	14.64	2219	1800
1 x 150/16KON	16.6	36.9	39.9	0.132	-	0.46	611	18.30	2637	2250
1 x 185/16KON	18.0	38.3	41.3	0.108	-	0.50	697	22.57	2995	2775
1 x 240/16KON	21.3	41.6	44.6	0.0817	-	0.54	820	29.28	3658	3600
12/20 kV NTMCGCWÖU										
1 x 16/16KON	5.7	26.0	29.0	1.240	-	0.20	150	1.95	971	240
1 x 25/16KON	6.9	27.2	30.2	0.795	-	0.22	198	3.05	1090	375
1 x 35/16KON	8.1	28.4	31.4	0.565	-	0.25	245	4.27	1236	525
1 x 50/16KON	9.7	31.0	34.0	0.393	-	0.27	307	6.10	1680	750
1 x 70/16KON	11.2	32.5	35.5	0.277	-	0.30	378	8.54	1776	1050
1 x 95/16KON	13.2	34.5	37.5	0.210	-	0.33	455	11.59	2170	1425
1 x 120/16KON	14.9	37.2	40.2	0.164	-	0.36	530	14.64	2481	1800
1 x 150/16KON	16.6	38.9	41.9	0.132	-	0.39	611	18.30	3020	2250
1 x 185/16KON	18.0	40.3	43.3	0.108	-	0.42	697	22.57	3182	2775
1 x 240/16KON	21.3	43.6	46.6	0.0817	-	0.45	820	29.28	3870	3600

(1) For single-core laying

# TRATOS ASNZS MTO®

Also meets the requirements of the Tunnelling Industry.





# TRATOS VDE MTO<sup>®</sup>

RUBBER SHEATHED FLEXIBLE CABLES / (N)SHÖU-J

## TRATOS FESTOON MTO<sup>®</sup>-M

Rubber-sheathed flexible cables for open-cast mining, suitable for laying alongside conveyor belts (also for shiftable units) and on material handling equipment, even when the cable is moved continuously, e.g. in cable suspension fittings and as connection between upper and lower cars. The cables are also suitable for connection of submersible pump units.

### FEATURES AND PERFORMANCES



#### CONSTRUCTION

- **Conductor:** Electrolytic copper, not tinned, finely stranded, Class 5 (refer also to DIN VDE 0295)
- **Insulation:** TRATOS MTO, basic material EPR, compound type: special compound (refer also to DIN VDE 0207, Part 20)
- **Core arrangement:** Three main conductors laid-up together with the protective-earth conductor, from 50 mm<sup>2</sup> with protective-earth conductor split into three in the outer interstices
- **Inner sheath:** Basic material EPR, compound type: special compound (refer also to DIN VDE 0207, Part 21)
- **Outer sheath:** Basic material CM, compound type: special compound, colour black (refer also to DIN VDE 0207, Part 21)
- **Core identification:** Natural colouring with black digits printed consecutively
- **Marking:** (Year of manufacture) TRATOS FESTOON MTO-M (N) SHÖU (number of cores) x (cross-section) (rated voltage)

#### STANDARDS

- DIN VDE 0250, Part 812

<b>Electrical parameters</b>			
<b>Rated voltage</b>	<ul style="list-style-type: none"> <li>• Control cables</li> <li>• Power cables</li> </ul>	U <sub>0</sub> /U = 450/750 V U <sub>0</sub> /U = 0.6/1 kV	
<b>Maximum permissible operating voltage in AC systems</b>		U <sub>0</sub> /U = 476/825 V to 0.7/1.2 kV	
<b>Maximum permissible operating voltage in DC systems</b>		U <sub>0</sub> /U = 619/1238 V to 0.9/1.8 kV	
<b>AC test voltage</b>		2.5 kV to 3 kV according to DIN VDE 0250, Part 812	
<b>Current-carrying capacity</b>		According to DIN VDE 0298, Part 4	
<b>Thermal parameters</b>			<b>Type K</b>
<b>Ambient temperature</b>	<ul style="list-style-type: none"> <li>• Fully flexible operation</li> <li>• Fixed installation</li> </ul>	-30 °C to + 80 °C -40 °C to + 80 °C	-60 °C to + 60 °C -60 °C to + 60 °C
<b>Maximum permissible operating temperature of the conductor</b>		90 °C	
<b>Short-circuit temperature of the conductor</b>		250 °C	
<b>Mechanical parameters</b>			
<b>Tensile load</b>		Up to 15 N/mm <sup>2</sup>	
<b>Torsional stresses</b>		±100 °/m	
<b>Minimum bending radii</b>		According to DIN VDE 0298, Part 3	
<b>Travel speed on rewinding with drum car</b>		Up to 100 m/min	
<b>Additional tests</b>		Roller bending test, torsional stress test, reversed bending test, water compatibility according to HD22.16	
<b>Chemical parameters</b>			
<b>Resistance to oil</b>		Given to DIN VDE 0473, Part 811-2-1, Para. 10	
<b>Behaviour in case of fire</b>		Given to DIN VDE 0482, Part 265-2-1	
<b>Weather resistance</b>		Unrestricted use outdoors and indoors, resistant to ozone and moisture	

## TRATOS FESTOON MTO®-M

Nominal Cross Sectional Area	Conductor diameter (guidance value)	Overall diameter of cable (guidance value)		Conductor resistance at 20 °C	Current carrying capacity at 30 °C	Permissible shortcircuit current (1s)	Approx. net weight	Maximum permissible tensile force
		Min. value	Max. value					
mm <sup>2</sup>	mm	mm	mm	Ω/km	A	kA	kg/km	N
(N)SHÖU-O								
1x16	5.7	9.5	11.1	1.210	99	1.95	230	240
1x25	6.7	11.0	12.6	0.780	131	3.05	335	375
1x35	8.0	12.3	13.9	0.554	162	4.27	435	525
1x50	9.5	14.6	16.6	0.386	202	6.10	620	750
1x70	11.0	16.4	18.4	0.272	250	8.54	835	1050
1x95	13.1	18.8	20.8	0.206	301	11.59	1070	1425
1x120	14.8	20.7	22.7	0.161	352	14.64	1340	1800
1x150	16.5	22.8	24.8	0.129	404	18.30	1650	2250
1x185	17.9	24.7	27.7	0.106	461	22.57	2020	2775
1x240	21.2	28.0	31.0	0.080	547	29.28	2600	3600
1x300	23.6	31.6	34.6	0.064	633	36.60	3250	4500
(N)SHÖU-J								
2x1.5	1.5	9.8	11.4	13.300	23	0.18	160	45
2x2.5	2.0	10.7	12.3	7.980	30	0.31	200	75
2x4	2.6	11.9	13.5	4.950	41	0.49	260	120
3x2.5	2.0	11.2	12.8	7.980	30	0.31	230	113
3x4	2.6	12.5	14.1	4.950	41	0.49	300	180
3x6	3.2	13.9	15.5	3.300	53	0.73	380	270
3x10	4.2	16.6	18.6	1.910	74	1.22	575	450
4x1.5	1.5	11.0	12.6	13.300	23	0.18	210	90
4x2.5	2.0	12.0	13.7	7.980	30	0.31	270	150
4x4	2.6	13.5	15.1	4.950	41	0.49	355	240
4x6	3.2	15.7	17.7	3.300	53	0.73	490	360
4x10	4.2	18.0	20.0	1.910	74	1.22	700	600
4x16	5.7	22.7	24.7	1.210	99	1.95	1110	960
4x25	6.7	26.8	29.8	0.780	131	3.05	1660	1500
4x35	8.0	29.9	32.9	0.554	162	4.27	2140	2100
3 x 50 + 3 x 25/3	9.5	32.5	32.5	0.386	202	6.10	2560	2250
3 x 70 + 3 x 35/3	11.0	36.4	39.4	0.272	250	8.54	3420	3150
3 x 95 + 3 x 50/3	13.1	42.1	45.1	0.206	301	11.59	4480	4275
3 x 120 + 3 x 70/3	14.8	46.3	49.3	0.161	352	14.64	5710	5400
5x1.5	1.5	11.9	13.5	13.300	23	0.18	245	113
5x2.5	2.0	13.0	14.6	7.980	30	0.31	310	188
5x4	2.6	15.3	17.3	4.950	41	0.49	445	300
5x6	3.2	17.0	19.0	3.300	53	0.73	580	450
5x10	4.2	20.4	22.4	1.910	74	1.22	875	750
5x16	5.7	24.3	27.3	1.210	99	1.95	1320	1200
5x25	6.7	29.3	32.3	0.780	131	3.05	1990	1875

