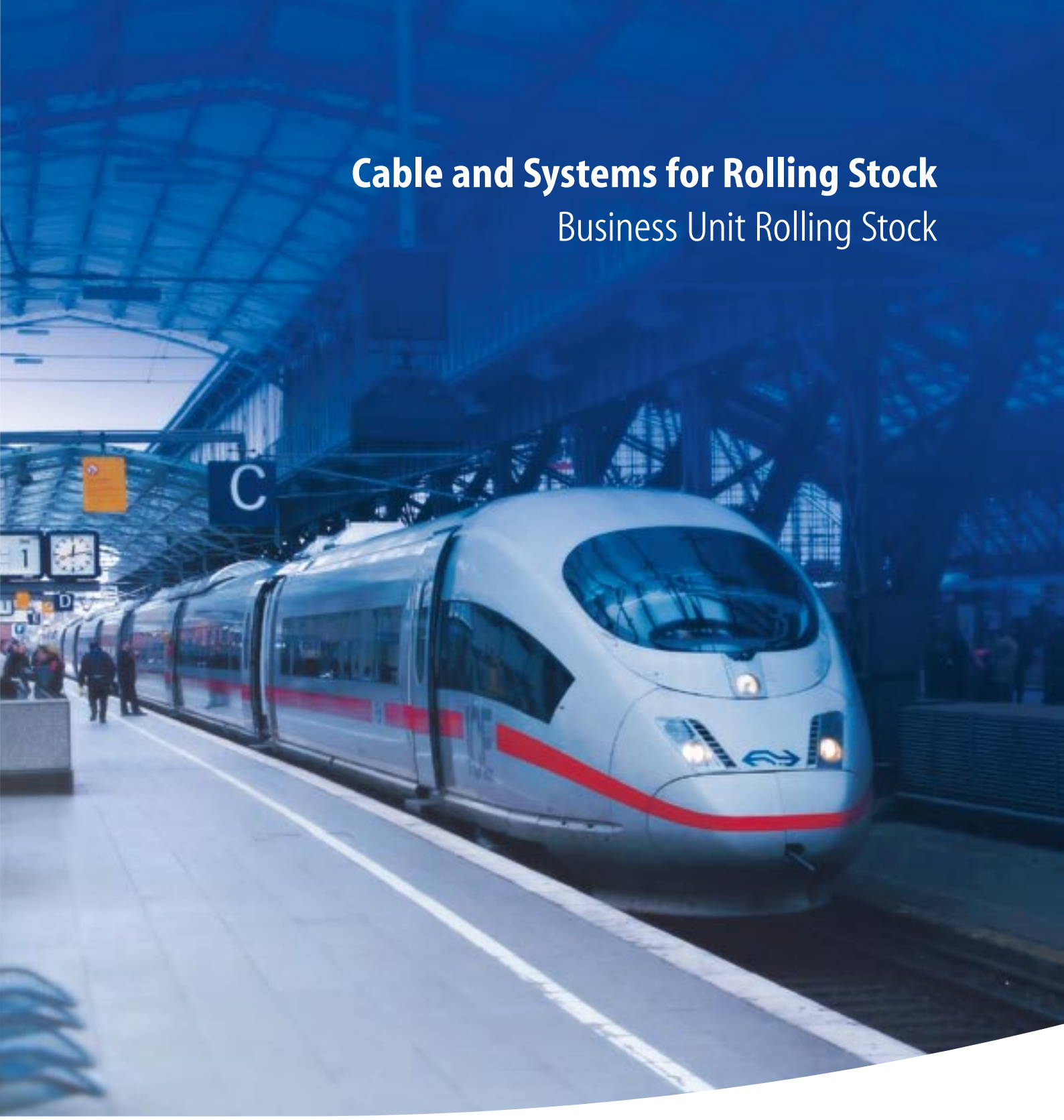


Cable and Systems for Rolling Stock

Business Unit Rolling Stock

The Quality Connection

LEONI

Consulting and Sales

Cable solutions
Phone +41 (0)62-288-8356
Fax +41 (0)62-288-8383

System solutions
Phone +49 (0)9172-6844-11
Fax +49 (0)9172-6844-29

Internet

Up-to-date-information,
news and cable details
can always be found on our home-page at:

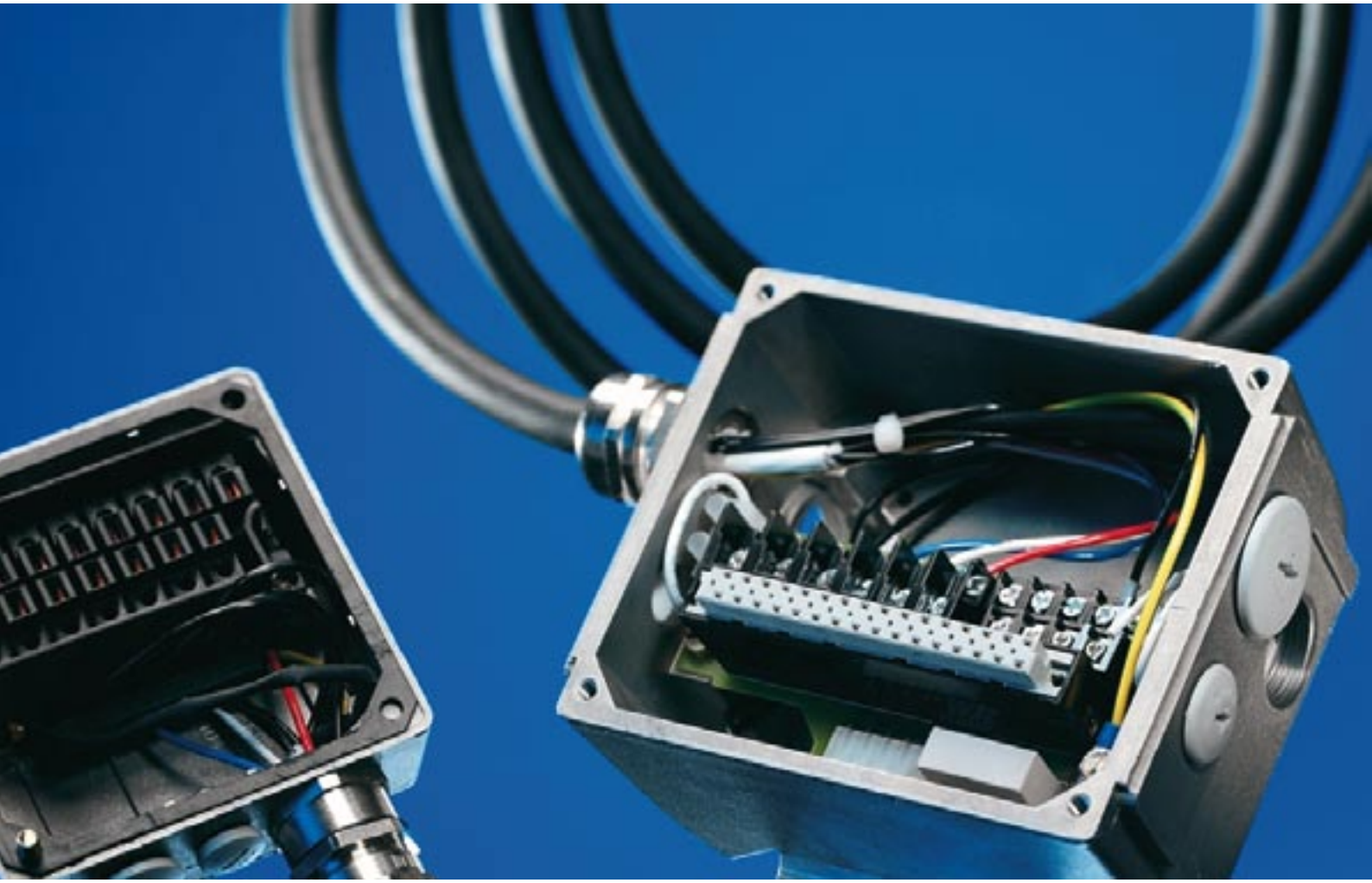
www.leoni-rolling-stock.com.
rolling-stock@leoni.com

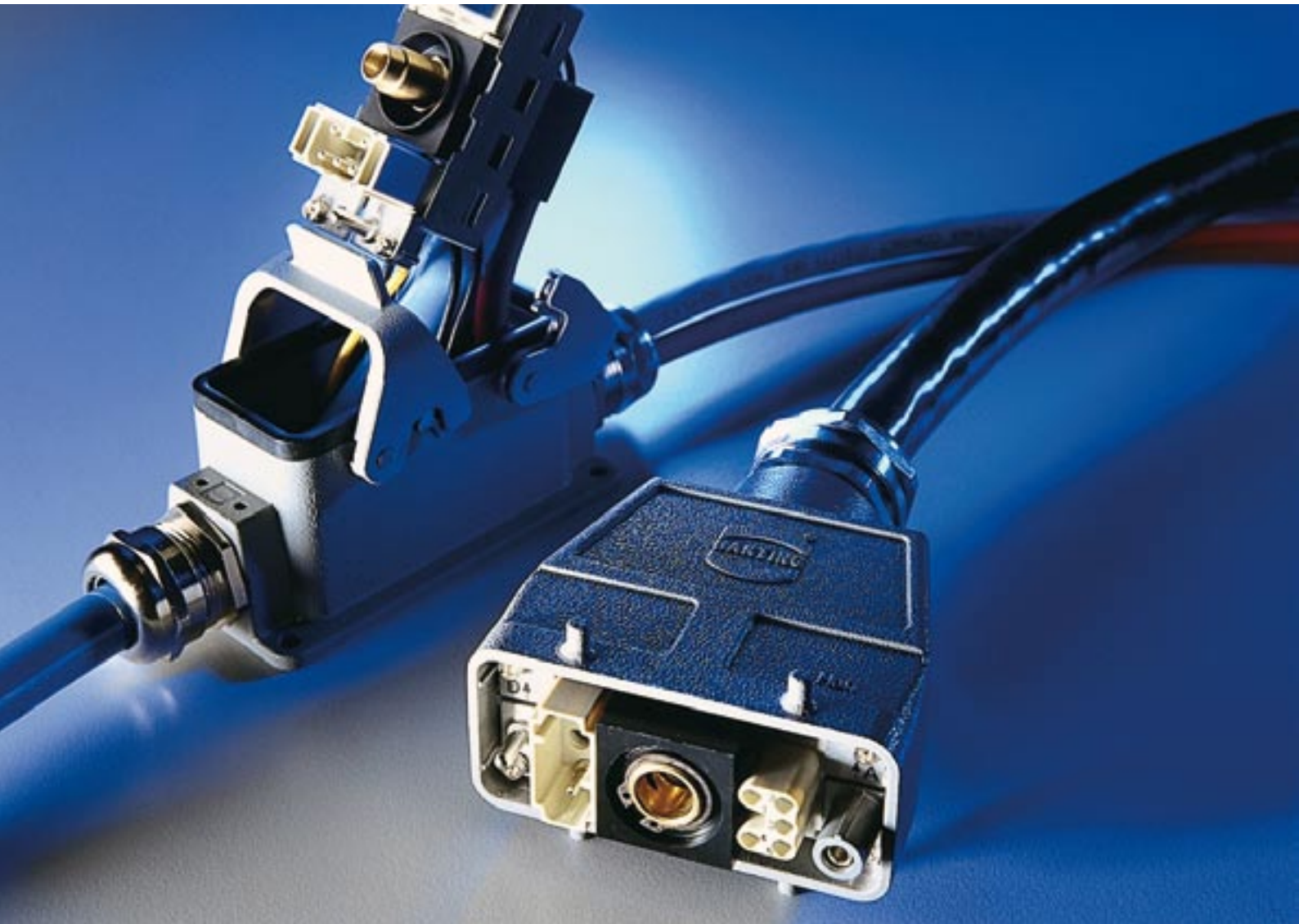
Safety instructions

Cables may only be used for their designed applications. The installation has to be carried out by qualified personnel.

Issue November 2007
Subject to change and error.

Content




HARTING

Business Unit Rolling Stock

High-tech cable and system solutions for rolling stock engineering
The Rolling Stock business unit is your strong partner for application-specific cable and system solutions meeting national and international standards. With our wide portfolio of products and services for internal and external wiring of rolling stock we will assist you across the entire lifecycle of your vehicles – worldwide. You can trust in our extensive experience and comprehensive know-how – **Quality – Reliability – Safety.**

Services

Product Range. The comprehensive product range offers perfect cable assembly solutions for all demanding customers' requirements.
An overview:
- Assembly of tailor-made cables of all kinds
- D-sub cables
- Coaxial cables
- Heavy-duty connectors
- Extrusion-coated and encapsulated cables
- Cable harnesses of all sizes
- Control units
- Distributor boxes
- Switch cabinets and panels
- Tailor-made terminal boxes

Engineering. Many years of experience, product and production know-how, system expertise and innovative production technologies provide the foundation for tailor made solutions. Modern management methods and a global quality control system guarantee an optimal project realisation.
Our core competences:
- Consulting
- Problem analysis
- Design to cost
- Project management
- Development
- Prototype development and production based on customer specifications
- Assembly
- Harnessing
- Technical documentation
- Customised logistics solutions
- Testing (visual check, wiring test, continuity test, short circuit test, high-voltage insulation test)

Processing. Most modern production technologies enable us to produce high-quality products from a simple cable to a complex, ready-to-mount system solution, from a prototype to a customised serial production.
Proceedings:
- Cutting, stripping the insulation, mounting (also with assembly robots)
- Soldering
- Crimping
- Assembling, mounting
- EMC-compliant assembly
- Fitting of electronic and mechanical components
- Fitting of complete components/systems incl. metal and plastic parts
- Fitting of connectors and cables
- Plastic injection-moulded parts
- Cable extrusion (connectors + sockets)

Quality

Quality

The global quality system secures the quality of production, the reliability and the fulfilment of the functional specifications during each work step by means of self-tests and process control with innovative technology and the consequent use of all quality system elements.

Safety Instructions and Explanations

Safety instructions

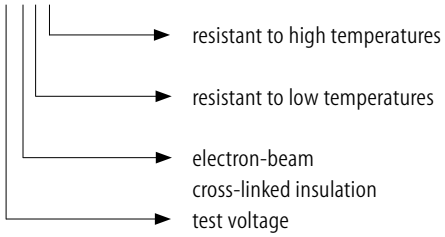
Cables from LEONI are to be used for designed applications only. In case of failure or damage to the cable or connector, switch off power immediately and replace all damaged parts.

Maintenance, repair and replacement of the cables and connectors must be carried out by authorised and trained personnel only.

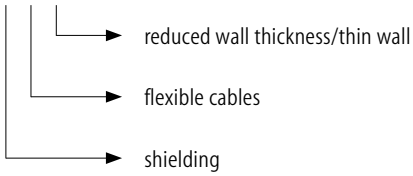
LEONI's policy is one of continuous material and product development. We reserve the right to offer alternatives consistent with our manufacturing programme at the time of enquiry. Technical data are based for reference values only.

Explanations

BETAtrans® 3 GKW



BETAtrans® GKW C-flex R



All information regarding material properties, technical data, etc. are without obligation. Dimensions and weights are reference values. All information can be changed at any time and without prior notice.

For further information about LEONI products please see our data sheets or at www.leoni-rolling-stock.com.

Our General Terms and Conditions of Sale apply exclusively. On request they may be put at your disposal at any time.

12	BETAtrans® GKW R (600 V)	
13	GKW R	single core, non screened
14	GKW flex R	multiple cores, non screened
18	GKW C-flex R	single and multiple cores, screened
21	BETAtrans® 3 GKW (600 V)	
22	3 GKW	single core, non screened
24	3 GKW flex	multiple cores, non screened
29	3 GKW C-flex	single and multiple cores, screened

BETAtrans® GKW R Cable Family

600/1000 V AC
900 V DC

The BETAtrans® GKW R Cable Family is an electron-beam cross-linked thin wall cable type with light weight, compact design and reduced outer cable diameter suited for compact system wiring in protected areas of applications where space and weight savings are important as well as for high (+120 °C) and low (–40 °C) operating temperature. The BETAtrans® GKW R Cable Family possesses excellent electrical and mechanical characteristics and an outstanding fire performance.

The BETAtrans® GKW R Cable Family consists of:

- **BETAtrans® GKW R**
  as single core version
- **BETAtrans® GKW flex R**
  as multi-core version, non screened
- **BETAtrans® GKW C-flex R**
  as multi-core version, screened, with optimized EMC screening

Cross sections

0,5–2,5 mm², other cross sections available on demand

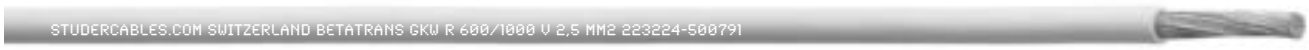
Advantages

- Easy to handling
- Easy to install
- Easy to strip
- Excellent flexibility
- Saves volume, optimized cable volume
- Saves weight, optimized cable weight
- Saves space, limited space required
- Operating temperature –40 °C to +120 °C
- meets highest requirements in fire performance
- Halogen free
- Low smoke density
- Flame retardant
- Low fire load
- Ozone and weathering resistance
- Fluorine free
- Resistance to oil
- Resistance to fuel
- Soldering iron resistant
- Tight bending radius by fixed installation

Application

- As Signal and Control cable for protected installations inside and outside of rail vehicles, buses and other transport vehicles. For applications where space and weight are an important factor, where process ability is important and costs for handling and installation have to be low.
- BETAtrans® GKW R cables are used in applications such as in cable harnesses, cable looms, switchboards and control panels, electrical cabinets, driver desks and many other applications.

