

CABLES FOR A MOVING WORLD

TRATOSFLEX[®]



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Mechanical torsion test

Reversed bending test

Chemical laboratory

CUSTOMIZED UPON REQUEST

- 1) **Reduced halogens and toxicity, flame retardant (e.g. for tunnels, buildings...) TratosGreen type**
- 2) **Improved response to chemical attack**
- 3) **Improved resistance to low temperatures (down to -50°C only for black outer sheath)**
- 4) **Composed cables (e.g. power and control cores screened or without screen)**

Tratos Cavi S.p.A. reserves the right to make at any time and without previous notice, variations on products described in this catalogue. Moreover Tratos Cavi S.p.A. shall not have responsibility for improper use of its electrical cables.

STANDARDS AND QUALITY SYSTEM

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 9001:2008 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 14001:2004 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.

APPROVALS

Reeling cables made by Tratos have been tested and certified by the following Approval Organisations:



Verband
Der Elektrotechnik



Instituto Marchio di Qualità



Lloyd's Register
Group



Underwriters
Laboratories Inc.®



EAC - Eurasian Conformity



Registro Italiano
Navale

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.

1. 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. Other important factors which are also considered for all the types are:

- Operating temperature
- Tensile stress
- Bending radius
- Operating speed

Table 1 Selection of cables

DESIGN	Reels							Festoons	Vertical Basket	Operating Temperature				
	Cable Laid on Ground									Ambient condition		On cable surface		
											Min. Value °C	Max Value °C	Min. Value °C	Max Value °C
	one way	two ways	random	spreader	tender system	vertical								
Operating max speed (mt/min)	60	200	300	200	60	200	60	300	240	160				
CONTROL CABLES														
TRATOSMART - (N) SHTÖU - JZ	S	MA	x	x	x	MA	S	x	S	x	-25	+80	-25	+60
TRATOSMART - (N) SHTÖU - JZK	S	MA	x	x	x	MA	S	x	S	x	-40	+60	-40	+60
TRATOSFESTOON	x	x	x	x	x	x	x	x	MA	x	-25	+80	-25	+60
TRATOSLIGHT - VRDB	x	x	x	x	x	S	S	MA	x	x	-25	+80	-25	+60
TRATOSCOILFLEX	x	x	x	x	x	x	x	x	x	MA	-20	+80	-20	+60
POWER L.V. CABLES														
TRATOSMART DB - (N) SHTÖU - J	S	S	S	MA	x	MA	x	x	S	x	-25	+80	-25	+60
TRATOSMART - (N) SHTÖU - J	S	MA	x	x	x	MA	S	x	S	x	-25	+80	-25	+60
TRATOSMART - (N) SHTÖU - JK	S	MA	x	x	x	MA	S	x	S	x	-40	+60	-40	+60
TRATOSFESTOON	x	x	x	x	x	x	x	x	MA	x	-25	+80	-25	+60
POWER M.V. CABLES														
TRATOSFLEX - ES3	MA	MA	x	x	x	x	MA	x	x	x	-30	+80	-30	+60
TRATOSFLEX - ESDB	S	S	MA	MA	MA	MA	S	x	x	x	-20	+60	-20	+60
TRATOSFLEX - FO ES3	MA	MA	x	x	x	x	MA	x	x	x	-30	+80	-30	+60
TRATOSFLEX - FO ESDB	S	S	MA	MA	MA	MA	S	x	x	x	-20	+60	-20	+60
TRATOSFLAT	MA	MA	x	x	x	x	x	x	x	x	-30	+80	-30	+60
FIBRE CABLES														
TRATOSFIBRE - DB	MA	MA	MA	x	x	x	x	x	MA	x	-25	+80	-25	+60

MA = Main application **S** = Suitable **x** = Not suitable

2. Recommended Bending Radius

The recommended values for different uses are given in Table 2.

Table 2

TYPES OF CABLES	CABLE DIAMETER MAX (mm)	APPLICATIONS				
		Festoons	Reels	Basket	Cable Carrier Chains	Fixed Installation
L. V. up to 1 kV	≤ 25	5 x O.D. (1)	6 x O.D. (1)		10 x O.D.	4 x O.D.
	≤ 40	6 x O.D. (1)	7 x O.D.	15 x O.D.	12 x O.D.	4 x O.D.
	> 40,1	7 x O.D.	8 x O.D.	15 x O.D.	12 x O.D.	4 x O.D.
M. V. over 1 kV	all		12 x O.D.		10 x O.D.	6 x O.D.

(1) For EMC shielded cables (Tratosflex OCS Type) minimum bending radius 7 x O.D.

Where the OD is the overall diameter in mm.

For low speed operations smaller bending radius values may be tolerated.



3. Current carrying capacities for continuous operation (at 30°C): 3 core cables + earth conductor According to DIN VDE 0298-4

Table 3 Low Voltage cables up to 0,6/1 kV and Medium Voltage cables up to 10 kV

Cross section mm ²	One cable	Festoon	Multi spire reels					Mono spire reels	
	Laid on ground	Suspended freely in air	Reeled in 1 layer	Reeled in 2 layers	Reeled in 3 layers	Reeled in 4 layers	Reeled in 5 layers	Round cables	Flat cables
	A	A	A	A	A	A	A	A	A
	(Factor 1)*	(1.05)*	(0.80)*	(0.61)*	(0.49)*	(0.42)*	(0.34)*	(0.80)*	(0.49)*
1	18	19	14	11	9	8	6	14	9
1,5	23	24	18	14	11	10	8	18	11
2,5	30	32	24	18	15	13	10	24	15
4	41	43	33	25	20	17	14	33	20
6	53	56	42	32	26	22	18	42	26
10	74	78	59	45	36	31	25	59	36
16	99	104	79	60	49	42	34	79	49
25	131	138	105	80	64	55	45	105	65
35	162	170	130	99	79	68	55	130	80
50	202	212	162	123	99	85	69	162	99
70	250	263	200	153	123	105	85	200	123
95	301	316	241	184	147	126	102	241	148
120	352	370	282	215	172	148	120	282	172
150	404	424	323	246	198	170	137	323	197
185	461	484	369	281	226	194	157	369	226
240	540	567	432	329	265	227	184	432	265
300	620	651	496	378	304	260	211	496	304

* De-rating factor

Table 3 Medium Voltage cables above 10 kV

Cross section mm ²	One cable	Festoon	Multi spire reels					Mono spire reels	
	Laid on ground	Suspended freely in air	Reeled in 1 layer	Reeled in 2 layers	Reeled in 3 layers	Reeled in 4 layers	Reeled in 5 layers	Round cables	Flat cables
	A	A	A	A	A	A	A	A	A
	(Factor 1)*	(1.05)*	(0.80)*	(0.61)*	(0.49)*	(0.42)*	(0.34)*	(0.80)*	(0.49)*
16	105		84	64	51	44	36	84	51
25	139		111	85	68	58	47	111	68
35	172		138	105	84	72	58	138	84
50	215		172	131	105	90	73	172	105
70	265		212	162	130	111	90	212	130
95	319		255	195	156	134	108	255	156
120	371		297	226	182	156	126	297	182
150	428		342	261	210	180	146	342	210
185	488		390	293	239	205	166	390	239

* De-rating factor

Table 3a De-rating factor for ambient temperatures other than 30°C

Cables	Ambient Temperature °C												
	10	15	20	25	30	35	40	45	50	55	60	65	70
POWER L.V. CABLES													
TRATOSMART (N) SHTÖU	1,15	1,12	1,08	1,04	1,00	0,96	0,91	0,87	0,82	0,76	0,71	0,65	0,58
TRATOSLIGHT - VR	1,15	1,12	1,08	1,04	1,00	0,96	0,91	0,87	0,82	0,76	0,71	0,65	0,58
TRATOSCOILFLEX	1,15	1,12	1,08	1,04	1,00	0,96	0,91	0,87	0,82	0,76	0,71	0,65	0,58
TRATOSFESTOON	1,15	1,12	1,08	1,04	1,00	0,96	0,91	0,87	0,82	0,76	0,71	0,65	0,58
POWER M.V. CABLES													
TRATOSFLEX - ES3 / ESDB	1,15	1,12	1,08	1,04	1,00	0,96	0,91	0,87	0,82	0,76	0,71	0,65	0,58
TRATOSFLEX - FO ES3 / ESDB	1,15	1,12	1,08	1,04	1,00	0,96	0,91	0,87	0,82	0,76	0,71	0,65	0,58
TRATOSFLAT	1,15	1,12	1,08	1,04	1,00	0,96	0,91	0,87	0,82	0,76	0,71	0,65	0,58

Table 3b De-rating factor for multicore cables with conductor cross section up to 10 mm²

Number of conductor loaded	5	7	12	18	24	30	36	42	54	61
De-rating Factor	0,75	0,65	0,53	0,44	0,40	0,40	0,36	0,35	0,32	0,30

4. Current carrying capacities for intermittent operation

In case of intermittent operation, for example, period of 10 minutes of full load is followed by a longer period with no load. These 10 minutes taken as percentage of total duration DT of the cycle provide a percentage load factor.

$$\text{Load factor FC \%} = (10mi / DT) \times 100$$

In this case the current carrying capacity as calculated using table 1, can be increased using factors given in table 4.

Table 4

Cable cross section (mm ²)	1,5	2,5	4	6	10	16	25	35	50	70	95	120	150	185	240	300
Load Factor (FC %)	Correction factors															
60%	1,00	1,00	1,00	1,00	1,03	1,07	1,10	1,13	1,16	1,18	1,20	1,21	1,22	1,23	1,24	1,25
40%	1,00	1,00	1,03	1,04	1,09	1,16	1,23	1,28	1,34	1,38	1,42	1,44	1,46	1,48	1,49	1,50
25%	1,00	1,02	1,05	1,13	1,21	1,34	1,45	1,53	1,62	1,69	1,74	1,78	1,81	1,82	1,85	1,87
20%	1,00	1,04	1,11	1,18	1,31	1,45	1,59	1,69	1,79	1,87	1,93	1,97	2,01	2,04	2,10	2,15
15%	1,00	1,08	1,19	1,27	1,44	1,62	1,79	1,90	2,03	2,13	2,21	2,26	2,30	2,32	2,36	2,39

