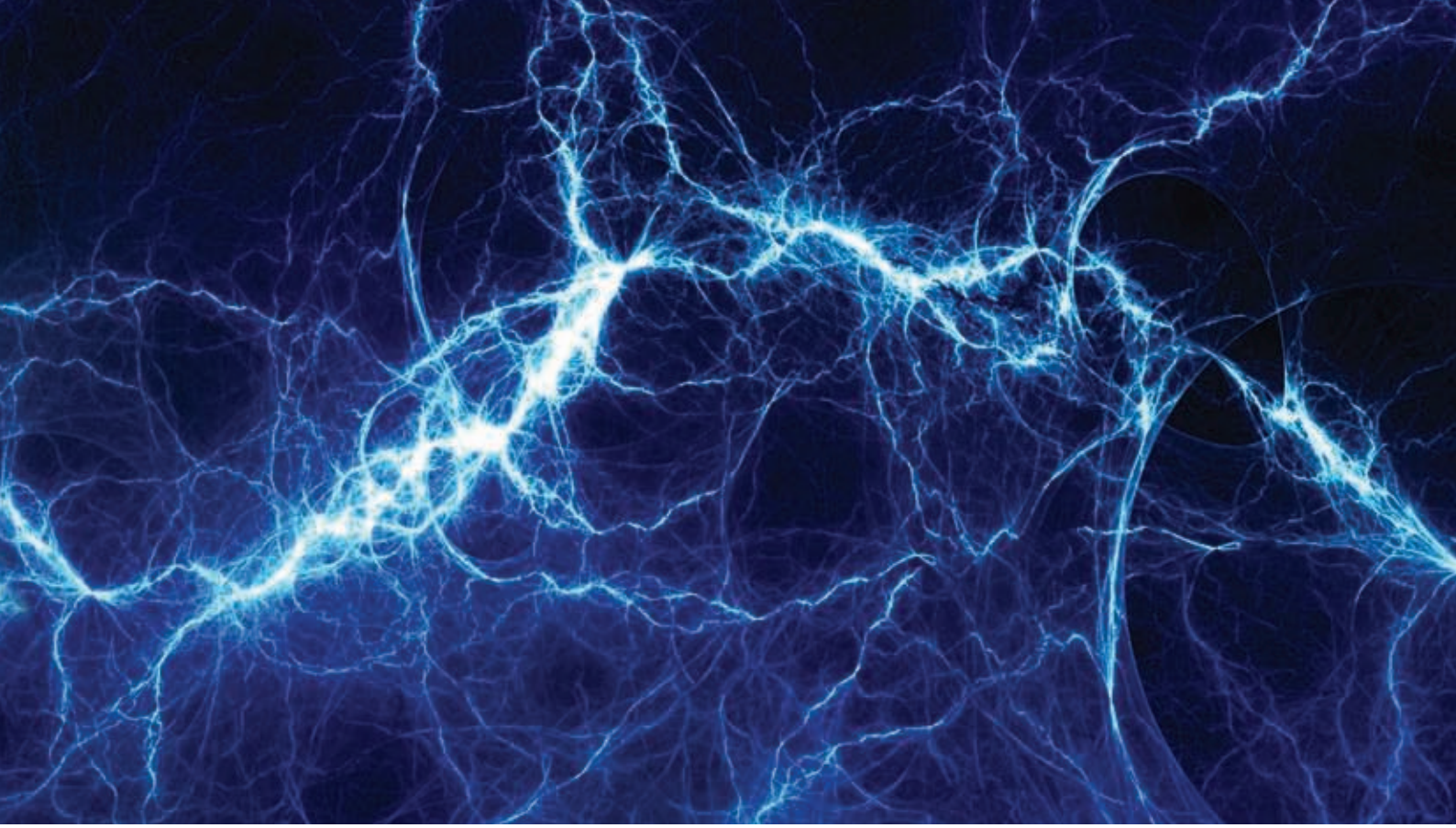


RTC-ELECTRO-M
RUSSIAN TECHNICAL COMPANY

TECHNICAL CATALOGUE

Solid insulated bus bar type TPL

Cast-resin bus bar type TKL

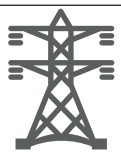
For safety critical applications

Fit & Forget solutions for lowest lifecycle costs

RTC-ELECTRO-M
RUSSIAN TECHNICAL COMPANY

CONTENTS:

GENERAL INFORMATION
CAST-RESIN BUS BAR TYPE TKL AND SOLID INSULATED BUS BAR TYPE TPL
FIELD OF APPLICATION:

	**POWER PLANTS** Generator — Generator circuit-breaker — Transformer Switchgear — Switchgear Auxiliary circuits
	**SUBSTATIONS** Transformer — Current limiting reactor — Switchgear Switchgear — Switchgear
	**INDUSTRIAL MANUFACTURING** Petrochemical, Chemical, Metallurgical, Pulp-and-paper, etc. For low & medium voltage electrical distribution
	**CIVIL ENGINEERING OBJECTS** High-rise residential and office buildings, Hospitals, Hotels, Casinos, Retail and entertainment centers, etc.
	**OFFSHORE** both oil & gas and wind park substations Transformer — Switchgear Switchgear — Switchgear Auxiliary transformer & other equipment

RANGE OF ELECTRICAL APPLICATION

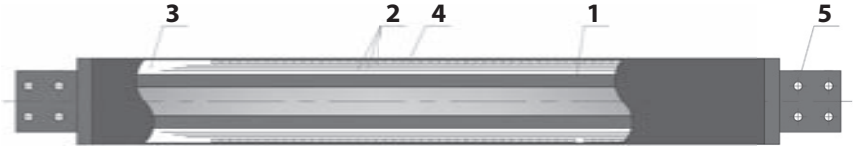
	TPL bus bars	TKL bus bars
Type of insulation	Epoxy Resin Impregnated Paper	Cast resin
Nominal voltage AC, kV	Up to 36	Up to 24
Nominal current AC, A	Up to 12 000	Up to 12 000
Nominal voltage DC, kV	Up to 60	Up to 33
Nominal current DC, A	Up to 14 000	Up to 18 000
Operating ambient temperature, °C	From -60° to +55 °C	From -60° to +55 °C
Degree of protection	Up to IP68 inclusive	
High chemical resistance	Yes	Yes

SOLID INSULATED BUS BAR TYPE TPL

INTENDED USE

The solid insulated bus bar type TPL is ideal for medium & low voltage safety critical projects. TPL is both electrically and geometrically made to measure according to project specifications. Up to 36 kV & 6500 A per single phase is possible. For shorter generator connections, where space is very limited, it is possible to provide up to 36 kV & 12 000 A. Here we use 2 X bus bars per phase.

Figure 1. The bus bar element's construction drawing



1. Conductor (Al, Cu)
2. Capacitive grading
3. Epoxy-impregnated paper wrapping
4. Earth layer
5. Flat terminal

The basic conductor tube (1) can be aluminium or copper & either solid or hollow, depending upon amperage.
Then the conductor tube is then wrapped with crepe paper and layers of semi conducting paper (2) in order to provide the capacitive grading layers. During manufacture under vacuum, epoxy is pulled through to ensure a void free partial discharge free composite dielectric (3). The embedded earth layer ensures that the system is touch safe whilst operational (4). To make connections easy between Bus bar — Bus bar and Bus bar — other equipment, there is a DIN flat terminal at the end of each section (5).
For low voltage solid insulated bus bar type TPL solutions up to 1.2 kV there are no capacitive grading layers & no earth layer required.

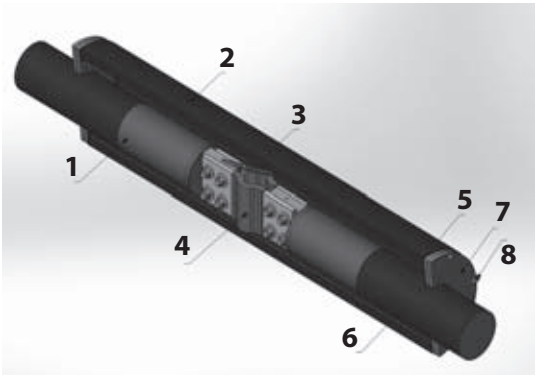
TPL CONNECTING SLEEVES

Busbars have capacitive control therefore there is a red grading length on the ends. Separate Busbar elements are connected to each other by use of bus expansion compensators which are flexible copper laminate connections.
These allow for thermal expansion & contraction.
They also allow build tolerances of up to ±50 mm per connection
The connection is then enclosed by a fully capacitively graded insulated connecting sleeve which has pressure-tight flanges on both sides.
In order to balance the potential between the current carrying conductor and the internal surface of the connecting sleeve a metal ring with contact spring are provided (3).

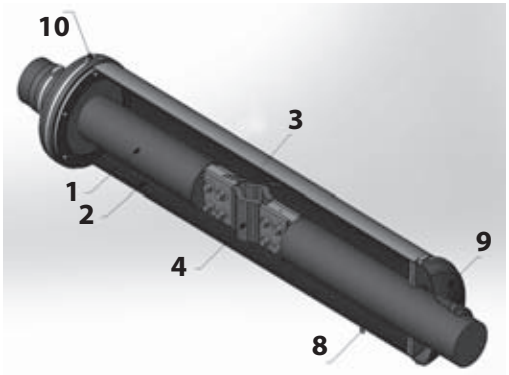
Connecting Sleeve:

Figure 2. The bus bar elements connection

a) indoor application:



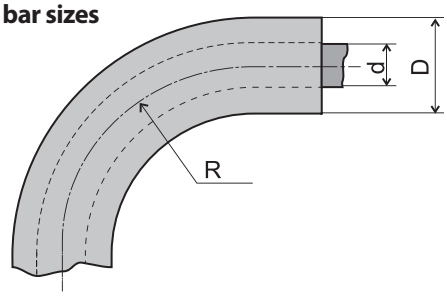
b) outdoor application:

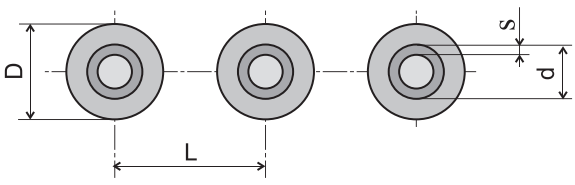


1. Busbar element
2. Connecting sleeve
3. Contact spring
4. Flexible
5. Flat washer
6. Sealing ring
7. Half flange
8. The connection sleeve's earthing
9. Bellows
10. Clamp