## TRATOS FESTOON MTO®-M

Nominal Cross Sectional Area	Conductor diameter (guidance value)	Overall diameter of cable (guidance value)		Conductor resistance at 20 °C	Current carrying capacity at 30 °C	Permissible shortcircuit current (1s)	Approx. net weight	Maximum permissible tensile force
		Min. value mm	Max. value mm					
mm <sup>2</sup>	mm			Ω/km	A	kA	kg/km	N
7x1.5	1.5	13.0	14.6	13.300	23	0.18	300	158
8x1.5	1.5	13.8	15.4	13.300	23	0.18	325	180
10x1.5	1.5	15.5	17.5	13.300	23	0.18	400	225
12x1.5	1.5	16.5	18.5	13.300	23	0.18	450	270
7x2.5	2.0	15.0	17.0	7.980	30	0.31	420	263
10x2.5	2.0	17.3	19.3	7.980	30	0.31	525	375
12x2.5	2.0	17.8	19.8	7.980	30	0.31	590	450
18x2.5	2.0	21.2	23.2	7.980	30	0.31	840	675
24x2.5	2.0	23.2	25.5	7.980	30	0.31	900	900

### TRATOSFLEX MTO<sup>®</sup>-MSR

Control, signalling and bus cables with the necessary transmission characteristics used for electric and electronic equipment, such as for measured value and process data processing and automation units in open-cast mining applications. Suitable for laying alongside conveyor belts and on material handling equipment

## FEATURES AND PERFORMANCES



### CONSTRUCTION

- **Conductor:** Finely stranded copper conductor, Class 5 (refer also to DIN VDE 0295)
- **Insulation:** Basic material: Polyethylene (PE), compound type: 2Y11 (refer also to DIN VDE 0207, Part 20)
- **Core arrangement:** Cores are laid-up in pairs in layers with a continuous serving of non-hygroscopic material over the conductor assembly
- **Inner sheath:** Basic material (special compound type) CM, compound type: EM2 (refer also to DIN VDE 0207, Part 21)
- **Screen:** Screen braiding of tinned copper wires between inner and outer sheath
- **Outer sheath:** Basic material (special compound type) CM, compound type: EM2 (refer also to DIN VDE 0207, Part 21)
- **Core identification:** Cores black with white digits printed thereon
- **Marking:** TRATOSFLEX MTO-MSR 2YSLGCGÖU (number of cores) x (cross-section) (rated voltage)

Electrical parameters			
Rated voltage	U = 250 V/250 V		
Maximum permissible operating voltage in AC systems	U = 350 V (peak value)		
Maximum permissible operating voltage in DC systems	U = 350 V (peak value)		
AC test voltage	1.5 kV		
Current-carrying capacity	According to DIN VDE 0298, Part 4		
Thermal parameters			Type K
Ambient temperature	<ul style="list-style-type: none"> <li>Fully flexible operation</li> <li>Fixed installation</li> </ul>	-30 °C to + 80 °C -40 °C to + 80 °C	-60 °C to + 60 °C -60 °C to + 60 °C
Maximum permissible operating temperature of the conductor	60 °C		
Short-circuit temperature of the conductor	150 °C		
Mechanical parameters			
Tensile load	Up to 15 N/mm <sup>2</sup>		
Torsional stresses	±25 °/m		
Minimum bending radii	According to DIN VDE 0298, Part 3		
Chemical parameters			
Resistance to oil	Given to DIN VDE 0473, Part 811-2-1, Para. 10		
Behaviour in case of fire	Given to DIN VDE 0482, Part 265-2-1, Para. 10		
Weather resistance	Unrestricted use outdoors and indoors, resistant to ozone and moisture		

## TRATOSFLEX MTO®-MSR

Nominal Cross Sectional Area	Cu factor for 1000 m	Conductor diameter Max.	Overall diameter of cable (guidance value)		Conductor resistance at 20 °C	Current carrying capacity at 30 °C	Operating capacitance per unit length at 800 Hz	Attenuation per unit length Max.		Coupling resistance of shield Max. at 30 MHz	Approx. net weight	Maximum permissible tensile force
			Min. value	Max. value				800 Hz	100 kHz			
mm <sup>2</sup>		mm	mm	mm	Ω/km	A	nF/km	dB/km	dB/km	W/km	kg/km	N
2YSLGCGÖU												
2x2x1	142	1,5	11	13	19,5	12	65	1	3(+0.5)	25	245	60
5x2x1	238	1.5	16	19	19.5	8.5	65	1	3(+0.5)	10	440	150
10x2x1	353	1.5	20	23	19.5	6.5	65	1	3(+0.5)	10	700	300
20x2x1	576	1.5	25	29	19.5	5	65	1	3(+0.5)	20	1040	600

# TRATOS VDE MTO®

OPTICAL FIBRE CABLE

## TRATOSFIBRE-DB®

Fibre optic cable.

### FEATURES AND PERFORMANCES



#### CONSTRUCTION

- 1) Optical fibre
- 2) Central support
- 3) Kevlar reinforcement
- 4) Antitorsional protection
- 5) Outer sheath black colour Tratosfibre-DB-OS®

Part Number	Fibres	Types (1)	Nominal Overall Diameter mm	Maximum Tensile Load N	Nominal Cable Weight Kg/Km	Minimum Bendig Radius mm
TFBG06	multiple-mode grade index	6 G 62,5/125	14	5000	225	130 festoon application 250 reeling application
TFBG12	multiple-mode grade index	12 G 62,5/125	14	5000	225	
TFBG18	multiple-mode grade index	18 G 62,5/125	14	5000	225	
TFBG24	multiple-mode grade index	24 G 62,5/125	14	5000	225	
TFBE06	monomode	6 E 9/125	14	5000	225	
TFBE12	monomode	12 E 9/125	14	5000	225	
TFBE18	monomode	18 E 9/125	14	5000	225	
TFBE24	monomode	24 E 9/125	14	5000	225	

(1) 50/125 type produced upon request



<b>OPTICAL parameters</b>		
	<b>Grade index fibre 62,5/125</b>	<b>Monomode fibre E9/125</b>
<b>Max attenuation at wavelength 850 nm</b>	3,2 dB/km	-
<b>Max attenuation at wavelength 1300 nm</b>	0,9 dB/km	0,4 dB/km
<b>Max attenuation at wavelength 1550 nm</b>	-	0,3 dB/km
<b>Bandwidth at 850 nm</b>	≥ 400 MHz	-
<b>Bandwidth at 1300 nm</b>	≥ 600 MHz	-
<b>Numerical aperture</b>	0,275 ± 0,015	0,140 ± 0,02
<b>Attenuation on completed cable (max) at wavelength 1300 nm</b>	5,00 dB/km	2,00 dB/km
<b>THERMAL parameters</b>		<b>Type K</b>
<b>Fully flexible operation (ambient temperature)</b>	-30 °C to + 80 °C	-60 °C to + 60 °C
<b>Fixed installation</b>	-40 °C to + 80 °C	-60 °C to + 60 °C
<b>THERMAL parameters</b>		
<b>Max tensile strength</b>	5000 N	
<b>Minimum bending radius for fixed installation</b>	130 mm	
<b>Minimum bending radius for cylindrical reel</b>	250 mm	
<b>Travel speed for festoon systems</b>	up to 240 m/min	
<b>CHEMICAL parameters</b>		
Transmission data of the fibre-optics		
<b>Weather resistance</b>	Resistant to ozone, UV and moisture	
<b>Resistance to oil</b>	Acc. to DIN VDE 0473	
<b>Travel Condition:</b>		
<b>Main application</b>	Monospiral Reel One Way	Festoon
<b>Suitable m/min Max</b>	-	-
<b>Operating max speed (mt/min)</b>	300	240

### TRATOS MTO<sup>®</sup>-Z

Used as power supply connection cable for mobile equipment in underground mining applications, such as coal shearer, tunnel driving machines and scoops (LHDs). (Z) Coal cutter cables are designed for free trailing operation and due to their special construction may be trailed for considerable distances behind the machine during operation.