5. Three phase voltage drop

Table 5 Factor calculation of voltage drop

Nominal cable	Operating electrical resistance (R) at 80°C	Reactance (x) at 50 Hz for three core + earth cables at operating voltage of:						Voltage drop
Cross section		up to 1kV	3 kV	6 kV	10 kV	15 kV	20 kV	factor K
mm ²	A.C. 50 Hz (Ohm / km)	(Ohm / km)	(Ohm / km)	(Ohm / km)	(Ohm / km)	(Ohm / km)	(Ohm / km)	(cos φ = 0,8)
	(Ohm / km)	(indicative value) kA						m V/A m
1,5	16,950	0,109						23,5
2,5	10,150	0,103						14,2
4	6,290	0,095						8,8
6	4,200	0,090						5,93
10	2,410	0,087	0,097					3,45
16	1,540	0,086	0,095	0,105	0,118			2,24
25	0,986	0,081	0,090	0,102	0,110	0,124		1,46
35	0,700	0,078	0,087	0,097	0,108	0,121	0,131	1,06
50	0,490	0,077	0,083	0,094	0,103	0,114	0,123	0,77
70	0,345	0,076	0,080	0,090	0,095	0,108	0,113	0,57
95	0,260	0,075	0,079	0,088	0,093	0,104		0,45
120	0,205	0,074	0,077	0,085	0,091			0,36
150	0,163	0,074	0,076	0,083	0,089			0,3
185	0,134	0,073	0,074	0,081				0,26
240	0,101	0,072	0,074					0,22

The value is calculated by multiplying the factors K (mV/Am) given in the table by effective current capacity I (A) of the cable then by the length of the connection L (in km):

$$\text{Voltage drop (v)} = I \text{ (A)} \times L \text{ (km)} \times K \text{ (mV/Am)}$$

The factors have been calculated using the formula:

$$K \text{ (mV/Am)} = 1.73 \times (R \cos \phi + X \sin \phi)$$

Where:

R = resistance of the conductor (Ohm/km) at operating temperature of 80°C and frequency of 50 Hz

X = Cable reactance (Ohm/km) at 50 Hz

6. Short circuit current

Short circuit current (thermal limit of short circuit) in heavy duty mobile application, must be calculated using the following reference values (VDE 0250 c.8/75)

Initial = 80°C (cable under full load)

Final short circuit temperature = 200°C

The short circuit currents (thermal limit) given in the table below have been calculated using these values and are valid for a base time of 1 sec.

Table 6

Nominal cable cross section mm ²	One second thermal limit for all voltages kA	Dynamic limit for three core cables					
		up to 1kV	3 kV	6 kV	10 kV	15 kV	20 kV
indicative value (1) kA							
1,5	0,20						
2,5	0,32						
4	0,51						
6	0,77						
10	1,29						
16	2,06	30	40	45	50	55	
25	3,22	35	43	50	55	60	
35	4,50	40	48	53	60	65	75
50	6,43	45	50	58	63	70	80
70	9,00	50	55	63	68	75	83
95	12,20	55	60	70	75	75	
120	15,40	60	65	72	78	80	
150	19,30	65	68	75	80		
185	23,80	70	72	80	84		
240	31,00	80					

For a different initial and final temperature (for example 90°C initial and 250°C final temperature admissible for our cable HEPR insulated). The thermal limits are calculated with:

$$I_{cc}(a) = \frac{K_{cc} \times \text{conductor cross section (mm}^2\text{)}}{\sqrt{t \text{ (sec)}}}$$

Where the coefficient K_{cc} assumes the following values:

Final short circuit temperature °C	Initial short circuit temperature of the conductor						
	30 °C	40 °C	50 °C	60 °C	70 °C	80 °C	90 °C
160	143	136	129	122	115	107	100
200	159	153	147	141	135	128	122
250	176	170	165	159	154	148	143

(1) Indicative value because in flexible cables only a very special construction (e.g. pitch conductors, cores assembly...) reduces the electrodynamic forces from separating the grouped cores.

7. Fibre optical technical information*

OPTICAL parameters		
	Grade index fibre 62,5/125	Monomode fibre E9/125
Max attenuation at wavelength 850 nm	3,2 dB/km	-
Max attenuation at wavelength 1300 nm	0,9 dB/km	0,4 dB/km
Max attenuation at wavelength 1550 nm	-	0,3 dB/km
Bandwidth at 850 nm	≥ 400 MHz	-
Bandwidth at 1300 nm	≥ 600 MHz	-
Numerical aperture	0,275 ± 0,015	0,140 ± 0,02
Attenuation on completed cable (max) at wavelength 1300 nm	5,00 dB/km	2,00 dB/km

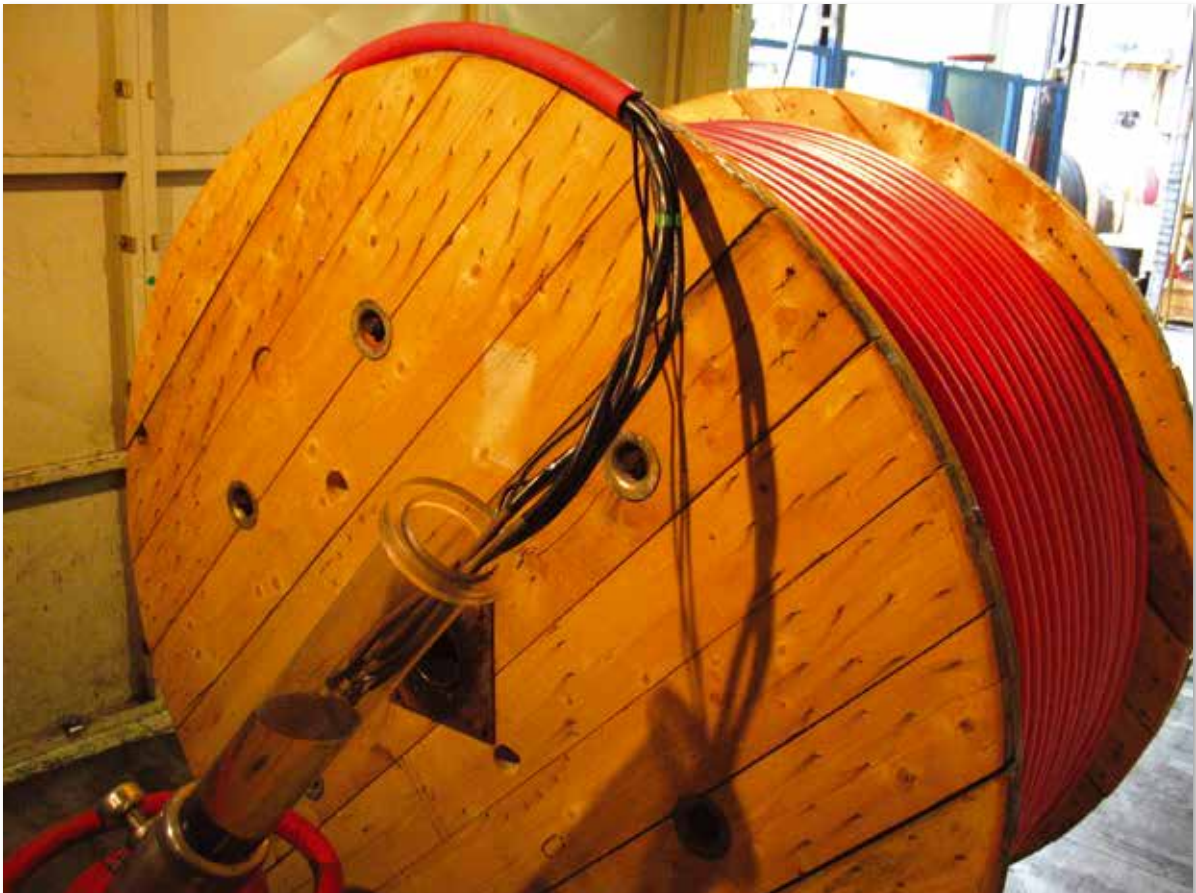
THERMAL parameters	
Fully flexible operation (ambient temperature)	-20 °C to +60 °C
Fixed installation	-40 °C to +80 °C

* 50/125 fibres available upon request

8. General recommendations

Fundamental to avoid:

- Misalignment in order to avoid cable torsion
- Sudden changes of bending radius
- Overtension of the cable
- Change of direction within a distance of less than 20 times cable O.D.
- Use of sheaves not having a flat profile



CONTROL CABLES according to standards VDE 0250 p.814 (as applicable)

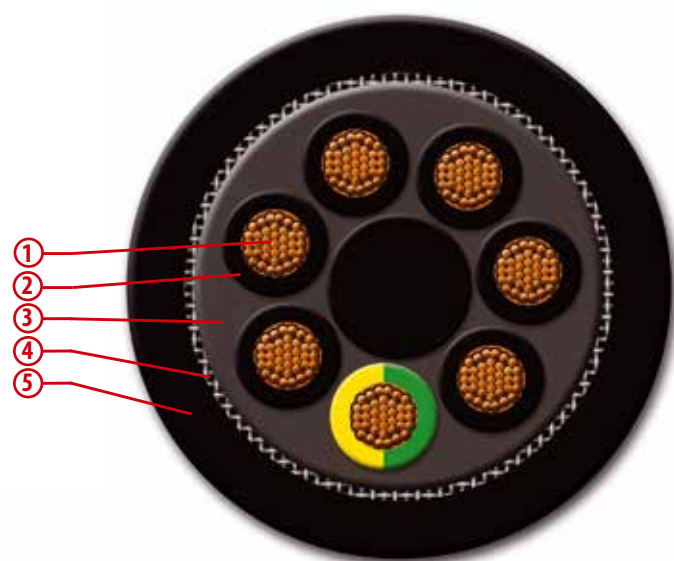
TRATOSMART® - (N)SHTÖU-JZ

TRATOSMART® - (N)SHTÖU-JZK⁽¹⁾

TRATOSGREEN® - (N)SHTÖU-JZ⁽¹⁾ - Reduced halogens and reduced toxicity⁽²⁾⁽³⁾

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®, equivalent to or better than EPR 3GI3 quality
- 3) Inner sheath special compound Tratosmart-IS®, better than GM1b quality
- 4) Antitorsional protection
- 5) Outer sheath black colour special compound Tratosmart-OS®, better than 5GM3 (or 5GM5 if required) quality

TECHNICAL SPECIFICATIONS

- Rated Voltage 0,6/1 kV
- Max Voltage AC 0,7/1,2 kV
- AC Voltage Test 2,5 kV



Working Ambient Temperature:	TRATOSMART	Type K
Fixed installation	-40 °C to +80 °C	-60 °C to +60 °C
In operation	-30 °C to +80 °C	-60 °C to +60 °C

Travel Condition:				
Main application	Monospiral Reel	Spreader Reels	-	-
Suitable	-	-	Tender System	Festoon
Operating max speed (mt/min)	240	200	60	240