TECHNICAL SPECIFICATIONS

Figure 3. The bus bar sizes





*Types, performance attributes and sizes of bus bars**

Type (indoor, from -45°C to 40°C)	Rated operating voltage, kV	Nominal current , A	Short circuit current, кА		Resistance of 1 m phase, mkOm/m		Power losses per 1 m***, W/m	Conductor material	Conductor diameter (outside), mm	Conductor thickness, mm	Bus bar diameter(no more than), mm	Phase to phase**, mm	Inner bending radius, mm	Weight of 1 bus bar phase (no more than), Kg/m
			Dyn	Thermal (3 sec)	Active	Reactive								
TPLA-1,2-1250-41	1,2	1250	41	16	31,64	218	49,4	Al	40	-	48	220	210	3,4
TPLA-1,2-1600-51		1600	51	20	23,01	204	58,9		50	-	58	250	215	5,3
TPLA-1,2-2000-51		2000	51	20	18,15	193	72,6		60	15	68	315	330	5,7
TPLA-1,2-2500-64		2500	64	25	12,58	174	78,6		80	15	88	315	440	8,3
TPLA-1,2-3150-81		3150	81	31,5	9,68	160	96,1		100	15	108	325	450	10,8
TPLA-1,2-4000-102		4000	102	40	7,92	149	126,7		120	15	128	350	610	13,4
TPLA-1,2-5000-128		5000	128	50	6,18	135	154,4		150	15	158	400	625	17,2
TPLA-1,2-6500-161		6500	161	63	4,49	117	178,4		200	15	208	450	650	23,5
TPLA-12-1250-64	7,2; 12	1250	64	25	31,9	204	50,0	Al	40	-	65	220	210	6
TPLA-12-1600-128		1600	128	50	23,2	190	59,5		50	-	75	250	215	8,4
TPLA-12-2000-161		2000	161	63	18,32	179	73,5		60	15	85	315	330	11,2
TPLA-12-2500-161		2500	161	63	12,68	160	79,5		80	15	105	315	440	12
TPLA-12-3150-161		3150	161	63	9,77	146	97,1		100	15	125	325	450	16,4
TPLA-12-4000-255		4000	255	100	8,0	135	128,3		120	15	145	350	610	20
TPLA-12-5000-255		5000	255	100	6,24	121	156,5		150	15	175	400	625	24
TPLA-12-6500-255		6500	255	100	4,55	103	193		200	15	225	450	650	34,2
TPLA-24-1250-64	24	1250	64	25	32,02	204	50,2	Al	40	-	70	220	210	6,7
TPLA-24-1600-128		1600	128	50	23,3	190	59,8		50	-	80	250	215	9,2
TPLA-24-2000-161		2000	161	63	18,4	179	73,9		60	15	90	315	330	12,2
TPLA-24-2500-161		2500	161	63	12,73	160	79,8		80	15	110	315	440	13,1
TPLA-24-3150-161		3150	161	63	9,81	146	97,6		100	15	130	325	450	17,8
TPLA-24-4000-255		4000	255	100	8,04	135	129,1		120	15	150	350	610	21,6
TPLA-24-5000-255		5000	255	100	6,27	121	157,4		150	15	180	400	625	29,6
TPLA-24-6500-255		6500	255	100	4,58	103	194,1		200	15	230	450	650	36,8
TPLA-36-1250-64	36	1250	64	25	32,27	204	50,6	Al	40	-	80	220	210	8,4
TPLA-36-1600-128		1600	128	50	23,48	190	60,4		50	-	90	250	215	11,1
TPLA-36-2000-161		2000	161	63	18,56	179	74,6		60	15	100	315	330	12,2
TPLA-36-2500-161		2500	161	63	12,83	160	80,5		80	15	120	315	440	15,6
TPLA-36-3150-161		3150	161	63	9,89	146	98,5		100	15	140	325	450	20,9
TPLA-36-4000-255		4000	255	100	8,11	135	130,5		120	15	160	350	610	26,4
TPLA-36-5000-255		5000	255	100	6,33	121	159,2		150	15	190	400	625	32,5
TPLA-36-6500-255		6500	255	100	4,62	103	196,3		200	15	240	450	650	43,0

** Upon request is possible to produce bus bars with other specifications*
*** Allowed laying of busbars with other interphase distances*
**** Excluding losses in contact joints*

*Types, performance attributes and sizes of bus bars**

Type (outdoor, from -60°C to +40°C)	Rated operating voltage, kV	Nominal current , A	Short circuit current, кА		Resistance of 1 m phase, mkOm/m		Power losses per 1 m***, W/m	Conductor material	Conductor diameter (outside), mm	Conductor thickness, mm	Bus bar diameter(no more than), mm	Phase to phase**, mm	Inner bending radius, mm	Weight of 1 bus bar phase (no more than), Kg/m
			Dyn	Thermal (3 sec)	Active	Reactive								
TPLA-1,2-1250-41	1,2	1250	41	16	32,47	218	50,7	Al	40	-	87	220	210	6
TPLA-1,2-1600-51		1600	51	20	23,45	204	60,0		50	-	87	250	215	8,4
TPLA-1,2-2000-51		2000	51	20	18,38	193	73,5		60	15	87	315	330	11,2
TPLA-1,2-2500-64		2500	64	25	12,72	174	79,5		80	15	107	315	440	12
TPLA-1,2-3150-81		3150	81	31,5	9,83	160	97,6		100	15	132	325	450	16,4
TPLA-1,2-4000-102		4000	102	40	8,02	149	128,4		120	15	147	350	610	20
TPLA-1,2-5000-128		5000	128	50	6,3	135	156,5		150	15	183	400	625	24
TPLA-1,2-6500-161		6500	161	63	4,58	117	181,6		200	15	233	450	650	34,2
TPLA-12-1250-64	7,2; 12	1250	64	25	32,3	204	50,7	Al	40	-	87	220	210	9,2
TPLA-12-1600-128		1600	128	50	17,92	179	46		60	15	107	250	215	14,0
TPLA-12-2000-161		2000	161	63	16,48	174	66,2		65	15	107	315	330	15,0
TPLA-12-2500-161		2500	161	63	12,89	160	81		80	15	132	315	440	18,2
TPLA-12-3150-161		3150	161	63	9,9	146	98,7		100	15	147	325	450	22,2
TPLA-12-4000-255		4000	255	100	7,67	132	123,6		125	15	168	350	610	26,6
TPLA-12-5000-255		5000	255	100	5,85	117	147,2		160	15	208	400	625	35,7
TPLA-12-6500-255		6500	255	100	4,36	100	185,4		210	15	258	450	650	48,9
TPLA-24-1250-64	24	1250	64	25	32,3	204	50,7	Al	40	-	87	220	210	9,3
TPLA-24-1600-128		1600	128	50	17,92	179	46		60	15	107	250	215	14,1
TPLA-24-2000-161		2000	161	63	15,03	169	60,4		70	15	132	315	330	15,5
TPLA-24-2500-161		2500	161	63	12,89	160	81		80	15	132	315	440	18,3
TPLA-24-3150-161		3150	161	63	9,9	146	98,7		100	15	147	325	450	22,4
TPLA-24-4000-255		4000	255	100	7,36	130	118,4		130	15	183	350	610	26,5
TPLA-24-5000-255		5000	255	100	5,85	117	147,2		160	15	208	400	625	39,6
TPLA-24-6500-255		6500	255	100	4,36	100	185,4		200	15	258	450	650	49,4
TPLA-36-1250-64	36	1250	64	25	26,78	197	42	Al	45	-	107	220	210	13,1
TPLA-36-1600-128		1600	128	50	18,13	179	46,6		60	15	132	250	215	14,2
TPLA-36-2000-161		2000	161	63	15,03	169	60,4		70	15	132	315	330	19,4
TPLA-36-2500-161		2500	161	63	11,95	157	75		85	15	147	315	440	22,6
TPLA-36-3150-161		3150	161	63	8,81	140	87,8		110	15	168	325	450	25,8
TPLA-36-4000-255		4000	255	100	6,77	125	108,8		140	15	208	350	610	33,6
TPLA-36-5000-255		5000	255	100	5,49	113	137,9		170	15	233	400	625	39,0
TPLA-36-6500-255		6500	255	100	4,67	103	198,7		200	15	258	450	650	51,2

** Upon request is possible to produce bus bars with other specifications*
*** Allowed laying of busbars with other interphase distances*
**** Excluding losses in contact joints*

*Types, performance attributes and sizes of bus bars**

Type (indoor, from -10°C to +50°C)	Rated operating voltage, kV	Nominal current , A	Short circuit current, кА		Resistance of 1 m phase, mkOm/m		Power losses per 1 m***, W/m	Conductor material	Conductor diameter (outside), mm	Conductor thickness, mm	Bus bar diameter(no more than), mm	Phase to phase**, mm	Inner bending radius, mm	Weight of 1 bus bar phase (no more than), Kg/m
			Dyn	Thermal (3 sec)	Active	Reactive								
TPLA-1,2-1250-41	1,2	1250	41	16	22,8	204	35.6	Al	50	-	58	250	215	5,3
TPLA-1,2-1600-51		1600	51	20	18,0	193	46.1		60	15	68	315	330	5,7
TPLA-1,2-2000-51		2000	51	20	12,53	174	50,1		80	15	88	315	440	8,3
TPLA-1,2-2500-64		2500	64	25	9,63	160	60,2		100	15	108	325	450	10,8
TPLA-1,2-3150-81		3150	81	31,5	7,86	149	77,9		120	15	128	350	610	13,4
TPLA-1,2-4000-102		4000	102	40	6,14	135	98,2		150	15	158	400	625	17,2
TPLA-1,2-5000-128		5000	128	50	4,47	117	111,8		200	15	208	450	650	23,5
TPLA-12-1250-64	7,2; 12	1250	64	25	23,14	172	36,2	Al	50	-	75	220	215	8,4
TPLA-12-1600-128		1600	128	50	18,27	160	46,8		60	15	85	250	330	11,2
TPLA-12-2000-161		2000	161	63	12,7	142	50,8		80	15	105	315	440	12
TPLA-12-2500-161		2500	161	63	9,77	128	61,0		100	15	125	315	450	16,4
TPLA-12-3150-161		3150	161	63	7,97	117	79,0		120	15	145	325	610	20
TPLA-12-4000-255		4000	255	100	6,23	103	99,6		150	15	175	350	625	24
TPLA-12-5000-255		5000	255	100	4,53	85	113,4		200	15	225	400	650	34,2
TPLA-24-1250-64	24	1250	64	25	23,19	172	36,2	Al	50	-	80	220	215	9,2
TPLA-24-1600-128		1600	128	50	18,32	160	46,9		60	15	90	250	330	12,2
TPLA-24-2000-161		2000	161	63	12,73	142	50,9		80	15	110	315	440	13,1
TPLA-24-2500-161		2500	161	63	9,79	128	61,2		100	15	130	315	450	17,8
TPLA-24-3150-161		3150	161	63	7,99	117	79,3		120	15	150	325	610	21,6
TPLA-24-4000-255		4000	255	100	6,25	103	99,9		150	15	180	350	625	29,6
TPLA-24-5000-255		5000	255	100	4,55	85	113,7		200	15	230	400	650	36,8
TPLA-36-1250-64	36	1250	64	25	23,3	172	36,4	Al	50	-	90	220	215	11,1
TPLA-36-1600-128		1600	128	50	18,42	160	47,2		60	15	100	250	330	12,2
TPLA-36-2000-161		2000	161	63	12,79	142	51,2		80	15	120	315	440	15,6
TPLA-36-2500-161		2500	161	63	9,84	128	61,5		100	15	140	315	450	20,9
TPLA-36-3150-161		3150	161	63	8,03	117	79,7		120	15	160	325	610	26,4
TPLA-36-4000-255		4000	255	100	6,28	103	100,5		150	15	190	350	625	32,5
TPLA-36-5000-255		5000	255	100	4,57	85	114,3		200	15	240	400	650	43,0