## FEATURES AND PERFORMANCES



### CONSTRUCTION

- **Conductor:** Finely stranded copper conductor, tinned, Class 5 (refer also to DIN VDE 0295)
- **Protective-earth conductor:** steel/Cu stranded braid between the inner and outer sheath
- **Control core:** double-concentric control/monitoring conductor elements in the outer interstice
- **Insulation:** TRATOS MTO, basic material EPR, compound type: 3GI3 (refer also to DIN VDE 0207, Part 20)
- **Electrical field control:** Outer semiconductive layer of semiconductive cold-strippable rubber
- **Core arrangement:** Three main cores laid-up, with double-concentric control/monitoring conductor elements in the outer interstice; length of lay approx. 6 x D
- **Inner sheath:** Vulcanized rubber inner sheath; basic material EPR, compound type: GM1b
- **Reinforced braid:** Braid of steel/copper wires in a vulcanized bond between inner and outer sheath
- **Outer sheath:** TRATOS MTO, basic material PCP, compound type: 5GM5, colour yellow
- **Core identification:** Main cores coloured, black, blue, brown  
Control cores blue
- **Marking:** (Year of manufacture) <VDE> TRATOS MTO-Z  
NSSHCGEÖU (number of cores) x (cross-section))

### STANDARDS

- DIN VDE 0250, Part 812

Electrical parameters			
Rated voltage	U <sub>0</sub> /U = 0.6/1 kV		
Maximum permissible operating voltage in AC systems	U <sub>0</sub> /U = 0.7/1.2 kV		
Maximum permissible operating voltage in DC systems	U <sub>0</sub> /U = 0.9/1.8 kV		
AC test voltage	Power cores: 3 kV Control cores: 2 kV		
Current-carrying capacity	According to DIN VDE 0298, Part 4		
Thermal parameters			Type K
Ambient temperature	<ul style="list-style-type: none"> <li>Fully flexible operation</li> <li>Fixed installation</li> </ul>	-30 °C to + 80 °C -40 °C to + 80 °C	-60 °C to + 60 °C -60 °C to + 60 °C
Maximum permissible operating temperature of the conductor	90 °C		
Short-circuit temperature of the conductor	200 °C		
Mechanical parameters			
Breaking load of the steel braid	Min. 40 kN		
Minimum bending radii	4 x D		
Chemical parameters			
Resistance to oil	Given to DIN VDE 0473, Part 811-2-1, Para. 10		
Behaviour in case of fire	Given to DIN VDE 0482, Part 265-2-1, Para. 10		
Weather resistance	Unrestricted use outdoors and indoors, resistant to ozone and moisture		

## TRATOS MTO®-Z

Nominal Cross Sectional Area mm <sup>2</sup>	Conductor diameter (guidance value) mm	Overall diameter of cable (guidance value)		Breaking load of the braid kN	Conductor resistance at 20 °C Ω/km	Inductance per unit length mH/km	Operating capacitance per unit length μF/km	Current carrying capacity at 30 °C A	Permissible shortcircuit current (1s) kA	Approx. net weight kg/km
		Min. value mm	Max. value mm							
0.6/1 kV NSSHCGEÖU										
3x16+3x(1.5STKON+16/3KON)	5.8	40	44	40	1.21	0.27	0.51	99	1.95	2740
3x25/16KON+3x(1.5STKON/1.5ÜLKON)	7.1	42	46	40	0.78	0.25	0.6	131	3.05	2950
3x35/16KON+3x(1.5STKON/1.5ÜLKON)	8.4	42	46	40	0.554	0.24	0.69	162	4.27	3250
3x50/25KON+3x(1.5STKON/1.5ÜLKON)	9.9	48	52	40	0.386	0.23	0.72	202	6.10	4180
3x70/35KON+3x(1.5STKON/1.5ÜLKON)	11.9	52	57	45	0.272	0.23	0.84	250	8.54	5160
3x95/50KON+3x(1.5STKON/1.5ÜLKON)	13.9	60	65	45	0.206	0.23	0.86	301	11.59	7230
3x70/35KON+3x(1.5STKON/1.5ÜLKON)	11.9	52	57	45	0.272	0.23	0.84	250	8.54	5160
3x95/50KON+3x(1.5STKON/1.5ÜLKON)	13.9	60	65	45	0.206	0.23	0.86	301	11.59	7230
0.6/1 kV NTSCGERLWÖU										
3x16+3x(1.5STKON+16/3KON)	5.8	41	45	40	1.21	0.27	0.51	99	1.95	2980
3x70+3x(1.5STKON+35/3KON)	11.9	51	56	45	0.272	0.23	0.84	250	8.54	5210
3x95+3x(1.5STKON+50/3KON)	13.9	59	64	45	0.206	0.23	0.86	301	11.59	6860
3x150+3x(1.5STKON+70/3KON)	17.6	68	74	45	0.129	0.22	0.92	404	18.30	9590

### TRATOS MTO<sup>®</sup>-V

Used as power supply connection cable for mobile equipment and machines in underground mining applications, such as coal cutting machines, etc. (V) Coal cutter cables are designed for use in cable protection chains, which are trailed behind the machine and which absorb the thereby occurring tensile forces.

## FEATURES AND PERFORMANCES



### CONSTRUCTION

- **Conductor:** Finely stranded copper conductor, tinned, Class 5 (refer also to DIN VDE 0295)
- **Protective-earth conductor:** overall concentric steel/copper wire spinning
- **Control core:** double-concentric control/monitoring conductor elements in the center element
- **Insulation:** TRATOS MTO, basic material EPR, compound type: 3GI3 (refer also to DIN VDE 0207, Part 20)
- **Electrical field control:** Outer semiconductive layer of semiconductive cold-strippable rubber
- **Core arrangement:** Three or six main cores laid-up, with double-concentric control/monitoring conductor elements in the outer interstice; length of lay approx. 6 x D
- **Inner sheath:** Vulcanized rubber inner sheath; basic material EPR, compound type: GM1b (refer also to DIN VDE 0207, Part 21)
- **Outer sheath:** TRATOS MTO, basic material PCP, compound type: 5GM5, colour yellow (refer also to DIN VDE 0207, Part 21)
- **Core identification:** Main cores coloured, black, blue, brown  
Control cores white, monitoring cores orange
- **Marking:** (Year of manufacture) <VDE> TRATOS MTO-V  
NSSHCGEÖU or NTSKCGECWÖU (number of cores) x (cross-section)

### STANDARDS

- DIN VDE 0250, Part 812 or Part 813;

<b>Electrical parameters</b>			
<b>Rated voltage</b>		U <sub>0</sub> /U = 0.6/1 kV; 1.8/3 kV; 3.6/6 kV	
<b>Maximum permissible operating voltage in AC systems</b>		U <sub>0</sub> /U = 0.7/1.2 kV; 2.1/3.6 kV; 4.2/7.2 kV	
<b>Maximum permissible operating voltage in DC systems</b>		U <sub>0</sub> /U = 0.9/1.8 kV; 2.7/5.4 kV; 5.4/10.8 kV	
<b>AC test voltage</b>		<ul style="list-style-type: none"> <li>• Power cores: 3 kV; 6 kV; 11 kV</li> <li>• Control cores: 2 kV</li> </ul>	
<b>Current-carrying capacity</b>		According to DIN VDE 0298, Part 4	
<b>Thermal parameters</b>			<b>Type K</b>
<b>Ambient temperature</b>	<ul style="list-style-type: none"> <li>• Fully flexible operation</li> <li>• Fixed installation</li> </ul>	-30 °C to + 80 °C -40 °C to + 80 °C	-60 °C to + 60 °C -60 °C to + 60 °C
<b>Maximum permissible operating temperature of the conductor</b>		90 °C	
<b>Short-circuit temperature of the conductor</b>		200 °C	
<b>Mechanical parameters</b>			
<b>Tensile load</b>		Up to 15 N/mm <sup>2</sup> , however, only 5 N/mm <sup>2</sup> for a bending radius of 2.3 x D <sup>(1)</sup>	
<b>Minimum bending radii</b>		According to DIN VDE 0298, Part 3, or 2.3 x D <sup>(1)</sup> at a tensile load of max. 5 N/mm <sup>2</sup>	
<b>Minimum distance with S-type directional changes</b>		20 x D <sup>(1)</sup>	
<b>Chemical parameters</b>			
<b>Resistance to oil</b>		Given to DIN VDE 0473, Part 811-2-1, Para. 10	
<b>Behaviour in case of fire</b>		Given to DIN VDE 0482, Part 265-2-1, Para. 10	
<b>Weather resistance</b>		Unrestricted use outdoors and indoors, resistant to ozone and moisture	

(1) D = overall diameter of the cable.