(1) Produced on request

(2) Toxicity index on finished cable <5

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

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

Part Number	Nominal Cross Section	Nominal Conductor Diameter	Maximum Conductor DC Resistance at 20 °C	Maximum Temperature of the Conductor During Operation	Maximum Temperature of the Conductor During Short Circuit	Max. Tensile Load During Installation and Operation	Minimum Overall Diameter	Maximum Overall Diameter	Nominal Cable Weight
	mm ²	mm	Ω/Km	°C	°C	N	mm	mm	Kg/m
FSA701	7x1,5	1,6	13,7	90	250	157	16,0	18,0	0,440
FSA121	12x1,5	1,6	13,7	90	250	270	21,0	23,0	0,650
FSA181	18x1,5	1,6	13,7	90	250	405	21,5	23,5	0,780
FSA241	24x1,5	1,6	13,7	90	250	540	26,0	28,0	0,990
FSA301	30x1,5	1,6	13,7	90	250	675	27,5	30,5	1,250
FSA361	36x1,5	1,6	13,7	90	250	810	28,5	31,5	1,350
FSA702	7x2,5	2,1	8,21	90	250	262	17,8	19,8	0,540
FSA122	12x2,5	2,1	8,21	90	250	450	23,3	26,3	0,950
FSA182	18x2,5	2,1	8,21	90	250	675	24,5	26,5	1,100
FSA242	24x2,5	2,1	8,21	90	250	900	28,5	31,5	1,450
FSA302	30x2,5	2,1	8,21	90	250	1125	31,0	34,0	1,850
FSA362	36x2,5	2,1	8,21	90	250	1350	32,0	35,0	1,950

Special signal - TRATOSMART-(N)SHTÖU-JZ - TRATOSMART-(N)SHTÖU-JZK

Part Number	Nominal Cross Section	Nominal Conductor Diameter	Conductor DC Resistance at 20 °C Max	Maximum Temperature of the Conductor During Operation	Maximum Temperature of the Conductor During Short Circuit	Max. Tensile Load During Installation and Operation	Minimum Overall Diameter	Maximum Overall Diameter	Nominal Cable Weight
	mm ²	mm	Ω/Km	°C	°C	N	mm	mm	Kg/m
FSA600C	3x(2x1)C*	1,3	20,0	90	250	90	22,5	24,5	0,650
FSA601C	3x(2x1,5)C*	1,6	13,7	90	250	135	23,5	25,5	0,800
FSA120C	6x(2x1)C*	1,3	20,0	90	250	180	28,0	29,5	1,150
FSA121C	6x(2x1,5)C*	1,6	13,7	90	250	270	28,5	31,5	1,300
FSA192501C	19x2,5+5x1,5(C)*	2,1/1,6	8,21/13,7	90	250	938	33,0	36,0	1,600

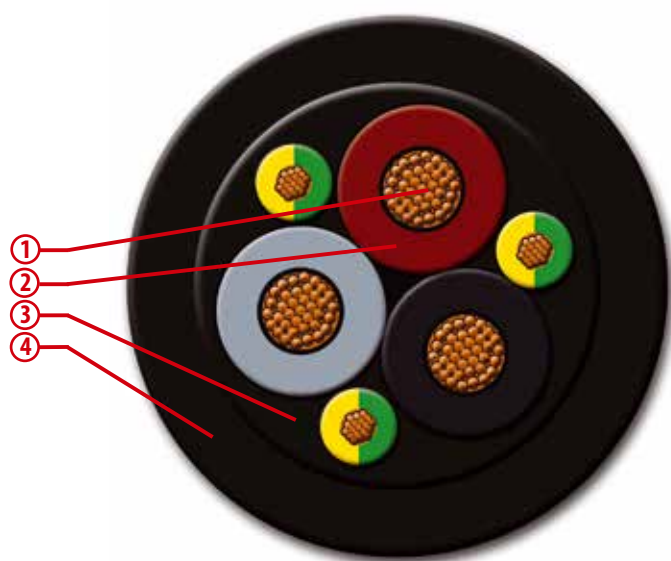
* Copper braid screened paires



TRATOSFESTOON®

Reduced dimension cable for festoon application.

FEATURES AND PERFORMANCES

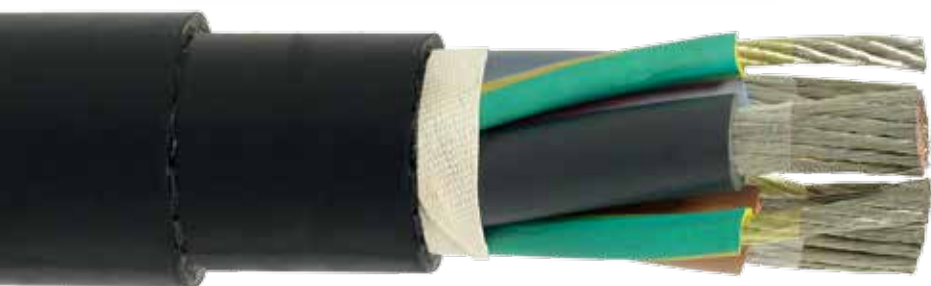


CONSTRUCTION

- 1) Tinned flexible conductor Cl. 5 VDE 0295
- 2) Insulation special compound Tratosfestoon-I®, equivalent to or better than EPR 3GI3
- 3) Inner sheath special compound Tratosfestoon-IS®
- 4) Outer sheath special compound Tratosfestoon-OS®, black colour, at least 5GM3 quality

TECHNICAL SPECIFICATIONS

- Rated Voltage 0,6/1 kV
- Max Voltage AC 0,7/1,2 kV
- AC Voltage Test 2,5 kV CONTROL CABLES
3,5 kV POWER CABLES



Working Ambient Temperature:	TRATOSFESTOON	Type K
Fixed installation	-40 °C to +80 °C	-60 °C to +60 °C
In operation	-30 °C to +80 °C	-60 °C to +60 °C

Travel Condition:	
Main application	FESTOON
Suitable m/min Max	-
Operating max speed (mt/min)	240

TRATOSFESTOON - Power cables - 0,6/1 kV

Part Number	Nominal Cross Section	Nominal Conductor Diameter	Maximum Conductor DC Resistance at 20 °C	Maximum Temperature of the Conductor During Operation	Maximum Temperature of the Conductor During Short Circuit	Max. Tensile Load During Installation and Operation	Minimum Overall Diameter	Maximum Overall Diameter	Nominal Cable Weight
	mm ²	mm	Ω/Km	°C	°C	N	mm	mm	Kg/m
FOA125	1x25	6,5	0,795	90	250	375	12,0	13,25	0,340
FOA135	1x35	7,9	0,565	90	250	525	13,3	14,60	0,450
FOA150	1x50	9,5	0,393	90	250	750	15,5	16,80	0,640
FOA170	1x70	11,4	0,277	90	250	1050	17,4	19,80	0,820
FOA195	1x95	13,0	0,210	90	250	1425	19,2	21,20	1,100
FOA10A	1x120	14,8	0,164	90	250	1750	20,4	22,40	1,360
FOA404	4x4	2,5	5,09	90	250	240	15,0	16,4	0,360
FOA406	4x6	3,1	3,39	90	250	360	16,8	18,2	0,470
FOA410	4x10	4,3	1,95	90	250	600	20,3	22,3	0,700
FOA416	4x16	5,4	1,24	90	250	960	23,0	25,0	1,100
FOA425	4x25	6,5	0,795	90	250	1500	27,5	29,5	1,650
FOA335	3x35+3x16/3	7,9/3,1	0,565/1,24*	90	250	1575	29,5	31,5	1,850
FOA350	3x50+3x25/3	9,5/4,2	0,393/0,795*	90	250	2250	33,9	35,9	2,600
FOA370	3x70+3x35/3	11,4/4,8	0,277/0,565*	90	250	3150	39,5	41,5	3,600

* Value of three conductors in parallel connection

TRATOSFESTOON - Control cables - 0,6/1 kV

Part Number	Nominal Cross Section	Nominal Conductor Diameter	Conductor DC Resistance at 20 °C Max	Maximum Temperature of the Conductor During Operation	Maximum Temperature of the Conductor During Short Circuit	Max. Tensile Load During Installation and Operation	Minimum Overall Diameter	Maximum Overall Diameter	Nominal Cable Weight
	mm ²	mm	Ω/Km	°C	°C	N	mm	mm	Kg/m
FOA122	12x2,5	2,1	8,21	90	250	450	23,8	25,8	0,840
FOA182	18x2,5	2,1	8,21	90	250	650	24,5	26,5	0,980
FOA242	24x2,5	2,1	8,21	90	250	900	27,8	30,8	1,250

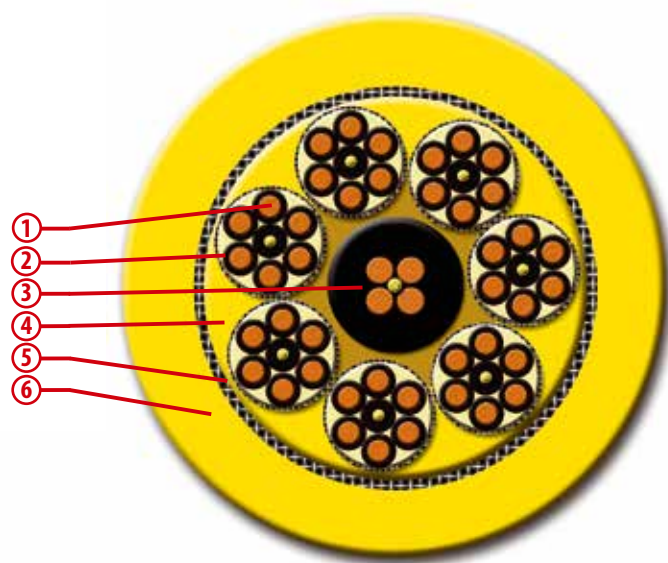


TRATOSLIGHT-VRDB® - Vertical Reels

TRATOSLIGHT-VRDB-FO® - Vertical Reels + Fibre optic

Cable for vertical application.