BETAtrans® GKW R



Specification

Product properties		
nominal voltage	U_0/U(Um)	0.6/1 (1.2) kV AC
		0.9 kV DC
testing voltage		3.5 kV AC
Max. conductor temperature	fixed installations	+120 °C
	short circuit	+200 °C
Min. ambient temperature	fixed installations	–45 °C

Fire performance for rolling stock		
BS 6853	interior use	Ia, Ib, II
	exterior use	Ia, Ib, II
DIN 5510-2	level of protection	1, 2, 3, 4
EN 50306-2	*all hazard levels	
NF F 16-101	classification	C / FO
	interior use	A1, A2, B
	exterior use	A1, A2, B

Fire performance in general	
Vertical flame propagation for a single insulated wire or cable	EN 50265-2-1, IEC 60332-1
Vertical flame spread of bunched wires and cables	EN 50266-2-4, IEC 60332-3-24
Halogen free	EN 50267-2-1, IEC 60754-1
Corrosivity of gases	EN 50267-2-3, IEC 60754-2
Toxicity of gases	EN 50305, NFX 70-100
Smoke density	EN 50268-2, IEC 61034-2

Material properties	
No fluorine	EN 60684-2
Resistance to oil	EN 50305, EN 60811-2-1
Resistance to fuel	EN 50305, EN 60811-2-1
Resistance to ozone	EN 50305
Low fire load	DIN 51900

*acc. HL4 as to today's version EN 45545

Technical data

cross section	**part no.**	**color**	**conductor**	**outer-Ø**	**R_{20}**	**weight**
[mm^2]		code	n x mm [mm]	approx. [mm]	[mΩ/m]	approx. [kg/km]
0.50	223220	white	16 x 0.20	1.45	40.10	6
0.75	223221	white	24 x 0.20	1.70	26.70	8
1.0	223222	white	32 x 0.20	1.90	20.00	11
1.5	223223	white	30 x 0.25	2.30	13.70	16
2.5	223224	white	50 x 0.25	2.80	8.21	26

BETAtrans® GKW flex R

Specification

Product properties		
Nominal voltage	U_0/U(Um)	0.6/1 (1.2) kV AC
		0.9 kV DC
Testing voltage		3.5 kV AC
Max. conductor temperature	fixed installations	+120 °C
	sporadically moved	+90 °C
	short circuit	+200 °C
Min. ambient temperature	fixed installations	–45 °C
Fire performance for rolling stock		
BS 6853	interior use	Ia, Ib, II
	exterior use	Ia, Ib, II
DIN 5510-2	level of protection	1, 2, 3, 4
EN 50306-4	*all hazard levels	
NF F 16-101	classification	C / FO
	interior use	A1, A2, B
	exterior use	A1, A2, B
Fire performance in generally		
Vertical flame propagation for a single insulated wire or cable	EN 50265-2-1, IEC 60332-1	
Vertical flame spread of bunched wires and cables	EN 50266-2-4, IEC 60332-3-24	
Halogen free	EN 50267-2-1, IEC 60754-1	
Corrosivity of gases	EN 50267-2-3, IEC 60754-2	
Toxicity of gases	EN 50305, NFX 70-100	
Smoke density	EN 50268-2, IEC 61034-2	
Material properties		
No fluorine	EN 60684-2	
Resistance to oil	EN 50305, EN 60811-2-1	
Resistance to fuel	EN 50305, EN 60811-2-1	
Resistance to ozone	EN 50305	
Low fire load	DIN 51900	

*acc. HL4 as to today's version EN 45545

BETAtrans® GKW flex R

Technical data

cable type	part no.	color	conductor	outer-Ø	R_{20}	weight
n x mm² [mm²]		code	n x mm [mm]	approx. [mm]	[mΩ/m]	approx. [kg/km]
2 x 0.5	223370	NR	16 x 0.20	4.30	40.10	30
3 x 0.5	223371	NR	16 x 0.20	4.50	40.10	35
4 x 0.5	224427	NR	16 x 0.20	4.90	40.10	43
5 x 0.5	224428	NR	16 x 0.20	5.30	40.10	51
6 x 0.5	224429	NR	16 x 0.20	5.80	40.10	58
7 x 0.5	224430	NR	16 x 0.20	6.40	40.10	70
8 x 0.5	224443	NR	16 x 0.20	6.70	40.10	79
9 x 0.5	✆	NR	16 x 0.20	7.30	40.10	89
10 x 0.5	✆	NR	16 x 0.20	7.00	40.10	86
12 x 0.5	✆	NR	16 x 0.20	7.40	40.10	99
14 x 0.5	✆	NR	16 x 0.20	7.80	40.10	113
16 x 0.5	✆	NR	16 x 0.20	8.20	40.10	126
18 x 0.5	✆	NR	16 x 0.20	8.70	40.10	142
19 x 0.5	✆	NR	16 x 0.20	9.10	40.10	155
20 x 0.5	✆	NR	16 x 0.20	9.20	40.10	159
24 x 0.5	224566	NR	16 x 0.20	10.10	40.10	179
27 x 0.5	✆	NR	16 x 0.20	10.60	40.10	198
36 x 0.5	✆	NR	16 x 0.20	11.90	40.10	258
48 x 0.5	✆	NR	16 x 0.20	13.50	40.10	334
2 x 0.75	223372	NR	24 x 0.20	4.80	26.70	39
3 x 0.75	223373	NR	24 x 0.20	5.10	26.70	47
4 x 0.75	223791	NR	24 x 0.20	5.50	26.70	57
5 x 0.75	223792	NR	24 x 0.20	6.00	26.70	68
6 x 0.75	224431	NR	24 x 0.20	6.60	26.70	79
7 x 0.75	224432	NR	24 x 0.20	7.10	26.70	91
8 x 0.75	224433	NR	24 x 0.20	7.60	26.70	104
9 x 0.75	✆	NR	24 x 0.20	8.30	26.70	123
10 x 0.75	✆	NR	24 x 0.20	8.00	26.70	116
12 x 0.75	✆	NR	24 x 0.20	8.50	26.70	135
14 x 0.75	✆	NR	24 x 0.20	8.90	26.70	154
16 x 0.75	224434	NR	24 x 0.20	9.40	26.70	173
18 x 0.75	224509	NR	24 x 0.20	10.00	26.70	195
19 x 0.75	✆	NR	24 x 0.20	10.40	26.70	212
20 x 0.75	✆	NR	24 x 0.20	10.40	26.70	215
24 x 0.75	✆	NR	24 x 0.20	11.70	26.70	245
27 x 0.75	✆	NR	24 x 0.20	12.20	26.70	273
36 x 0.75	✆	NR	24 x 0.20	13.70	26.70	358
48 x 0.75	✆	NR	24 x 0.20	15.60	26.70	465

Further dimensions on request

BETAtrans® GKW flex R

Technical data

cable type	part no.	color	conductor	outer-Ø	R_{20}	weight
n x mm² [mm²]		code	n x mm [mm]	approx. [mm]	[mΩ/m]	approx. [kg/km]
2 x 1	223374	NR	32 x 0.20	5.20	20.00	48
3 x 1	223375	NR	32 x 0.20	5.50	20.00	58
4 x 1	223527	NR	32 x 0.20	6.10	20.00	72
5 x 1	223585	NR	32 x 0.20	6.60	20.00	86
6 x 1	✆	NR	32 x 0.20	7.20	20.00	100
7 x 1	✆	NR	32 x 0.20	8.10	20.00	116
8 x 1	✆	NR	32 x 0.20	8.30	20.00	133
9 x 1	✆	NR	32 x 0.20	9.10	20.00	135
10 x 1	✆	NR	32 x 0.20	8.80	20.00	148
12 x 1	224435	NR	32 x 0.20	9.30	20.00	172
14 x 1	✆	NR	32 x 0.20	9.80	20.00	197
16 x 1	✆	NR	32 x 0.20	10.30	20.00	221
18 x 1	✆	NR	32 x 0.20	11.50	20.00	252
19 x 1	✆	NR	32 x 0.20	11.00	20.00	273
20 x 1	225725	NR	32 x 0.20	11.60	20.00	280
24 x 1	✆	NR	32 x 0.20	12.90	20.00	316
27 x 1	✆	NR	32 x 0.20	13.40	20.00	352
36 x 1	223584	NR	32 x 0.20	15.10	20.00	465
48 x 1	✆	NR	32 x 0.20	17.20	20.00	603
2 x 1.5	223376	NR	30 x 0.25	6.00	13.70	66
3 x 1.5	223377	NR	30 x 0.25	6.40	13.70	80
4 x 1.5	224436	NR	30 x 0.25	7.00	13.70	98
5 x 1.5	224437	NR	30 x 0.25	7.60	13.70	119
6 x 1.5	224438	NR	30 x 0.25	8.40	13.70	139
7 x 1.5	224439	NR	30 x 0.25	9.30	13.70	160
8 x 1.5	224440	NR	30 x 0.25	9.70	13.70	186
9 x 1.5	✆	NR	30 x 0.25	10.70	13.70	187
10 x 1.5	224441	NR	30 x 0.25	10.40	13.70	208
12 x 1.5	224442	NR	30 x 0.25	11.00	13.70	242
14 x 1.5	✆	NR	30 x 0.25	11.60	13.70	277
16 x 1.5	223528	NR	30 x 0.25	12.20	13.70	312
18 x 1.5	✆	NR	30 x 0.25	13.00	13.70	356
19 x 1.5	✆	NR	30 x 0.25	13.60	13.70	385
20 x 1.5	✆	NR	30 x 0.25	13.60	13.70	394
24 x 1.5	✆	NR	30 x 0.25	15.30	13.70	447
27 x 1.5	✆	NR	30 x 0.25	15.90	13.70	498
36 x 1.5	✆	NR	30 x 0.25	17.90	13.70	660
37 x 1.5	✆	NR	30 x 0.25	18.50	13.70	688
48 x 1.5	✆	NR	30 x 0.25	20.50	13.70	859

Further dimensions on request

BETAtrans® GKW flex R

Technical data

cable type			part no.	color	conductor			outer-Ø	R_{20}	weight
n	x	mm² [mm²]		code	n	x	mm [mm]	approx. [mm]	[mΩ/m]	approx. [kg/km]
2	x	2.5	223378	NR	50	x	0.25	7.00	8.21	95
3	x	2.5	223379	NR	50	x	0.25	7.40	8.21	116
4	x	2.5	✆	NR	50	x	0.25	8.20	8.21	146
5	x	2.5	✆	NR	50	x	0.25	9.00	8.21	179
6	x	2.5	✆	NR	50	x	0.25	9.80	8.21	207
7	x	2.5	✆	NR	50	x	0.25	11.00	8.21	241
8	x	2.5	✆	NR	50	x	0.25	11.60	8.21	284
9	x	2.5	✆	NR	50	x	0.25	12.70	8.21	283
10	x	2.5	✆	NR	50	x	0.25	12.40	8.21	317
12	x	2.5	✆	NR	50	x	0.25	13.00	8.21	370
14	x	2.5	✆	NR	50	x	0.25	13.80	8.21	426
16	x	2.5	✆	NR	50	x	0.25	14.60	8.21	481
18	x	2.5	✆	NR	50	x	0.25	15.40	8.21	546
19	x	2.5	✆	NR	50	x	0.25	16.30	8.21	596
20	x	2.5	✆	NR	50	x	0.25	16.30	8.21	609
24	x	2.5	✆	NR	50	x	0.25	18.30	8.21	692
27	x	2.5	✆	NR	50	x	0.25	18.90	8.21	772
36	x	2.5	✆	NR	50	x	0.25	21.30	8.21	1026
48	x	2.5	✆	NR	50	x	0.25	24.50	8.21	1342

Further dimensions on request

BETAtrans® GKW C-flex R

Specification

Product properties		
Nominal voltage	U_0/U(Um)	0.6/1 (1.2) kV AC
		0.9 kV DC
Testing voltage	conductor/conductor	3.5 kV AC
	conductor/shielding	3.5 kV AC
Max. conductor temperature	fixed installations	+120 °C
	sporadically moved	+90 °C
	short circuit	+200 °C
Min. ambient temperature	fixed installations	–45 °C
	sporadically moved	–35 °C
Fire performance for rolling stock		
BS 6853	interior use	Ia, Ib, I
	exterior use	Ia, Ib, II
DIN 5510-2	level of protection	1, 2, 3, 4
EN 50306-4	*all hazard levels	
Fire performance in general		
NF F 16-101	classification	C / FO
	interior use	A1, A2, B
	exterior use	A1, A2, B
Vertical flame propagation for a single insulated wire or cable	EN 50265-2-1, IEC 60332-1	
Vertical flame spread of bunched wires and cables	EN 50266-2-4, IEC 60332-3-24	
Halogen free	EN 50267-2-1, IEC 60754-1	
Corrosivity of gases	EN 50267-2-3, IEC 60754-2	
Toxicity of gases	EN 50305	
Smoke density	EN 50268-2, IEC 61034-2	
Material properties		
No fluorine	EN 60684-2	
Resistance to oil	EN 50305, EN 60811-2-1	
Resistance to fuel	EN 50305 , EN 60811-2-1	
Resistance to ozone	EN 50305	
Low fire load	DIN 51900	

*acc. HL4 as to today's version EN 45545

BETAtrans® GKW C-flex R

Technical data

cable type			part no.	color	conductor			outer-Ø	R_{20}	weight
n	x	mm² [mm²]		code	n	x	mm [mm]	approx. [mm]	[mΩ/m]	approx. [kg/km]
2	x	0.5	223380	NR	16	x	0.20	4.80	40.10	38
3	x	0.5	223381	NR	16	x	0.20	5.00	40.10	44
4	x	0.5	223382	NR	16	x	0.20	5.40	40.10	51
5	x	0.5	224444	NR	16	x	0.20	6.00	40.10	67
6	x	0.5	223383	NR	16	x	0.20	6.50	40.10	78
7	x	0.5	✆	NR	16	x	0.20	7.00	40.10	92
8	x	0.5	225727	NR	16	x	0.20	7.40	40.10	102
9	x	0.5	✆	NR	16	x	0.20	7.70	40.10	105
10	x	0.5	224445	NR	16	x	0.20	7.70	40.10	110
12	x	0.5	224446	NR	16	x	0.20	8.10	40.10	127
14	x	0.5	224447	NR	16	x	0.20	8.50	40.10	140
16	x	0.5	224494	NR	16	x	0.20	8.70	40.10	154
18	x	0.5	✆	NR	16	x	0.20	9.40	40.10	172
22	x	0.5	✆	NR	16	x	0.20	10.30	40.10	209
24	x	0.5	✆	NR	16	x	0.20	10.60	40.10	216
27	x	0.5	224448	NR	16	x	0.20	11.00	40.10	237
36	x	0.5	✆	NR	16	x	0.20	12.30	40.10	302
48	x	0.5	✆	NR	16	x	0.20	13.90	40.10	385
2x2	x	0.5	223384	NR	16	x	0.20	7.10	40.10	89
3x2	x	0.5	224449	NR	16	x	0.20	7.50	40.10	103
4x2	x	0.5	223385	NR	16	x	0.20	8.20	40.10	130
2	x	0.75	223386	NR	24	x	0.20	5.30	26.70	46
3	x	0.75	223387	NR	24	x	0.20	5.60	26.70	54
4	x	0.75	223388	NR	24	x	0.20	6.20	26.70	73
5	x	0.75	✆	NR	24	x	0.20	6.70	26.70	88
6	x	0.75	224450	NR	24	x	0.20	7.30	26.70	102
7	x	0.75	224451	NR	24	x	0.20	7.70	26.70	116
8	x	0.75	224028	NR	24	x	0.20	8.30	26.70	133
9	x	0.75	✆	NR	24	x	0.20	8.70	26.70	137
10	x	0.75	✆	NR	24	x	0.20	8.70	26.70	143
12	x	0.75	224452	NR	24	x	0.20	9.20	26.70	164
14	x	0.75	✆	NR	24	x	0.20	9.60	26.70	184
16	x	0.75	224453	NR	24	x	0.20	9.80	26.70	203
18	x	0.75	✆	NR	24	x	0.20	10.70	26.70	231
22	x	0.75	✆	NR	24	x	0.20	11.70	26.70	279
24	x	0.75	✆	NR	24	x	0.20	12.10	26.70	289
27	x	0.75	✆	NR	24	x	0.20	12.60	26.70	318
36	x	0.75	✆	NR	24	x	0.20	14.10	26.70	411
2x2	x	0.75	224454	NR	24	x	0.20	8.00	26.70	100
6x2	x	0.75	✆	NR	24	x	0.20	11.60	26.70	202