** Upon request is possible to produce bus bars with other specifications*
*** Allowed laying of busbars with other interphase distances*
**** Excluding losses in contact joints*

*Types, performance attributes and sizes of bus bars**

Type (outdoor, from -10°C to +50°C)	Rated operating voltage, kV	Nominal current , A	Short circuit current, кА		Resistance of 1 m phase, mkOm/m		Power losses per 1 m***, W/m	Conductor material	Conductor diameter (outside), mm	Conductor thickness, mm	Bus bar diameter(no more than), mm	Phase to phase**, mm	Inner bending radius, mm	Weight of 1 bus bar phase (no more than), Kg/m
			Dyn	Thermal (3 sec)	Active	Reactive								
TPLA-1,2-1250-41	1,2	1250	41	16	23,25	204	36,3	Al	50	-	75	250	215	8,4
TPLA-1,2-1600-51		1600	51	20	18,33	193	46,9		60	15	85	315	330	11,2
TPLA-1,2-2000-51		2000	51	20	12,61	174	74,6		80	15	105	315	440	12
TPLA-1,2-2500-64		2500	64	25	9,73	160	80,5		100	15	125	325	450	16,4
TPLA-1,2-3150-81		3150	81	31,5	7,92	149	98,5		120	15	145	350	610	20
TPLA-1,2-4000-102		4000	102	40	6,21	135	130,5		150	15	175	400	625	24
TPLA-1,2-5000-128		5000	128	50	4,52	117	159,2		200	15	225	450	650	34,2
TPLA-12-1250-64	7,2; 12	1250	64	25	18,03	160	28,2	Al	60	15	107	220	215	14,0
TPLA-12-1600-128		1600	128	50	16,51	155	42,3		65	15	107	250	330	15,0
TPLA-12-2000-161		2000	161	63	12,87	142	51,5		80	15	132	315	440	18,2
TPLA-12-2500-161		2500	161	63	9,88	128	61,7		100	15	147	315	450	22,2
TPLA-12-3150-161		3150	161	63	7,66	114	76,0		125	15	168	325	610	26,6
TPLA-12-4000-255		4000	255	100	5,85	99	93,5		160	15	208	350	625	35,7
TPLA-12-5000-255		5000	255	100	4,34	82	108,5		210	15	258	400	650	48,9
TPLA-24-1250-64	24	1250	64	25	18,03	160	28,2	Al	60	15	107	220	215	14,1
TPLA-24-1600-128		1600	128	50	15,05	151	38,5		70	15	132	250	330	15,5
TPLA-24-2000-161		2000	161	63	12,87	142	51,5		80	15	132	315	440	18,3
TPLA-24-2500-161		2500	161	63	9,88	128	61,7		100	15	147	315	450	22,4
TPLA-24-3150-161		3150	161	63	7,34	112	72,8		130	15	183	325	610	26,5
TPLA-24-4000-255		4000	255	100	5,85	99	93,5		160	15	208	350	625	39,6
TPLA-24-5000-255		5000	255	100	4,34	82	108,5		210	15	258	400	650	49,4
TPLA-36-1250-64	36	1250	64	25	18,15	160	28,4	Al	60	15	132	220	215	14,2
TPLA-36-1600-128		1600	128	50	15,05	151	38,5		70	15	132	250	330	19,4
TPLA-36-2000-161		2000	161	63	11,94	139	47,8		85	15	147	315	440	22,6
TPLA-36-2500-161		2500	161	63	8,81	122	55,1		110	15	168	315	450	25,8
TPLA-36-3150-161		3150	161	63	6,75	107	67,0		140	15	208	325	610	33,6
TPLA-36-4000-255		4000	255	100	5,48	95	87,6		170	15	233	350	625	39,0
TPLA-36-5000-255		5000	255	100	4,62	85	115,5		200	15	258	400	650	51,2

** Upon request is possible to produce bus bars with other specifications*
*** Allowed laying of busbars with other interphase distances*
**** Excluding losses in contact joints*

*Types, performance attributes and sizes of bus bars**

Type (indoor, from -45°C to 40°C)	Rated operating voltage, kV	Nominal current , A	Short circuit current, кА		Resistance of 1 m phase, mkOm/m		Power losses per 1 m***, W/m	Conductor material	Conductor diameter (outside), mm	Conductor thickness, mm	Bus bar diameter(no more than), mm	Phase to phase**, mm	Inner bending radius, mm	Weight of 1 bus bar phase (no more than), Kg/m
			Dyn	Thermal (3 sec)	Active	Reactive								
TPLM-1,2-1250-41	1,2	1250	41	16	29,2	230	45,6	Cu	33	-	41	220	207	7,6
TPLM-1,2-1600-51		1600	51	20	22,43	218	57,4		40	-	48	250	210	11,2
TPLM-1,2-2000-51		2000	51	20	16,73	204	66,9		50	-	58	315	215	17,5
TPLM-1,2-2500-64		2500	64	25	11,33	183	70,8		70	10	78	315	335	16,8
TPLM-1,2-3150-81		3150	81	31,5	8,47	167	84		90	10	98	325	445	22,4
TPLM-1,2-4000-102		4000	102	40	6,83	154	109,3		110	10	118	350	455	28,0
TPLM-1,2-5000-128		5000	128	50	5,24	139	131		140	10	148	400	620	36,4
TPLM-1,2-6300-161		6300	161	63	3,99	123	169,8		180	10	188	450	640	47,5
TPLM-12-1250-64	7,2; 12	1250	64	25	29,77	216	46,6	Cu	33	-	58	220	207	10
TPLM-12-1600-128		1600	128	50	22,89	204	58,8		40	-	65	250	210	14
TPLM-12-2000-161		2000	161	63	17,07	190	68,5		50	-	75	315	215	20,8
TPLM-12-2500-161		2500	161	63	11,68	169	73,3		70	10	95	315	335	21,2
TPLM-12-3150-161		3150	161	63	8,73	153	87,1		90	10	115	325	445	27,9
TPLM-12-4000-255		4000	255	100	7,07	140	113,8		110	10	135	350	455	34,5
TPLM-12-5000-255		5000	255	100	5,42	125	136.4		140	10	165	400	620	44,5
TPLM-12-6500-255		6500	255	100	3,88	106	161,4		190	10	215	450	650	61
TPLM-24-1250-64	24	1250	64	25	29,89	216	46,8	Cu	33	-	63	220	207	10,7
TPLM-24-1600-128		1600	128	50	23,0	204	59,1		40	-	70	250	210	14,7
TPLM-24-2000-161		2000	161	63	17,15	190	68,8		50	-	80	315	215	21,7
TPLM-24-2500-161		2500	161	63	11,77	169	74		70	10	100	315	335	22,3
TPLM-24-3150-161		3150	161	63	8,8	153	87,9		90	10	120	325	445	29,3
TPLM-24-4000-255		4000	255	100	7,14	140	115		110	10	140	350	455	36,1
TPLM-24-5000-255		5000	255	100	5,48	125	137,9		140	10	170	400	620	46,4
TPLM-24-6500-255		6500	255	100	3,66	103	155,8		200	10	230	450	650	68,5
TPLM-36-1250-64	36	1250	64	25	30,12	216	47,3	Cu	33	-	73	220	207	12,2
TPLM-36-1600-128		1600	128	50	23,2	204	59,7		40	-	80	250	210	15,5
TPLM-36-2000-161		2000	161	63	17,3	190	69,6		50	-	90	315	215	16,4
TPLM-36-2500-161		2500	161	63	11,93	169	75,2		70	10	110	315	335	24,7
TPLM-36-3150-161		3150	161	63	8,93	153	89,4		90	10	130	325	445	32
TPLM-36-4000-255		4000	255	100	7,27	140	117,5		110	10	150	350	455	39,4
TPLM-36-5000-255		5000	255	100	5,58	125	141		140	10	180	400	620	54,1
TPLM-36-6500-255		6500	255	100	3,72	103	158,9		200	10	240	450	650	75

** Upon request is possible to produce bus bars with other specifications*
*** Allowed laying of busbars with other interphase distances*
**** Excluding losses in contact joints*