FEATURES AND PERFORMANCES



CONSTRUCTION

- 1) Very fine plain copper conductor cl. 6 VDE 0295
- 2) Tratoslight-IR® special technopolymer
- 3) Reinforced central support
- 4) Inner sheath special elastomeric compound Tratoslight-IS®
- 5) Antitorsional braid embedded between inner and outer sheath
- 6) Outer sheath special elastomeric compound Tratoslight-OS®, yellow colour resistant to tearing and abrasion

TECHNICAL SPECIFICATIONS

- Rated Voltage 0,6/1 kV
- Max Voltage AC 0,7/1,2 kV
- AC Voltage Test 2,5 kV



Working Ambient Temperature:	TRATOSLIGHT-VRDB	Type K
Fixed installation	-40 °C to +80 °C	-60 °C to +60 °C
In operation	-30 °C to +80 °C	-60 °C to +60 °C

Travel Condition:			
Main application	-	-	Vertical Reels
Suitable m/min Max	Spreader Reels	Tender System	-
Operating max speed (mt/min)	300	180	300

TRATOSLIGHT-VRDB - Vertical Reels

Part Number	Nominal Cross Section	Nominal Conductor Diameter	Maximum Conductor DC Resistance at 20 °C	Maximum Temperature of the Conductor During Operation	Maximum Temperature of the Conductor During Short Circuit	Max. Tensile Load During Installation and Operation	Minimum Overall Diameter	Maximum Overall Diameter	Nominal Cable Weight
	mm ²	mm	Ω/Km	°C	°C	N	mm	mm	Kg/m
FLDVA482	48x1	1,3	19,5	90	250	2000	35,0	38,0	1,600
FLDVA182	18x2,5*	2,15	7,98	90	250	3000	22,0	26,0	1,100
FLDVA242	24x2,5*	2,15	7,98	90	250	3600	26,4	29,4	1,400
FLDVA302	30x2,5(5x6x2,5)	2,15	7,98	90	250	4700	30,2	34,2	1,600
FLDVA362	36x2,5(6x6x2,5)	2,15	7,98	90	250	4700	34,7	38,5	2,080
FLDVA362S	36x2,5*	2,15	7,98	90	250	4700	30,2	33,0	1,850
FLDVA422	42x2,5(7x6x2,5)	2,15	7,98	90	250	6600	37,8	41,8	2,280
FLDVA442	44x2,5*	2,15	7,98	90	250	5500	32,5	35,5	1,950
FLDVA542	54x2,5(9x6x2,5)	2,15	7,98	90	250	6600	43,8	48,8	2,800
FLDVA363	36x3,3(6x6x3,3)	2,65	6,00	90	250	4700	38,0	42,0	2,400
FLDVA423	42x3,3(7x6x3,3)	2,65	6,00	90	250	6600	44,0	48,0	2,700

* Cores assembled in different concentric layers

TRATOSLIGHT-VRDB-FO - Vertical Reels + Fibre optic

Part Number	Nominal Cross Section	Nominal Conductor Diameter	Maximum Conductor DC Resistance at 20 °C	Maximum Temperature of the Conductor During Operation	Maximum Temperature of the Conductor During Short Circuit	Max. Tensile Load During Installation and Operation	Minimum Overall Diameter	Maximum Overall Diameter	Nominal Cable Weight
	mm ²	mm	Ω/Km	°C	°C	N	mm	mm	Kg/m
FLDVA242F	24x2,5/4x(6x2,5)+FO**	2,15	7,98	90	250	4700	30,2	34,2	1,600
FLDVA302F	30x2,5/5x(6x2,5)+FO**	2,15	7,98	90	250	4700	34,7	38,5	2,080
FLDVA362F	36x2,5/6x(6x2,5)+FO**	2,15	7,98	90	250	6600	37,8	41,8	2,280
FLDVA548F	48x2,5/8x(6x2,5)+FO**	2,15	7,98	90	250	6600	43,8	48,8	2,800

* Cores assembled in different concentric layers

** Upon request available special construction with 6 up to 24 integrated optical fibres. Standard fibres type 62,5/125 (also available 50/125 and monomode E9/125)



CONTROL CABLES FOR GRAVITY-FED COLLECTOR IN BASKET suitable for spreader connection

TRATOSCOILFLEX® - 300/500 V - Lead free

TRATOSCOILFLEX-K® - 300/500 V - Lead free

TRATOSCOILFLEX-FO® - 300/500 V - Lead free + Fibre optic

Heavy duty cable for **basket operation**.

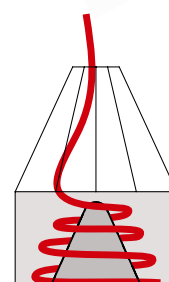
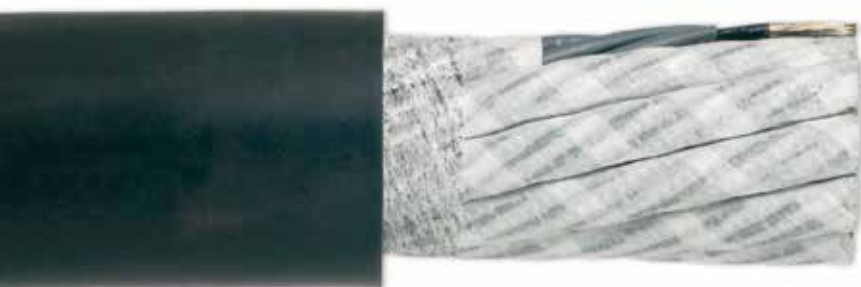
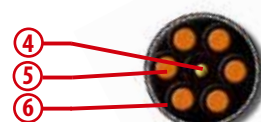
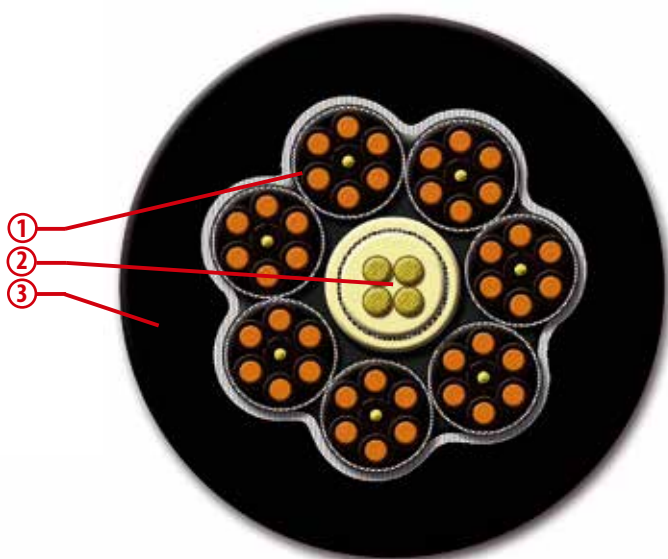
FEATURES AND PERFORMANCES

CONSTRUCTION

- 1) 6 core group
- 2) Kevlar support
- 3) Outer sheath black colour special polychloroprene compound
Tratoscoilflex-OS®, better than 5GM3 quality
- 4) Kevlar support
- 5) Extra flexible conductor
- 6) Special EPR (90°C) insulation

TECHNICAL SPECIFICATIONS

- Rated Voltage 300/500 V
- Max Voltage AC 550 V
- AC Voltage Test 2 kV



Working Ambient Temperature:	TRATOSCOILFLEX	Type K
Fixed installation	-40 °C to +80 °C	-60 °C to +60 °C
In operation	-30 °C to +80 °C	-60 °C to +60 °C

Travel Condition:	
Main application	Vertical Basket
Operating max speed (mt/min)	160

Conductors/groups/total assembly lefthand: during the installation please consider that cable turns to left direction
Clockwise coiling recommended starting from the bottom of the basket

TRATOSCOILFLEX / TRATOSCOILFLEX-K - Lead free

Part Number	Nominal Cores and Nominal Cross Section	Maximum Single Wire Diameter	Nominal Conductor Diameter	Maximum Conductor DC Resistance at 20 °C	Maximum Tensile Load	Minimum Overall Diameter	Maximum Overall Diameter	Nominal Cable Weight	Approx Minimum Bending Radius
	mm ² /AWG	mm	mm	Ω/Km	N	mm	mm	Kg/m	mm
FCA362	36x2,5/14AWG	0,16	2,00	8,21	2000	38,0	41,0	2,600	650
FCA422	42x2,5/14AWG	0,16	2,00	8,21	2000	40,8	43,8	3,100	700
FCA482	48x2,5/14AWG	0,16	2,00	8,21	2000	45,8	48,8	3,700	750
FCA542	54x2,5/14AWG	0,16	2,00	8,21	2000	47,0	51,0	4,100	800
FCA363	36x3,3/12AWG	0,16	2,60	6,11	2000	44,5	47,5	3,250	700
FCA423	42x3,3/12AWG	0,16	2,60	6,11	2000	46,6	49,6	3,800	750
FCA483	48x3,3/12AWG	0,16	2,60	6,11	2000	52,0	55,0	4,500	800
FCA543	54x3,3/12AWG	0,16	2,60	6,11	2000	57,0	60,0	5,000	900

TRATOSCOILFLEX-FO - Lead free + Fibre optic*

Part Number	Nominal Cores and Nominal Cross Section	Maximum Single Wire Diameter	Nominal Conductor Diameter	Maximum Conductor DC Resistance at 20 °C	Maximum Tensile Load	Minimum Overall Diameter	Maximum Overall Diameter	Nominal Cable Weight	Approx Minimum Bending Radius
	mm ² /AWG	mm	mm	Ω/Km	N	mm	mm	Kg/m	mm
FCA362F	36x2,5/14AWG+FO*	0,16	2,00	8,21	2000	40,8	43,8	3,100	700
FCA422F	42x2,5/14AWG+FO*	0,16	2,00	8,21	2000	45,8	48,8	3,700	750
FCA482F	48x2,5/14AWG+FO*	0,16	2,00	8,21	2000	47,0	51,0	4,100	800
FCA363F	36x3,3/12AWG+FO*	0,16	2,60	6,11	2000	46,6	49,6	3,800	750
FCA423F	43x3,3/12AWG+FO*	0,16	2,60	6,11	2000	52,0	55,0	4,500	800
FCA483F	48x3,3/12AWG+FO*	0,16	2,60	6,11	2000	57,0	60,0	5,000	900

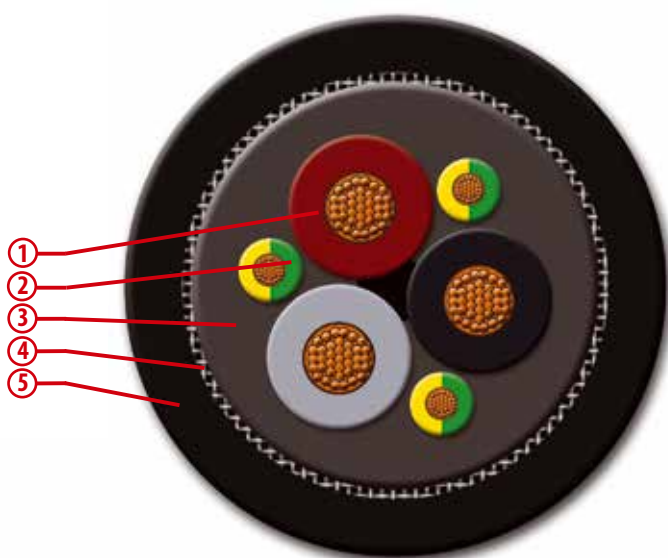
* Upon request available special construction with 6 up to 24 integrated optical fibres. Standard fibres type 62,5/125 (also available 50/125 and monomode E9/125)



TRATOSMART-DB® - (N)SHTÖU-J - High speed, high pull & torsion resistance TRATOSGREEN-DB® - (N)SHTÖU-J⁽¹⁾ - Reduced halogens and reduced toxicity⁽²⁾⁽³⁾

High speed, high pull & torsion resistance. Main application Electrified rubber tyred gantry cranes (E-RTG) and reel two ways.