Further dimensions on request

BETAtrans® GKW C-flex R

Technical data

cable type	part no.	color	conductor	outer-Ø	R_{20}	weight
n x mm² [mm²]		code	n x mm [mm]	approx. [mm]	[mΩ/m]	approx. [kg/km]
2 x 1	223389	NR	32 x 0.20	5.90	20.00	61
3 x 1	223390	NR	32 x 0.20	6.20	20.00	72
4 x 1	223391	NR	32 x 0.20	6.80	20.00	90
5 x 1	223583	NR	32 x 0.20	7.30	20.00	105
6 x 1	225730	NR	32 x 0.20	7.90	20.00	127
7 x 1	✆	NR	32 x 0.20	8.50	20.00	144
8 x 1	✆	NR	32 x 0.20	9.00	20.00	161
9 x 1	✆	NR	32 x 0.20	9.50	20.00	168
10 x 1	✆	NR	32 x 0.20	9.50	20.00	177
12 x 1	224455	NR	32 x 0.20	10.00	20.00	203
24 x 1	✆	NR	32 x 0.20	13.30	20.00	364
27 x 1	✆	NR	32 x 0.20	13.80	20.00	402
36 x 1	✆	NR	32 x 0.20	15.70	20.00	542
2x2 x 1	224456	NR	32 x 0.20	8.90	20.00	116
2 x 1.5	223392	NR	30 x 0.25	6.70	13.70	80
3 x 1.5	223393	NR	30 x 0.25	7.10	13.70	95
4 x 1.5	223394	NR	30 x 0.25	7.70	13.70	116
5 x 1.5	224457	NR	30 x 0.25	8.30	13.70	141
6 x 1.5	224458	NR	30 x 0.25	9.10	13.70	166
7 x 1.5	✆	NR	30 x 0.25	9.70	13.70	191
8 x 1.5	✆	NR	30 x 0.25	10.40	13.70	218
9 x 1.5	✆	NR	30 x 0.25	11.10	13.70	230
10 x 1.5	✆	NR	30 x 0.25	11.10	13.70	243
12 x 1.5	224459	NR	30 x 0.25	11.70	13.70	178
24 x 1.5	✆	NR	30 x 0.25	15.90	13.70	526
27 x 1.5	✆	NR	30 x 0.25	16.50	13.70	580
36 x 1.5	✆	NR	30 x 0.25	18.50	13.70	752
2 x 2.5	225732	NR	50 x 0.25	7.70	8.21	110
3 x 2.5	225733	NR	50 x 0.25	8.10	8.21	133
4 x 2.5	225734	NR	50 x 0.25	8.90	8.21	165
5 x 2.5	225735	NR	50 x 0.25	9.70	8.21	201
6 x 2.5	✆	NR	50 x 0.25	10.50	8.21	238
7 x 2.5	✆	NR	50 x 0.25	11.40	8.21	280
8 x 2.5	✆	NR	50 x 0.25	12.30	8.21	320
9 x 2.5	✆	NR	50 x 0.25	13.10	8.21	331
10 x 2.5	✆	NR	50 x 0.25	13.10	8.21	353
12 x 2.5	✆	NR	50 x 0.25	13.70	8.21	409
24 x 2.5	✆	NR	50 x 0.25	18.90	8.21	787
27 x 2.5	✆	NR	50 x 0.25	19.50	8.21	870
36 x 2.5	✆	NR	50 x 0.25	21.90	8.21	1137

Further dimensions on request

BETAtrans® 3 GKW Cable Family

600/1000 V AC
900 kV DC

The BETAtrans® 3 GKW Cable Family is a robust, halogen free and electron-beam cross-linked cable type with improved fire and temperature performance. The cable is weight optimised with reduced outer diameter and withstands high (+120 °C) and low (–40 °C) operating temperature.

The BETAtrans® 3 GKW Cable Family possesses excellent electrical and mechanical characteristics and an outstanding fire performance.

The BETAtrans® 3 GKW Cable Family consists of:

- **BETAtrans® 3 GKW**
  as single core version, non screened
- **BETAtrans® 3 GKW flex**
  as multi-core version, non screened
- **BETAtrans® 3 GKW C-flex**
  as multi-core version, screened, with optimized EMC screening

On request:

- **BETAtrans® 3 GKW FE 180**
  as single core version, non screened with insulation integrity for 180 minutes
- **BETAtrans® 3 GKW FE 180 flex**
  as multi-core version, non screened with insulation integrity for 180 minutes
- **BETAtrans® 3 GKW FE 180 C-flex**
  as multi-core version, screened, with optimized EMC screening
  and with insulation integrity for 180 minutes

Cross sections

0,5–400 mm^2

Advantages

- Resistance to cold down to –45 °C
- Saves volume, optimized cable volume
- Saves weight, optimized cable weight
- Saves space, limited space required
- High operating temperature up to +120 °C
- meets highest requirements in fire performance
- Easy to handle
- Easy to install
- Easy to strip
- Excellent flexibility
- Halogen free
- Low smoke density
- Flame retardant
- Low fire load
- Ozone and weathering resistance
- Fluorine free
- Resistance to oil
- Resistance to fuel
- Soldering iron resistant
- Tight bending radius by fixed installation

Application

- As Power and Control cable for protected installations inside and outside of rail vehicles, buses and other transport vehicles. For applications where process ability is important and costs of handling and installation have to be low.
- BETAtrans® 3 GKW cables are used in control-, auxiliary- and main circuit wiring applications such as in cable harnesses, cable looms, switchboards and control panels, electrical cabinets, driver desks and vehicle wiring.

BETAtrans® 3 GKW

Specification

Product properties		
Nominal voltage	U_0/U(Um)	0.6/1 (1.2) kV AC
		0.9 kV DC
Testing voltage		3.5 kV AC
Max. conductor temperature	fixed installations	+120 °C
	sporadically moved	+90 °C
	short circuit	+200 °C
Min. ambient temperature	fixed installations	–45 °C
	sporadically moved	–35 °C
Fire performance for rolling stock		
BS 6853	interior use	Ia, Ib, II
	exterior use	Ia, Ib, II
DIN 5510	level of protection	1, 2, 3, 4
EN 50264-1	*all hazard levels	
NF F 16-101	classification	C / FO
	interior use	A1, A2, B
	exterior use	A1, A2, B
Fire performance in general		
Vertical flame propagation for a single insulated wire or cable	EN 50265-2-1, IEC 60332-1	
Vertical flame spread of bunched wires and cables	EN 50266-2-4, IEC 60332-3-24	
Halogen free	EN 50267-2-1, IEC 60754-1	
Corrosivity of gases	EN 50267-2-2, IEC 60754-2	
Toxicity of gases	EN 50305, NFX 70-100	
Smoke density	EN 50268-2, IEC 61034-2	
Approvals		
Swiss Federal Railway (SBB)		
Material properties		
No fluorine	EN 60684-2	
Resistance to oil	EN 50305	
Resistance to fuel	EN 50305	
Resistance to ozone	EN 50305	
Low fire load	DIN 51900	

*acc. HL4 as to today's version EN 45545

BETAtrans® 3 GKW

Technical data

cross section	part no.	color	conductor	outer-Ø	R_{20}	weight
[mm²]		code	n x mm [mm]	approx. [mm]	[mΩ/m]	approx. [kg/km]
0.50	223293	grey	16 x 0.20	1.95	40.10	8
0.50	223313	green-yellow	16 x 0.20	1.95	40.10	8
0.75	223294	grey	24 x 0.20	2.20	26.70	11
0.75	223314	green-yellow	24 x 0.20	2.20	26.70	11
1.0	223295	grey	32 x 0.20	2.40	20.00	14
1.0	223315	green-yellow	32 x 0.20	2.40	20.00	14
1.5	223296	grey	30 x 0.25	2.70	13.70	19
1.5	223316	green-yellow	30 x 0.25	2.70	13.70	19
2.5	223297	grey	50 x 0.25	3.30	8.21	30
2.5	223317	green-yellow	50 x 0.25	3.30	8.21	30
4	223298	grey	56 x 0.30	3.85	5.09	45
4	223318	green-yellow	56 x 0.30	3.85	5.09	45
6	223299	grey	84 x 0.30	4.35	3.39	64
6	223319	green-yellow	84 x 0.30	4.35	3.39	64
10	223300	grey	80 x 0.40	5.30	1.95	102
10	223320	green-yellow	80 x 0.40	5.30	1.95	102
16	223301	grey	119 x 0.40	6.90	1.24	156
16	223321	green-yellow	119 x 0.40	6.90	1.24	156
25	223302	grey	182 x 0.40	8.40	0.795	238
25	223322	green-yellow	182 x 0.40	8.40	0.795	238
35	223303	grey	259 x 0.40	9.50	0.565	330
35	223323	green-yellow	259 x 0.40	9.50	0.565	330
50	223304	grey	380 x 0.40	11.90	0.393	483
50	223324	green-yellow	380 x 0.40	11.90	0.393	483
70	223305	grey	342 x 0.50	14.10	0.277	674
70	223325	green-yellow	342 x 0.50	14.10	0.277	674
95	223306	grey	456 x 0.50	15.40	0.210	883
95	223326	green-yellow	456 x 0.50	15.40	0.210	883
120	223307	grey	570 x 0.50	17.40	0.164	1103
120	223327	green-yellow	570 x 0.50	17.40	0.164	1103
150	223308	grey	703 x 0.50	20.10	0.132	1370
150	223328	green-yellow	703 x 0.50	20.10	0.132	1370
185	223309	grey	874 x 0.50	22.00	0.108	1699
185	223329	green-yellow	874 x 0.50	22.00	0.108	1699
240	223310	grey	1147 x 0.50	24.80	0.0817	2220
240	223330	green-yellow	1147 x 0.50	24.80	0.0817	2220
300	223311	grey	1443 x 0.50	27.10	0.0654	2775
300	223331	green-yellow	1443 x 0.50	27.10	0.0654	2775
400	223312	grey	1887 x 0.50	31.50	0.0495	3625
400	223332	green-yellow	1887 x 0.50	31.50	0.0495	3625

Further dimensions on request

BETAtrans® 3 GKW flex

Specification

Product properties		
Nominal voltage	U_0/U(Um)	0.6/1 (1.2) kV AC
		0.9 kV DC
Testing voltage		3.5 kV AC
Max. conductor temperature	fixed installations	+120 °C
	sporadically moved	+90 °C
	short circuit	+200 °C
Min. ambient temperature	fixed installations	–45 °C
	sporadically moved	–35 °C

Fire performance for rolling stock		
BS 6853	interior use	Ia, Ib, II
	exterior use	Ia, Ib, II
DIN 5510	level of protection	1, 2, 3, 4
EN 50264-1	*all hazard levels	
NF F 16-101	classification	C / FO
	interior use	A1, A2, B
	exterior use	A1, A2, B

Fire performance in general	
Vertical flame propagation for a single insulated wire or cable	EN 50265-2-1, IEC 60332-1
Vertical flame spread of bunched wires and cables	EN 50266-2-4, IEC 60332-3-24
Halogen free	EN 50267-2-1, IEC 60754-1
Corrosivity of gases	EN 50267-2-2, IEC 60754-2
Toxicity of gases	EN 50305, NFX 70-100
Smoke density	EN 50268-2, IEC 61034-2

Material properties	
No fluorine	EN 60684-2
Resistance to oil	EN 50305, EN 60811-2-1, UK 895
Resistance to fuel	EN 50305, EN 60811-2-1, UK 895
Resistance to ozone	EN 50305
Low fire load	DIN 51900

*acc. HL4 as to today's version EN 45545

BETAtrans® 3 GKW flex

Technical data

cable type			part no.	color	conductor			outer-Ø	R_{20}	weight
n	x	mm² [mm²]		code	n	x	mm [mm]	approx. [mm]	[mΩ/m]	approx. [kg/km]
2	x	0.5	223395	NR	16	x	0.20	5.30	40.10	43
3	x	0.5	223396	NR	16	x	0.20	5.70	40.10	51
4	x	0.5	223397	NR	16	x	0.20	6.30	40.10	62
5	x	0.5	223398	NR	16	x	0.20	6.90	40.10	75
6	x	0.5	✆	NR	16	x	0.20	7.50	40.10	86
7	x	0.5	223399	NR	16	x	0.20	8.40	40.10	99
8	x	0.5	✆	NR	16	x	0.20	8.80	40.10	118
9	x	0.5	✆	NR	16	x	0.20	9.50	40.10	112
10	x	0.5	224460	NR	16	x	0.20	9.30	40.10	126
12	x	0.5	✆	NR	16	x	0.20	10.00	40.10	149
14	x	0.5	✆	NR	16	x	0.20	10.50	40.10	168
16	x	0.5	✆	NR	16	x	0.20	11.20	40.10	190
20	x	0.5	✆	NR	16	x	0.20	12.50	40.10	241
24	x	0.5	✆	NR	16	x	0.20	13.90	40.10	266
27	x	0.5	✆	NR	16	x	0.20	14.50	40.10	297
36	x	0.5	✆	NR	16	x	0.20	16.30	40.10	389
48	x	0.5	✆	NR	16	x	0.20	19.00	40.10	519
2	x	0.75	223400	NR	24	x	0.20	5.90	26.70	55
3	x	0.75	223401	NR	24	x	0.20	6.20	26.70	63
4	x	0.75	223402	NR	24	x	0.20	6.90	26.70	78
5	x	0.75	223403	NR	24	x	0.20	7.70	26.70	96
6	x	0.75	✆	NR	24	x	0.20	8.30	26.70	110
7	x	0.75	223404	NR	24	x	0.20	9.30	26.70	126
8	x	0.75	✆	NR	24	x	0.20	10.00	26.70	156
9	x	0.75	✆	NR	24	x	0.20	10.70	26.70	148
10	x	0.75	✆	NR	24	x	0.20	10.50	26.70	166
12	x	0.75	✆	NR	24	x	0.20	11.10	26.70	193
14	x	0.75	✆	NR	24	x	0.20	11.70	26.70	218
16	x	0.75	✆	NR	24	x	0.20	12.40	26.70	246
20	x	0.75	✆	NR	24	x	0.20	14.00	26.70	314
24	x	0.75	✆	NR	24	x	0.20	15.60	26.70	351
27	x	0.75	✆	NR	24	x	0.20	16.10	26.70	387
36	x	0.75	✆	NR	24	x	0.20	18.10	26.70	508
48	x	0.75	✆	NR	24	x	0.20	21.20	26.70	682

Further dimensions on request

BETAtrans® 3 GKW flex

Technical data

cable type			part no.	color	conductor			outer-Ø	R_{20}	weight
n	x	mm^2 [mm^2]		code	n	x	mm [mm]	approx. [mm]	[mΩ/m]	approx. [kg/km]
2	x	1	223405	NR	32	x	0.20	6.30	20.00	65
3	x	1	223406	NR	32	x	0.20	6.80	20.00	78
4	x	1	223407	NR	32	x	0.20	7.40	20.00	95
5	x	1	223408	NR	32	x	0.20	8.30	20.00	118
6	x	1	✆	NR	32	x	0.20	8.90	20.00	133
7	x	1	223409	NR	32	x	0.20	10.10	20.00	157
7	G	1	223932	NRPE	32	x	0.20	10.10	20.00	157
8	x	1	✆	NR	32	x	0.20	10.70	20.00	188
9	x	1	✆	NR	32	x	0.20	11.60	20.00	182
10	x	1	✆	NR	32	x	0.20	11.40	20.00	205
12	x	1	✆	NR	32	x	0.20	12.10	20.00	239
14	x	1	✆	NR	32	x	0.20	12.70	20.00	270
16	x	1	✆	NR	32	x	0.20	13.50	20.00	306
20	x	1	✆	NR	32	x	0.20	15.10	20.00	388
24	x	1	✆	NR	32	x	0.20	16.90	20.00	435
27	x	1	✆	NR	32	x	0.20	17.50	20.00	481
36	x	1	✆	NR	32	x	0.20	19.90	20.00	647
48	x	1	✆	NR	32	x	0.20	22.90	20.00	841
2	x	1.5	223410	NR	30	x	0.25	7.00	13.70	83
3	x	1.5	223411	NR	30	x	0.25	7.40	13.70	98
3	G	1.5	223412	NRPE	30	x	0.25	7.40	13.70	98
4	x	1.5	223413	NR	30	x	0.25	8.30	13.70	123
4	G	1.5	223414	NRPE	30	x	0.25	8.30	13.70	123
5	x	1.5	223415	NR	30	x	0.25	9.10	13.70	150
5	G	1.5	225345	NRPE	30	x	0.25	9.10	13.70	150
6	x	1.5	✆	NR	30	x	0.25	10.10	13.70	177
7	x	1.5	223416	NR	30	x	0.25	11.30	13.70	205
8	x	1.5	✆	NR	30	x	0.25	11.80	13.70	240
9	x	1.5	✆	NR	30	x	0.25	12.90	13.70	237
10	x	1.5	✆	NR	30	x	0.25	12.70	13.70	267
12	x	1.5	224511	NR	30	x	0.25	13.40	13.70	311
14	x	1.5	✆	NR	30	x	0.25	14.10	13.70	353
16	x	1.5	✆	NR	30	x	0.25	15.00	13.70	399
20	x	1.5	✆	NR	30	x	0.25	17.00	13.70	513
24	x	1.5	✆	NR	30	x	0.25	19.10	13.70	585
27	x	1.5	✆	NR	30	x	0.25	19.70	13.70	646
36	x	1.5	✆	NR	30	x	0.25	22.30	13.70	856
48	x	1.5	✆	NR	30	x	0.25	25.70	13.70	1125