*Types, performance attributes and sizes of bus bars**

Type (outdoor, from -60°C to +40°C)	Rated operating voltage, kV	Nominal current , A	Short circuit current, кА		Resistance of 1 m phase, mkOm/m		Power losses per 1 m***, W/m	Conductor material	Conductor diameter (outside), mm	Conductor thickness, mm	Bus bar diameter(no more than), mm	Phase to phase**, mm	Inner bending radius, mm	Weight of 1 bus bar phase (no more than), Kg/m
			Dyn	Thermal (3 sec)	Active	Reactive								
TPLM-1,2-1250-41	1,2	1250	41	16	22,03	218	34,4	Cu	40	-	87	220	207	11,2
TPLM-1,2-1600-51		1600	51	20	16,47	204	42,2		50	-	87	250	210	17,5
TPLM-1,2-2000-51		2000	51	20	13,61	193	54,4		60	10	87	315	215	14
TPLM-1,2-2500-64		2500	64	25	11,33	183	70,8		70	10	87	315	335	16,8
TPLM-1,2-3150-81		3150	81	31,5	10,18	174	101,1		80	10	107	325	445	19,6
TPLM-1,2-4000-102		4000	102	40	6,93	154	110,9		110	10	132	350	455	28
TPLM-1,2-5000-128		5000	128	50	5,37	139	134,4		140	10	168	400	620	36,5
TPLM-1,2-6300-161		6300	161	63	4,10	123	162,6		180	10	208	450	640	47,6
TPLM-12-1250-64	7,2; 12	1250	64	25	27,4	212	42,5	Cu	35	-	87	220	207	15,0
TPLM-12-1600-128		1600	128	50	21,47	201	54,6		42	-	87	250	210	18,0
TPLM-12-2000-161		2000	161	63	16,06	184	63,5		55	10	107	315	215	24,1
TPLM-12-2500-161		2500	161	63	10,95	165	67,7		75	10	132	315	335	28,6
TPLM-12-3150-161		3150	161	63	8,89	153	87,5		90	10	132	325	445	32,0
TPLM-12-4000-255		4000	255	100	7,29	140	115,7		110	10	158	350	455	40,7
TPLM-12-5000-255		5000	255	100	5,54	125	137,8		140	10	183	400	620	50,2
TPLM-12-6500-255		6500	255	100	3,97	106	166,7		190	10	233	450	650	67,0
TPLM-24-1250-64	24	1250	64	25	27,4	212	42,5	Cu	35	-	87	220	207	15,2
TPLM-24-1600-128		1600	128	50	21,47	201	54,6		42	-	87	250	210	18,2
TPLM-24-2000-161		2000	161	63	16,06	184	63,5		55	10	107	315	215	25,8
TPLM-24-2500-161		2500	161	63	10,95	165	67,7		75	10	132	315	335	27,6
TPLM-24-3150-161		3150	161	63	9,08	153	89,2		90	10	147	325	445	36,2
TPLM-24-4000-255		4000	255	100	7,29	140	115,7		110	10	158	350	455	41,0
TPLM-24-5000-255		5000	255	100	5,16	121	128,1		150	10	208	400	620	60,0
TPLM-24-6500-255		6500	255	100	3,79	103	159,1		200	10	258	450	650	81,1
TPLM-36-1250-64	36	1250	64	25	27,73	212	42,9	Cu	35	-	107	220	207	18,7
TPLM-36-1600-128		1600	128	50	19,55	197	49,7		45	-	107	250	210	21,1
TPLM-36-2000-161		2000	161	63	14,38	179	56,8		60	10	132	315	215	24,4
TPLM-36-2500-161		2500	161	63	10,95	165	67,7		75	10	132	315	335	31,1
TPLM-36-3150-161		3150	161	63	9,08	153	89,2		90	10	147	325	445	36,6
TPLM-36-4000-255		4000	255	100	6,59	135	104,4		120	10	183	350	455	49,3
TPLM-36-5000-255		5000	255	100	5,16	121	123,6		150	10	208	400	620	63,8
TPLM-36-6500-255		6500	255	100	3,79	103	158,9		200	10	258	450	650	83,2

** Upon request is possible to produce bus bars with other specifications*
*** Allowed laying of busbars with other interphase distances*
**** Excluding losses in contact joints*

*Types, performance attributes and sizes of bus bars**

Type (indoor, from -10°C to +50°C)	Rating operating voltage, kV	Nominal current , A	Short circuit current, кА		Resistance of 1 m phase, mkOm/m		Power losses per 1 m***, W/m	Conductor material	Conductor diameter (outside), mm	Conductor thickness, mm	Bus bar diameter(no more than), mm	Phase to phase**, mm	Inner bending radius, mm	Weight of 1 bus bar phase (no more than), Kg/m
			Dyn	Thermal (3 sec)	Active	Reactive								
TPLM-1,2-1250-41	1,2	1250	41	16	22,14	218	34,6	Cu	40	-	48	220	207	11,2
TPLM-1,2-1600-51		1600	51	20	16,57	204	42,4		50	-	58	250	210	17,5
TPLM-1,2-2000-51		2000	51	20	13,81	193	56,3		60	10	68	315	215	14,0
TPLM-1,2-2500-64		2500	64	25	11,66	183	72,9		70	10	78	315	335	16,8
TPLM-1,2-3150-81		3150	81	31,5	8,72	167	86,5		90	10	98	325	445	22,4
TPLM-1,2-4000-102		4000	102	40	6,29	149	100,6		120	10	128	350	455	30,8
TPLM-1,2-5000-128		5000	128	50	4,94	135	123,5		150	10	158	400	620	39,2
TPLM-12-1250-64	7,2; 12	1250	64	25	22,71	186	35,5	Cu	40	-	65	220	210	14
TPLM-12-1600-128		1600	128	50	16,99	172	43,5		50	-	75	250	215	20,8
TPLM-12-2000-161		2000	161	63	11,69	151	46,8		70	10	95	315	335	21,2
TPLM-12-2500-161		2500	161	63	8,74	135	54,6		90	10	115	315	445	27,9
TPLM-12-3150-161		3150	161	63	7,03	122	69,8		110	10	135	325	455	34,5
TPLM-12-4000-255		4000	255	100	5,42	107	86,7		140	10	165	350	620	44,5
TPLM-12-5000-255		5000	255	100	3,87	88	96.7		190	10	215	400	650	61
TPLM-24-1250-64	24	1250	64	25	22,77	186	35,6	Cu	40	-	70	220	210	14,7
TPLM-24-1600-128		1600	128	50	17,04	172	43,6		50	-	80	250	215	21,7
TPLM-24-2000-161		2000	161	63	11,74	151	47		70	10	100	315	335	22,3
TPLM-24-2500-161		2500	161	63	8,78	135	54,9		90	10	120	315	445	29,3
TPLM-24-3150-161		3150	161	63	7,07	122	70,2		110	10	140	325	455	36,1
TPLM-24-4000-255		4000	255	100	5,45	107	87,2		140	10	170	350	620	46,4
TPLM-24-5000-255		5000	255	100	3,66	85	91,4		200	10	230	400	650	68,5
TPLM-36-1250-64	36	1250	64	25	22,88	186	35,8	Cu	40	-	80	220	210	15,5
TPLM-36-1600-128		1600	128	50	17,13	172	43,9		50	-	90	250	215	16,4
TPLM-36-2000-161		2000	161	63	11,84	151	47,4		70	10	110	315	335	24,7
TPLM-36-2500-161		2500	161	63	8,86	135	55,4		90	10	130	315	445	32
TPLM-36-3150-161		3150	161	63	7,15	122	70,9		110	10	150	325	455	39,4
TPLM-36-4000-255		4000	255	100	5,51	107	88,1		140	10	180	350	620	54,1
TPLM-36-5000-255		5000	255	100	3,69	85	92,2		200	10	240	400	650	75

** Upon request is possible to produce bus bars with other specifications*
*** Allowed laying of busbars with other interphase distances*
**** Excluding losses in contact joints*

*Types, performance attributes and sizes of bus bars**

Type (outdoor, from -10°C to +50°C)	Rating operating voltage, kV	Rated operating voltage, kV	Short circuit current, кА		Resistance of 1 m phase, mkOm/m		Power losses per 1 m***, W/m	Conductor material	Conductor diameter (outside), mm	Conductor thickness, mm	Bus bar diameter(no more than), mm	Phase to phase**, mm	Inner bending radius, mm	Weight of 1 bus bar phase (no more than), Kg/m
			Dyn	Thermal (3 sec)	Active	Reactive								
TPLM-1,2-1250-41	1,2	1250	41	16	16,37	204	25,6	Cu	50	-	87	220	207	17,5
TPLM-1,2-1600-51		1600	51	20	13,5	193	34,6		60	10	87	250	210	14,0
TPLM-1,2-2000-64		2000	51	20	11,24	183	45,0		70	10	87	315	215	16,8
TPLM-1,2-2500-81		2500	64	25	9,91	174	61,9		80	10	107	315	335	19,6
TPLM-1,2-3150-102		3150	81	31,5	6,81	154	67,6		110	10	132	325	445	28,0
TPLM-1,2-4000-128		4000	102	40	5,28	139	84,4		140	10	168	350	455	36,4
TPLM-1,2-5000-161		5000	128	50	4,02	123	100,6		180	10	208	400	620	47,6
TPLM-12-1250-64	7,2; 12	1250	64	25	21,35	183	33,4	Cu	42	-	87	220	210	18,0
TPLM-12-1600-128		1600	128	50	15,97	166	40,9		55	10	107	250	215	24,1
TPLM-12-2000-161		2000	161	63	10,95	146	43,8		75	10	132	315	335	28,6
TPLM-12-2500-161		2500	161	63	8,89	135	55,5		90	10	132	315	445	32,0
TPLM-12-3150-161		3150	161	63	7,21	122	71,6		110	10	158	325	455	40,7
TPLM-12-4000-255		4000	255	100	5,54	107	88,6		140	10	183	350	620	50,2
TPLM-12-5000-255		5000	255	100	3,94	88	98.6		190	10	233	400	650	67,0
TPLM-24-1250-64	24	1250	64	25	21,35	183	33,4	Cu	42	-	87	220	210	18,2
TPLM-24-1600-128		1600	128	50	15,97	166	40,9		55	10	107	250	215	25,8
TPLM-24-2000-161		2000	161	63	10,95	146	43,8		75	10	132	315	335	27,6
TPLM-24-2500-161		2500	161	63	9,0	135	56,2		90	10	147	315	445	36,2
TPLM-24-3150-161		3150	161	63	7,21	122	71,6		110	10	158	325	455	41,0
TPLM-24-4000-255		4000	255	100	5,14	103	82,3		150	10	208	350	620	60,0
TPLM-24-5000-255		5000	255	100	3,75	85	93,8		200	10	258	400	650	81,1
TPLM-36-1250-64	36	1250	64	25	19,45	179	30,4	Cu	45	-	107	220	210	21,1
TPLM-36-1600-128		1600	128	50	14,31	160	36,6		60	10	132	250	215	24,4
TPLM-36-2000-161		2000	161	63	10,95	146	43,8		75	10	132	315	335	31,1
TPLM-36-2500-161		2500	161	63	9,0	135	56,2		90	10	147	315	445	36,6
TPLM-36-3150-161		3150	161	63	6,53	117	64,8		120	10	183	325	455	49,3
TPLM-36-4000-255		4000	255	100	5,14	103	82,3		150	10	208	350	620	63,8
TPLM-36-5000-255		5000	255	100	3,75	85	93,8		200	10	258	400	650	83,2

** Upon request is possible to produce bus bars with other specifications*
*** Allowed laying of busbars with other interphase distances*
**** Excluding losses in contact joints*