FEATURES AND PERFORMANCES

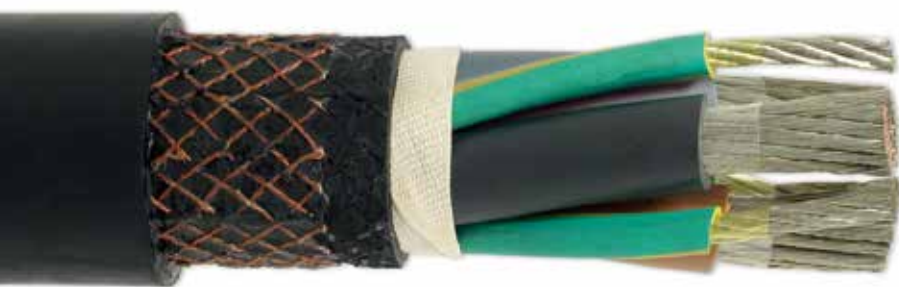


CONSTRUCTION

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

TECHNICAL SPECIFICATIONS

- Rated Voltage 0,6/1 kV
- Max Voltage AC 0,7/1,2 kV
- AC Voltage Test 3,5 kV



Working Ambient Temperature:	TRATOSMART-DB	Type K
Fixed installation	-40 °C to +80 °C	-60 °C to +60 °C
In operation	-30 °C to +80 °C	-60 °C to +60 °C

Travel Condition:				
Main application	-	Monospiral Reel Two Ways	Spreader Reels	-
Suitable m/min Max	Monospiral Reel One Way	-	-	Festoon
Operating max speed (mt/min)	300	200	200	240

(1) Produced on request
(2) Toxicity index on finished cable <5
(3) Upon request special construction with copper braid screen according to **atex recommendations**

TRATOSMART-DB-(N)SHTÖU-J/JK - TRATOSGREEN-DB-(N)SHTÖU-JZ - High speed, high pull & torsion resistance

Part Number	Nominal Cross Section mm ²	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	Maximum Permanent Tensile Load N	Maximum Dynamical Tensile Load During Acceleration Process N	Minimum Overall Diameter mm	Maximum Overall Diameter mm	Nominal Cable Weight Kg/m
FDSA416	4x16	5,4	1,24	90	250	2000	2500	25,0	28,0	1,180
FDSA425	4x25	6,5	0,795	90	250	3000	3600	28,5	31,5	1,710
FDSA435	4x35	7,9	0,565	90	250	3500	4000	33,0	36,0	2,420
FDSA450	4x50	9,5	0,393	90	250	4000	5000	37,5	40,5	2,800
FDSA370	3x70+3x35/3	11,4/4,8	0,277/0,565*	90	250	5600	6800	40,2	43,2	3,700
FDSA395	3x95+3x50/3	13,0/5,4	0,210/0,393*	90	250	6700	8500	44,5	47,5	4,680
FDSA30A	3x120+3x70/3	14,7/6,5	0,164/0,277*	90	250	8500	11000	49,5	53,5	5,900
FDSA30B	3x150+3x70/3	16,5/6,5	0,132/0,277*	90	250	11000	14000	53,8	57,8	6,950
FDSA30C	3x185+3x95/3	18,3/7,8	0,108/0,210*	90	250	14000	17000	59,0	63,0	8,400
FDSA30D	3x240+3x120/3	20,7/9,3	0,0817/0,164*	90	250	16000	21800	66,0	70,0	11,560

* Value of three conductors in parallel connection

Single, two and three cores cable produced upon request



LOW VOLTAGE POWER CABLES - (N)SHTÖU-J VDE 0250 p.814

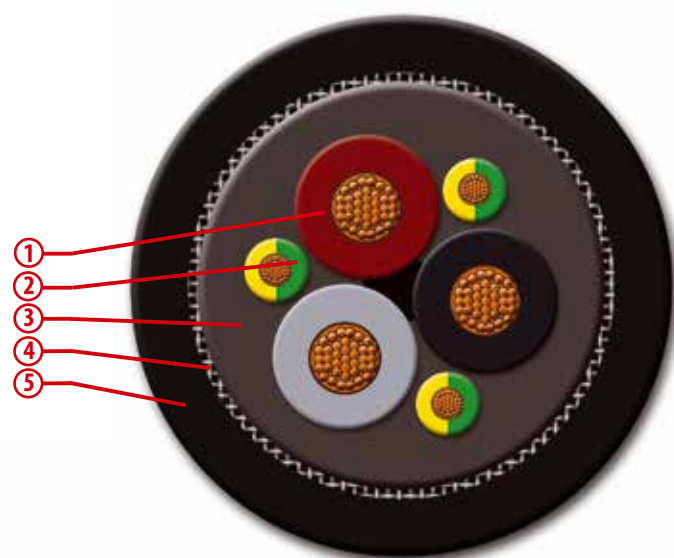
TRATOSMART® - (N)SHTÖU-J

TRATOSMART® - (N)SHTÖU-JK⁽¹⁾

TRATOSGREEN® - (N)SHTÖU-J⁽¹⁾ - Reduced halogens and reduced toxicity⁽²⁾⁽³⁾

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

FEATURES AND PERFORMANCES

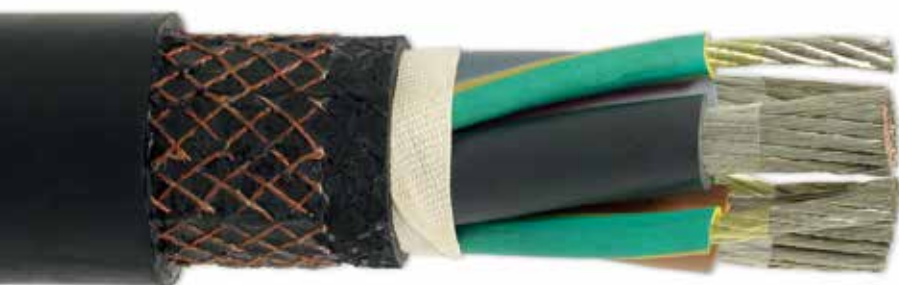


CONSTRUCTION

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

TECHNICAL SPECIFICATIONS

- Rated Voltage 0,6/1 kV
- Max Voltage AC 0,7/1,2 kV
- AC Voltage Test 3,5 kV



Working Ambient Temperature:	TRATOSMART	Type K
Fixed installation	-40 °C to +80 °C	-60 °C to +60 °C
In operation	-30 °C to +80 °C	-60 °C to +60 °C

Travel Condition:				
Main application	Monospiral Reel	Spreader Reel	-	-
Suitable m/min Max	-	-	Tender System	Festoon
Operating max speed (mt/min)	200	200	60	240

(1) Produced on request

(2) Toxicity index on finished cable <5

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

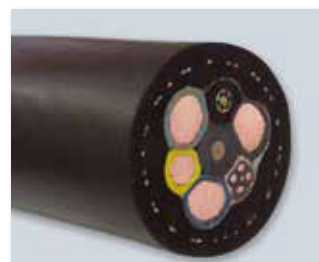
TRATOSMART-(N)SHTÖU-JZ - TRATOSMART-(N)SHTÖU-JZK - TRATOSGREEN-(N)SHTÖU-JZ

Part Number	Nominal Cross Section mm ²	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

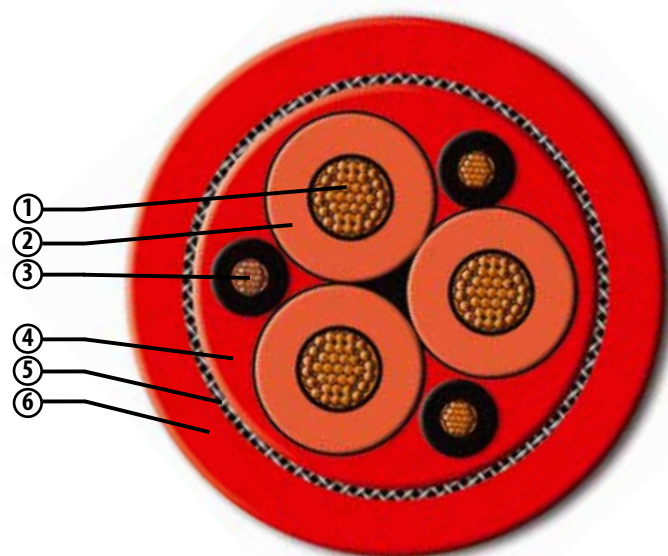
Single, two and three cores cable produced upon request



TRATOSFLEX-ESDB® - High speed, high pull & torsion resistance

High speed, high pull & torsion resistance for reeling one and two ways application.

FEATURES AND PERFORMANCES



CONSTRUCTION

- 1) Conductor more flexible than CI. 5 VDE 0295
- 2) Semiconducting layer + Insulation Tratosflex-ESDB-I®, equivalent to or better than HEPR + Semiconducting layer*
- 3) Ground conductor with semiconducting layer
- 4) Inner sheath red colour elastomeric compound Tratosflex-ESDB-IS®
- 5) Antitorsional protection
- 6) Outer sheath red colour elastomeric compound Tratosflex-ESDB-OS®, better than 5GM5 quality

TECHNICAL SPECIFICATIONS

• Rated Voltage	3,6/6 kV	6/10 kV	8,7/15 kV	12/20 kV
• Max Voltage AC	4,2/7,2 kV	6,9/12 kV	10,4/18 kV	13,9/24 kV
• AC Voltage Test	11 kV	17 kV	24 kV	29 kV



Working Ambient Temperature:	TRATOSFLEX-ESDB	Type K
Fixed installation	-40 °C to +80 °C	-60 °C to +60 °C
In operation	-30 °C to +80 °C	-60 °C to +60 °C

Travel Condition:					
Main application	Monospiral Reel One Way	Monospiral Reel Two Ways	Random	Spreader Reel	-
Suitable m/min Max	-	-	-	-	Tender System
Operating max speed (mt/min)	300	200	60	200	60

*Very special semiconducting compound which acts as a screen: the resistance between the ground conductor and semiconductive external layer of phase conductor must be maximum 500 Ohm measured according to VDE 0472 part 512