Further dimensions on request

BETAtrans® 3 GKW flex

Technical data

cable type			part no.	color	conductor			outer-Ø	R_{20}	weight
n	x	mm² [mm²]		code	n	x	mm [mm]	approx. [mm]	[mΩ/m]	approx. [kg/km]
2	x	2.5	223417	NR	50	x	0.25	8.30	8.21	121
3	x	2.5	223418	NR	50	x	0.25	8.80	8.21	145
3	G	2.5	223419	NRPE	50	x	0.25	8.80	8.21	145
4	x	2.5	223420	NR	50	x	0.25	9.90	8.21	185
4	G	2.5	223421	NRPE	50	x	0.25	9.90	8.21	185
5	x	2.5	223422	NR	50	x	0.25	11.00	8.21	229
6	x	2.5	✆	NR	50	x	0.25	12.10	8.21	267
7	x	2.5	223423	NR	50	x	0.25	13.30	8.21	305
8	x	2.5	✆	NR	50	x	0.25	14.30	8.21	369
9	x	2.5	✆	NR	50	x	0.25	15.40	8.21	362
10	x	2.5	✆	NR	50	x	0.25	15.10	8.21	402
12	x	2.5	✆	NR	50	x	0.25	15.90	8.21	470
14	x	2.5	✆	NR	50	x	0.25	16.50	8.21	535
16	x	2.5	✆	NR	50	x	0.25	17.50	8.21	603
20	x	2.5	✆	NR	50	x	0.25	20.00	8.21	782
24	x	2.5	✆	NR	50	x	0.25	21.40	8.21	877
27	x	2.5	✆	NR	50	x	0.25	22.50	8.21	976
2	x	4	223424	NR	56	x	0.30	9.40	5.09	137
3	x	4	223425	NR	56	x	0.30	10.20	5.09	164
3	G	4	223426	NRPE	56	x	0.30	10.20	5.09	164
4	x	4	223427	NR	56	x	0.30	11.30	5.09	262
5	x	4	223428	NR	56	x	0.30	12.60	5.09	250
6	x	4	✆	NR	56	x	0.30	13.90	5.09	290
7	x	4	✆	NR	56	x	0.30	15.20	5.09	328
8	x	4	✆	NR	56	x	0.30	16.30	5.09	400
9	x	4	✆	NR	56	x	0.30	17.70	5.09	384
10	x	4	✆	NR	56	x	0.30	17.50	5.09	432
12	x	4	✆	NR	56	x	0.30	18.30	5.09	495
14	x	4	✆	NR	56	x	0.30	19.70	5.09	582
16	x	4	✆	NR	56	x	0.30	20.80	5.09	651
20	x	4	✆	NR	56	x	0.30	23.50	5.09	845
24	x	4	✆	NR	56	x	0.30	26.20	5.09	939
27	x	4	✆	NR	56	x	0.30	27.00	5.09	1036
2	x	6	223429	NR	84	x	0.30	10.60	3.39	157
3	x	6	223430	NR	84	x	0.30	11.40	3.39	180
3	G	6	223431	NRPE	84	x	0.30	11.40	3.39	180
4	x	6	223432	NR	84	x	0.30	12.60	3.39	220
5	x	6	223433	NR	84	x	0.30	14.00	3.39	269
6	x	6	✆	NR	84	x	0.30	15.70	3.39	299
7	x	6	✆	NR	84	x	0.30	17.20	3.39	360

Further dimensions on request

BETAtrans® 3 GKW flex

Technical data

cable type	part no.	color	conductor	outer-Ø	R_{20}	weight
n x mm² [mm²]		code	n x mm [mm]	approx. [mm]	[mΩ/m]	approx. [kg/km]
2 x 10	223434	NR	80 x 0.40	12.80	1.95	309
3 x 10	223435	NR	80 x 0.40	13.60	1.95	432
4 x 10	223436	NR	80 x 0.40	15.40	1.95	515
4 G 10	✆	NRPE	80 x 0.40	15.40	1.95	515
5 x 10	223437	NR	80 x 0.40	17.00	1.95	644
5 G 10	✆	NRPE	80 x 0.40	17.00	1.95	644
6 x 10	✆	NR	80 x 0.40	19.10	1.95	797
7 x 10	✆	NR	80 x 0.40	20.70	1.95	923
2 x 16	223438	NR	119 x 0.40	16.50	1.24	485
3 x 16	223439	NR	119 x 0.40	17.60	1.24	593
4 x 16	223440	NR	119 x 0.40	19.80	1.24	791
4 G 16	✆	NRPE	119 x 0.40	19.80	1.24	791
5 x 16	✆	NR	119 x 0.40	22.10	1.24	997
6 x 16	✆	NR	119 x 0.40	24.30	1.24	1197
7 x 16	✆	NR	119 x 0.40	26.50	1.24	1415
2 x 25	✆	NR	182 x 0.40	19.90	0.795	721
3 x 25	✆	NR	182 x 0.40	21.40	0.795	934
4 x 25	✆	NR	182 x 0.40	23.80	0.795	1184
5 x 25	✆	NR	182 x 0.40	26.40	0.795	1488
6 x 25	✆	NR	182 x 0.40	29.90	0.795	1825
7 x 25	✆	NR	182 x 0.40	32.10	0.795	2137
2 x 35	✆	NR	259 x 0.40	22.30	0.565	781
3 x 35	✆	NR	259 x 0.40	24.00	0.565	943
4 x 35	✆	NR	259 x 0.40	26.70	0.565	1237
5 x 35	✆	NR	259 x 0.40	29.60	0.565	1550
6 x 35	✆	NR	259 x 0.40	33.30	0.565	1899
7 x 35	✆	NR	259 x 0.40	36.70	0.565	2274

Further dimensions on request

BETAtrans® 3 GKW C-flex

Specification

Product properties		
Nominal voltage	U_0/U(Um)	0.6/1 (1.2) kV AC
		0.9 kV DC
Testing voltage	conductor/conductor	3.5 kV AC
	conductor/shielding	3.5 kV AC
Max. conductor temperature	fixed installations	+120 °C
	sporadically moved	+90 °C
	short circuit	+200 °C
Min. ambient temperature	fixed installations	–45 °C
	sporadically moved	–35 °C
Fire performance for rolling stock		
BS 6853	interior use	Ia, Ib, II
	exterior use	Ia, Ib, II
DIN 5510	level of protection	1, 2, 3, 4
EN 50264-1	*all hazard levels	
Fire performance in general		
NF F 16-101	classification	C / FO
	interior use	A1, A2, B
	exterior use	A1, A2, B
Vertical flame propagation for a single insulated wire or cable	EN 50265-2-1, IEC 60332-1	
Vertical flame spread of bunched wires and cables	EN 50266-2-4, IEC 60332-3-24	
Halogen free	EN 50267-2-1, IEC 60754-1	
Corrosivity of gases	EN 50267-2-3, IEC 60754-2	
Toxicity of gases	EN 50305	
Smoke density	EN 50268-2, IEC 61034-2	
Material properties		
No fluorine	EN 60684-2	
Resistance to oil	EN 50305, EN 60811-2-1	
Resistance to fuel	EN 50305, EN 60811-2-1	
Resistance to ozone	EN 50305	
Low fire load	DIN 51900	

*acc. HL4 as to today's version EN 45545

BETAtrans® 3 GKW C-flex

Technical data

cable type			part no.	color	conductor			outer-Ø	R_{20}	weight
n	x	mm^2 [mm^2]		code	n	x	mm [mm]	approx. [mm]	[mΩ/m]	approx. [kg/km]
2	x	0.5	223441	NR	16	x	0.20	6.00	40.10	55
3	x	0.5	223442	NR	16	x	0.20	6.30	40.10	64
4	x	0.5	223443	NR	16	x	0.20	7.00	40.10	80
5	x	0.5	223444	NR	16	x	0.20	7.50	40.10	92
6	x	0.5	✆	NR	16	x	0.20	8.20	40.10	112
7	x	0.5	223445	NR	16	x	0.20	8.80	40.10	126
8	x	0.5	✆	NR	16	x	0.20	9.40	40.10	143
9	x	0.5	✆	NR	16	x	0.20	9.90	40.10	177
10	x	0.5	223446	NR	16	x	0.20	9.90	40.10	155
12	x	0.5	223447	NR	16	x	0.20	10.40	40.10	176
14	x	0.5	224447	NR	16	x	0.20	11.00	40.10	199
16	x	0.5	224461	NR	16	x	0.20	11.60	40.10	224
20	x	0.5	✆	NR	16	x	0.20	12.90	40.10	276
24	x	0.5	✆	NR	16	x	0.20	13.90	40.10	312
27	x	0.5	224462	NR	16	x	0.20	14.50	40.10	345
2	x	0.75	223448	NR	24	x	0.20	6.60	26.70	68
3	x	0.75	223449	NR	24	x	0.20	6.90	26.70	79
4	x	0.75	223450	NR	24	x	0.20	7.50	26.70	94
5	x	0.75	223451	NR	24	x	0.20	8.30	26.70	117
6	x	0.75	✆	NR	24	x	0.20	8.90	26.70	134
7	x	0.75	223452	NR	24	x	0.20	9.90	26.70	162
8	x	0.75	224520	NR	24	x	0.20	10.60	26.70	184
9	x	0.75	✆	NR	24	x	0.20	11.00	26.70	228
10	x	0.75	223453	NR	24	x	0.20	11.00	26.70	196
12	x	0.75	223454	NR	24	x	0.20	11.50	26.70	222
14	x	0.75	✆	NR	24	x	0.20	12.20	26.70	254
16	x	0.75	✆	NR	24	x	0.20	12.80	26.70	280
20	x	0.75	✆	NR	24	x	0.20	14.50	26.70	356
24	x	0.75	✆	NR	24	x	0.20	15.60	26.70	403
27	x	0.75	✆	NR	24	x	0.20	16.30	26.70	462
2	x	1	223455	NR	32	x	0.20	7.00	20.00	81
3	x	1	223456	NR	32	x	0.20	7.40	20.00	91
4	x	1	223457	NR	32	x	0.20	8.10	20.00	115
5	x	1	223458	NR	32	x	0.20	8.90	20.00	136
6	x	1	✆	NR	32	x	0.20	9.50	20.00	158
7	x	1	223459	NR	32	x	0.20	10.50	20.00	190
8	x	1	✆	NR	32	x	0.20	11.40	20.00	221
9	x	1	✆	NR	32	x	0.20	11.80	20.00	273
10	x	1	✆	NR	32	x	0.20	11.80	20.00	236
12	x	1	✆	NR	32	x	0.20	12.50	20.00	270
14	x	1	✆	NR	32	x	0.20	13.20	20.00	307
16	x	1	✆	NR	32	x	0.20	13.90	20.00	341
20	x	1	✆	NR	32	x	0.20	15.60	20.00	432
24	x	1	✆	NR	32	x	0.20	17.10	20.00	513
27	x	1	✆	NR	32	x	0.20	17.70	20.00	562

Further dimensions on request

BETAtrans® 3 GKW C-flex

Technical data

cable type			part no.	color	conductor			outer-Ø	R_{20}	weight
n	x	mm² [mm²]		code	n	x	mm [mm]	approx. [mm]	[mΩ/m]	approx. [kg/km]
2	x	1.5	223460	NR	30	x	0.25	7.70	13.70	98
3	x	1.5	223461	NR	30	x	0.25	8.10	13.70	115
3	G	1.5	223462	NRPE	30	x	0.25	8.10	13.70	115
4	x	1.5	223463	NR	30	x	0.25	8.90	13.70	139
5	x	1.5	223464	NR	30	x	0.25	9.90	13.70	173
5	G	1.5	223465	NRPE	30	x	0.25	9.90	13.70	173
6	x	1.5	✆	NR	30	x	0.25	10.70	13.70	204
7	x	1.5	223466	NR	30	x	0.25	11.70	13.70	244
8	x	1.5	✆	NR	30	x	0.25	12.50	13.70	275
9	x	1.5	✆	NR	30	x	0.25	13.20	13.70	343
10	x	1.5	✆	NR	30	x	0.25	13.20	13.70	300
12	x	1.5	✆	NR	30	x	0.25	13.80	13.70	344
14	x	1.5	✆	NR	30	x	0.25	14.60	13.70	392
16	x	1.5	✆	NR	30	x	0.25	15.50	13.70	442
20	x	1.5	✆	NR	30	x	0.25	17.60	13.70	579
24	x	1.5	✆	NR	30	x	0.25	19.30	13.70	673
27	x	1.5	✆	NR	30	x	0.25	19.90	13.70	737
2	x	2.5	223467	NR	50	x	0.25	8.90	8.21	134
3	x	2.5	223468	NR	50	x	0.25	9.40	8.21	156
3	G	2.5	223469	NRPE	50	x	0.25	9.40	8.21	156
4	x	2.5	223470	NR	50	x	0.25	10.50	8.21	201
5	x	2.5	223471	NR	50	x	0.25	11.60	8.21	251
5	G	2.5	223472	NRPE	50	x	0.25	11.60	8.21	251
6	x	2.5	✆	NR	50	x	0.25	12.70	8.21	297
7	x	2.5	223473	NR	50	x	0.25	13.70	8.21	347
8	x	2.5	✆	NR	50	x	0.25	14.90	8.21	404
9	x	2.5	✆	NR	50	x	0.25	16.00	8.21	526
10	x	2.5	✆	NR	50	x	0.25	16.00	8.21	464
12	x	2.5	✆	NR	50	x	0.25	16.80	8.21	533
14	x	2.5	✆	NR	50	x	0.25	17.70	8.21	604
16	x	2.5	✆	NR	50	x	0.25	19.00	8.21	694
20	x	2.5	✆	NR	50	x	0.25	23.50	8.21	873
24	x	2.5	✆	NR	50	x	0.25	23.30	8.21	1008
27	x	2.5	✆	NR	50	x	0.25	24.00	8.21	1109
2	x	4	223474	NR	56	x	0.30	10.20	5.09	181
3	x	4	223475	NR	56	x	0.30	10.80	5.09	217
3	G	4	223476	NRPE	56	x	0.30	10.80	5.09	217
4	x	4	223477	NR	56	x	0.30	11.90	5.09	280
5	x	4	223478	NR	56	x	0.30	13.30	5.09	347
6	x	4	✆	NR	56	x	0.30	14.60	5.09	417
7	x	4	✆	NR	56	x	0.30	15.70	5.09	487
8	x	4	✆	NR	56	x	0.30	17.20	5.09	587
9	x	4	✆	NR	56	x	0.30	18.30	5.09	724
10	x	4	✆	NR	56	x	0.30	18.30	5.09	643
12	x	4	✆	NR	56	x	0.30	19.50	5.09	764

Further dimensions on request

BETAtrans® 3 GKW C-flex

Technical data

cable type	part no.	color	conductor	outer-Ø	R_{20}	weight
n x mm² [mm²]		code	n x mm [mm]	approx. [mm]	[mΩ/m]	approx. [kg/km]
2 x 6	223479	NR	84 x 0.30	11.30	3.39	235
3 x 6	223480	NR	84 x 0.30	12.10	3.39	292
3 G 6	223481	NRPE	84 x 0.30	12.10	3.39	292
4 x 6	223482	NR	84 x 0.30	13.30	3.39	372
5 x 6	223483	NR	84 x 0.30	14.70	3.39	459
6 x 6	✆	NR	84 x 0.30	16.30	3.39	572
7 x 6	✆	NR	84 x 0.30	17.80	3.39	676
8 x 6	✆	NR	84 x 0.30	19.40	3.39	778
9 x 6	✆	NR	84 x 0.30	20.70	3.39	981
10 x 6	✆	NR	84 x 0.30	20.70	3.39	878
12 x 6	✆	NR	84 x 0.30	21.80	3.39	1030
2 x 10	223484	NR	80 x 0.40	13.40	1.95	347
3 x 10	223485	NR	80 x 0.40	14.30	1.95	433
3 G 10	223486	NRPE	80 x 0.40	14.30	1.95	433
4 x 10	223487	NR	80 x 0.40	16.00	1.95	582
4 G 10	223488	NRPE	80 x 0.40	16.00	1.95	582
5 x 10	223489	NR	80 x 0.40	17.60	1.95	716
6 x 10	✆	NR	80 x 0.40	19.70	1.95	879
7 x 10	✆	NR	80 x 0.40	21.50	1.95	1022
8 x 10	✆	NR	80 x 0.40	23.70	1.95	1194
2 x 16	223490	NR	119 x 0.40	17.10	1.24	542
3 x 16	223491	NR	119 x 0.40	18.20	1.24	662
4 x 16	223492	NR	119 x 0.40	20.40	1.24	877
5 x 16	225081	NR	119 x 0.40	22.70	1.24	1087
6 x 16	✆	NR	119 x 0.40	24.90	1.24	1299
7 x 16	✆	NR	119 x 0.40	27.10	1.24	1527
8 x 16	✆	NR	119 x 0.40	29.60	1.24	1815
2 x 25	✆	NR	196 x 0.40	20.50	0.795	781
3 x 25	✆	NR	196 x 0.40	22.00	0.795	980
4 x 25	✆	NR	196 x 0.40	24.40	0.795	1276
5 x 25	✆	NR	196 x 0.40	27.00	0.795	1590

Further dimensions on request

Auxilary- and Main- Power Circuits

34	BETAtrans® 4 GKW-AXplus (1.8 kV)	
35	4 GKW-AXplus	single core, non screened
37	4 GKW-AXplus C-flex	single core, screened
39	BETAtrans® 9 GKW-AXplus (3.6 kV)	
40	9 GKW -AXplus	single core, non screened
42	9 GKW -AXplus C-flex	single core, screened

BETAtrans® 4 GKW-AXplus Cable Family

1.8 / 3.0 kV AC
2.7 kV DC

The BETAtrans® 4 GKW-AXplus Cable Family is a robust, compact dual wall halogen free and electron-beam cross-linked cable type with improved fire and temperature performance. With a voltage rating up to 1.8/3 kV and high corona resistance. The cable is weight optimised with a reduced outer diameter and withstands high (+120 °C) and low (–60 °C) operating temperature.

The BETAtrans® 4 GKW-AXplus Cable Family possesses excellent electrical and mechanical characteristics as well as an excellent resistance to mineral oil and detergents and has an outstanding fire performance.