## TRATOS MTO®-V

Nominal Cross Sectional Area  mm <sup>2</sup>	Conductor diameter (guidance value)  mm	Overall diameter of cable (guidance value)		Conductor resistance at 20 °C  Ω/km	Inductance per unit length  mH/km	Operating capacitance per unit length  µF/km	Current carrying capacity at 30 °C  A	Permissible shortcircuit current (1s)  kA	Approx. net weight  kg/km	Maximum permissible tensile force  N
		Min. value  mm	Max. value  mm							
0.6/1 kV NSSHCGEÖU										
3x25/16KON+3x(1.5STKON/1.5ÜLKON)	7.1	40.0	44.0	0.795	0.25	0.60	131	3.05	2850	1125
3x35/16KON+3x(1.5STKON/1.5ÜLKON)	8.4	40.0	44.0	0.565	0.24	0.69	162	4.27	3070	1575
3x50/25KON+3x(1.5STKON/1.5ÜLKON)	9.9	46.0	50.0	0.393	0.24	0.72	202	6.1	4010	2250
3x70/35KON+3x(1.5STKON/1.5ÜLKON)	11.9	48.0	52.0	0.277	0.23	0.84	250	8.54	4970	3150
3x95/50KON+3x(1.5STKON/1.5ÜLKON)	13.9	56.0	61.0	0.210	0.23	0.86	301	11.59	6580	4275
1.8/3 kV NTSKCGECWÖU										
3x35+3x(1.5STKON+25/3KON)+ÜLKON	8.4	43.0	48.0	0.554	0.29	0.49	162	4.27	3850	1575
3x50+3x(1.5STKON+25/3KON)+ÜLKON	9.9	47.0	52.0	0.368	0.28	0.56	202	6.10	4840	2250
3x70+3x(1.5STKON+35/3KON)+ÜLKON	11.9	54.0	59.0	0.272	0.27	0.64	250	8.54	6180	3150
3x95+3x(1.5STKON+50/3KON)+ÜLKON	13.9	60.5	65.5	0.206	0.26	0.67	301	11.59	7920	4275
3.6/6 kV NTSKCGECWÖU										
3x35+3x(1.5STKON+25/3KON)+ÜLKON	8.4	45.0	50.0	0.554	0.31	0.38	162	4.27	4040	1575
3x50+3x(1.5STKON+50/3KON)+ÜLKON	9.9	49.0	54.0	0.368	0.30	0.43	202	6.10	5050	2250
3x70+3x(1.5STKON+70/3KON)+ÜLKON	11.9	55.5	60.5	0.272	0.29	0.49	250	8.54	6410	3150
3x95+3x(1.5STKON+95/3KON)+ÜLKON	13.9	60.5	65.5	0.206	0.28	0.55	301	11.59	7970	4275
1.8/3 kV NTSKCGECWÖU										
3x50+3x(35+35/3KON)+ 2x(0.75STKON)+1x(2x0.75ÜLKON)	9.9	62.5	67.5	0.368	0.40	0.56	162	6.10	8150	3825
3x70+3x(50+50/3KON)+ 2x(0.75STKON)+1x(2x0.75ÜLKON)	11.9	70.0	75.0	0.272	0.39	0.64	200	8.54	10050	5400
3x95+3x(70+70/3KON)+ 2x(0.75STKON)+1x(2x0.75ÜLKON)	13.9	80.0	85.0	0.206	0.38	0.67	241	11.59	12950	7425
3.6/6 kV NTSKCGECWÖU										
3x35+3x(35+35/3KON)+ 2x(0.75STKON)+1x(2x0.75ÜLKON)	8.4	65.5	70.5	0.544	0.44	0.37	130	4.27	7570	2700
3x50+3x(50+50/3KON)+ 2x(0.75STKON)+1x(2x0.75ÜLKON)	9.9	69.0	74.0	0.368	0.42	0.43	152	6.10	9060	3825
3x70+3x(70+70/3KON)+ 2x(0.75STKON)+1x(2x0.75ÜLKON)	11.9	75.5	80.5	0.272	0.40	0.49	200	8.54	11250	5400
3x95+3x(95+95/3KON)+ 2x(0.75STKON)+1x(2x0.75ÜLKON)	13.9	84.5	89.5	0.206	0.39	0.55	241	11.59	13520	7425



# TRATOS MTO®

based on AS/NZS, VDE, BS, UL, CSA, MSHA, OSHA

Specifically customized for the mining market;  
TRATOS MTO® is designed to **resist sunlight**,  
**water, extreme temperature**, chemical,  
oil and **abrasion**, while also performing  
**consistently** in tough drilling environments.  
The voltage range for TRATOS MTO®  
is between **600V** and **35KV**.



Cables for a moving world



# TRATOS VDE MTO®

RUBBER-SHEATHED FLEXIBLE CABLES / NSSHÖU

## TRATOS MTO®-F .../3E

The cables are suitable for fixed installation as power supply cables to motors, distribution boards, etc., for underground mining applications, for tunnel building applications, for open-cast mining applications, for use in quarries and similar applications. Permitted for applications according to DIN VDE 0118.

### FEATURES AND PERFORMANCES



#### CONSTRUCTION

- **Conductor:** Finely stranded copper conductor, tinned, Class 5 (refer also to DIN VDE 0295)
- **Insulation:** TRATOS MTO, basic material EPR, compound type: 3GI3 (refer also to DIN VDE 0207, Part 20)
- **Arrangement of protective-earth conductor:** Individual-concentric lay or overall concentric lay
- **Core arrangement:** Three, four or five cores laid-up
- **Inner sheath:** Vulcanized rubber inner sheath; basic material EPR, compound type: GM1b (refer also to DIN VDE 0207, Part 21)
- **Outer sheath:** Basic material PCP, rubber compound: 5GM5, colour yellow (refer also to DIN VDE 0207, Part 21)
- **Core identification:** Up to five cores coloured Core colours: black, blue, brown, black, black
- **Marking:** (Year of manufacture) <VDE> TRATOS MTO-F.../3E NSSHÖU (number of cores) x (cross-section)

#### STANDARDS

- DIN VDE 0250, Part 812

<b>Electrical parameters</b>			
<b>Rated voltage</b>		$U_0/U = 0.6/1$ kV	
<b>Maximum permissible operating voltage in AC systems</b>		$U_0/U = 0.7/1.2$ kV	
<b>Maximum permissible operating voltage in DC systems</b>		$U_0/U = 0.9/1.8$ kV	
<b>AC test voltage</b>		3 kV	
<b>Current-carrying capacity</b>		According to DIN VDE 0298, Part 4	
<b>Thermal parameters</b>			<b>Type K</b>
<b>Ambient temperature</b>	<ul style="list-style-type: none"> <li>• Fully flexible operation</li> <li>• Fixed installation</li> </ul>	-30 °C to + 80 °C -40 °C to + 80 °C	-60 °C to + 60 °C -60 °C to + 60 °C
<b>Maximum permissible operating temperature of the conductor</b>		90 °C	
<b>Short-circuit temperature of the conductor</b>		200 °C	
<b>Mechanical parameters</b>			
<b>Tensile load</b>		Up to 15 N/mm <sup>2</sup> ,	
<b>Minimum bending radii</b>		According to DIN VDE 0298, Part 3	
<b>Chemical parameters</b>			
<b>Resistance to oil</b>		Given to DIN VDE 0473, Part 811-2-1, Para. 10	
<b>Behaviour in case of fire</b>		Given to DIN VDE 0482, Part 265-2-1, Para. 10	
<b>Weather resistance</b>		Unrestricted use outdoors and indoors, resistant to ozone and moisture	