TRATOSFLEX-ESDB - High speed, high pull & torsion resistance

Part Number	Nominal Cross Section	Nominal Conductor Diameter	Maximum Conductor DC Resistance at 20 °C	Maximum Permanent Tensile Load	Maximum Dynamical Tensile Load During Acceleration Process	Minimum Overall Diameter	Maximum Overall Diameter	Nominal Cable Weight
	mm ²	mm	Ω/Km	N	N	mm	mm	Kg/m
3,6/6 kV (N)TSCGEWÖU								
FDC325	3x25+3x10	6,5/4,2	0,795/0,795*	3000	4125	42,5	45,5	2,560
FDC335	3x35+3x10	7,8/4,2	0,565/0,795*	3000	4125	44,2	47,2	3,050
FDC350	3x50+3x10	9,5/4,2	0,393/0,795*	3600	5250	47,3	50,2	3,520
FDC370	3x70+3x16	11,4/5,4	0,277/0,565*	5000	7500	50,0	54,2	4,950
FDC395	3x95+3x16	13,0/5,4	0,210/0,393*	6500	8900	55,4	59,4	5,780
FDC30A	3x120+3x25	14,7/6,5	0,164/0,277*	7500	10800	60,6	64,6	6,800
FDC30B	3x150+3x25	16,5/6,5	0,132/0,277*	9000	12000	64,0	67,0	8,200
		(1) (2)	(1) (2)					
6/10 kV (N)TSCGEWÖU								
FDD325	3x25+3x10	6,5/4,2	0,795/0,795*	3000	4125	42,5	45,5	2,560
FDD335	3x35+3x10	7,8/4,2	0,565/0,795*	3000	4125	44,2	47,2	3,050
FDD350	3x50+3x10	9,5/4,2	0,393/0,795*	3600	5250	47,3	50,2	3,520
FDD370	3x70+3x16	11,4/5,4	0,277/0,565*	5000	7500	50,0	54,2	4,700
FDD395	3x95+3x16	13,0/5,4	0,210/0,393*	6500	8900	55,4	59,4	5,880
FDD30A	3x120+3x25	14,7/6,5	0,164/0,277*	7500	10800	60,6	64,6	6,950
FDD30B	3x150+3x25	16,5/6,5	0,132/0,277*	9000	12000	64,0	67,0	8,200
8,7/15 kV (N)TSCGEWÖU								
FDE325	3x25+3x10	6,5/4,2	0,795/0,795*	3000	4125	43,5	47,0	2,750
FDE335	3x35+3x10	7,8/4,2	0,565/0,795*	3000	4125	47,1	50,1	3,250
FDE350	3x50+3x10	9,5/4,2	0,393/0,795*	3600	5250	50,0	54,0	3,890
FDE370	3x70+3x16	11,4/5,4	0,277/0,565*	5000	7500	54,0	58,0	5,100
FDE395	3x95+3x16	13,0/5,4	0,210/0,393*	6500	8900	59,1	63,1	6,270
FDE30A	3x120+3x25	14,7/6,5	0,164/0,277*	7500	10800	64,5	68,5	7,700
FDE30B	3x150+3x25	16,5/6,5	0,132/0,277*	9000	12000	69,5	73,5	8,600
12/20 kV (N)TSCGEWÖU								
FDF325	3x25+3x10	6,5/4,2	0,795/0,795*	3000	4125	48,0	51,0	3,060
FDF335	3x35+3x10	7,8/4,2	0,565/0,795*	3000	4125	50,2	54,2	3,590
FDF350	3x50+3x10	9,5/4,2	0,393/0,795*	3600	5250	55,4	59,4	4,470
FDF370	3x70+3x16	11,4/5,4	0,277/0,565*	5000	7500	59,0	63,0	5,490
FDF395	3x95+3x16	13,0/5,4	0,210/0,393*	6500	8900	63,6	67,6	6,900
FDF30A	3x120+3x25	14,7/6,5	0,164/0,277*	7500	10800	68,4	72,4	8,150
FDFE30B	3x150+3x25	16,5/6,5	0,132/0,277*	9000	12000	73,0	77,0	9,150

(1) = Phase conductor
 (2) = Protective conductors

* Value of three conductors in parallel connection

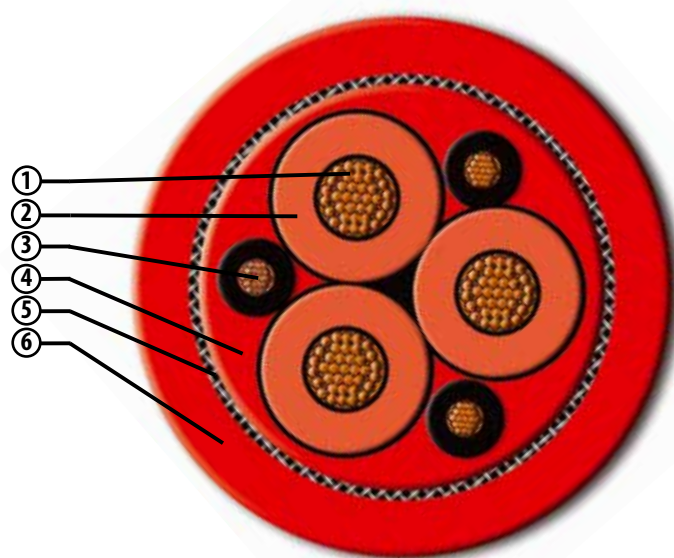
Special dimensions produced upon request



TRATOSFLEX-ES3® - (Extruded Screen) - Reduced weight and dimension TRATOSGREEN-ES3® - Reduced halogens and reduced toxicity⁽¹⁾⁽²⁾

Extruded screen. Reduced weight and dimension for **reeling one way application**.

FEATURES AND PERFORMANCES



CONSTRUCTION

- 1) Conductor more flexible than cl. 5 VDE 0295
- 2) Semiconducting layer + insulation Tratosflex-ES3-I®, equivalent to HEPR + Semiconducting layer*
- 3) Ground conductor with semiconducting layer
- 4) Inner sheath high grade compound Tratosflex-ES3-IS®, better than GM1b quality
- 5) Antitorsional protection
- 6) Outer sheath red colour polychloroprene Tratosflex-ES3-OS®, equivalent to or better than 5GM3 (or 5GM5 if required) quality

TECHNICAL SPECIFICATIONS

• Rated Voltage	3,6/6 kV	6/10 kV	8,7/15 kV	12/20 kV
• Max Voltage AC	4,2/7,2 kV	6,9/12 kV	10,4/18 kV	13,9/24 kV
• AC Voltage Test	11 kV	17 kV	24 kV	29 kV



Working Ambient Temperature:	TRATOSFLEX-ES3	Type K
Fixed installation	-40 °C to +80 °C	-60 °C to +60 °C
In operation	-30 °C to +80 °C	-60 °C to +60 °C

Travel Condition:		
Main application	Monospiral Reel One Way	Tender System
Suitable m/min Max	-	-
Operating max speed (mt/min)	200	60

***Very special semiconducting compound which acts as a screen: the resistance between the ground conductor and the semiconductive external layer of phase conductor must be maximum 500 Ohm measured according to VDE 0472 part 512**

(1) Toxicity index on finished cable <5

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

TRATOSFLEX-ES3 - Reduced weight and dimension / TRATOSGREEN-ES3 - Reduced weight and dimension

Part Number	Nominal Cross Section mm ²	Nominal Conductor Diameter mm	Maximum Conductor DC Resistance at 20 °C Ω/Km	Maximum Permanent Tensile Load ** N	Maximum Dynamical Tensile Load ** During Acceleration Process N	Minimum Overall Diameter mm	Maximum Overall Diameter mm	Nominal Cable Weight Kg/m
6/10 kV (N)TSCGEWÖU								
F3ED325	3x25+3x10	6,5/4,2	0,795/0,795*	1500	2250	39,1	42,1	2,470
F3ED335	3x35+3x10	7,8/4,2	0,565/0,795*	2100	3150	41,8	44,8	2,970
F3ED350	3x50+3x10	9,5/4,2	0,393/0,795*	3000	4500	44,8	47,8	3,470
F3ED370	3x70+3x16	11,4/5,4	0,277/0,565*	4200	5250	49,5	53,5	4,600
F3ED395	3x95+3x16	13,0/5,4	0,210/0,393*	5700	7000	53,9	57,9	5,800
F3ED30A	3x120+3x25	14,7/6,5	0,164/0,277*	7200	9000	58,0	62,0	6,950
F3ED30B	3x150+3x25	16,5/6,5	0,132/0,277*	9000	11250	62,3	66,3	8,200
F3ED30C	3x185+3x35	18,3/7,8	0,108/0,210*	11100	13800	67,5	71,5	9,700
8,7/15 kV (N)TSCGEWÖU								
F3EE325	3x25+3x10	6,5/4,2	0,795/0,795*	1500	2250	42,7	45,7	2,780
F3EE335	3x35+3x10	7,8/4,2	0,565/0,795*	2100	3150	45,4	48,4	3,240
F3EE350	3x50+3x10	9,5/4,2	0,393/0,795*	3000	4500	48,8	51,8	3,990
F3EE370	3x70+3x16	11,4/5,4	0,277/0,565*	4200	5250	53,0	57,0	5,050
F3EE395	3x95+3x16	13,0/5,4	0,210/0,393*	5700	7000	57,8	61,8	6,180
F3EE30A	3x120+3x25	14,7/6,5	0,164/0,277*	7200	9000	62,5	66,5	7,580
F3EE30B	3x150+3x25	16,5/6,5	0,132/0,277*	9000	12000	67,6	71,6	9,000
12/20 kV (N)TSCGEWÖU								
F3EF325	3x25+3x10	6,5/4,2	0,795/0,795*	1500	2250	46,3	49,3	3,050
F3EF335	3x35+3x10	7,8/4,2	0,565/0,795*	2100	3150	48,6	51,6	3,570
F3EF350	3x50+3x10	9,5/4,2	0,393/0,795*	3000	4500	52,7	56,7	4,440
F3EF370	3x70+3x16	11,4/5,4	0,277/0,565*	4200	5250	56,8	60,8	5,460
F3EF395	3x95+3x16	13,0/5,4	0,210/0,393*	5700	7000	62,3	66,3	6,780
F3EF30A	3x120+3x25	14,7/6,5	0,164/0,277*	7200	9000	66,5	70,5	8,050
F3EF30B	3x150+3x25	16,5/6,5	0,132/0,277*	9000	12000	71,60	75,6	9,900

(1) = Phase conductor
(2) = Protective conductors

* Value of three conductors in parallel connection
** Please respect minimum bending radius

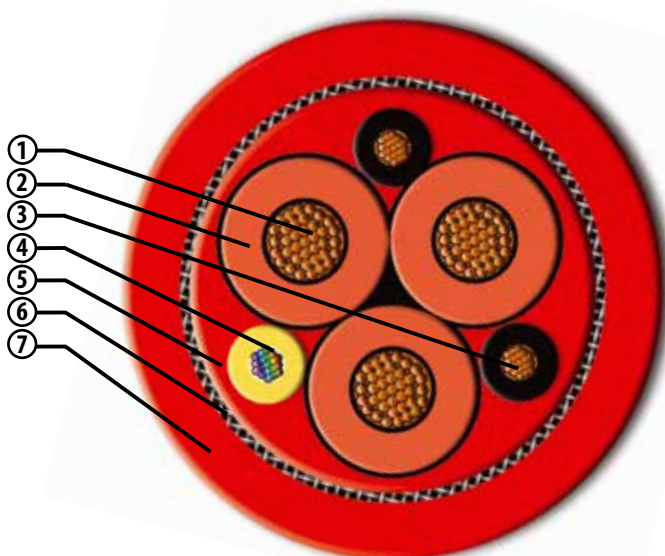
Cables for rated voltage >= 18/30 kV are produced upon request.



TRATOSFLEX-ESDB-FO® - High speed, high pull & torsion resistance

High speed, high pull & torsion resistance for reeling one and two ways application with optical fibre.