The BETAtrans® 4 GKW-AXplus Cable Family consists of:

- **BETAtrans® 4 GKW-AXplus**
  as single core version, non screened

On request:

- **BETAtrans® 4 GKW-AXplus flex**
  as multi-core version, non screened
- **BETAtrans® 4 GKW-AXplus C-flex**
  as single and multi-core version, screened, with optimized EMC screening

Cross sections

1–400 mm^2

Advantages

- Resistance to cold down to –60 °C
- Resistance to corona discharge
- Saves volume, optimized cable volume
- Saves weight, optimized cable weight
- Saves space, limited space required
- High performance to short circuit and earth fault
- High operating temperature up to +120 °C
- meets highest requirements in fire performance
- Easy handling
- Easy to install
- Easy to strip
- Excellent flexibility
- Halogen free
- Low smoke density
- Flame retardant
- Low fire load
- Ozone and weathering resistance
- Fluorine free
- Excellent resistance to oil
- Excellent resistance to fuel
- Soldering iron resistant
- Tight bending radius by fixed installation

Application

- The BETAtrans® 4 GKW-AXplus is designed as power and control cable for protected installations both inside and outside of rolling stock, underground railway systems, buses and other transport systems.
- BETAtrans® 4 GKW-AXplus cables are used in control-, auxiliary- and main power circuit wiring applications such as in cable harnesses, cable looms, switchboards and control panels, electrical cabinets, power converters, resister- and braking blocks and many other applications.

BETAtrans® 4 GKW-AXplus

Specification

Product properties		
Nominal voltage	U_0/U(Um)	1.8/3 (3.6) kV AC
		2.7 kV DC
Testing voltage		6.5 kV AC
Max. conductor temperature	fixed installations	+120 °C
	sporadically moved	+90 °C
	short circuit	+200 °C
Min. ambient temperature	fixed installations	–60 °C
	sporadically moved	–35 °C

Fire performance for rolling stock		
BS 6853	interior use	Ia, Ib, II
	exterior use	Ia, Ib, II
DIN 5510	level of protection	1, 2, 3, 4
EN 50264-1	*all hazard levels	
NF F 16-101	classification	C / FO
	interior use	A1, A2, B
	exterior use	A1, A2, B

Fire performance in general	
Vertical flame propagation for a single insulated wire or cable	EN 50265-2-1, IEC 60332-1
Vertical flame spread of bunched wires and cables	EN 50266-2-4, IEC 60332-3-24
Halogen free	EN 50267-2-1, IEC 60754-1
Corrosivity of gases	EN 50267-2-3, IEC 60754-2
Toxicity of gases	EN 50305, NF X 70-100
Smoke density	EN 50268-2, IEC 61034-2

Approvals
Swiss Federal Railway (SBB)

Material properties	
No fluorine	EN 60684-2
Resistance to oil	EN 50305, EN 60811-2-1
Resistance to fuel	EN 50305, EN 60811-2-1
Resistance to ozone	EN 50305
Low fire load	DIN 51900

*acc. HL4 as to today's version EN 45545

BETAtrans® 4 GKW-AXplus

Technical data

cross section	part no.	color	conductor	outer-Ø	R_{20}	weight
[mm²]		code	n x mm [mm]	approx. [mm]	[mΩ/m]	approx. [kg/km]
1	222827	black	32 x 0.20	2.80	20.00	17
1.5	222082	black	30 x 0.25	3.20	13.70	23
2.5	222083	black	50 x 0.25	3.70	8.21	34
4	222084	black	56 x 0.30	4.45	5.09	53
6	222085	black	84 x 0.30	5.05	3.39	74
10	222086	black	80 x 0.40	6.10	1.95	118
16	222087	black	119 x 0.40	8.30	1.24	182
25	222088	black	182 x 0.40	10.00	0.795	274
35	222089	black	259 x 0.40	11.40	0.565	379
50	222090	black	380 x 0.40	13.60	0.393	536
70	222091	black	342 x 0.50	15.60	0.277	729
95	222092	black	456 x 0.50	17.30	0.210	960
120	222093	black	570 x 0.50	19.60	0.164	1203
150	222094	black	703 x 0.50	21.90	0.132	1464
185	222095	black	874 x 0.50	23.80	0.108	1802
240	222096	black	1147 x 0.50	26.80	0.0817	2348
300	222097	black	1443 x 0.50	29.30	0.0654	2928
400	222098	black	1887 x 0.50	33.50	0.0495	3786

Further dimensions on request

BETAtrans® 4 GKW-AXplus C-flex

Specification

Product properties

Nominal voltage	U_0/U(Um)	1.8/3 (3.6) kV AC
		2.7 kV DC
Testing voltage		6.5 kV AC
Max. conductor temperature	fixed installations	+120 °C
	sporadically moved	+ 90 °C
	short circuit	+200 °C
Min. ambient temperature	fixed installations	– 60 °C
	sporadically moved	– 35 °C

Fire performance for rolling stock

BS 6853	interior use	Ia, Ib, II
	exterior use	Ia, Ib, II
DIN 5510	level of protection	1, 2, 3, 4
EN 50264-1	*all hazard levels	
NF F 16-101	classification	C / FO
	interior use	A1, A2, B
	exterior use	A1, A2, B

Fire performance in general

Vertical flame propagation for a single insulated wire or cable	EN 50265-2-1, IEC 60332-1
Vertical flame spread of bunched wires and cables	EN 50266-2-4, IEC 60332-3-24
Halogen free	EN 50267-2-1, IEC 60754-1
Corrosivity of gases	EN 50267-2-3, IEC 60754-2
Toxicity of gases	EN 50305, NFX 70-100
Smoke density	EN 50268-2, IEC 61034-2

Approvals

Swiss Federal Railway (SBB)

Material properties

No fluorine	EN 60684-2
Resistance to oil	EN 50305, EN 60811-2-1
Resistance to fuel	EN 50305, EN 60811-2-1
Resistance to ozone	EN 50305
Low fire load	DIN 51900

*acc. HL4 as to today's version EN 45545

BETAtrans® 4 GKW-AXplus C-flex

Technical data

cross section	part no.	colour	conductor	outer-Ø	R_{20}	weight
[mm²]		code	n x mm [mm]	approx. [mm]	[mΩ/m]	approx. [kg/km]
1	223335	black	32 x 0.20	4.50	20.00	38
1.5	223336	black	30 x 0.25	4.90	13.70	47
2.5	223337	black	50 x 0.25	5.90	8.21	62
4	223338	black	56 x 0.30	6.55	5.09	95
6	223339	black	84 x 0.30	7.25	3.39	123
10	223340	black	80 x 0.40	8.40	1.95	179
16	223341	black	119 x 0.40	10.70	1.24	262
25	223342	black	182 x 0.40	12.50	0.795	372
35	223343	black	259 x 0.40	14.00	0.565	493
50	223344	black	380 x 0.40	16.50	0.393	695
70	223345	black	342 x 0.50	18.60	0.277	915
95	223346	black	456 x 0.50	20.30	0.210	1167
120	223347	black	570 x 0.50	22.80	0.164	1444
150	223348	black	703 x 0.50	25.10	0.132	1734
185	223349	black	874 x 0.50	27.00	0.10	2092
240	223350	black	1147 x 0.50	30.20	0.0817	2713
300	223351	black	1443 x 0.50	32.80	0.0654	3334
400	223352	black	1887 x 0.50	37.10	0.0495	4255

Further dimensions on request

BETAtrans® 9 GKW-AXplus Cable Family

3.6/6.0 V AC
5.4 kV DC

The BETAtrans® 9 GKW-AXplus Cable Family is a robust, compact dual wall halogen free and electron-beam cross-linked cable type with improved fire and temperature performance. With a voltage rating up to 3.6/6 kV and high corona resistance. The cable is weight optimised with a reduced outer diameter and withstands high (+120 °C) and low (–60 °C) operating temperature.

The BETAtrans® 9 GKW-AXplus Cable Family possesses excellent electrical and mechanical characteristics as well as a excellent resistance to mineral oil and detergents and has an outstanding fire performance.

The BETAtrans® 9 GKW-AXplus Cable Family consists of:

- **BETAtrans® 9 GKW-AXplus**
  as single core version, non screened
- **BETAtrans® 9 GKW-AXplus C-flex**
  as single core version, screened, with optimized EMC screening

Cross sections

1,5–400 mm²

Advantages

- Resistance to cold down to –60 °C
- Resistance to corona discharge
- Saves volume, optimized cable volume
- Saves weight, optimized cable weight
- Saves space, limited space required
- High performance to short circuit and earth fault
- High operating temperature up to +120 °C
- meets highest requirements in fire performance
- Easy handling
- Easy to install
- Easy to strip
- Excellent flexibility
- Halogen free
- Low smoke density
- Flame retardant
- Low fire load
- Ozone and weathering resistance
- Fluorine free
- Excellent resistance to oil
- Excellent resistance to fuel
- Soldering iron resistant
- Tight bending radius

Application

- The BETAtrans® 9 GKW-AXplus is designed as power and control cable for protected installations both inside and outside of rolling stock, underground railway systems, buses and other transport systems.
- BETAtrans® 9 GKW-AXplus cables are used in control-, auxiliary- and main power circuit wiring applications such as in cable harnesses, cable looms, switchboards and control panels, electrical cabinets, power converters, resister- and braking blocks and many other applications.

BETAtrans® 9 GKW-AXplus

Specification

Product properties		
Nominal voltage	U_0/U(Um)	3.6/6 (7.2) kV AC
		5.4 kV DC
Testing voltage		11 kV AC
Max. conductor temperature	fixed installations	+120 °C
	sporadically moved	+90 °C
	short circuit	+200 °C
Min. ambient temperature	fixed installations	–60 °C
	sporadically moved	–35 °C

Fire performance for rolling stock		
BS 6853	interior use	Ia, Ib, II
	exterior use	Ia, Ib, II
DIN 5510	level of protection	1, 2, 3, 4
EN 50264-1	*all hazard levels	
NF F 16-101	classification	C / FO
	interior use	A1, A2, B
	exterior use	A1, A2, B

Fire performance in general	
Vertical flame propagation for a single insulated wire or cable	EN 50265-2-1, IEC 60332-1
Vertical flame spread of bunched wires and cables	EN 50266-2-4, IEC 60332-3-24
Halogen free	EN 50267-2-1, IEC 60754-1
Corrosivity of gases	EN 50267-2-3, IEC 60754-2
Toxicity of gases	EN 50305, NFX 70-100
Smoke density	EN 50268-2, IEC 61034-2

Approvals
Swiss Federal Railway (SBB)

Material properties	
No fluorine	EN 60684-2
Resistance to oil	EN 50305, EN 60811-2-1
Resistance to fuel	EN 50305, EN 60811-2-1
Resistance to ozone	EN 50305
Low fire load	DIN 51900

*acc. HL4 as to today's version EN 45545

BETAtrans® 9 GKW-AXplus

Technical data

cross section	part no.	color	conductor	outer-Ø	R_{20}	weight
[mm²]		code	n x mm [mm]	approx. [mm]	[mΩ/m]	approx. [kg/km]
1.5	222931	black	30 x 0.25	4.50	13.70	35
2.5	222932	black	50 x 0.25	5.20	8.21	50
4	222933	black	56 x 0.30	6.00	5.09	71
6	222934	black	84 x 0.30	6.60	3.39	95
10	222935	black	80 x 0.40	7.80	1.95	146
16	222936	black	119 x 0.40	9.70	1.24	219
25	222937	black	182 x 0.40	11.50	0.795	333
35	222938	black	259 x 0.40	12.80	0.565	450
50	222939	black	380 x 0.40	14.90	0.393	625
70	222940	black	342 x 0.50	17.20	0.277	867
95	222941	black	456 x 0.50	19.20	0.210	1104
120	222942	black	570 x 0.50	21.30	0.164	1391
150	222943	black	703 x 0.50	23.30	0.132	1714
185	222944	black	874 x 0.50	25.30	0.108	2108
240	222945	black	1147 x 0.50	28.50	0.0817	2687
300	222946	black	1443 x 0.50	31.10	0.0654	3153
400	222947	black	1887 x 0.50	36.70	0.0495	4174

Further dimensions on request

BETAtrans® 9 GKW-AXplus C-flex

Specification

Product properties		
Nominal voltage	U_0/U(Um)	3.6/6 (7.2) kV AC
		5.4 kV DC
Testing voltage		11 kV AC
Max. conductor temperature	fixed installations	+120 °C
	sporadically moved	+90 °C
	short circuit	+200 °C
Min. ambient temperature	fixed installations	–60 °C
	sporadically moved	–35 °C

Fire performance for rolling stock		
BS 6853	interior use	Ia, Ib, II
	exterior use	Ia, Ib, II
DIN 5510	level of protection	1, 2, 3, 4
EN 50264-1	*all hazard levels	
NF F 16-101	classification	C / FO
	interior use	A1, A2, B
	exterior use	A1, A2, B

Fire performance in general	
Vertical flame propagation for a single insulated wire or cable	EN 50265-2-1, IEC 60332-1
Vertical flame spread of bunched wires and cables	EN 50266-2-4, IEC 60332-3-24
Halogen free	EN 50267-2-1, IEC 60754-1
Corrosivity of gases	EN 50267-2-3, IEC 60754-2
Toxicity of gases	EN 50305, NFX 70-100
Smoke density	EN 50268-2, IEC 61034-2

Approvals
Swiss Federal Railway (SBB)

Material properties	
No fluorine	EN 60684-2
Resistance to oil	EN 50305, EN 60811-2-1
Resistance to fuel	EN 50305, EN 60811-2-1
Resistance to ozone	EN 50305
Low fire load	DIN 51900

*acc. HL4 as to today's version EN 45545

BETAtrans® 9 GKW-AXplus C-flex

Technical data

cross section	part no.	color	conductor	outer-Ø	R_{20}	weight
[mm²]		code	n x mm [mm]	approx. [mm]	[mΩ/m]	approx. [kg/km]
1.5	223353	black	30 x 0.25	6.30	13.70	72
2.5	223354	black	50 x 0.25	6.90	8.21	91
4	223355	black	56 x 0.30	7.80	5.09	120
6	223356	black	84 x 0.30	8.50	3.39	151
10	223357	black	80 x 0.40	9.80	1.95	212
16	223358	black	119 x 0.40	11.80	1.24	297
25	223359	black	182 x 0.40	13.40	0.795	403
35	223360	black	259 x 0.40	14.80	0.565	524
50	223361	black	380 x 0.40	17.40	0.393	736
70	223362	black	342 x 0.50	19.50	0.277	967
95	223363	black	456 x 0.50	21.30	0.210	1218
120	223364	black	570 x 0.50	23.50	0.164	1487
150	223365	black	703 x 0.50	26.00	0.132	1792
185	223366	black	874 x 0.50	28.00	0.10	2199
240	223367	black	1147 x 0.50	31.00	0.0817	2773
300	223368	black	1443 x 0.50	33.60	0.0654	3401
400	223369	black	1887 x 0.50	38.30	0.0495	4370

Further dimensions on request

Databus- and Coaxial Cables

46	BETAtrans® Databus	
47	MVB Databus	(Multifunction Vehicle Bus)
48	WTB Databus	(Wired Train Bus (120 Ohm)
49	Databus	
52	CAT 5 Databus	

BETAtrans® Databus- and Coaxial Cable Family

300 V AC
450 V DC

The BETAtrans® Databus- and Coaxial Cable Family is designed for various high frequency and low attenuation data transmission. The cables are very flexible and designed for the harsh railway environment. The BETAtrans® electron-beam cross-linked sheath is halogen free and with improved fire performance and possesses excellent electrical and mechanical characteristics.

The tinned copper wire screening braids are optimised for EMC, therefore high performance screening is assured.

The BETAtrans® Databus- and Coaxial Cable Family consists of:

- **BETAtrans® WTB Databus (Wired Train Bus) 120 Ω**
- **BETAtrans® MVB Databus (Multifunction Vehicle Bus) 120 Ω**
- **BETAtrans® CAT 5 Databus**

On request:

- **BETAtrans® Databus (acc. customer requirements)**
- **BETAtrans® Koaxial (acc. customer requirements)**
- **BETAtrans® CAT 5 Databus (acc. customer requirements)**

Cross sections

0,5–0,75 mm^2

Advantages

- Symmetrical data lines with very good transmission qualities at high frequencies
- Resistance to low temperatures down to –40 °C
- High operating temperature up to +90 °C
- High performance screening
- meets highest requirements in fire performance
- Easy handling
- Easy to install
- Easy to strip
- Excellent flexibility
- Halogen free
- Low smoke density
- Flame retardant
- Low fire load
- Ozone and weathering resistance
- Tight bending radius

Application

- The BETAtrans® Databus- and Coaxial cables are designed for protected installations both inside and outside of rolling stock, underground railway systems, buses and other transport systems.
- BETAtrans® Databus- and Coaxial cables are used in communication systems, for video surveillance and entertainment (CCTV), passenger infotainment systems for real time passenger information and entertainment (PIS) and other most modern applications.