## TRATOS MTO®-F.../3E

Nominal Cross Sectional Area  mm <sup>2</sup>	Conductor diameter (guidance value)  mm	Overall diameter of cable (guidance value)		Conductor resistance at 20 °C  Ω/km	Inductance per unit length  mH/km	Operating capacitance per unit length  µF/km	Current carrying capacity at 30 °C  A	Permissible shortcircuit current (1s)  kA	Approx. net weight  kg/km	Maximum permissible tensile force  N
		Min. value  mm	Max. value  mm							
NSSHÖU.../3E										
3 x 1.5 + 3 x 1.5/3E	1.5	11.0	15.0	13.7	0.32	0.25	23	0.18	290	68
3 x 2.5 + 3 x 2.5/3E	2.0	13.0	17.0	8.21	0.28	0.28	30	0.31	335	113
3 x 4 + 3 x 4/3E	2.6	15.0	20.0	5.09	0.24	0.31	41	0.49	500	180
3 x 6 + 3 x 6/3E	3.2	17.0	21.0	3.39	0.21	0.37	53	0.73	600	270
3 x 10 + 3 x 10/3E	4.2	21.0	25.0	1.95	0.18	0.40	74	1.22	885	450
3 x 16 + 3 x 16/3E	5.7	24.0	30.0	1.24	0.15	0.51	99	1.95	1240	720
3 x 25 + 3 x 16/3E	7.0	28.0	34.0	0.795	0.14	0.53	131	3.05	1720	1125
3 x 35 + 3 x 16/3E	8.1	32.0	38.0	0.565	0.13	0.58	162	4.27	2240	1575
3 x 50 + 3 x 25/3E	9.7	37.0	44.0	0.393	0.12	0.62	202	6.10	3160	2250
3 x 70 + 3 x 35/3E	11.3	42.0	48.0	0.277	0.11	0.71	250	8.54	3960	3150
3 x 95 + 3 x 50/3E	13.1	47.0	55.0	0.21	0.10	0.76	301	11.59	5070	4275
3 x 120 + 3 x 70/3E	15.0	53.0	61.0	0.164	0.10	0.85	352	14.64	6460	5400
3 x 150 + 3 x 70/3E	16.6	59.0	67.0	0.132	0.10	0.85	404	18.3	7590	6750
3 x 185 + 3 x 95/3E	19.0	63.0	72.0	0.108	0.09	0.84	461	22.57	9330	8325
NSSHÖU.../3E + ST										
3 x 2.5 + 3 x 2.5/3E + 3 x 1.5ST	2.0	17.0	20.0	8.21	0.28	0.28	30	0.31	520	113
3 x 4 + 3 x 4/3E + 3 x 1.5ST	2.6	18.0	21.0	5.09	0.24	0.31	41	0.49	600	180
3 x 6 + 3 x 6/3E + 3 x 1.5ST	3.2	18.0	22.0	3.39	0.21	0.37	53	0.73	670	270
3 x 10 + 3 x 10/3E + 3 x 2.5ST	4.2	21.0	26.0	1.95	0.18	0.34	74	1.22	1010	450
3 x 16 + 3 x 16/3E + 3 x 2.5ST	5.7	24.0	30.0	1.24	0.15	0.51	99	1.95	1290	720
3 x 25 + 3 x 16/3E + 3 x 2.5ST	7.0	28.0	34.0	0.795	0.14	0.53	131	3.05	1780	1125
3 x 35 + 3 x 16/3E + 3 x 2.5ST	8.1	32.0	38.0	0.565	0.13	0.59	162	4.27	2300	1575
3 x 50 + 3 x 25/3E + 3 x 2.5ST	9.7	37.0	44.0	0.393	0.12	0.62	202	6.10	3200	2250
3 x 70 + 3 x 35/3E + 3 x 2.5ST	11.3	42.0	48.0	0.277	0.11	0.71	250	8.54	4010	3150
3 x 95 + 3 x 50/3E + 3 x 2.5ST	13.1	47.0	55.0	0.21	0.10	0.76	301	11.59	5100	4275
3 x 120 + 3 x 70/3E + 3 x 2.5ST	15.0	53.0	61.0	0.164	0.10	0.85	352	14.64	6510	5400
3 x 150 + 3 x 70/3E + 3 x 2.5ST	16.6	59.0	67.0	0.132	0.09	0.91	404	18.3	7600	6750
3 x 185 + 3 x 95/3E + 3 x 2.5ST	19.0	63.0	72.0	0.108	0.09	0.97	461	22.57	9400	8325
NSSHÖU.../KON										
3 x 1.5/1.5KON	1.5	11.0	14.0	13.70	0.30	0.25	23	0.18	265	68
3 x 2.5/2.5KON	2.0	13.0	16.0	8.21	0.26	0.28	30	0.31	335	113
4 x 6/6KON	3.2	18.0	22.0	3.39	0.21	0.37	53	0.73	375	360
4 x 10/10KON	4.2	22.0	27.0	1.95	0.18	0.32	74	1.22	1050	600
5 x 2.5/2.5KON	2.0	16.0	20.0	8.21	0.25	0.28	30	0.31	490	188
5 x 4/4KON	2.6	18.0	22.0	5.09	0.23	0.31	41	0.49	640	300
5 x 6/6KON	3.2	21.0	24.0	3.39	0.21	0.37	53	0.73	845	450





MEDIUM VOLTAGE FLEXIBLE CABLES FOR UNDERGROUND USE

**TRATOS MTO®-FU NYHSSYCY - PVC 3.6/6 kV**

**TRATOS MTO®-FU N3GHSSYCY - Rubber 3.6/6 kV to 12/20 kV**

As feeder cable for power supply of shiftable MV equipment e.g. explosion-proof transformers, for underground mining applications as well as for tunnel sites.

## FEATURES AND PERFORMANCES



### CONSTRUCTION

- **Conductor:** Finely stranded copper conductor, not tinned, Class 5 (refer also to DIN VDE 0295)
- **Insulation:** (refer also to DIN VDE 0207, Part 4 and Part 20)
  - PVC based thermoplastic compound, compound type: YI5
  - EPR based insulation compound, compound type: 3GI3
- **Arrangement of protective-earth conductor:** Individually laid-up concentrically around each main core
- **Electrical Field Control<sup>(1)</sup>:** Copper wire braiding individually laid-up concentrically as an outer semiconductive layer
- **Core arrangement:** Three main cores laid-up each with one control core in the outer interstices
- **Filler:** EPR filler compound
- **Intermediate sheath:** PVC based plastic compound, compound type: YM5
- **Monitoring conductor:** Conductive tape serving and overall concentric Cu wire spinning
- **Intermediate sheath:** PVC based plastic compound, compound type: YM5
- **Anti-torsion braid:** Braid of galvanized steel wires
- **Outer sheath:** PVC based thermoplastic compound, compound type: YM5, colour red
- **Marking:** (Year of manufacture) <VDE> TRATOS MTO-FU NYHSSYCY (cross-section) (rated voltage)
- **Core Identification:** Main cores bright, control cores: colour black with white digits

### STANDARDS

- DIN VDE 0250, Part 212 (for PVC)
- DIN VDE 0250, Part 605 (for Rubber)

(1) For TRATOS MTO®-FU Rubber: Inner and outer semiconductive layer of semiconductive rubber, for 6 kV outer semiconductive layer only