*Types, performance attributes and sizes of bus bars**

Type	Rating operating voltage, kV	Nominal current , A	Short circuit current, кА		Resistance of 1 m phase, mkOm/m		Power losses per 1 m***, W/m	Conductor material	Conductor diameter (outside), mm	Conductor thickness, mm	Bus bar diameter(no more than), mm	Phase to phase**, mm	Inner bending radius, mm	Weight of 1 bus bar phase (no more than), Kg/m
			Dyn	Thermal (3 sec)	Active	Reactive								
Indoor, from -45°C to 40°C														
TPLA-24-7000-255 (2xTPLA-24-4000-255)	24	7000	255	100	4,02	68	181	Al	120	15	150	350	610	43,2
TPLA-24-9000-255 (2xTPLA-24-5000-255)		9000	255	100	3,14	61	242		150	15	180	400	625	59,2
TPLA-24-11500-255 (2xTPLA-24-6500-255)		11500	255	100	2,28	52	297		200	15	230	450	650	73,6
Outdoor, from -60°C to +40°C														
TPLA-24-7000-255 (2xTPLA-24-4000-255)		7000	255	100	3,68	65	166		130	15	183	350	610	53,0
TPLA-24-9000-255 (2xTPLA-24-5000-255)		9000	255	100	2,93	59	227		160	15	208	400	625	79,2
TPLA-24-11500-255 (2xTPLA-24-6500-255)		11500	255	100	2,18	50	284		210	15	258	450	650	98,8
Indoor, from -10°C to +50°C														
TPLA-24-7000-255 (2xTPLA-24-4000-255)		7000	255	100	3,13	52	181		150	15	180	350	625	59,2
TPLA-24-9000-255 (2xTPLA-24-5000-255)		9000	255	100	2,28	43	242		200	15	230	400	650	73,6
Outdoor, from -10°C to +50°C														
TPLA-24-7000-255 (2xTPLA-24-4000-255)		7000	255	100	2,93	50	166		160	15	208	350	625	79,2
TPLA-24-9000-255 (2xTPLA-24-5000-255)		9000	255	100	2,17	41	227		210	15	258	400	650	98,8
Indoor, from -45°C to +40°C														
TPLM-24-7000-255 (2xTPLM-24-4000-255)	24	7000	255	100	3,57	70	161	Cu	110	10	140	350	455	72,2
TPLM-24-9000-255 (2xTPLM-24-5000-255)		9000	255	100	2,74	63	212		140	10	170	400	620	92,8
TPLM-24-11500-255 (2xTPLM-24-6500-255)		11500	255	100	1,83	52	239		200	10	230	450	650	137,0
Outdoor, from -60°C to +40°C														
TPLM-24-7000-255 (2xTPLM-24-4000-255)		7000	255	100	3,65	70	162		110	10	158	350	455	82
TPLM-24-9000-255 (2xTPLM-24-5000-255)		9000	255	100	2,58	61	198		150	10	208	400	620	120
TPLM-24-11500-255 (2xTPLM-24-6500-255)		11500	255	100	1,9	52	244		200	10	258	450	650	162,2
Indoor, from -10°C to +50°C														
TPLM-24-7000-255 (2xTPLM-24-4000-255)		7000	255	100	2,73	54	122		140	10	170	350	620	92,8
TPLM-24-9000-255 (2xTPLM-24-5000-255)		9000	255	100	1,83	43	141		200	10	230	400	650	137,0
Outdoor, from -10°C to +50°C														
TPLM-24-7000-255 (2xTPLM-24-4000-255)		7000	255	100	2,57	52	115		150	10	208	350	620	120
TPLM-24-9000-255 (2xTPLM-24-5000-255)		9000	255	100	1,88	43	145		200	10	258	400	650	162,2

**** Upon request is possible to produce bus bars with other specifications***
***** Allowed laying of busbars with other interphase distances***

CAST-RESIN BUS BAR TYPE TKL

INTENDED USE

The compact dimensioned cast resin bus bar TKL is intended for connections in AC & DC circuits.
For AC circuits the voltage range is up to 24 kV and rated current is up to 12 000 A, frequency can be 50 or 60 Hz.
For DC circuits the voltage range is up to 33 kV, rated current up to 18 000 A.

OPERATING CONDITIONS

TKL is intended for operation between ambient temperatures ranging from -60 to +55 °C.
The lifespan of the product is 40 years.
With degree of protection up to IP68, it's an optimal solution for marine, offshore & wet environments.
The very high fire withstand >3 hours means that it is perfect for service entrance & risers in civil constructions.
TKL has extreme resistance to chemicals & aggressive atmospheres.
TKL can be easily modified and extended as the facility grows/needs change.

PRODUCTION LINES OF THE BUS BAR

Cast-resin bus bar type TKL is manufactured for low and medium voltage systems.

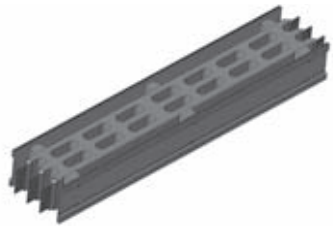
Low voltage systems:

AC		DC	
Nominal voltage	Up to 1 kV	Nominal voltage	Up to 1.5 kV
Nominal current	Up to 7 500 A	Nominal current	Up to 10 000 A

TKLN — nominal voltage of up to 1 kV, rated currents up to 7 500 A. Copper or aluminum conductors (from 2 to 10), sealed in one housing made of a special compound. In the same housing a neutral and/or a protective conductor (section of 50%, 100%, and 150%) can be placed. Bus bars are completed with holders for the bus bar support during the installation on the metal structures. Special assembly supports are provided.

Medium voltage systems:

AC		DC	
Nominal voltage	Up to 24 kV	Nominal voltage	Up to 33 kV
Nominal current	Up to 12 000 A	Nominal current	Up to 18 000 A

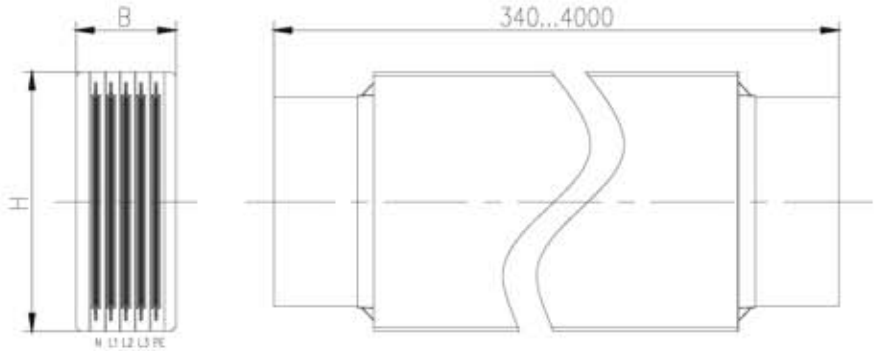


TKLC — nominal voltage of up to 24 kV, rated currents up to 12 000 A. The air gaps are designed in to allow for natural cooling of the bus bar. Single or paired conductors can be used in the bus bar design. Bus bars are completed with a self-supporting screen, and holders for the bus bar support during the installation on the metal structures. Special assembly supports are also provided.

Systems with a rated voltage of 3,6 kV and higher are completed with a special mesh protective screen.
Bus bars for outdoor installation are completed with a climate screen.

*Types, performance attributes and sizes of bus bars**

Type	Rated operating voltage, kV	Nominal current, A	Short circuit current, кA		Resistance of 1 m phase, mkOm/m			Power losses per 1 m, W/m	Conductor material	Dimensions of one phase conductor, b×a, mm	Conductor cross-section of one phase, mm²	B×H, mm	Weight of 1 bus bar phase (no more than), Kg/m
			Dyn, i_{pk}	Thermal (3sec) I_t	Active R_{20}	Active R_{120}	Reactive						
TKLN(A)-1-800-41	1	874	95	11,7	73,2	92	25,2	58,9	Al	60×6	360	120×120	30,1
TKLN(A)-1-1000-52		1041	95	14,6	59	74	32,2	74		80×6	480	120×140	35,3
TKLN(A)-1-1200-64		1243	248	18,4	38,4	46,3	38,5	72,3		100×6	600	120×160	40,5
TKLN(A)-1-1600-81		1693	271	37,9	33,2	38,5	19,2	98,6		150×6	900	120×210	53,6
TKLN(A)-1-2000-102		2136	279	37,9	31	38,5	16,8	154		200×6	1200	120×260	66,7
TKLN(A)-1-2500-128		2564	290	37,9	20,4	24,7	11,7	154,4		250×6	1500	120×310	79,7
TKLN(M)-1-1000-52	1	1125	95	20	45,1	57,1	25,2	57,1	Cu	60×6	360	120×120	41,3
TKLN(M)-1-1250-64		1340	95	25	37,4	46,1	32,2	72		80×6	480	120×140	50,3
TKLN(M)-1-1600-81		1600	248	31,5	32,1	38,2	23,6	97,8		100×6	600	120×160	59,2
TKLN(M)-1-2000-102		2180	271	65	21,3	24,1	19,2	96,4		150×6	900	120×210	81,6
TKLN(M)-1-2500-128		2750	279	65	16	19,1	11,8	119,4		200×6	1200	120×260	104,0
TKLN(M)-1-3200-161		3300	290	65	13,2	15,4	11,7	152,8		250×6	1500	120×310	126,5



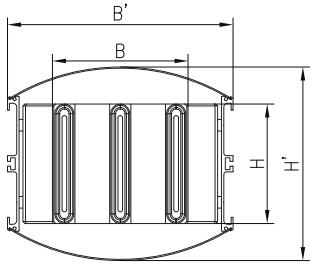
Upon request is possible to produce bus bars with other specications

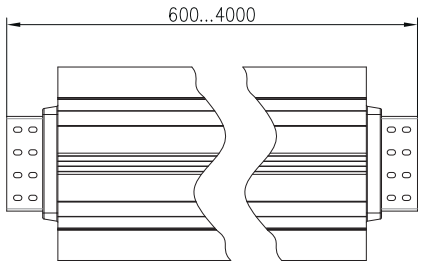
Suitable for Indoor and Outdoor application.
Rated operating current specified for ambient temperatures up to +40 C.
For other higher ambient temperatures, please use de-rating factor:
K Temperature +45= 0,96
K Temperature +50= 0,91
K Temperature +55= 0,86

Short circuit current specified according DEKRA certificates.
Higher value of short circuit current according DEKRA certificates may extend to bus bars with higher nominal currents.