BETAtrans® Data sw 2 x 0.5 mm² 120 Ω MVB

Specification

Product properties			
Nominal voltage		300 V	
Testing voltage		2 kV AC	
Max. conductor temperature	fixed installations	+90 °C	
	short circuit	+160 °C	
Min. ambient temperature	fixed installations	–40 °C	

Technical data			
Impedance		0.75–3 MHz	120 ±12 Ω
Transfer impedance		20 MHz	≤ 20 mΩ/m
Attenuation		1 MHz	≤ 12 db/km
		2 MHz	≤ 17 db/km
		3 MHz	≤ 23 db/km
DC resistance			< 41 mΩ/m

Fire performance for rolling stock		
DIN 5510-2	level of protection	1, 2, 3, 4

Fire performance in generally	
Vertical flame propagation for a single insulated wire or cable	EN 50265-2-1, IEC 60332-1
Halogen free	EN 50267-2-1, IEC 60754-1
Corrosivity of gases	EN 50267-2-3, IEC 60754-2
Toxicity of gases	EN 50305, NFX 70-100
Smoke density	EN 50268-2, IEC 61034-2

Material properties	
No fluorine	EN 60684-2
Resistance to oil	EN 50305, EN 60811-2-1
Resistance to fuel	EN 50305, EN 60811-2-1
Resistance to ozone	EN 50305
Low fire load	DIN 51900

Other cable configurations on request

BETAtrans® Data sw 2 x 0.75 mm² 120 Ω WTB

Specification

Product properties			
Nominal voltage		300 V	
Testing voltage		2 kV AC	
Max. conductor temperature	fixed installations	+90 °C	
	short circuit	+160 °C	
Min. ambient temperature	fixed installations	–40 °C	

Technical data			
Impedance		0.75–3 MHz	120 ±12 Ω
Transfer impedance		20 MHz	≤ 30 mΩ/m
Attenuation		1 MHz	≤ 10 db/km
		2 MHz	≤ 14 db/km
		3 MHz	≤ 18 db/km
DC resistance			< 26.7 mΩ/m

Fire performance for rolling stock		
DIN 5510-2	level of protection	1, 2, 3, 4

Fire performance in general	
Vertical flame propagation for a single insulated wire or cable	EN 50265-2-1, IEC 60332-1
Halogen free	EN 50267-2-1, IEC 60754-1
Corrosivity of gases	EN 50267-2-3, IEC 60754-2
Toxicity of gases	EN 50305, NFX 70-100
Smoke density	EN 50268-2, IEC 61034-2

Material properties	
No fluorine	EN 60684-2
Resistance to oil	EN 50305, EN 60811-2-1
Resistance to fuel	EN 50305, EN 60811-2-1
Resistance to ozone	EN 50305
Low fire load	DIN 51900

Other cable configurations on request

BETAtrans® Data sw 1 x 4 x 0.5 mm² 120 Ω

Specification

Product properties			
Nominal voltage		300 V	
Testing voltage		2 kV AC	
Max. conductor temperature	fixed installations	+90 °C	
	short circuit	+160 °C	
Min. ambient temperature	fixed installations	–40 °C	

Technical data			
Impedance		0.75–3 MHz	120 ±12 Ω
Transfer impedance		20 MHz	≤ 20 mΩ/m
Attenuation		1 MHz	≤ 12 db/km
		2 MHz	≤ 17 db/km
		3 MHz	≤ 23 db/km
Near and crosstalk		0.75–3 MHZ	55 db
DC resistance		< 41 mΩ/m	

Fire performance for rolling stock		
DIN 5510-2	level of protection	1, 2, 3, 4

Fire performance in general	
Vertical flame propagation for a single insulated wire or cable	EN 50265-2-1, IEC 60332-1
Halogen free	EN 50267-2-1, IEC 60754-1
Corrosivity of gases	EN 50267-2-3, IEC 60754-2
Toxicity of gases	EN 50305, NFX 70-100
Smoke density	EN 50268-2, IEC 61034-2

Material properties	
No fluorine	EN 60684-2
Resistance to oil	EN 50305
Resistance to fuel	EN 50305
Resistance to ozone	EN 50305
Low fire load	DIN 51900

Other cable configurations on request

BETAtrans® Data sw 1 x 4 x 0.75 mm² 120 Ω

Specification

Product properties			
Nominal voltage		300 V	
Testing voltage		2 kV AC	
Max. conductor temperature	fixed installations	+90 °C	
	short circuit	+160 °C	
Min. ambient temperature	fixed installations	–40 °C	

Technical data			
Impedance		0.5–2 MHz	120 ±12 Ω
Transfer impedance		20 MHz	≤ 30 mΩ/m
Attenuation		1 MHz	≤ 10 db/km
		2 MHz	≤ 14 db/km
		3 MHz	≤ 18 db/km
Near and crosstalk		0.5–2 MHZ	55 db
DC resistance		< 26.7 mΩ/m	

Fire performance for rolling stock		
DIN 5510-2	level of protection	1, 2, 3, 4

Fire performance in general	
Vertical flame propagation for a single insulated wire or cable	EN 50265-2-1, IEC 60332-1
Halogen free	EN 50267-2-1, IEC 60754-1
Corrosivity of gases	EN 50267-2-3, IEC 60754-2
Toxicity of gases	EN 50305, NFX 70-100
Smoke density	EN 50268-2, IEC 61034-2

Material properties	
No fluorine	EN 60684-2
Resistance to oil	EN 50305
Resistance to fuel	EN 50305
Resistance to ozone	EN 50305
Low fire load	DIN 51900

Other cable configurations on request

BETAtrans® Data sw 2 x 2 x 0.5 mm² / 120 Ω 2 x 1 x 0.5 mm²

Specification

Product properties			
Nominal voltage		300 V	
Testing voltage		2 kV AC	
Max. conductor temperature	fixed installations	+90 °C	
	short circuit	+160 °C	
Min. ambient temperature	fixed installations	–40 °C	

Technical data			
Impedance		0.75–3 MHz	120 ±12 Ω
Transfer impedance		20 MHz	≤ 20 mΩ/m
Attenuation		1 MHz	≤ 12 db/km
		2 MHz	≤ 17 db/km
		3 MHz	≤ 23 db/km
Near and crosstalk		0.75–3 MHZ	55 db
DC resistance		< 41 mΩ/m	

Fire performance for rolling stock		
DIN 5510-2	level of protection	1, 2, 3, 4

Fire performance in general	
Vertical flame propagation for a single insulated wire or cable	EN 50265-2-1, IEC 60332-1
Halogen free	EN 50267-2-1, IEC 60754-1
Corrosivity of gases	EN 50267-2-3, IEC 60754-2
Toxicity of gases	EN 50305, NFX 70-100
Smoke density	EN 50268-2, IEC 61034-2

Material properties	
No fluorine	EN 60684-2
Resistance to oil	EN 50305
Resistance to fuel	EN 50305
Resistance to ozone	EN 50305
Low fire load	DIN 51900

Other cable configurations on request

BETAtrans® Data C-flex sw 1 x 4 x AWG 22 CAT 5

Specification

Product properties			
Nominal voltage		300 V	
Testing voltage		2 kV AC	
Max. conductor temperature	fixed installations	+90 °C	
	short circuit	+160 °C	
Min. ambient temperature	fixed installations	–40 °C	

Technical data			
Impedance		100 MHz	100 ±15 Ω
Transfer impedance		20 MHz	≤ 20 mΩ/m
DC resistance		< 59.4 mΩ/m	

Fire performance for rolling stock		
DIN 5510-2	level of protection	1, 2, 3, 4

Fire performance in general	
Vertical flame propagation for a single insulated wire or cable	EN 50265-2-1, IEC 60332-1
Halogen free	EN 50267-2-1, IEC 60754-1
Corrosivity of gases	EN 50267-2-3, IEC 60754-2
Toxicity of gases	EN 50305, NFX 70-100
Smoke density	EN 50268-2, IEC 61034-2

Material properties	
No fluorine	EN 60684-2
Resistance to oil	EN 50305
Resistance to fuel	EN 50305
Resistance to ozone	EN 50305
Low fire load	DIN 51900

Transmission properties	EN 50173, ISO / IEC 11801

Other cable configurations on request

UIC Cables

UIC Cable Family

The UIC Cable Family cover all wishes of multifunctional UIC Railway cables for all modern fixed and flexible cable applications. The cables are designed for various high frequency and low attenuation data transmission, both inside and outside of rolling stock vehicles, underground railway systems, buses and other transport systems.
The cables are very flexible and designed for the harsh railway environment.

The UIC Cable Family consists of:

- **UIC Jumper Cable 18 – cores for flexible installation**
- **UIC Cable 16 – cores for fixed installation**
- **UIC Cable 4 – cores shielded for fixed installation**
- **UIC EP Cable 9 – cores for fixed installation**
- **UIC EP Cable 10 – cores for fixed installation**
- **UIC Jumper cable 12 – cores for flexible installation**
- **UIC Cable 12 – cores for fixed installation**

On request:

- Other UIC Cable types on request

Advantages

- Resistance to low temperatures down to –40 °C
- High operating temperature up to +90 °C
- High performance screening
- Easy handling
- Easy to install
- Easy to strip
- Excellent flexibility
- Halogen free
- Low smoke density
- Flame retardant
- Low fire load
- Low toxicity
- Ozone and weathering resistant

Application

- The multifunctional UIC Railway cables are ideal for applications such as
  - Jumper cable between vehicles
  - Cables for fixed installation and connections inside railway vehicles
  - for new railway trains as well as for retrofit or modification of rolling stock.
- UIC cables are used in communication systems, remote control of equipment, the control of the electro pneumatic brake system of a train.

PUR-sheath
halogen free, flame retardant
18 cores

UIC Jumper Cable, 18 cores UIC 558

Specification

Construction

Databus 1 x 2 x 0.75 mm²	conductor	Tinned copper, 19-wires
	insulation	foamed polyolefin with skin
	color of conductors	black, white
	shielding	Tin plated copper braid, Min coverage 90%
	sheath	TPE, black
Starquad 4 x 4 x 1.0 mm²	conductor	Tinned copper, 19-wires
	insulation	Polymer halogen free
	color of conductors	white with printed numbers
Other Construction	shielding	Tin plated copper braid, Min coverage 90%
	outer sheath	PUR, black
Marking	print	UIC 18 cores size DB 80500001

Technical data

Flame retardant	IEC 60332-1
Halogen free	IEC 60754-1
Corrosivity of gases	IEC 60754-2
Resistance to ozone	IEC 60811-2-1, Section 8
Resistance to oil	IEC 60811-2-1, Section 10
Hydrocarbon resistance	UIC 895, # 43.2.2
Operating Temperature range	–40 °C to +90 °C
Min. bending radius	8 x Cable-Ø
Max. tensile strength	1500 N

UIC Jumper Cable, 18 cores UIC 558

Technical data

	Conductor-Ø	Core-Ø	Sheath-Wdd.	Outer-Ø
	Value [mm]	Value [mm]	Value [mm]	Value [mm]
UIC Databus Cable	1.1	2.7	0.25	6.5
Starquad	1.3	1.8	–	–
UIC Jumper Cable	–	–	2.0	17.5 ± 0.5

Electrical data at 20 °C

		Character	Unit	Bus Cable	Twisted Quad
				0.75 mm^2	1.0 mm^2
Conductor resistance		max.	Ω / km	26	20.0
Insulation resistance		min.	MΩ x km	5000	
Capacitance	core/core	max.	nF / km	65	65 (nom.)
	core/screen	max.	nF / km	120	–
Impedance at 0.5–2 Mhz		nom.	Ω	120 ±12	–
Attenuation at	16 kHz	max.	dB / km	–	3.24
	49 kHz	max.	dB / km	–	5.66
	100 kHz	max.	dB / km	–	8.08
	1 MHz	max.	dB / km	10	–
	2 MHz	max.	dB / km	14	–
Cross talk attenuation by 1 MHz	pair/quad	min.	dB	70	–
	quad/quad	min.	dB	–	50
	as quad	min.	dB	–	50
Transfer impedance at	500 kHz	max.	mΩ / m	–	10
	30 MHz	nom.	mΩ / m	5	20
Capacitive earth coupling		max.	pF / km	1500	–
Propagation delay		nom.	ns / m	5	–
Test voltage	core/core	U_{eff}	V	1500	
	core/screen	U_{eff}	V	1500	
Max. voltage rating		U_{eff}	V	300	

Polymer sheath
halogen free, flame retardant
16 cores

UIC Cable, 16 cores UIC 558

Specification

Construction

Starquad 4 x 4 x 1.0 mm²	conductor	Tinned copper, 19-wires
	insulation	Polymer halogen free
	color of conductors	white with printed numbers
Other Construction	shielding	Tin plated copper braid, Min coverage 90%
	outer sheath	Polymer halogen free, flame retardant, black
Marking	print	UIC 16 cores size DB 80590000

Technical data

Flame retardant	IEC 60332-3, Category C (bunched cable test)
Halogen free	IEC 60754-1
Corrosivity of gases	IEC 60754-2
Smoke density	IEC 61034-2
Resistance to ozone	IEC 60811-2-1, Section 8
Resistance to oil	ICEA S-61-402 (ASTM-ÖI Nr. 2, 70 °C/4 h)
Operating Temperature range	–25 °C to +90 °C
Min. bending radius	6 x cable-Ø

Technical data

	conductor-Ø	Core-Ø	sheath-Wdd.	outer-Ø
	Value [mm]	Value [mm]	Value [mm]	Value [mm]
UIC Cable	1.3	1.8	1.3	14.5 ± 0.5

Electrical data at 20 °C

		Character	Unit	cross section
				1.0 mm²
Conductor resistance		max.	Ω / km	20.0
Insulation resistance		min.	MΩ x km	5000
Capacitance		max.	nF / km	65
Attenuation at	16 kHz	max.	dB / km	3.24
	49 kHz	max.	dB / km	5.66
	100 kHz	max.	dB / km	8.08
Cross talk attenuation by 1 MHz	as quad	min.	dB	50
	quad/quad	min.	dB	50
Transfer impedance at	500 kHz	max.	mΩ / m	10
	30 MHz	nom.	mΩ / m	20
Test voltage	core/core	U_{eff}	V	1500
	core/screen	U_{eff}	V	1500
Max. voltage rating		U_{eff}	V	300

Polymer sheath
halogen free, flame retardant
4 cores

UIC Twisted Quad Shielded Cable, 4 cores UIC 558

Specification

Construction

Starquad 1 x 4 x 1.0 mm²	conductor	Tinned copper, 19-wires
	insulation	Polymer halogen free
	color of conductors	white with printed numbers
Other Construction	shielding	Tin plated copper braid, Min coverage 90%
	outer sheath	Polymer halogen free, flame retardant, black
Marking	print	UIC 4 cores size DB 80590001

Technical data

Flame retardant	IEC 60332-3, Category C (bunched cable test)
Halogen free	IEC 60754-1
Corrosivity of gases	IEC 60754-2
Smoke density	IEC 61034-2
Resistance to ozone	IEC 60811-2-1, Section 8
Resistance to oil	ICEA S-61-402 (ASTM-ÖI N° 2, 70 °C/4 h)
Operating Temperature range	–25 °C to +90 °C
Min. bending radius	6 x cable-Ø

Technical data

	conductor-Ø	Core-Ø	sheath-Wdd.	outer-Ø
	Value [mm]	Value [mm]	Value [mm]	Value [mm]
UIC-Transit circuit cable	1.3	2.1	1.0	8.0 ± 0.5

Electrical data at 20 °C

		Character	Unit	cross section
				1.0 mm²
Conductor resistance		max.	Ω / km	20.0
Insulation resistance		min.	MΩ x km	5000
Capacitance		max.	nF / km	65
Attenuation at	16 kHz	max.	dB / km	3.24
	49 kHz	max.	dB / km	5.66
	100 kHz	max.	dB / km	8.08
Cross talk attenuation by 1 MHz	as quad	min.	dB	50
Transfer impedance at	30 MHz	nom.	mΩ / m	30
Test voltage	core/core	U_{eff}	V	1500
	core/screen	U_{eff}	V	1500
Max. voltage rating		U_{eff}	V	300

PUR-sheath
halogen free, flame retardant
9 cores

UIC EP Cable, 9 cores UIC 541-5

Specification

Construction

Databus Cable 1 x 2 x 0.75 mm^2	conductor	Tinned copper, 19-wires
	insulation	foamed polyolefin with skin
	color of conductors	black, white
	shielding	Tin plated copper braid, Min coverage 90%
	sheath	TPE, black
Power conductors 1 x 2.5 mm^2, 4 x 10 mm^2, 2 x 6 mm^2	conductor	Tinned copper, fine strands
	insulation	Elastomer halogen free
	color of conductors	white with printed numbers
Other Construction	outer sheath	PUR, black
Marking	print	UIC 9 cores size DB 80570000

Technical data	
Flame retardant	IEC 60332-1
Halogen free	IEC 60754-1
Corrosivity of gases	IEC 60754-2
Resistance to ozone	IEC 60811-2-1, Section 8
Resistance to oil	IEC 60811-2-1, Section 10
Hydrocarbon resistance	UIC 895, # 43.2.2
Operating Temperature range	–40 °C to +90 °C
Min. bending radius	8 x Cable-Ø
Max. tensile strength	1500 N

PUR-sheath
halogen free, flame retardant
9 cores

UIC EP Cable, 9 cores UIC 541-5 (continued)

Technical data

		conductor-Ø	Core-Ø	sheath-Wdd.	outer-Ø
		Value [mm]	max. value [mm]	Value [mm]	Value [mm]
UIC Databus Cable		1.1	1.8 (Value)	0.25	6.5
Power conductors	10 mm^2	4.4	7.5	–	–
	6 mm^2	3.5	5.5	–	–
	2.5 mm^2	2.1	3.5	–	–
EP Control cable		–	–	2.2	26.0 ± 1.0