		TRATOS MTO-FU PVC		TRATOS MTO-FU Rubber	
<b>Electrical parameters</b>					
<b>Rated voltage</b>		U <sub>0</sub> /U = 3.6/6 kV		U <sub>0</sub> /U = 3.6/6 kV to 12/20 kV	
<b>Maximum permissible operating voltage in AC systems</b>		U <sub>0</sub> /U = 4.2/7.2 kV		U <sub>0</sub> /U = 4.2/7.2 kV to 13.9/24 kV	
<b>Maximum permissible operating voltage in DC systems</b>		U <sub>0</sub> /U = 5.4/10.8 kV		U <sub>0</sub> /U = 5.4/10.8 kV to 18/36 kV	
<b>AC test voltage</b>		11 kV		11 kV to 29 kV	
<b>Current-carrying capacity</b>		According to DIN VDE 0298, Part 4		According to DIN VDE 0298, Part 4	
<b>Thermal parameters</b>		<b>Type K</b>		<b>Type K</b>	
<b>Ambient temperature</b>	Fully flexible operation Fixed installation	-30 °C to +80 °C -40 °C to +80 °C	-60 °C to +60 °C -60 °C to +60 °C	-30 °C to +80 °C -40 °C to +80 °C	-60 °C to +60 °C -60 °C to +60 °C
<b>Maximum permissible operating temperature of the conductor</b>		70 °C		90 °C	
<b>Short-circuit temperature of the conductor</b>		150 °C		250 °C	
<b>Mechanical parameters</b>					
<b>Tensile load</b>		Up to 15 N/mm <sup>2</sup>		Up to 15 N/mm <sup>2</sup>	
<b>Minimum bending radii</b>		According to DIN VDE 0298, Part 3		According to DIN VDE 0298, Part 3	
<b>Chemical parameters</b>					
<b>Behaviour in case of fire</b>		Given to DIN VDE 0482, Part 265-2-1, Para. 10		Given to DIN VDE 0482, Part 265-2-1, Para. 10	
<b>Weather resistance</b>		Unrestricted use indoors and in underground mines according to DIN VDE 0118, resistant to ozone and moisture		Unrestricted use indoors and in underground mines according to DIN VDE 0118, resistant to ozone and moisture	

# TRATOS VDE MTO®

## TRATOS MTO®-FU PVC

Nominal Cross Sectional Area mm <sup>2</sup>	Conductor diameter (guidance value) mm	Overall diameter of cable (guidance value)		Conductor resistance at 20 °C Ω/km	Inductance per unit length mH/km	Operating capacitance per unit length μF/km	Current carrying capacity at 30 °C A	Permissible shortcircuit current (1s) kA	Approx. net weight kg/km	Maximum permissible tensile force N
		Min. value mm	Max. value mm							
3.6/6 kV NYHSSYCY PVC										
3x25+3x16/3E+3x2.5ST+ÜL	6.9	47.0	51.0	0.780	0.33	0.57	103	2.88	3900	1125
3x35+3x16/3E+3x2.5ST+ÜL	8.3	51.0	55.0	0.554	0.32	0.64	129	4.02	4500	1575
3x50+3x25/3E+3x2.5ST+ÜL	9.8	53.0	58.0	0.386	0.30	0.73	157	5.75	5500	2250
3x70+3x35/3E+3x2.5ST+ÜL	11.3	58.0	63.0	0.272	0.29	0.82	201	8.05	6500	3150
3x95+3x50/3E+3x2.5ST+ÜL	13.2	62.0	67.0	0.206	0.28	0.93	244	10.90	7800	4275
3x120+3x70/3E+3x2.5ST+ÜL	15.0	67.0	72.0	0.161	0.26	1.04	275	13.80	9000	5400

## TRATOS MTO®-FU Rubber

Nominal Cross Sectional Area mm <sup>2</sup>	Conductor diameter (guidance value) mm	Overall diameter of cable (guidance value)		Conductor resistance at 20 °C Ω/km	Inductance per unit length mH/km	Operating capacitance per unit length μF/km	Current carrying capacity at 30 °C A	Permissible shortcircuit current (1s) kA	Approx. net weight kg/km	Maximum permissible tensile force N
		Min. value mm	Max. value mm							
3.6/6 kV N3GHSSYCY Rubber										
3x25+3x16/3E+3x2.5ST+ÜL	6.9	49.0	53.0	0.780	0.36	0.22	131	3.05	4190	1125
3x35+3x16/3E+3x2.5ST+ÜL	8.3	52.0	56.0	0.554	0.34	0.25	162	4.27	4800	1575
3x50+3x25/3E+3x2.5ST+ÜL	9.8	55.0	59.0	0.386	0.32	0.28	202	6.10	5600	2250
3x70+3x35/3E+3x2.5ST+ÜL	11.3	59.0	63.0	0.272	0.31	0.31	250	8.54	6650	3150
3x95+3x50/3E+3x2.5ST+ÜL	13.2	63.0	67.0	0.206	0.29	0.35	301	11.59	7940	4275
6/10 kV N3GHSSYCY Rubber										
3x25+3x16/3E+3x2.5ST+ÜL	6.9	55.0	58.0	0.780	0.37	0.19	131	3.05	5300	1125
3x35+3x16/3E+3x2.5ST+ÜL	8.3	58.0	61.0	0.554	0.35	0.21	162	4.27	5910	1575
3x50+3x25/3E+3x2.5ST+ÜL	9.8	61.0	65.0	0.386	0.33	0.24	202	6.10	6790	2250
3x70+3x35/3E+3x2.5ST+ÜL	11.3	65.0	69.0	0.272	0.31	0.27	250	8.54	7860	3150
3x95+3x50/3E+3x2.5ST+ÜL	13.2	68.0	73.0	0.206	0.30	0.30	301	11.59	9180	4275
8.7/15 kV N3GHSSYCY Rubber										
3x25+3x16/3E+3x2.5ST+ÜL	6.9	58.0	62.0	0.780	0.40	0.17	139	3.05	6810	1125
3x35+3x16/3E+3x2.5ST+ÜL	8.2	61.0	65.0	0.554	0.37	0.19	172	4.27	7850	1575
3x50+3x25/3E+3x2.5ST+ÜL	9.8	64.7	68.7	0.386	0.36	0.21	215	6.10	9130	2250
3x70+3x35/3E+3x2.5ST+ÜL	11.3	67.9	71.9	0.272	0.34	0.23	265	8.54	10750	3150
3x95+3x50/3E+3x2.5ST+ÜL	13.2	72.4	76.4	0.206	0.33	0.26	319	11.59	12290	4275
12/20 kV N3GHSSYCY Rubber										
3x25+3x16/3E+3x2.5ST+ÜL	6.9	62.3	66.3	0.780	0.42	0.16	139	3.05	8790	1125
3x35+3x16/3E+3x2.5ST+ÜL	8.2	65.3	69.3	0.554	0.39	0.17	172	4.27	9930	1575
3x50+3x25/3E+3x2.5ST+ÜL	9.8	69.0	73.0	0.386	0.37	0.19	215	6.10	11360	2250
3x70+3x35/3E+3x2.5ST+ÜL	11.3	72.2	76.2	0.272	0.36	0.21	265	8.54	13100	3150
3x95+3x50/3E+3x2.5ST+ÜL	13.2	76.8	80.8	0.206	0.34	0.24	319	11.59	14750	4275





# TRATOS VDE MTO<sup>®</sup>

MINE HOIST CABLES FOR UNDERGROUND HOISTS / NTMTWÖU

## TRATOS MTO<sup>®</sup>-MH-FU

Used as suspended cable for intrinsically safe control of user-operated mine hoists (lifts) with telephonic connection in underground mines. TRATOS MTO rubber-sheathed flexible cables can be operated as self-supported cables of length up to 200 m with a safety factor of 5.