*Types, performance attributes and sizes of bus bars**

Type (indoor, from -45°C to +40°C)	Rated operating voltage, kV	Nominal current, A	Short circuit current, kA		Resistance of 1 m phase, mkOm/m			Power losses per 1 m, W/m	Conductor material	Dimensions of one phase conductor, b×a, mm	Conductor cross-section of one phase, mm²	B×H, mm	B'×H,' mm	Weight of 1 bus bar phase (no more than), Kg/m
			Dyn, i_{yg}	Thermal (3sec) I_T	Active R_{20}	Active R_{120}	Reactive							
TKLC(A)-3,6-1600-51	3,6	1600	51	20	53,7	74,8	120,7	116,9	Al	50×12	600	345×120	585×385	57,3
TKLC(A)-3,6-2000-81		2000	81	31,5	33,5	46,2	109,3	118,3		100×10	1100	345×160	585×385	93,3
TKLC(A)-3,6-2500-102		2500	102	40	29,5	38,9	85,2	155,5		100×12	1200	345×160	585×385	90,7
TKLC(A)-3,6-3150-161		3150	161	63	20,5	27,6	83,2	172,7		150×12	1800	345×210	585×435	100,3
TKLC(A)-3,6-4000- 204		4000	204	80	16,1	21,6	81,9	214,8		200×12	2400	345×260	585×485	139,3
TKLC(A)-3,6-4800- 255		4800	255	100	13,2	17,6	81,9	281,7		250×12	3000	345×310	585×535	197,0
TKLC(A)-7,2-1600-51	7,2	1600	51	20	53,7	74,8	120,7	116,9		50×12	600	345×120	585×385	57,3
TKLC(A)-7,2-2000-81		2000	81	31,5	33,5	46,2	109,3	118,3		100×10	1100	345×160	585×585	93,3
TKLC(A)-7,2-2500-102		2500	102	40	29,5	38,9	85,2	155,5		100×12	1200	345×160	585×585	90,7
TKLC(A)-7,2-3150-161		3150	161	63	20,5	27,6	83,2	172,7		150×12	1800	345×210	585×435	100,3
TKLC(A)-7,2-4000-204		4000	204	80	16,1	21,6	81,9	214,8		200×12	2400	345×260	585×485	139,3
TKLC(A)-7,2-4800-255		4800	255	100	13,2	17,6	81,9	281,7		250×12	3000	345×310	585×535	197,0
TKLC(A)-12-1600-51	12	1600	51	20	53,7	74,8	120,7	116,9		50×12	600	345×120	585×385	57,3
TKLC(A)-12-2000-81		2000	81	31,5	33,5	46,2	109,3	118,3		100×10	1100	345×160	585×385	93,3
TKLC(A)-12-2500-102		2500	102	40	29,5	38,9	85,2	155,5		100×12	1200	345×160	585×385	90,7
TKLC(A)-12-3150-161		3150	161	63	20,5	27,6	83,2	172,7		150×12	1800	345×210	585×435	100,3
TKLC(A)-12-4000-204		4000	204	80	16,1	21,6	81,9	214,8		200×12	2400	345×260	585×485	139,3
TKLC(A)-12-4800-255		4800	255	100	13,2	17,6	81,9	281,7		250×12	3000	345×310	585×635	197,0
TKLC(A)-17,5-1600-51	17,5	1600	51	20	53,7	74,8	120,7	116,9		50×12	600	345×120	585×385	57,3
TKLC(A)-17,5-2000-81		2000	81	31,5	33,5	46,2	109,3	118,3		100×10	1100	345×160	585×385	93,3
TKLC(A)-17,5-2500-102		2500	102	40	29,5	38,9	85,2	155,5		100×12	1200	345×160	585×385	90,7
TKLC(A)-17,5-3150-161		3150	161	63	20,5	27,6	83,2	172,7		150×12	1800	345×210	585×435	100,3
TKLC(A)-17,5-4000-204		4000	204	80	16,1	21,6	81,9	214,8		200×12	2400	345×260	585×485	139,3
TKLC(A)-17,5-4800-255		4800	255	100	13,2	17,6	81,9	281,7		250×12	3000	345×310	585×535	197,0
TKLC(A)-24-1600-51	24	1600	51	20	53,7	74,8	120,7	116,9		50×12	600	345×120	585×385	57,3
TKLC(A)-24-2000- 81		2000	81	31,5	33,5	46,2	109,3	118,3		100×10	1100	345×160	585×385	93,3
TKLC(A)-24-2500-102		2500	102	40	29,5	38,9	85,2	155,5		100×12	1200	345×160	585×385	90,7
TKLC(A)-24-3150-161		3150	161	63	20,5	27,6	83,2	172,7		150×12	1800	345×210	585×435	100,3
TKLC(A)-24-4000- 204		4000	204	80	16,1	21,6	81,9	214,8		200×12	2400	345×260	585×485	139,3
TKLC(A)-24-4800- 255		4800	255	100	13,2	17,6	81,9	281,7		250×12	3000	345×310	585×535	197,0

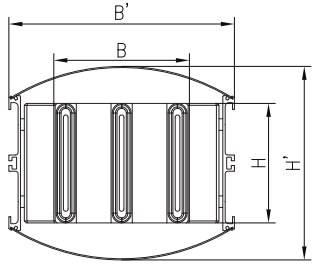


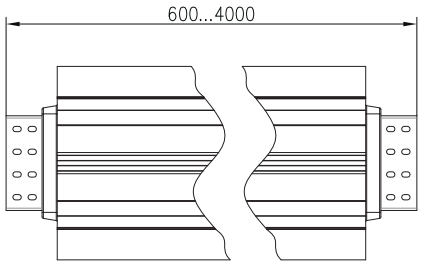


**** Upon request is possible to produce bus bars with other specifications***

*Types, performance attributes and sizes of bus bars**

Type (indoor, from -45°C to +40°C)	Rated operating voltage, kV	Nominal current, A	Short circuit current, кА		Resistance of 1 m phase, mkOm/m			Power losses per 1 m, W/m	Conductor material	Dimensions of one phase conductor, b×a, mm	Conductor cross-section of one phase, mm²	B×H, mm	B'×H,' mm	Weight of 1 bus bar phase (no more than), Kg/m
			Dyn, i_{yg}	Thermal (3sec) I_T	Active R_{20}	Active R_{120}	Reactive							
TKLC(M)-3,6-2000-81	3,6	2000	81	31,5	30,9	43,8	120,7	175,2	Cu	50×12	600	345×120	585×585	82,3
TKLC(M)-3,6-2500-128		2500	128	50	20,8	28,5	109,3	178,3		100×10	1100	345×160	585×385	112,0
TKLC(M)-3,6-3150-161		3150	161	63	18,2	25,0	85,2	248,3		100×12	1200	345×160	585×385	116,3
TKLC(M)-3,6-4000-204		4000	204	80	12,6	17,5	83,2	280,3		150×12	1800	345×210	585×435	149,0
TKLC(M)-3.6-5000-255		5000	255	100	10	13,6	81,9	338,9		200×12	2400	345×260	585×485	184,3
TKLC(M)-3,6-6000-312		6000	312	120	8,2	11,1	81,9	399,4		250×12	3000	345×510	585×535	252,7
TKLC(M)-7,2-2000-81	7,2	2000	81	31,5	30,9	43,8	120,7	175,2		50×12	600	345×120	585×385	82,3
TKLC(M)-7,2-2500-128		2500	128	50	20,8	28,5	109,3	178,3		100×10	1100	345×160	585×385	112,0
TKLC(M)-7,2-3150-161		3150	161	63	18,2	25,0	85,2	248,3		100×12	1200	345×160	585×385	116,3
TKLC(M)-7,2-4000-204		4000	204	80	12,6	17,5	83,2	280,3		150×12	1800	345×210	585×435	149,0
TKLC(M)-7,2-5000-255		5000	255	100	10	13,6	81,9	338,9		200×12	2400	345×260	585×485	184,3
TKLC(M)-7,2-6000-312		6000	312	120	8,2	11,1	81,9	399,4		250×12	3000	345×310	585×535	252,7
TKLC(M)-12-2000-81	12	2000	81	31,5	30,9	43,8	120,7	175,2		50×12	600	345×120	585×385	82,3
TKLC(M)-12-2500-128		2500	128	50	20,8	28,5	109,3	178,3		100×10	1100	345×160	585×385	112,0
TKLC(M)-12-3150-161		3150	161	63	18,2	25,0	85,2	248,3		100×12	1200	345×160	585×385	116,3
TKLC(M)-12-4000-204		4000	204	80	12,6	17,5	83,2	280,3		150×12	1800	345×210	585×435	149,0
TKLC(M)-12-5000-255		5000	255	100	10	13,6	81,9	338,9		200×12	2400	345×260	585×485	184,3
TKLC(M)-12-6000-312		6000	312	120	8,2	11,1	81,9	399,4		250×12	3000	345×310	585×535	252,7
TKLC(M)-17,5-2000-81	17,5	2000	81	31,5	30,9	43,8	120,7	175,2		50×12	600	345×120	585×385	82,3
TKLC(M)-17,5-2500-128		2500	128	50	20,8	28,5	109,3	178,3		100×10	1100	345×160	585×385	112,0
TKLC(M)-17,5-3150-161		3150	161	63	18,2	25,0	85,2	248,3		100×12	1200	345×160	585×385	116,3
TKLC(M)-17,5-4000-204		4000	204	80	12,6	17,5	83,2	280,3		150×12	1800	345×210	585×435	149,0
TKLC(M)-17,5-5000-255		5000	255	100	10	13,6	81,9	338,9		200×12	2400	345×260	585×485	184,3
TKLC(M)-17,5-6000-312		6000	312	120	8,2	11,1	81,9	399,4		250×12	3000	345×310	585×535	252,7
TKLC(M)-24-2000-81	24	2000	81	31,5	30,9	43,8	120,7	175,2		50×12	600	345×120	585×385	82,3
TKLC(M)-24-2500-128		2500	128	50	20,8	28,5	109,3	178,3		100×10	1100	345×160	585×385	112,0
TKLC(M)-24-3150-161		3150	161	63	18,2	25,0	85,2	248,3		100×12	1200	345×160	585×385	116,3
TKLC(M)-24-4000-204		4000	204	80	12,6	17,5	83,2	280,3		150×12	1800	345×210	585×435	149,0
TKLC(M)-24-5000-255		5000	255	100	10	13,6	81,9	338,9		200×12	2400	345×260	585×485	184,3
TKLC(M)-24-6000-312		6000	312	120	8,2	11,1	81,9	399,4		250×12	3000	345×310	585×535	252,7