Electrical data at 20 °C

		Character	Unit	Databus Cable	cross section (Energie conductors)		
				0.75 mm^2	2.5 mm^2	6 mm^2	10 mm^2
Conductor resistance		max.	Ω / km	26.0	8.21	3.39	1.95
Insulation resistance		min.	MΩ x km	5000	300	300	300
Capacitance	core/core	max.	nF / km	65	–	–	–
	core/screen	max.	nF / km	120	–	–	–
Impedance at 0.5–2 MHz		nom.	Ω	120 ± 12	–	–	–
Attenuation at	2 MHz	max.	dB / km	10	–	–	–
	2 MHz	max.	dB / km	14	–	–	–
Transfer impedance at	30 MHz	nom.	mΩ / m	30	–	–	–
Capacitive earth coupling		max.	pF / km	1500	–	–	–
Propagation delay		nom.	ns / m	5	–	–	–
Testing voltage	core/core	U_{eff}	V	1500	2500	2500	2500
	core/screen	U_{eff}	V	1500	2500	2500	2500
Max. voltage rating		U_{eff}	V	300	500	500	500

UIC EP Cable, 10 cores, gen. to UIC 541-5

Specification

Construction

Databus 1 x 2 x 0.75 mm²	conductor	Tinned copper, 19-wires
	insulation	foamed polyolefin with skin
	color of conductors	black, white
	shielding	Tin plated copper braid, Min coverage 90%
	sheath	TPE, black
Starquad 1 x 4 x 1.0 mm²	conductor	Tinned copper, 19-wires
	insulation	Polymer halogen free
	color of conductors	white with printed numbers
	sheath	TPE, black
Energy conductors 4 x 6 mm²	conductor	Tinned copper, fine strands
	insulation	Elastomer halogen frree
	color of conductors	white with printed numbers
Further Construction	shielding	Tin plated copper braid, Min coverage 90%
	outer sheath	PUR, black
Marking	print	UIC 10 cores size DB 80600000

Technical data

Flame retardant	IEC 60332-1
Level of protections 1–4	DIN 5510-1 and DIN 5510-2
Halogen free	IEC 60754-1
Corrosivity of gases	IEC 60754-2
Resistance to ozone	IEC 60811-2-1, Section 8
Resistance to oil	IEC 60811-2-1, Section 10
Hydrocarbon resistance	UIC 895, # 43.2.2
Operating Temperature range	–40 °C to +90 °C
Min. bending radius	8 x cable-Ø
Max. tensile strength	1500 N

UIC EP Cable, 10 cores, gen. to UIC 541-5 (continued)

Technical data

	conductor-Ø	Core-Ø	sheath-Wdd.	outer-Ø
	Value [mm]	Value [mm]	Value [mm]	Value [mm]
UIC Databus Cable	1.1	2.7	0.25	6.5
Power conductor 6 mm²	3.5	5.5 (max.)	–	–
Starquad	1.3	1.8	0.25	4.7
EP Control cable	–	–	1.6	21.3 ± 0.5

Electrical data at 20 °C

		Character	Unit	Databus Cable	Twisted Quad	Energie conductor
				0.75 mm²	1.0 mm²	6 mm²
Conductor resistance		max.	Ω / km	26	20.0	3.39
Insulation resistance		min.	MΩ x km	5000	5000	300
Capacitance	core/core	max.	nF / km	65	65 (Richtw.)	–
	core/sceen	max.	nF / km	120	–	–
Impedance at 0.5–2 Mhz		nom.	Ω	120 ±12	–	–
Attenuation at	16 kHz	max.	dB / km	–	3.24	–
	49 kHz	max.	dB / km	–	5.66	–
	100 kHz	max.	dB / km	–	8.08	–
	1 MHz	max.	dB / km	10	–	–
	2 MHz	max.	dB / km	14	–	–
Cross talk attenuation by 1 MHz	pair/quad	min.	dB	70	–	–
	quad/quad	min.	dB	–	50	–
	as quad	min.	dB	–	50	–
Transfer impedance at	500 kHz	max.	mΩ / m	–	10	–
	30 MHz	nom.	mΩ / m	5	20	–
Capacitive earth coupling		max.	pF / km	1500	–	–
Propagation delay		nom.	ns / m	5	–	–
Testing voltage	core/core	U_{eff}	V	1500	1500	2500
	core/sceen	U_{eff}	V	1500	1500	2500
Max. voltage rating		U_{eff}	V	300	300	500

PUR-sheath
halogen free, flame retardant
12 cores

UIC Jumper Cable, 12 cores

Specification

Construction

Starquad 3 x 4 x 1.0 mm²	conductor	Tinned copper, 19-wires
	insulation	Polymer halogen free
	color of conductors	red, black, white, yellow
	quad marking	red, black or white Ring reorganization at colored strands
Further Construction	shielding	Tin plated copper braid, Min coverage 90%
	outer sheath	PUR, black
Marking	print	UIC 12 cores size DB 80520002 halogen free PUR

Technical data

Flame retardant	IEC 60332-1
Halogen free	IEC 60754-1
Corrosivity of gases	IEC 60754-2
Resistance to ozone	IEC 60811-2-1, Section 8
Resistance to oil	IEC 60811-2-1, Section10
Resistance to hydrocarbon	UIC 895, # 43.2.2
Operating Temperature range	–25 °C to +90 °C
Min. bending radius	6 x Cable-Ø
Max. tensile strength	1500 N

PUR-sheath
halogen free, flame retardant
12 cores

UIC Jumper Cable, 12 cores (continued)

Technical data

	conductor-Ø	Core-Ø	sheath-Wdd.	outer-Ø
	Value [mm]	Value [mm]	Value [mm]	Value [mm]
UIC Cable	1.3	1.9	1.2	13.2 ± 0.5

Electrical data at 20 °C

		Character	Unit	cross section
				1.0 mm²
Conductor resistance		max.	Ω / km	20.0
Insulation resistance		min.	MΩ x km	5000
Capacitance		max.	nF / km	65
Attenuation at	16 kHz	max.	dB / km	3.24
	25 kHz	max.	dB / km	.05
	36 kHz	max.	dB / km	5.20
	49 kHz	max.	dB / km	5.66
	64 kHz	max.	dB / km	6.47
	81 kHz	max.	dB / km	7.28
	100 kHz	max.	dB / km	8.08
Cross talk attenuation by 1 MHz	as quad	min.	dB	50
	quad/quad	min.	dB	50
Transfer impedance at	500 kHz	max. value	mΩ x m	10
	30 MHz	ref. value	mΩ x m	20
Test voltage	core/core	U_{eff}	V	1500
	core/screen	U_{eff}	V	1500
Max. voltage rating		U_{eff}	V	300

Polymer sheath
halogen free, flame retardant
12 cores

UIC Cable, 12 cores

Specification

Construction

Starquad 3 x 4 x 1.0 mm²	conductor	Tinned copper, 19-wires
	insulation	Polymer halogen free
	color of conductors	red, black, white, yellow
	quad marking	red, black or white Ring reorganization at colored strands
Further Construction	shielding	Tin plated copper braid, Min coverage 90%
	outer sheath	Polymer, halogen free, flame retardant, black
Marking	print	UIC 12 cores at par DB 80590002 halogen free LSZH

Technical data

Flame retardant	IEC 60332-3, Category C (bunched cable test)
Halogen free	IEC 60754-1
Corrosivity of gases	IEC 60754-2
Smoke density	IEC 61034-2
Resistance to ozone	IEC 60811-2-1, Section 8
Resistance to oil	ICEA S-61-402 (ASTM-Öl Nr. 2, 70 °C/4 h)
Operating Temperature range	–25 °C to +90 °C
Min. bending radius	6 x cable-Ø

UIC Cable, 12 cores (continued)

Technical data

	conductor-Ø	Core-Ø	sheath-Wdd.	outer-Ø
	Value [mm]	Value [mm]	Value [mm]	Value [mm]
UIC Cable	1.3	1.9	1.2	13.2 ± 0.5

Electrical data at 20 °C

		Character	Unit	cross section
				1.0 mm^2
Conductor resistance		max.	Ω / km	20.0
Insulation resistance		min.	MΩ x km	5000
Capacitance		max.	nF / km	65
Attenuation at	16 kHz	max.	dB / km	3.24
	25 kHz	max.	dB / km	4.05
	36 kHz	max.	dB / km	5.20
	49 kHz	max.	dB / km	5.66
	64 kHz	max.	dB / km	6.47
	81 kHz	max.	dB / km	7.28
	100 kHz	max.	dB / km	8.08
Cross talk attenuation by 1 MHz	as quad	min.	dB	50
	quad/quad	min.	dB	50
Transfer impedance at	500 kHz	max.	mΩ / m	10
	30 MHz	nom.	mΩ / m	20
Test voltage	core/core	U_{eff}	V	1500
	core/screen	U_{eff}	V	1500
Max. voltage rating		U_{eff}	V	300

Fiber Optic Cables for the Railway Industry

Fast and trouble-free communications are taken for granted nowadays. To make this possible, hundreds of metres of cable thread through locomotives and passenger vehicles, linking equipment and systems. Even whole train units are interlinked by cable.

Fiber optic cables provide the ideal solution for future-proof installations because they enable not only high rates of data transmission with major spare capacity, but also the highest possible degree of operating security.

Fiber optic cables can be used in all parts of the railway industry in order to ensure insensitivity to electromagnetic radiation. In railways, one prefers fiber optic cables in the infrastructure for transport of large data rates long distances.

LEONI Fiber optic cables are suitable for fixed installation in cable trays or tubes and in jumper cable applications. They are also suitable for direct connector assembly.

The halogen free and flame retardant cable jacket guarantees compliance with the strict fire protection requirements (IEC 60332-1 and IEC 60332-3) on cables.

We offer you various fiber optic designs using plastic or glass fiber optics to enhance our existing broad range of fiber optic cables as well as professional support on products and applications to allow you to select the best transmission medium for your application.

Transmitting data, signals and images or light for illumination purposes by means of optical fibers has a very promising future. The market is growing and new applications are repeatedly confronting the manufacturers with fresh technical challenges. We are thus able to offer you a range of products and services that is unique in its extent and quality.

POF – Polymer Optical Fibers

Polymer optical fiber (POF) has been on the market for many years. Both the fiber core and the cladding are made of polymer. Key advantages of polymer optical fibers are high flexibility (high alternate bending resistance with smaller bending radii) as well as more economical connecting and transmission technology than in the case of glass. Moreover, this type of fiber also has all the major benefits of a fiber optical cable connection:
EMC security, clear galvanic separation, no crosstalk, low weight, etc.

POF can meanwhile be used to connect over distances up to 70 metres. It is even possible to cover distances up to 150 metres by selecting suitable active components.

Fiber Optic glass cable

LEONI customers expect the high quality they are used to even in case of cables with special requirements.

We offer customized „tailor-made“ solutions in fiber optic cables. Comprehensive know how, years of experience and highly flexible production processes make it possible for us to manufacture the right cable for even the most demanding application.

No matter for which application you require the cable – we have the right solution for you.




Inter-car / Jumper Cables and Assemblies Family

300 V–3.6 kV AC
450 V–5.4 kV DC

The LEONI Inter-car / Jumper Cable Family is designed to withstand high mechanical and moving stress especially for applications between cars and / or car to boogies. Our Inter-car / Jumper cables are specially developed and designed according to customer requirements. All possible designs and combinations of jumper cable solutions such as signal-, power-, data bus-, fiber optic- and coaxial applications are possible.

LEONI's Inter-car / Jumper cable solutions use special constructions and innovative materials for high flexibility, strength and durability.

The Inter-car / Jumper Cable Family consists of:

- **Single core cables, 300/500V, 600/1000V, 1.8 /3kV, 3.6/6kV**
  screened, non screened
- **Multi-core customer specific cables**
  Signal-, Control-, Databus-, Fiber optic- and / or Coaxial cables screened, non screened

We would be pleased to offer you our Inter-car / Jumper assembly solutions.

Cross sections

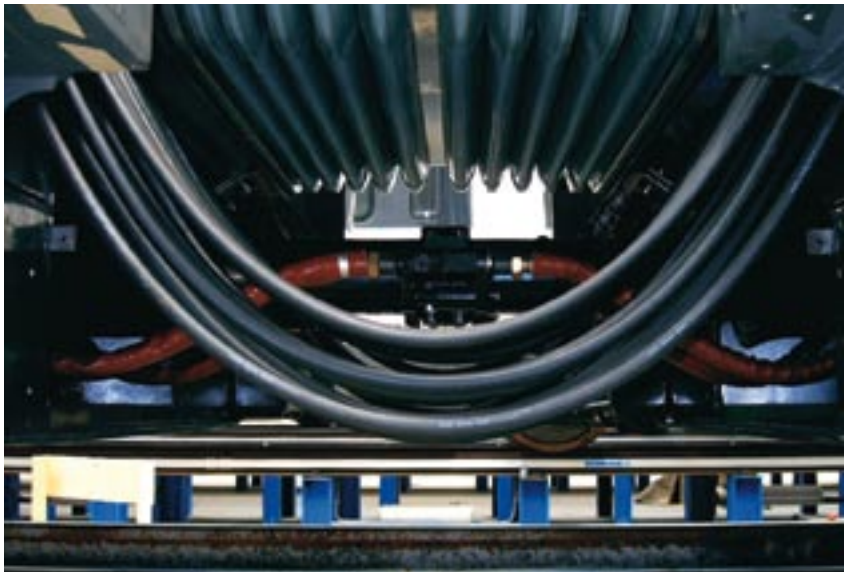
0,5–400 mm^2

Advantages

- Hybrid technology possible
- Fully assembled and tested deliveries possible
- Resistance to cold up to –40 °C
- High operating temperature up to +90 °C
- meets highest requirements in fire performance
- Excellent flexibility
- Halogen free
- Low smoke density
- Flame retardant
- Low fire load
- Ozone and weathering resistance

Application

- Highly flexible Signal- Control-, Power- and Hybrid cables for rolling stock, underground railway systems, buses and other transport systems.
- Between cars and / or car to boogie as well as for moving parts with high mechanical and moving stress.
- For flexible signal-, energy- and data transmission



System Solutions

The range of LEONI products and services comprises project specific engineering and logistics services for high quality system solutions.

Therefore LEONI perfectly combines a high level of pooled system expertise in the areas of development, design, production, logistics, after-sales services and project management.

Harnessing

We plan, design, build, assembly and test all possible harnesses such as

- crimping cables and connectors
- harnessing looms
- Mechanical and electrical assembly of parts and equipment, panels, cubicles and systems according your requirements and documentation

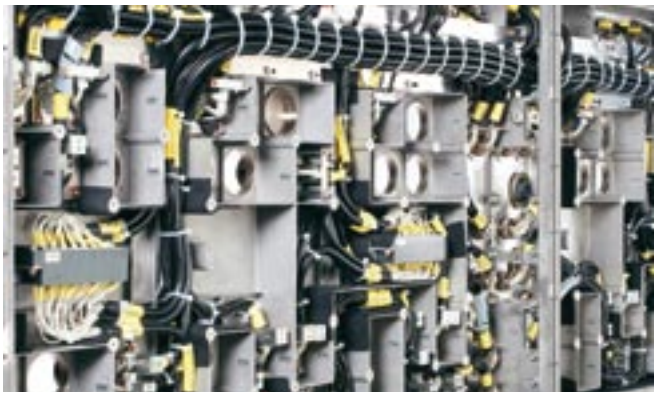
Development of System Solutions for customers

as a professional system provider we are able already in the design phase connecting us directly into your value chain to help you with all required project work. We can provide sketches, proposals, drawings, documentation, designs and systems for you. The production is very competent, professional and with the highest possible quality and best economic efficiency.

- Prototyping, serial production
- Cable Harnessing
- Panels, cubicles and systems
- Flexible High voltage Inter-car / Jumper solutions
- and more

With a worldwide presence LEONI is also the right choice as a partner, for entirely new business models connecting directly into your value chain.

Prototyping, Serial Production



Harnessing

Panels, Cubicles and Systems

Equipment Cabinet

Inter-car Jumper Assembly

High Voltage Inter-car Jumper

Technical description

Halogen free

The halogens are the elements of the 7th group in the Periodic Table of Elements: chlorine (Cl), fluorine (F), bromine (Br), iodine (I).

Halogen free cables are free of all these elements.
They are called halogens because in reaction with bases they build salts. (hals: Greek for salt); chlorine reacts with sodium and builds table salt (NaCl).
The halogens are an integrated component of many acids

HCl	= Salt acid (hydrochloric acid)
HF	= Hydrogenfluorid
HBr	= Hydrogenbromid

The most popular plastic containing halogens is PVC (polyvinylchloride). In case of fire or at high temperature PVC starts to degradate. Hydrochloric acid and other fission products are generated and lead to extremely aggressive corrosion. Therefore the current trend is to replace the halogen containing plastics with halogen free ones. For instance PVC is currently being replaced at a large scale with polyolefin i.e. polyethylene. Thanks to halogen free cables the formation of corrosive and toxic gases can be prevented.

Corrosive gases

Corrosive active gases link with humidity and generate aggressive acids which attack metal parts, thus causing great subsequent damages, even if the initial fire damage was small.

These damages also do not regard directly the area affected by the event of fire. Most endangered are the electric contacts, electronic devices and apparatus, machines and metal constructions. Even the iron of the concrete reinforcement could be attacked by these acids.

Toxic gases

During combustion small amounts of toxic gases such as CO and CO_2 are inevitably emitted. Combustion gases may not contain any halogen hydrogen compounds (HCl, HF, HBr) nor any strong toxic gases (Phosgene, HCN).
The same applies to sulphur and nitric oxides.
The toxicity of gases is defined by the so called mortality rate L50.

The most relevant international standard hereto are:

NES 02-713 Part 3 (Naval Engineering Standard)
The sum of all toxic elements in a material based on a mortality rate L50 after 30 min. impact. Rating by means of dimensionless index number (the lower the better).