### FEATURES AND PERFORMANCES



#### CONSTRUCTION

- **Conductor:** Finely stranded copper conductor, tinned, Class 5 (refer also to DIN VDE 0295)
- **Insulation:** TRATOS MTO, basic material EPR, compound type: 3GI3 (refer also to DIN VDE 0207, Part 20)
- **Core arrangement:** Concentrically laid-up around a central steel support element
- **Anti-torsion braid:** Textile braid
- **Outer sheath:** TRATOS MTO, basic material PCP, compound type: 5GM5, colour blue (refer also to DIN VDE 0207, Part 21)
- **Core identification:** Coloured, colours: black, blue, brown
- **Marking:** (Year of manufacture) <VDE> TRATOS MTO-MH-FU NTMTWÖU (number of cores) x (cross-section)

#### STANDARDS

- DIN VDE 0250, Part 813,

Electrical parameters			
Rated voltage	U <sub>0</sub> /U = 0.6/1 kV		
Maximum permissible operating voltage in AC systems	U <sub>0</sub> /U = 0.7/1.2 kV		
Maximum permissible operating voltage in DC systems	U <sub>0</sub> /U = 0.9/1.8 kV		
AC test voltage	4 kV		
Current-carrying capacity	According to DIN VDE 0298, Part 4		
Thermal parameters			Type K
Ambient temperature	• Fully flexible operation	-30 °C to +80 °C	-60 °C to +60 °C
	• Fixed installation	-40 °C to +80 °C	-60 °C to +60 °C
Maximum permissible operating temperature of the conductor	90 °C		
Short-circuit temperature of the conductor	200 °C		
Mechanical parameters			
Tensile load	Up to 15 N/mm <sup>2</sup> Suspension length max. 200 m with a safety factor of 5		
Minimum bending radii	According to DIN VDE 0298, Part 3		
Travel speed	Max. 1.5 m/s		
Chemical parameters			
Resistance to oil	Given to DIN VDE 0473, Part 811-2-1, Para. 10		
Behaviour in case of fire	Given to DIN VDE 0482, Part 265-2-1, Para. 10		
Weather resistance	Unrestricted use outdoors and indoors, resistant to ozone and moisture		

## TRATOS MTO<sup>®</sup>-MH-FU

Nominal Cross Sectional Area mm <sup>2</sup>	Conductor diameter (guidance value) mm	Overall diameter of cable (guidance value)		Max. free suspension length m	Conductor resistance at 20 °C Ω/km	Current carrying capacity at 30 °C A	Permissible shortcircuit current (1s) kA	Approx. net weight kg/km
		Min. value mm	Max. value mm					
NTMTWÖU								
8 x 2.5ST + 2 x 1FM(C)	2.6	21.0	24.0	200	8.21	30.0	0.305	760
8 x 2.5ST + 10 x (2x1FM)C	2.6	34.0	37.5	200	8.21	30.0	0.305	1450
14 x 2.5ST + 6 x 1FM(C)	2.6	27.0	31.0	200	8.21	30.0	0.305	1200
18 x 2.5ST + 6 x 1FM(C)	2.6	38.0	42.0	200	8.21	30.0	0.305	1800

# TRATOS VDE MTO<sup>®</sup>

LOW VOLTAGE POWER CABLES / (N)SHTÖU

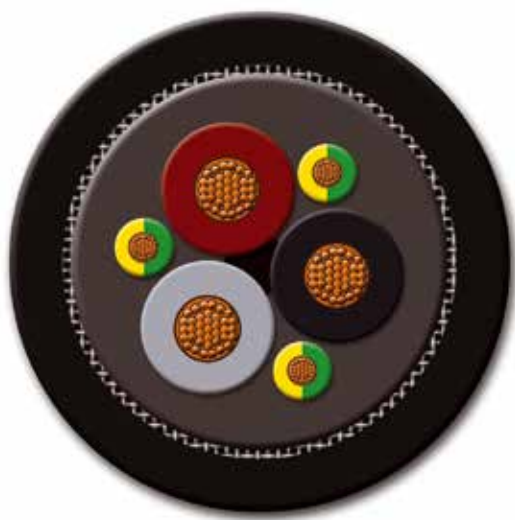
**TRATOSMART<sup>®</sup> MTO - (N)SHTÖU-J**

**TRATOSMART<sup>®</sup> MTO - (N)SHTÖU-JK<sup>(1)</sup>**

**TRATOSGREEN<sup>®</sup> MTO - (N)SHTÖU-J<sup>(1)</sup> - Reduced halogens and reduced toxicity<sup>(2)(3)</sup>**

Reduced dimension cable laid on ground for **reeling one way application**.

## FEATURES AND PERFORMANCES



### CONSTRUCTION

- 1) Tinned flexible conductor Cl. 5 VDE 0295
- 2) Insulation special compound Tratosmart-I<sup>®</sup>, better than EPR 3GI3 quality
- 3) Inner sheath special compound Tratosmart-IS<sup>®</sup>, better than GM1B quality
- 4) Antitorsional protection
- 5) Outer sheath black colour special compound Tratosmart-OS<sup>®</sup>, better than 5GM3 (or 5GM5 if required) quality

### STANDARDS

- VDE 0250 p.814

(1) Produced on request

(2) Toxicity index on finished cable <5

(3) Upon request special construction with copper braid screen according to **atex recommendations**

Electrical parameters				
Rated voltage	0,6/1 kV			
Maximum permissible operating voltage in AC systems	0,7/1,2 kV			
AC test voltage	3,5 kV			
Thermal parameters				
	Type K			
Fixed installation	-30 °C to + 80 °C		-60 °C to + 60 °C	
In operation	-40 °C to + 80 °C		-60 °C to + 60 °C	
Mechanical parameters				
Main application	Monospiral Reel	Spreader Reel	-	-
Suitable m/min Max	-	-	Tender System	Festoon
Operating max speed (mt/min)	200	200	60	240

**TRATOSMART-(N)SHTÖU-JZ - TRATOSMART-(N)SHTÖU-JZK - TRATOSGREEN-(N)SHTÖU-JZ**

Part Number	Nominal Cross Section mm <sup>2</sup>	Nominal Conductor Diameter mm	Maximum Conductor DC Resistance at 20 °C Ω/Km	Maximum Temperature of the Conductor During Operation °C	Maximum Temperature of the Conductor During Short Circuit °C	Max. Tensile Load During Installation and Operation N	Minimum Overall Diameter mm	Maximum Overall Diameter mm	Nominal Cable Weight Kg/m
FSA401	4x1,5	1,6	13,7	90	250	120	12,0	14,0	0,240
FSA402	4x2,5	2,1	8,21	90	250	200	13,3	15,3	0,350
FSA404	4x4	2,5	5,09	90	250	320	16,0	18,0	0,470
FSA406	4x6	3,1	3,39	90	250	480	17,6	19,6	0,630
FSA410	4x10	4,2	1,95	90	250	800	21,5	23,5	0,940
FSA416	4x16	5,4	1,24	90	250	1280	24,0	27,0	1,260
FSA425	4x25	6,5	0,795	90	250	2000	28,5	31,5	1,840
FSA435	4x35	7,9	0,565	90	250	2800	32,5	35,0	2,540
FSA350	3x50+3x25/3	9,5/4,2	0,393/0,795*	90	250	3000	34,3	37,5	2,750
FSA370	3x70+3x35/3	11,4/4,8	0,277/0,565*	90	250	4200	39,5	42,5	3,950
FSA395	3x95+3x50/3	13,0/5,4	0,210/0,393*	90	250	5700	44,0	47,0	5,100
FSA30A	3x120+3x70/3	14,7/6,5	0,164/0,277*	90	250	7200	49,5	53,5	6,350
FSA30B	3x150+3x70/3	16,5/6,5	0,132/0,277*	90	250	9000	53,8	57,8	7,600
FSA30C	3x185+3x95/3	18,3/7,8	0,108/0,210*	90	250	11000	59,0	63,0	9,000
FSA30D	3x240+3x120/3	20,7/9,3	0,0817/0,164*	90	250	14400	66,0	70,0	12,000
FSA501	5x1,5	1,6	13,7	90	250	150	12,8	14,8	0,320
FSA502	5x2,5	2,1	8,21	90	250	250	14,8	16,8	0,380
FSA504	5x4	2,5	5,09	90	250	400	17,0	19,2	0,500
FSA506	5x6	3,1	3,39	90	250	600	19,5	21,0	0,700
FSA510	5x10	4,2	1,95	90	250	1000	24,0	26,0	1,100
FSA516	5x16	5,4	1,24	90	250	1600	27,8	29,8	1,550
FSA410402**	4x10+4x2,5	4,2/2,1	1,95/8,21	90	250	800	23,2	25,2	1,030
FSA416402**	4x16+4x2,5	5,4/2,1	1,24/8,21	90	250	1280	25,6	27,6	1,300
FSA425402**	4x25+4x2,5	6,5/2,1	0,795/8,21	90	250	2000	29,5	32,5	1,850
FSA435402**	4x35+4x2,5	7,8/2,1	0,565/8,21	90	250	2800	33,0	36,0	2,500

\* Value of three conductors in parallel connection

\*\* Mechanical grabs

NOTE: Single, two and three cores cable produced upon request



### TRATOS MTO®-TDM

The cables are suitable for use as reeling power supply cables for tunnel driving machines in underground mines and for tunnel construction applications.