FEATURES AND PERFORMANCES



CONSTRUCTION

- 1) Conductor more flexible than CI. 5 VDE 0295
- 2) Semiconducting layer + Insulation Tratosflex-ESDB-I®, equivalent to or better than HEPR + Semiconducting layer*
- 3) Ground conductor with semiconducting layer
- 4) Optical Fibre cable
- 5) Inner sheath red colour elastomeric compound Tratosflex-ESDB-IS®
- 6) Antitorsional protection
- 7) Outer sheath red colour elastomeric compound Tratosflex-ESDB-OS®, better than 5MG5 quality

TECHNICAL SPECIFICATIONS

• Rated Voltage	3,6/6 kV	6/10 kV	8,7/15 kV	12/20 kV
• Max Voltage AC	4,2/7,2 kV	6,9/12 kV	10,4/18 kV	13,9/24 kV
• AC Voltage Test	11 kV	17 kV	24 kV	29 kV



Working Ambient Temperature:	TRATOSFLEX-ESDB-FO	Type K
Fixed installation	-40 °C to +80 °C	-60 °C to +60 °C
In operation	-30 °C to +80 °C	-60 °C to +60 °C

Travel Condition:					
Main application	Monospiral Reel One Way	Monospiral Reel Two Ways	Random	Spreader Reel	-
Suitable m/min Max	-	-	-	-	Tender System
Operating max speed (mt/min)	300	200	60	200	60

*Very special semiconducting compound which acts as a screen: the resistance between the ground conductor and semiconductive external layer of phase conductor must be maximum 500 Ohm measured according to VDE 0472 part 512

TRATOSFLEX-ESDB-FO - High speed, high pull & torsion resistance

Part Number	Nominal Cross Section mm ²	Nominal Conductor Diameter mm	Maximum Conductor DC Resistance at 20 °C Ω/Km	Maximum Permanent Tensile Load N	Maximum Dynamical Tensile Load During Acceleration Process N	Minimum Overall Diameter mm	Maximum Overall Diameter mm	Nominal Cable Weight Kg/m
3,6/6 kV (N)TSCGEWÖU								
FDC325F	3x25+2x25/2+FO**	6,5/4,8	0,795/0,795*	3000	4125	42,5	45,5	2,560
FDC335F	3x35+2x25/2+FO**	7,8/4,8	0,565/0,795*	3000	4125	44,2	47,2	3,050
FDC350F	3x50+2x25/2+FO**	9,5/4,8	0,393/0,795*	3600	5250	47,3	50,2	3,520
FDC370F	3x70+2x35/2+FO**	11,4/5,4	0,277/0,565*	5000	7500	52,2	54,2	4,950
FDC395F	3x95+2x50/2+FO**	13,0/6,4	0,210/0,393*	6500	8900	55,4	59,4	5,780
FDC30AF	3x120+2x70/2+FO**	14,7/7,8	0,164/0,277*	7500	10800	60,6	64,6	6,800
FDC30BF	3x150+2x70/2+FO**	16,5/7,8	0,132/0,277*	9000	12000	64,0	67,3	8,600
FDC30CF	3x185+2x95/2+FO**	18,3/9,3	0,108/0,210*	11100	14000	69,0	73,0	10,100
		(1) (2)	(1) (2)					
6/10 kV (N)TSCGEWÖU								
FDD325F	3x25+2x25/2+FO**	6,5/4,8	0,795/0,795*	3000	4125	42,5	45,5	2,560
FDD335F	3x35+2x25/2+FO**	7,8/4,8	0,565/0,795*	3000	4125	44,2	47,2	3,050
FDD350F	3x50+2x25/2+FO**	9,5/4,8	0,393/0,795*	3600	5250	48,2	50,2	3,520
FDD370F	3x70+2x35/2+FO**	11,4/5,4	0,277/0,565*	5000	7500	50,0	54,2	4,700
FDD395F	3x95+2x50/2+FO**	13,0/6,4	0,210/0,393*	6500	8900	55,4	59,4	5,880
FDD30AF	3x120+2x70/2+FO**	14,7/7,8	0,164/0,277*	7500	10800	60,6	64,6	6,950
FDD30BF	3x150+2x70/2+FO**	16,5/7,8	0,132/0,277*	9000	12000	64,0	68,0	8,600
FDD30CF	3x185+2x95/2+FO**	18,3/9,3	0,108/0,210*	11100	14000	69,3	73,3	10,300
8,7/15 kV (N)TSCGEWÖU								
FDE325F	3x25+2x25/2+FO**	6,5/4,8	0,795/0,795*	3000	4125	45,3	48,3	2,840
FDE335F	3x35+2x25/2+FO**	7,8/4,8	0,565/0,795*	3000	4125	47,1	50,1	3,250
FDE350F	3x50+2x25/2+FO**	9,5/4,8	0,393/0,795*	3600	5250	50,0	54,0	3,890
FDE370F	3x70+2x35/2+FO**	11,4/5,4	0,277/0,565*	5000	7500	54,0	58,0	5,100
FDE395F	3x95+2x50/2+FO**	13,0/6,4	0,210/0,393*	6500	8900	59,1	63,1	6,270
FDE30AF	3x120+2x70/2+FO**	14,7/7,8	0,164/0,277*	7500	10800	64,5	68,5	7,700
FDE30BF	3x150+2x70/2+FO**	16,5/7,8	0,132/0,277*	9000	12000	69,0	73,0	9,200
FDE30CF	3x185+2x95/2+FO**	18,3/9,3	0,108/0,210*	11100	14000	75,0	79,0	11,000
12/20 kV (N)TSCGEWÖU								
PDF325F	3x25+2x25/2+FO**	6,5/4,8	0,795/0,795*	3000	4125	48,6	51,0	3,180
PDF335F	3x35+2x25/2+FO**	7,8/4,8	0,565/0,795*	3000	4125	52,3	54,7	3,800
PDF350F	3x50+2x25/2+FO**	9,5/4,8	0,393/0,795*	3600	5250	56,4	59,4	4,470
PDF370F	3x70+2x35/2+FO**	11,4/5,4	0,277/0,565*	5000	7500	60,9	63,9	5,800
PDF395F	3x95+2x50/2+FO**	13,0/6,4	0,210/0,393*	6500	8900	64,6	68,5	6,900
PDF30AF	3x120+2x70/2+24FO*	14,7/7,8	0,164/0,277*	7500	10800	69,0	73,0	8,150

(1) = Phase conductor

(2) = Protective conductors

* Value of two conductors in parallel connection

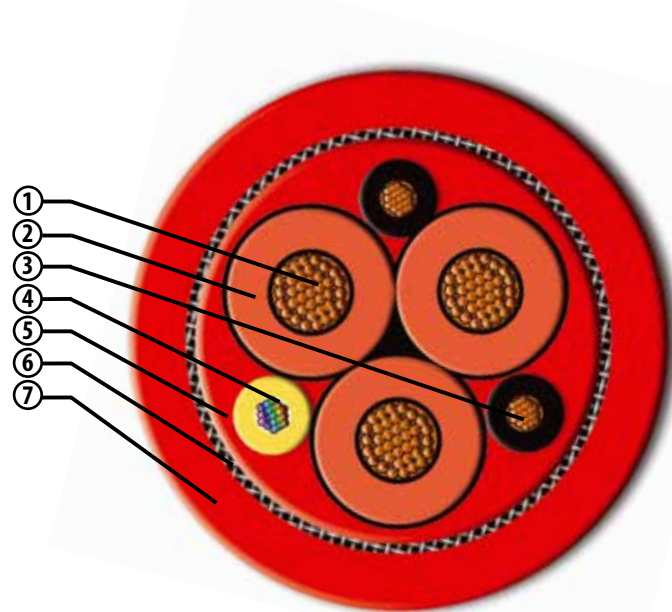
** Upon request available special construction with 6 up to 24 integrated optical fibres. Standard fibres type 62,5/125 (also available 50/125 and monomode E9/125)



TRATOSFLEX-ES3-FO® - (Extruded Screen) - Reduced weight and dimension TRATOSGREEN-ES3-FO® - Reduced halogens and reduced toxicity⁽¹⁾⁽²⁾

Extruded screen. Reduced weight and dimension for reeling **one way application** with optical fibre.

FEATURES AND PERFORMANCES



CONSTRUCTION

- 1) Conductor more flexible than cl. 5 VDE 0295
- 2) Semiconducting layer + insulation Tratosflex-ES3-I®, equivalent to HEPR + Semiconducting layer*
- 3) Ground conductor with semiconducting layer
- 4) Optical Fibre cable
- 5) Inner sheath high grade compound Tratosflex-ES3-IS®, better than GM1b quality
- 6) Antitorsional protection
- 7) Outer sheath red colour polychloroprene Tratosflex-ES3-OS®, equivalent to or better than 5GM3 (or 5GM5 if required) quality

TECHNICAL SPECIFICATIONS

• Rated Voltage	3,6/6 kV	6/10 kV	8,7/15 kV	12/20 kV
• Max Voltage AC	4,2/7,2 kV	6,9/12 kV	10,4/18 kV	13,9/24 kV
• AC Voltage Test	11 kV	17 kV	24 kV	29 kV



Working Ambient Temperature:	TRATOSFLEX-ES3-FO	Type K
Fixed installation	-40 °C to +80 °C	-60 °C to +60 °C
In operation	-30 °C to +80 °C	-60 °C to +60 °C

Travel Condition:		
Main application	Monospiral Reel One Way	Tender System
Suitable m/min Max	-	-
Operating max speed (mt/min)	200	60

***Very special semiconducting compound which acts as a screen: the resistance between the ground conductor and semiconductive external layer of phase conductor must be maximum 500 Ohm measured according to VDE 0472 part 512**