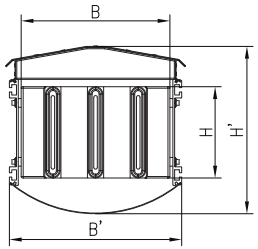


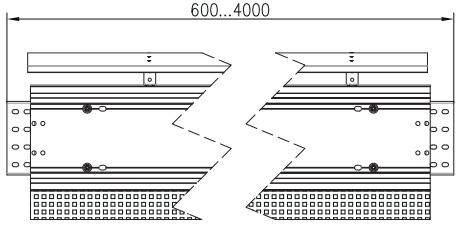


**** Upon request is possible to produce bus bars with other specifications***

*Types, performance attributes and sizes of bus bars**

Type (outdoor, from -60°C to +40°C)	Rated operating voltage, kV	Nominal current, A	Short circuit current, kA		Resistance of 1 m phase, mkOm/m			Power losses per 1 m, W/m	Conductor material	Dimensions of one phase conductor, b×a, mm	Conductor cross-section of one phase, mm²	B×H, mm	B'×H,' mm	Weight of 1 bus bar phase (no more than), Kg/m
			Dyn, i_{yg}	Thermal (3sec) I_T	Active R_{20}	Active R_{120}	Reactive							
TKLC(A)-3,6-1600-51	3,6	1600	51	20	53,7	74,8	120,7	116,9	Al	50×12	600	345×120	585×420	57,3
TKLC(A)-3,6-2000-81		2000	81	31,5	33,5	46,2	109,3	118,3		100×10	1100	345×160	585×420	93,3
TKLC(A)-3,6-2500-102		2500	102	40	29,5	38,9	85,2	155,5		100×12	1200	345×160	585×420	90,7
TKLC(A)-3,6-3150-161		3150	161	63	20,5	27,6	83,2	172,7		150×12	1800	345×210	585×470	100,3
TKLC(A)-3,6-4000-204		4000	204	80	16,1	21,6	81,9	214,8		200×12	2400	345×260	585×620	139,3
TKLC(A)-3,6-4800-255		4800	255	100	13,2	17,6	81,9	281,7		250×12	3000	345×310	585×670	197,0
TKLC(A)-7,2-1600-51	7,2	1600	51	20	53,7	74,8	120,7	116,9		50×12	600	345×120	585×420	57,3
TKLC(A)-7,2-2000-81		2000	81	31,5	33,5	46,2	109,3	118,3		100×10	1100	345×160	585×420	93,3
TKLC(A)-7,2-2500-102		2500	102	40	29,5	38,9	85,2	155,5		100×12	1200	345×160	585×420	90,7
TKLC(A)-7,2-3150-161		3150	161	63	20,5	27,6	83,2	172,7		150×12	1800	345×210	585×470	100,3
TKLC(A)-7,2-4000-204		4000	204	80	16,1	21,6	81,9	214,8		200×12	2400	345×260	585×520	139,3
TKLC(A)-7,2-4800-255		4800	255	100	13,2	17,6	81,9	281,7		250×12	3000	345×310	585×570	197,0
TKLC(A)-12-1600-51	12	51	20	53,7	74,8	120,7	116,9	175,2		50×12	600	345×120	585×420	57,3
TKLC(A)-12-2000-81		81	31,5	33,5	46,2	109,3	118,3	178,3		100×10	1100	345×160	585×420	93,3
TKLC(A)-12-2500-102		102	40	29,5	38,9	85,2	155,5	248,3		100×12	1200	345×160	585×420	90,7
TKLC(A)-12-3150-161		161	63	20,5	27,6	83,2	172,7	280,3		150×12	1800	345×210	585×470	100,3
TKLC(A)-12-4000-204		204	80	16,1	21,6	81,9	214,8	338,9		200×12	2400	345×260	585×520	139,3
TKLC(A)-12-4800-255		255	100	13,2	17,6	81,9	281,7	399,4		250×12	3000	345×310	585×670	197,0
TKLC(A)-17,5-1600-51	17,5	51	20	53,7	74,8	120,7	116,9	175,2		50×12	600	345×120	585×420	57,3
TKLC(A)-17,5-2000-81		81	31,5	33,5	46,2	109,3	118,3	178,3		100×10	1100	345×160	585×420	93,3
TKLC(A)-17,5-2500-102		102	40	29,5	38,9	85,2	155,5	248,3		100×12	1200	345×160	585×420	90,7
TKLC(A)-17,5-3150-161		161	63	20,5	27,6	83,2	172,7	280,3		150×12	1800	345×210	585×470	100,3
TKLC(A)-17,5-4000-204		204	80	16,1	21,6	81,9	214,8	338,9		200×12	2400	345×260	585×620	139,3
TKLC(A)-17,5-4800-255		255	100	13,2	17,6	81,9	281,7	399,4		250×12	3000	345×310	585×570	197,0
TKLC(A)-24-1600-51	24	51	20	53,7	74,8	120,7	116,9	175,2		50×12	600	345×120	585×420	57,3
TKLC(A)-24-2000-81		81	31,5	33,5	46,2	109,3	118,3	178,3		100×10	1100	345×160	585×420	93,3
TKLC(A)-24-2500-102		102	40	29,5	38,9	85,2	155,5	248,3		100×12	1200	345×160	585×420	90,7
TKLC(A)-24-3150-161		161	63	20,5	27,6	83,2	172,7	280,3		150×12	1800	345×210	585×470	100,3
TKLC(A)-24-4000-204		204	80	16,1	21,6	81,9	214,8	338,9		200×12	2400	345×260	585×520	139,3
TKLC(A)-24-4800-255		255	100	13,2	17,6	81,9	281,7	399,4		250×12	3000	345×310	585×570	197,0

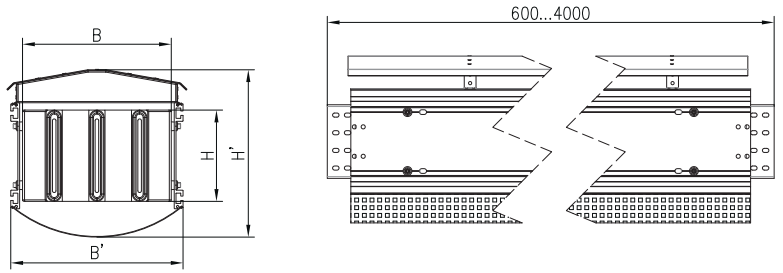




**** Upon request is possible to produce bus bars with other specifications***

*Types, performance attributes and sizes of bus bars**

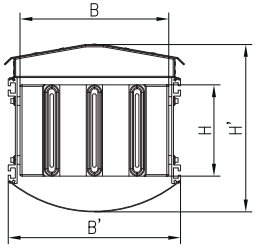
Type (outdoor, from -60°C to +40°C)	Rated operating voltage, kV	Nominal current, A	Short circuit current, кА		Resistance of 1 m phase, mkOm/m			Power losses per 1 m, W/m	Conductor material	Dimensions of one phase conductor, b×a, mm	Conductor cross-section of one phase, mm²	B×H, mm	B'×H,' mm	Weight of 1 bus bar phase (no more than), Kg/m
			Dyn, i_{yg}	Thermal (3sec) I_T	Active R_{20}	Active R_{120}	Reactive							
TKLC(M)-3,6-2000-81	3,6	2000	81	31,5	30,9	43,8	120,7	175,2	Cu	50×12	600	345×120	585×420	82,3
TKLC(M)-3,6-2500-128		2500	128	50	20,8	28,5	109,3	178,3		100×10	1100	345×160	585×420	112,0
TKLC(M)-3,6-3150-161		3150	161	63	18,2	25,0	85,2	248,3		100×12	1200	345×160	585×420	116,3
TKLC(M)-3,6-4000-204		4000	204	80	12,6	17,5	83,2	280,3		150×12	1800	345×210	585×470	149,0
TKLC(M)-3,6-5000-255		5000	255	100	10	13,6	81,9	338,9		200×12	2400	345×260	585×520	184,3
TKLC(M)-3,6-6000-312		6000	312	120	8,2	11,1	81,9	399,4		250×12	3000	345×310	585×570	252,7
TKLC(M)-7,2-2000-81	7,2	2000	81	31,5	30,9	43,8	120,7	175,2		50×12	600	345×120	585×420	82,3
TKLC(M)-7,2-2500-128		2500	128	50	20,8	28,5	109,3	178,3		100×10	1100	345×160	585×420	112,0
TKLC(M)-7,2-3150-161		3150	161	63	18,2	25,0	85,2	248,3		100×12	1200	345×160	585×420	116,3
TKLC(M)-7,2-4000-204		4000	204	80	12,6	17,5	83,2	280,3		150×12	1800	345×210	585×470	149,0
TKLC(M)-7,2-5000-255		5000	255	100	10	13,6	81,9	338,9		200×12	2400	345×260	585×620	184,3
TKLC(M)-7,2-6000-312		6000	312	120	8,2	11,1	81,9	399,4		250×12	3000	345×310	585×670	252,7
TKLC(M)-12-2000-81	12	2000	81	31,5	30,9	43,8	120,7	175,2		50×12	600	345×120	585×420	82,3
TKLC(M)-12-2500-128		2500	128	50	20,8	28,5	109,3	178,3		100×10	1100	345×160	585×420	112,0
TKLC(M)-12-3150-161		3150	161	63	18,2	25,0	85,2	248,3		100×12	1200	345×160	585×420	116,3
TKLC(M)-12-4000-204		4000	204	80	12,6	17,5	83,2	280,3		150×12	1800	345×210	585×470	149,0
TKLC(M)-12-5000-255		5000	255	100	10	13,6	81,9	338,9		200×12	2400	345×260	585×520	184,3
TKLC(M)-12-6000-312		6000	312	120	8,2	11,1	81,9	399,4		250×12	3000	345×310	585×670	252,7
TKLC(M)-17,5-2000-81	17,5	2000	81	31,5	30,9	43,8	120,7	175,2		50×12	600	345×120	585×420	82,3
TKLC(M)-17,5-2500-128		2500	128	50	20,8	28,5	109,3	178,3		100×10	1100	345×160	585×420	112,0
TKLC(M)-17,5-3150-161		3150	161	63	18,2	25,0	85,2	248,3		100×12	1200	345×160	585×420	116,3
TKLC(M)-17,5-4000-204		4000	204	80	12,6	17,5	83,2	280,3		150×12	1800	345×210	585×470	149,0
TKLC(M)-17,5-5000-255		5000	255	100	10	13,6	81,9	338,9		200×12	2400	345×260	585×620	184,3
TKLC(M)-17,5-6000-312		6000	312	120	8,2	11,1	81,9	399,4		250×12	3000	345×310	585×570	252,7
TKLC(M)-24-2000-81	24	2000	81	31,5	30,9	43,8	120,7	175,2		50×12	600	345×120	585×420	82,3
TKLC(M)-24-2500-128		2500	128	50	20,8	28,5	109,3	178,3		100×10	1100	345×160	585×420	112,0
TKLC(M)-24-3150-161		3150	161	63	18,2	25,0	85,2	248,3		100×12	1200	345×160	585×420	116,3
TKLC(M)-24-4000-204		4000	204	80	12,6	17,5	83,2	280,3		150×12	1800	345×210	585×470	149,0
TKLC(M)-24-5000-255		5000	255	100	10	13,6	81,9	338,9		200×12	2400	345×260	585×520	184,3
TKLC(M)-24-6000-312		6000	312	120	8,2	11,1	81,9	399,4		250×12	3000	345×310	585×570	252,7