## FEATURES AND PERFORMANCES



### CONSTRUCTION

- **Conductor:** Finely stranded copper conductor, tinned, Class 5 (refer also to DIN VDE 0295)
- **Insulation:** TRATOS MTO, basic material EPR, compound type: 3GI3 (refer also to DIN VDE 0207, Part 20)
- **Electrical field control:** Inner and outer semiconductive layer of semiconductive rubber
- **Arrangement of protective-earth conductor:** Copper/textile combined braid individually laid-up concentrically around each individual core
- **Core arrangement:** Three main conductors laid-up with three control cores in the outer interstice
- **Inner sheath:** Vulcanized rubber inner sheath; basic material EPR, compound type: GM1b (refer also to DIN VDE 0207, Part 21)
- **Monitoring conductor:** Overall concentric lay of copper wire spinning
- **Outer sheath:** Basic material PCP, compound type: 5GM5, colour red (refer also to DIN VDE 0207, Part 21)
- **Core identification:** Main cores: natural colouring with black semiconductive rubber Control cores: black
- **Marking:** (Year of manufacture) <VDE> TRATOS MTO-TDM NTSCGECWÖU (number of cores) x (rated cross-section)

### STANDARDS

- DIN VDE 0250, Part 813

<b>Electrical parameters</b>			
<b>Rated voltage</b>		U <sub>0</sub> /U = 3.6/6 kV to 12/20 kV	
<b>Maximum permissible operating voltage in AC systems</b>		U <sub>0</sub> /U = 4.2/7.2 kV to 13.9/24 kV	
<b>Maximum permissible operating voltage in DC systems</b>		U <sub>0</sub> /U = 5.4/10.8 kV to 18/36 kV	
<b>AC test voltage</b>		11 kV to 29 kV	
<b>Current-carrying capacity</b>		According to DIN VDE 0298, Part 4	
<b>Thermal parameters</b>			<b>Type K</b>
<b>Ambient temperature</b>	<ul style="list-style-type: none"> <li>• Fully flexible operation</li> <li>• Fixed installation</li> </ul>	-30 °C to +80 °C -40 °C to +80 °C	-60 °C to +60 °C -60 °C to +60 °C
<b>Maximum permissible operating temperature of the conductor</b>		90 °C	
<b>Short-circuit temperature of the conductor</b>		200 °C	
<b>Mechanical parameters</b>			
<b>Tensile load</b>		Up to 15 N/mm <sup>2</sup> ,	
<b>Torsional stresses</b>		± 25 °/m	
<b>Minimum bending radii</b>		According to DIN VDE 0298, Part 3	
<b>Minimum distance with S-type directional changes</b>		20 x D	
<b>Travel speed</b>		Max. 60 m/min	
<b>Chemical parameters</b>			
<b>Resistance to oil</b>		Given to DIN VDE 0473, Part 811-2-1, Para. 10	
<b>Behaviour in case of fire</b>		Given to DIN VDE 0482, Part 265-2-1, Para. 10	
<b>Weather resistance</b>		Unrestricted use outdoors and indoors, resistant to ozone and moisture	

## TRATOS MTO®-TDM

Nominal Cross Sectional Area  mm <sup>2</sup>	Conductor diameter (guidance value)  mm	Overall diameter of cable (guidance value)		Conductor resistance at 20 °C  Ω/km	Inductance per unit length  mH/km	Operating capacitance per unit length  µF/km	Current carrying capacity at 30 °C  A	Permissible short-circuit current (1s)  kA	Approx. net weight  kg/km	Maximum permissible tensile force  N
		Min. value  mm	Max. value  mm							
3.6/6 kV NTSCGECWÖU										
3x 25+3x 16/3E+3x 2.5ST + 6ÜL KON	6.9	50.0	56.0	0.795	0.15	0.25	131	3.05	3980	1125
3x 35+3x 25/3E+3x 2.5ST + 6ÜL KON	8.3	53.0	59.0	0.565	0.14	0.28	162	4.27	4570	1575
3x 50+3x 25/3E+3x 2.5ST + 6ÜL KON	9.9	59.0	65.0	0.393	0.13	0.32	202	6.10	5720	2250
3x 70+3x 35/3E+3x 2.5ST + 6ÜL KON	11.7	63.0	70.0	0.277	0.12	0.36	250	8.54	6900	3150
3x 95+3x 50/3E+3x 2.5ST + 6ÜL KON	13.4	68.0	74.0	0.210	0.11	0.40	301	11.59	8170	4275
3x120+3x 70/3E+3x 2.5ST + 6ÜL KON	15.2	72.0	79.0	0.164	0.10	0.45	352	14.64	9980	5400
6/10 kV NTSCGECWÖU										
3x 25+3x 16/3E+3x 2.5ST + 6ÜL KON	6.9	52.0	59.0	0.795	0.15	0.23	131	3.05	4250	1125
3x 35+3x 25/3E+3x 2.5ST + 6ÜL KON	8.3	57.0	63.0	0.565	0.14	0.26	162	4.27	5110	1575
3x 50+3x 25/3E+3x 2.5ST + 6ÜL KON	9.9	61.0	68.0	0.393	0.13	0.29	202	6.10	6100	2250
3x 70+3x 35/3E+3x 2.5ST + 6ÜL KON	11.7	63.0	70.0	0.277	0.12	0.33	250	8.54	6840	3150
3x 95+3x 50/3E+3x 2.5ST + 6ÜL KON	13.4	69.0	76.0	0.210	0.11	0.37	301	11.59	8540	4275
3x120+3x 70/3E+3x 2.5ST + 6ÜL KON	15.2	75.0	82.0	0.164	0.10	0.41	352	14.64	10300	5400
12/20 kV NTSCGECWÖU										
3x 25+3x 16/3E+3x 2.5ST + 6ÜL KON	6.9	64.0	71.0	0.795	0.14	0.14	139	3.05	5540	1125
3x 35+3x 25/3E+3x 2.5ST + 6ÜL KON	8.3	67.0	74.0	0.565	0.13	0.17	172	4.27	6600	1575
3x 50+3x 25/3E+3x 2.5ST + 6ÜL KON	9.9	71.0	78.0	0.393	0.12	0.20	215	6.10	7070	2250
3x 70+3x 35/3E+3x 2.5ST + 6ÜL KON	11.7	76.0	83.0	0.277	0.11	0.23	265	8.54	8500	3150
3x 95+3x 50/3E+3x 2.5ST + 6ÜL KON	13.4	79.0	87.0	0.210	0.10	0.27	319	11.59	10320	4275
3x120+3x 70/3E+3x 2.5ST + 6ÜL KON	15.2	85.0	93.0	0.164	0.09	0.31	371	14.64	11500	5400



# EPC SERVICES

We are able to carry out the detailed engineering design of a project, procure all the equipment and materials necessary, and then construct the application to deliver a functioning asset to clients, with a full after-sales support service following its completion.



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