(1) Toxicity index on finished cable <5

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

TRATOSFLEX-ES3-FO / TRATOSGREEN-ES3-FO - Reduced weight and dimension

Part Number	Nominal Cross Section mm ²	Nominal Conductor Diameter mm	Maximum Conductor DC Resistance at 20 °C Ω/Km	Maximum Permanent Tensile Load N	Maximum Dynamical Tensile Load During Acceleration Process N	Minimum Overall Diameter mm	Maximum Overall Diameter mm	Nominal Cable Weight Kg/m
6/10 kV (N)TSCGEWÖU								
F3ED325F	3x25+2x25/2+ FO**	6,5/4,8	0,795/0,795*	1500	2250	39,5	42,5	2,510
F3ED335F	3x35+2x25/2+ FO**	7,8/4,8	0,565/0,795*	2100	3150	42,8	45,8	2,980
F3ED350F	3x50+2x25/2+ FO**	9,5/4,8	0,393/0,795*	3000	4500	45,7	48,7	3,550
F3ED370F	3x70+2x35/2+ FO**	11,4/5,4	0,277/0,565*	4200	5250	49,3	53,3	4,800
F3ED395F	3x95+2x50/2+ FO**	13,0/6,4	0,210/0,393*	5700	7000	54,5	58,5	5,800
F3ED30AF	3x120+2x70/2+ FO**	14,7/7,8	0,164/0,277*	7200	9000	58,8	62,8	7,400
F3ED30BF	3x150+2x70/2+ FO**	16,5/7,8	0,132/0,277*	9000	11250	64,2	68,2	8,500
F3ED30CF	3x185+2x95/2+ FO**	18,3/9,3	0,108/0,210*	11100	13800	69,0	73,0	10,000
8,7/15 kV (N)TSCGEWÖU								
F3EE325F	3x25+2x25/2+ FO**	6,5/4,8	0,795/0,795*	1500	2250	44,0	47,0	2,950
F3EE335F	3x35+2x25/2+ FO**	7,8/4,8	0,565/0,795*	2100	3150	46,4	49,4	3,340
F3EE350F	3x50+2x25/2+ FO**	9,5/4,8	0,393/0,795*	3000	4500	49,3	53,3	4,150
F3EE370F	3x70+2x35/2+ FO**	11,4/5,4	0,277/0,565*	4200	5250	54,0	58,0	5,300
F3EE395F	3x95+2x50/2+ FO**	13,0/6,4	0,210/0,393*	5700	7000	58,3	62,3	6,100
F3EE30AF	3x120+2x70/2+ FO**	14,7/7,8	0,164/0,277*	7200	9000	62,6	66,6	7,700
F3EE30BF	3x150+2x70/2+ FO**	16,5/7,8	0,132/0,277*	9000	11250	69,0	73,0	9,300
12/20 kV (N)TSCGEWÖU								
F3EF325F	3x25+2x25/2+ FO**	6,5/4,8	0,795/0,795*	1500	2250	47,2	50,2	3,250
F3EF335F	3x35+2x25/2+ FO**	7,8/4,8	0,565/0,795*	2100	3150	49,7	53,7	3,800
F3EF350F	3x50+2x25/2+ FO**	9,5/4,8	0,393/0,795*	3000	4500	53,8	57,8	4,650
F3EF370F	3x70+2x35/2+ FO**	11,4/5,4	0,277/0,565*	4200	5250	57,7	61,7	5,670
F3EF395F	3x95+2x50/2+ FO**	13,0/6,4	0,210/0,393*	5700	7000	63,0	67,0	6,690
F3EF30AF	3x120+2x70/2+ FO**	14,7/7,8	0,164/0,277*	7200	9000	68,3	72,3	8,350
F3EF30BF	3x150+2x70/2+ FO**	16,5/7,8	0,132/0,277*	9000	11250	74,0	78,0	10,500

(1) = Phase conductor

(2) = Protective conductors

* Value of two conductors in parallel connection

** Upon request available special construction with 6 up to 24 integrated optical fibres. Standard fibres type 62,5/125 (also available 50/125 and monomode E9/125)

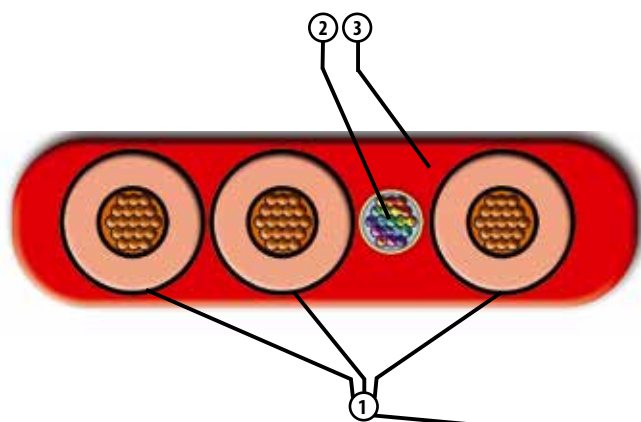
Cables for rated voltage $\geq 18/30$ kV are produced upon request.

MEDIUM VOLTAGE FLAT CABLE for reeling application

TRATOSFLAT[®] TRATOSFLAT-FO[®]

Medium voltage flat cable.

FEATURES AND PERFORMANCES

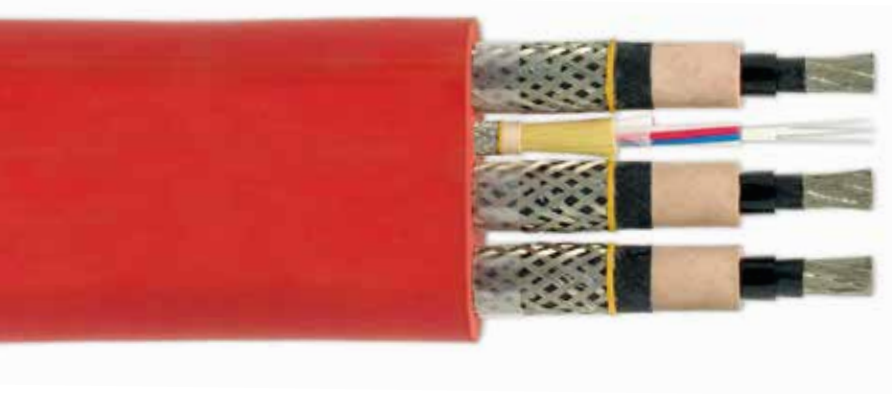


CONSTRUCTION

- 1) Screened phase conductors
- 2) Optical fibre cable
- 3) Outer sheath red colour polychloroprene Tratoflat-OS[®], equivalent to or better than 5GM3 (or 5GM5 if required) quality

TECHNICAL SPECIFICATIONS

- Rated Voltage 3,6/6 kV 6/10 kV
- Max Voltage AC 4,2/7,2 kV 6,9/12 kV
- AC Voltage Test 11 kV 17 kV



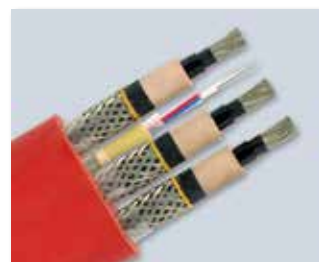
Working Ambient Temperature:	TRATOSFLAT	Type K
Fixed installation	-40 °C to +80 °C	-60 °C to +60 °C
In operation	-30 °C to +80 °C	-60 °C to +60 °C

Travel Condition:	
Main application	Monospiral Reel One Way
Suitable m/min Max	-
Operating max speed (mt/min)	200

TRATOSFLAT / TRATOSFLAT-FO

Part Number	Nominal Cross Section mm ²	Maximum Temperature of the Conductor During Operation °C	Maximum Temperature of the Conductor During Short Circuit °C	Maximum Tensile Load During Installation and Operation N	Maximum Dimension mm	Nominal Cable Weight Kg/m
3,6/6 kV (N)TSCGEWÖU						
FT3DB435F	3x35+4x25/4E+OFE12x62,5/125	90	250	1575	87 x 30,0	4,000
FT3DB450F	3x50+4x25/4E+OFE12x62,5/125	90	250	2250	92 x 32,5	4,700
6/10 kV (N)TSCGEWÖU						
FT3DC435F	3x35+4x25/4E+OFE12x62,5/125	90	250	1575	89 x 30,5	4,100
FT3DC450F	3x50+4x25/4E+OFE12x62,5/125	90	250	2250	95 x 33,0	5,100
8,7/15 kV (N)TSCGEWÖU						
FT3DD435F	3x35+4x25/4E+OFE12x62,5/125	90	250	1620	93 x 32,0	4,800
FT3DD450F	3x50+4x25/4E+OFE12x62,5/125	90	250	2300	97 x 33,5	5,200

Standard fibres type 62,5/125 or 50/125 on request

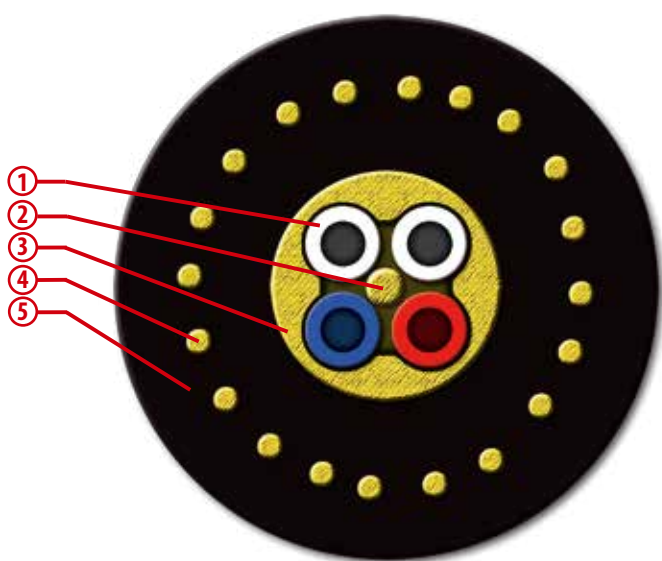


FIBRE CABLE

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®

TRATOSFIBRE-DB

Part Number	Fibres	Types (1)	Nominal Overall Diameter	Maximum Tensile Load	Nominal Cable Weight	Minimum Bendig Radius
			mm	N	Kg/Km	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

TRATOSFIBRE-DB

OPTICAL parameters		
	Grade index fibre 62,5/125	Monomode fibre E9/125
Max attenuation at wavelength 850 nm	3,2 dB/km	-
Max attenuation at wavelength 1300 nm	0,9 dB/km	0,4 dB/km
Max attenuation at wavelength 1550 nm	-	0,3 dB/km
Bandwidth at 850 nm	≥ 400 MHz	-
Bandwidth at 1300 nm	≥ 600 MHz	-
Numerical aperture	0,275 ± 0,015	0,140 ± 0,02
Attenuation on completed cable (max) at wavelength 1300 nm	5,00 dB/km	2,00 dB/km

THERMAL parameters	TRATOSFIBRE-DB	Type K
Fully flexible operation (ambient temperature)	-40 °C to +80 °C	-60 °C to +60 °C
Fixed installation	-30 °C to +80 °C	-60 °C to +60 °C

THERMAL parameters	
Max tensile strength	5000 N
Minimum bending radius for fixed installation	130 mm
Minimum bending radius for cylindrical reel	250 mm
Travel speed for festoon systems	up to 240 m/min

CHEMICAL parameters	
Transmission data of the fibre-optics	
Weather resistance	Resistant to ozone, UV and moisture
Resistance to oil	Acc. to DIN VDE 0473

Travel Condition:		
Main application	Monospiral Reel One Way	Festoon
Suitable m/min Max	-	-
Operating max speed (mt/min)	300	240



SPECIAL CABLES TAILORED

BESPOKEN CABLES

"Cables Tailor Made" is a special division of Tratos Cavi S.p.A. Working with our customers Cables Tailor Made are able to offer custom designed and built solutions to the most demanding of circumstances. Using our **40 years of cable design and construction experience** we can examine the challenges facing our customers and bring together our expertise and cutting edge technology to provide the ideal tailor made solution. Our **special cables** can incorporate power, control, signalling and fibre-optic elements.

www.reelingcables.com



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