Typical permissible limit values

shipbuilding	5–8
SBB	< 5
BETAtrans®	< 1.2

and French standard NF C20-454
Burning of a material sample. No biological damage after 30 min.

Flame retardant (self-extinguishing)

Flame retardant cables are cables which, when installed as a single cable, although ignitable on exposure to flame source, will greatly reduce flame spread and self-extinguish once the flame source is removed.

However in a vertical cable bundle, e.g. in vertical risers, fire can spread along the cables (chimney effect). In order to avoid this danger, the so called «non-flame propagating» cables should be used.

Non flame propagating

Non-flame propagating cables are those cables which can be ignited by a flame source, however they do not allow the fire to spread even if the cable bundle is placed vertically; they are self extinguishing once the fire source is removed.

Limiting Oxygen Index LOI

LOI = Limiting Oxygen Index. According to ISO 4589 the LOI represents the minimum Oxygen concentration expressed in percentage of volume which in combination with azote (nitrogen) could still sustain the burning of the plastic.

LOI	≤ 23	=	combustible
LOI	24–28	=	limited flame retardancy
LOI	29–35	=	flame retardant
LOI	> 36	=	especially flame retardant
LOI	ca. 45	=	peak value at halogen free materials
LOI	33–45	=	BETAtrans®

Smoke density

The formation of combustion gases has several unpleasant consequences. On the one hand it considerably lowers the visibility in a fire event, thus impeding the people trapped inside closed rooms to escape and the firemen to carry on their rescue and extinguish actions. On the other hand it produces smoke poisoning because of the carbon monoxide.

Regarding the formation of the combustion gases the PVC comes off quite badly. This however is not because of the PVC itself, as often wrongfully presumed, but because of the additives in its composition. Normally the softening additives in the PVC are the cause of considerable combustion gas formation.

Infusible (VDE 0472 part 615)

Electron beam cross-linking enable our heat-resistant cable to keep its mechanical properties and remain infusible, even at high temperatures (> 100 °C). Cross linked materials do not drip and therefore guarantee a high operating safety and short-circuit security.

Circuit Integrity

The circuit integrity indicates how long a non-protected cable maintains its insulation properties when exposed to fire under certain predefined conditions, without causing a short circuit.

(As per IEC 60331: A cable is laid horizontally over a burner and kept for three hours at ca. 800 °C. No short circuit may occur during this time). The circuit integrity is designated with FE (e.g. FE 180 = circuit integrity of 180 min.).

Fire load

Fire load is the quantity of energy which can be set free through combustion. The fire load of cables is calculated from the heat value and the quantity of inflammable materials used; this value forms a baseline for choosing the security measures to be applied (e.g. the measurement of sprinkler systems and the layout of cable trays).

Thermoplastic insulation materials

Thermoplastics consist of filiform macromolecules which can exist in either an unorganised structure (amorphous) or in an organized structure (crystalline). The transition temperature of the amorphous phase (Tg = brittle temperature) limits its use in cold conditions, the transition temperature of the crystalline phase (Tm = melting temperature) limits its use in warm conditions.

Above the melting temperature the crystalline phase disappears, the filiform molecules can move freely and the material begins to flow. The polymer can be given a thermoplastic processing.

Cross-linked insulating materials

Cross-linking binds together the filiform molecules by means of a linking (in the amorphous phase). This leads to a three-dimensional network. The filiform molecules can no longer move freely (irrespective of temperature). Above the melting temperature the material can no longer flow but it goes into a rubber-like elastic state.

Advantages of cross-linked insulation materials:

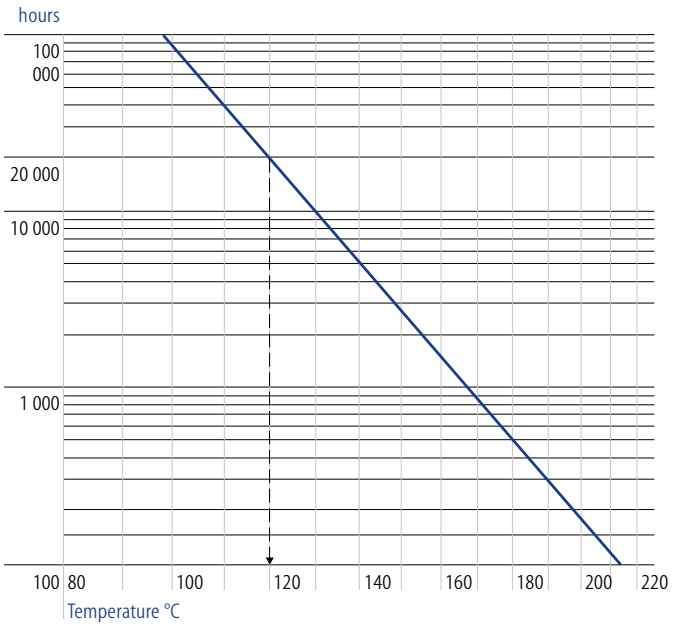
- increased shear and compressive strength
- improved integrity in case of electrical failures (overload, short circuit)
- improved resistance to chemicals
- infusible, soldering iron resistance
- improved impact strength and crack resistance
- better weather- and abrasion-resistance

Temperature index as per IEC 60216 / VDE 0304 part 21

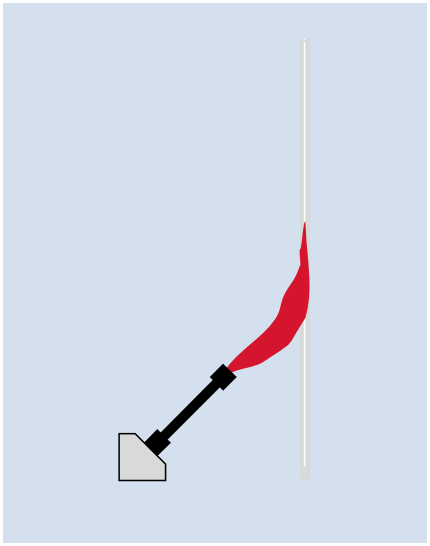
The temperature index describes the long-term performance of plastics. The temperature index defines the ageing temperature (in °C), at which the material still has an absolute elongation at break of 50% after 20 000 hours. A rise in the temperature index of + 10 °C results in approximately doubling the life span of the insulation.

In order to determine the long term temperature stability of an insulation material the different ageing times corresponding to different temperatures are measured and recorded in a so called Arrhenius-Diagram (ordinate-axis: log time, abscissa axis: the reciprocal absolute temperature).

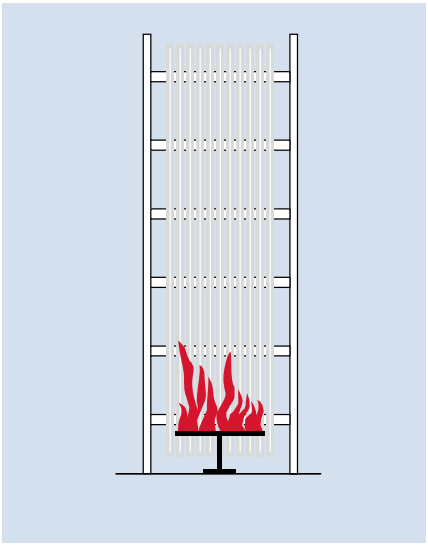
A straight line is drawn to connect the various recorded points. By prolonging the straight line until it intersects the 20 000 h axis it is possible to determine the lifetime or the temperature index.



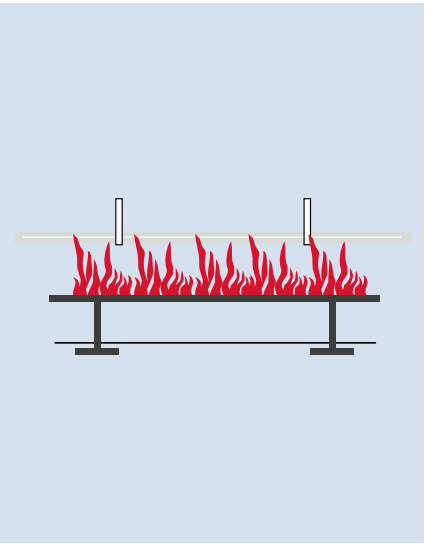
Test procedures



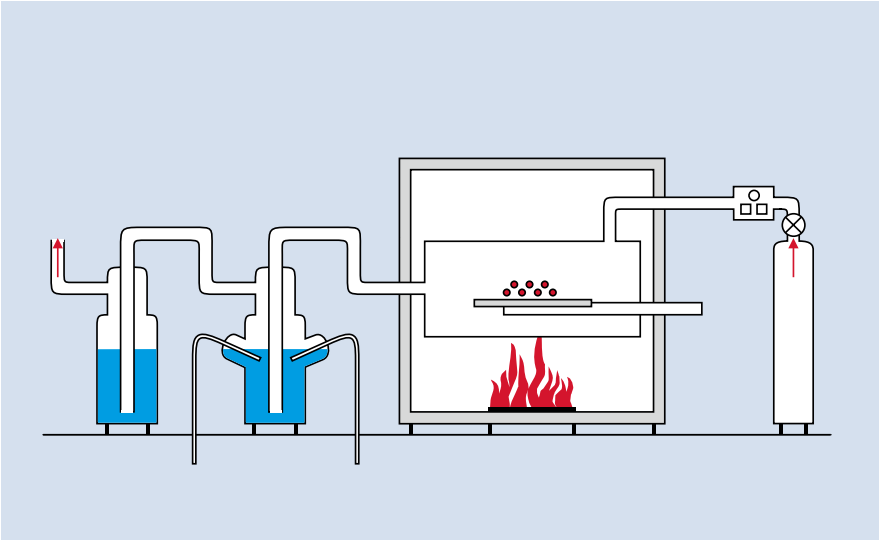
Fire performance of a single cable according to
IEC/CEI 60332-1
EN 50265
BETAtrans® GKW R
BETAtrans® 3 GKW
BETAtrans® 4 GKW-AX$_{plus}$
BETAtrans® 9 GKW-AX$_{plus}$
BETAtrans® GKW flex R
BETAtrans® GKW C-flex R
BETAtrans® 3 GKW flex
BETAtrans® 3 GKW C-flex
BETAtrans® 3 GKW FE 180

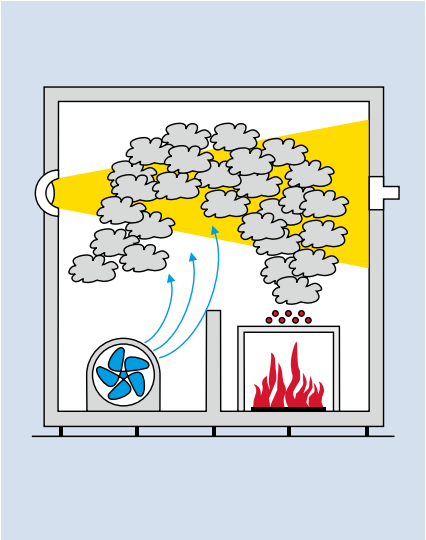


Fire performance of cable bundles according to
IEC/CEI 60332-3
EN 50305
EN 50266-2
BETAtrans® GKW R
BETAtrans® 3 GKW
BETAtrans® 4 GKW-AXplus
BETAtrans® 9 GKW-AXplus
BETAtrans® GKW flex R
BETAtrans® GKW C-flex R
BETAtrans® 3 GKW flex
BETAtrans® 3 GKW C-flex
BETAtrans® 3 GKW FE 180
BETAtrans® 4 GKW-AX plus FE 180
BETAtrans® 3 GKW FE 180 flex
BETAtrans® 3 GKW FE 180 C-flex



Circuit integrity according to
IEC/CEI 60331
VDE 0472-814
Upon request





Halogen free

1000 mg of the testing material must be held at one termination of an preannealed copper wire in a gas flame.

Requirement

The material is considered to be halogen free if no green to blue-green flame discoloration occurs. The chlorine and the bromine would cause such a discoloration, however the existence of fluorine cannot be proven like that.

Test standards

IEC 60754-1, EN 50267-2-1

Corrosivity of combustion gases

1000 mg insulation material is burned in a combustion furnace at ≤ 935 °C with pre-defined air supply for over ≤ 30 minutes. By means of two gas washing containers held in the airflow the conductivity and the ph-value are measured. Like that even small quantities of halogen containing substances can be detected and proven.

The test is considered to be passed when
the ph-value > 4,3
the conductivity < 10 µS/mm

Test standards

IEC 60754-2, EN 50267-2-2

Smoke emission

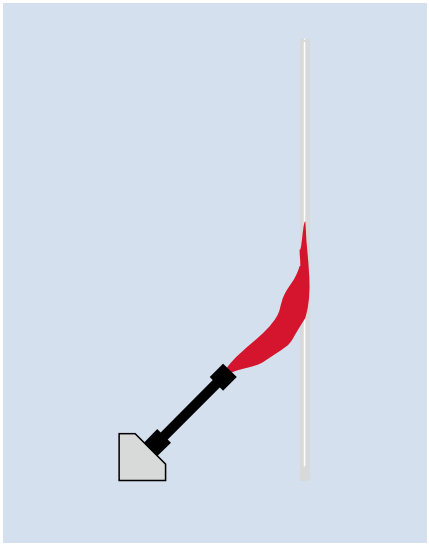
The density of smoke emission can be determined by measuring the light penetrability. Cable samples are lit with alcohol in a test chamber (cubical with an edge length of 3 m). The so formed smoke is uniformly spread by a ventilator and influences the light measuring section

The test is considered to be passed when the following light penetrability is reached

level of danger	requirement
HL 1	–
HL 2 and HL 3	60%
HL 4	70%

Test standards

IEC 61034, EN 50268-2



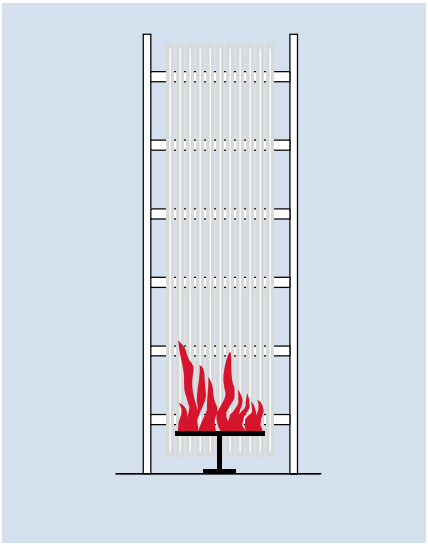
Fire performance for single cable (flame retardant)

This test procedure describes the minimum requirements for flame retardant cables and it is valid for lead wires or single cables only.

A lead wire or a cable is being aflamed with a propane-air-burner (1- kW- flame).
Test duration:
Ø ≤ 25 = 60 s
Ø 25...50 = 120 s
Ø 50...75 = 20 s
Ø >75 = 480 s
The burning cable should self-extinguish as soon as the fire source has been removed.
The fire damage may not be higher than 60 cm.

The test is considered to be passed if: The sample has not burned and the damage (carbonisation) has not reached any of the terminations of the sample (> 50 mm).

Test standards
IEC 60332-1, EN 50265-2-1



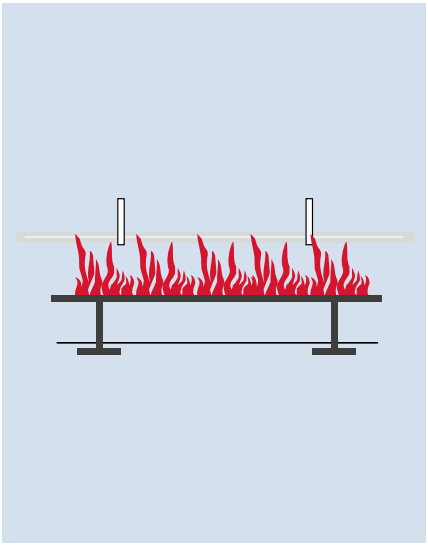
Fire performance of a cable bundle (non-flame propagating)

This test simulates the chimney effect in vertical cable installations. In a standardized cabinet the cable bundle is kept in a burner fire for 20–40 minutes (gas burner 75±5 MJ/h). Thereby the temperature is kept constant to 750 °C. Depending on the volume of the non-metal (combustible) materials per running meter it can be differentiated in the categories A F/R, A, B, C und D as follows:
The cables must self-extinguish after removing the fire source. The fire may not have propagated any further than 2.5 m from the burner.

Category	Liter (dm^3) of insulation material per 1 m sample	aflame time (min)
A F/R	7,0	40
A	7,0	40
B	3,5	40
C	1,5	20
D	0,5	20

With the cables of Studer this should reach no further than 50 to 60 cm.

Test standards
IEC 60332-3-24, EN 50305, EN 50266-2-4



Circuit integrity under flame impact

The evidence of conservation of the insulation of a conductor under no mechanical stress. The sample is fastened at 75 mm above the burner. The conductor is connected to a power source at nominal voltage via an 2 A fuse.

The test is considered to be passed if the fuse remains intact during the test.

Test standards
IEC 60331-21 Category

References rolling stock projects

- Alstom AG
- Bombardier Transportation
- BVZ Zermatt-Bahn
- Deutsche Bahn
- Gmeinder Lokomotivenfabrik GmbH
- Graz-Köflacher Eisenbahn
- Matisa Materiel
- Österreichische Bundesbahnen
- Rotem Company
- Schweizerische Bundesbahnen
- Siemens Transportation
- Stadler Rail
- Windhoff Bahn- und Anlagentechnik GmbH
- Verkehrsbetriebe Zürich
- Zhuzhou E.L.W.

Notes

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