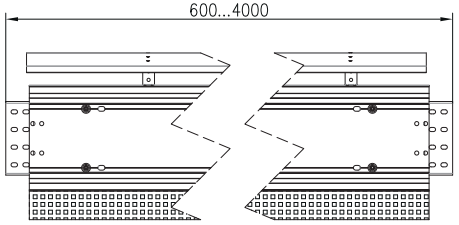


**** Upon request is possible to produce bus bars with other specifications***

*Types, performance attributes and sizes of bus bars**

Type (outdoor, from -10°C to +50°C)	Rated operating voltage, kV	Nominal current, A	Short circuit current, kA		Resistance of 1 m phase, mkOm/m			Power losses per 1 m, W/m	Conductor material	Dimensions of one phase conductor, b×a, mm	Conductor cross-section of one phase, mm²	B×H, mm	B'×H,' mm	Weight of 1 bus bar phase (no more than), Kg/m
			Dyn, i_{yg}	Thermal (3sec) I_T	Active R_{20}	Active R_{120}	Reactive							
TKLC(A)-3,6-630-51	3,6	630	51	20	53,7	74,8	120,7	116,9	Al	50×12	600	345×120	585×355	57,3
TKLC(A)-3,6-1000-81		1000	81	31,5	33,5	46,2	109,3	118,3		100×10	1100	345×160	585×395	93,3
TKLC(A)-3,6-1250-102		1250	102	40	29,5	38,9	85,2	155,5		100×12	1200	345×160	585×395	90,7
TKLC(A)-3,6-1600-161		1600	161	63	20,5	27,6	83,2	172,7		150×12	1800	345×210	585×445	100,3
TKLC(A)-3,6-2000-204		2000	204	80	16,1	21,6	81,9	214,8		200×12	2400	345×260	585×495	139,3
TKLC(A)-3,6-2500-255		2500	255	100	13,2	17,6	81,9	281,7		250×12	3000	345×310	585×545	197,0
TKLC(A)-7,2-630-51	7,2	630	51	20	53,7	74,8	120,7	116,9		50×12	600	345×120	585×355	57,3
TKLC(A)-7,2-1000-81		1000	81	31,5	33,5	46,2	109,3	118,3		100×10	1100	345×160	585×595	93,3
TKLC(A)-7,2-1250-102		1250	102	40	29,5	38,9	85,2	155,5		100×12	1200	345×160	585×595	90,7
TKLC(A)-7,2-1600-161		1600	161	63	20,5	27,6	83,2	172,7		150×12	1800	345×210	585×445	100,3
TKLC(A)-7,2-2000-204		2000	204	80	16,1	21,6	81,9	214,8		200×12	2400	345×260	585×495	139,3
TKLC(A)-7,2-2500-255		2500	255	100	13,2	17,6	81,9	281,7		250×12	3000	345×310	585×545	197,0
TKLC(A)-12-630-51	12	630	51	20	53,7	74,8	120,7	116,9		50×12	600	345×120	585×355	57,3
TKLC(A)-12-1000-81		1000	81	31,5	33,5	46,2	109,3	118,3		100×10	1100	345×160	585×395	93,3
TKLC(A)-12-1250-102		1250	102	40	29,5	38,9	85,2	155,5		100×12	1200	345×160	585×395	90,7
TKLC(A)-12-1600-161		1600	161	63	20,5	27,6	83,2	172,7		150×12	1800	345×210	585×445	100,3
TKLC(A)-12-2000-204		2000	204	80	16,1	21,6	81,9	214,8		200×12	2400	345×260	585×495	139,3
TKLC(A)-12-2500-255		2500	255	100	13,2	17,6	81,9	281,7		250×12	3000	345×310	585×645	197,0
TKLC(A)-17,5-630-51	17,5	630	51	20	53,7	74,8	120,7	116,9		50×12	600	345×120	585×355	57,3
TKLC(A)-17,5-1000-81		1000	81	31,5	33,5	46,2	109,3	118,3		100×10	1100	345×160	585×395	93,3
TKLC(A)-17,5-1250-102		1250	102	40	29,5	38,9	85,2	155,5		100×12	1200	345×160	585×395	90,7
TKLC(A)-17,5-1600-161		1600	161	63	20,5	27,6	83,2	172,7		150×12	1800	345×210	585×445	100,3
TKLC(A)-17,5-2000-204		2000	204	80	16,1	21,6	81,9	214,8		200×12	2400	345×260	585×495	139,3
TKLC(A)-17,5-2500-255		2500	255	100	13,2	17,6	81,9	281,7		250×12	3000	345×310	585×545	197,0
TKLC(A)-24-630-51	24	630	51	20	53,7	74,8	120,7	116,9		50×12	600	345×120	585×355	57,3
TKLC(A)-24-1000-81		1000	81	31,5	33,5	46,2	109,3	118,3		100×10	1100	345×160	585×395	93,3
TKLC(A)-24-1250-102		1250	102	40	29,5	38,9	85,2	155,5		100×12	1200	345×160	585×395	90,7
TKLC(A)-24-1600-161		1600	161	63	20,5	27,6	83,2	172,7		150×12	1800	345×210	585×445	100,3
TKLC(A)-24-2000-204		2000	204	80	16,1	21,6	81,9	214,8		200×12	2400	345×260	585×495	139,3
TKLC(A)-24-2500-255		2500	255	100	13,2	17,6	81,9	281,7		250×12	3000	345×310	585×545	197,0

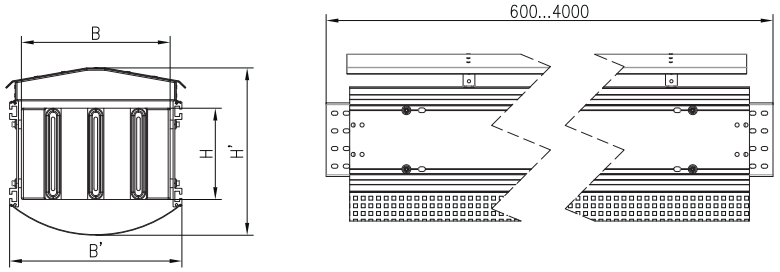




**** Upon request is possible to produce bus bars with other specifications***

*Types, performance attributes and sizes of bus bars**

Type (outdoor, from -10°C to +50°C)	Rated operating voltage, kV	Nominal current, A	Short circuit current, кА		Resistance of 1 m phase, mkOm/m			Power losses per 1 m, W/m	Conductor material	Dimensions of one phase conductor, b×a, mm	Conductor cross-section of one phase, mm²	B×H, mm	B'×H,' mm	Weight of 1 bus bar phase (no more than), Kg/m
			Dyn, i_{yg}	Thermal (3sec) I_T	Active R_{20}	Active R_{120}	Reactive							
TKLC(M)-3,6-1250-51	3,6	1250	51	20	53,7	43,8	120,7	175,2	Cu	50×12	600	345×120	585×555	82,3
TKLC(M)-3,6-1600-81		1600	81	31,5	33,5	28,5	109,3	178,3		100×10	1100	345×160	585×395	112,0
TKLC(M)-3,6-2000-161		2000	161	63	18,2	25,0	85,2	248,3		100×12	1200	345×160	585×395	116,3
TKLC(M)-3,6-2500-204		2500	204	80	12,6	17,5	83,2	280,3		150×12	1800	345×210	585×445	149,0
TKLC(M)-3,6-3150-255		3150	255	100	10	13,6	81,9	338,9		200×12	2400	345×260	585×495	184,3
TKLC(M)-3,6-4000-312		4000	312	120	8,2	11,1	81,9	399,4		250×12	3000	345×610	585×545	252,7
TKLC(M)-7,2-1250-51	7,2	1250	51	20	53,7	43,8	120,7	175,2		50×12	600	345×120	585×355	82,3
TKLC(M)-7,2-1600-81		1600	81	31,5	33,5	28,5	109,3	178,3		100×10	1100	345×160	585×395	112,0
TKLC(M)-7,2-2000-161		2000	161	63	18,2	25,0	85,2	248,3		100×12	1200	345×160	585×395	116,3
TKLC(M)-7,2-2500-204		2500	204	80	12,6	17,5	83,2	280,3		150×12	1800	345×210	585×445	149,0
TKLC(M)-7,2-3150-255		3150	255	100	10	13,6	81,9	338,9		200×12	2400	345×260	585×495	184,3
TKLC(M)-7,2-4000-312		4000	312	120	8,2	11,1	81,9	399,4		250×12	3000	345×310	585×545	252,7
TKLC(M)-12-1250-51	12	1250	51	20	53,7	43,8	120,7	175,2		50×12	600	345×120	585×355	82,3
TKLC(M)-12-1600-81		1600	81	31,5	33,5	28,5	109,3	178,3		100×10	1100	345×160	585×395	112,0
TKLC(M)-12-2000-161		2000	161	63	18,2	25,0	85,2	248,3		100×12	1200	345×160	585×395	116,3
TKLC(M)-12-2500-204		2500	204	80	12,6	17,5	83,2	280,3		150×12	1800	345×210	585×445	149,0
TKLC(M)-12-3150-255		3150	255	100	10	13,6	81,9	338,9		200×12	2400	345×260	585×495	184,3
TKLC(M)-12-4000-312		4000	312	120	8,2	11,1	81,9	399,4		250×12	3000	345×310	585×545	252,7
TKLC(M)-17,5-1250-51	17,5	1250	51	20	53,7	43,8	120,7	175,2		50×12	600	345×120	585×355	82,3
TKLC(M)-17,5-1600-81		1600	81	31,5	33,5	28,5	109,3	178,3		100×10	1100	345×160	585×395	112,0
TKLC(M)-17,5-2000-161		2000	161	63	18,2	25,0	85,2	248,3		100×12	1200	345×160	585×395	116,3
TKLC(M)-17,5-2500-204		2500	204	80	12,6	17,5	83,2	280,3		150×12	1800	345×210	585×445	149,0
TKLC(M)-17,5-3150-255		3150	255	100	10	13,6	81,9	338,9		200×12	2400	345×260	585×495	184,3
TKLC(M)-17,5-4000-312		4000	312	120	8,2	11,1	81,9	399,4		250×12	3000	345×310	585×545	252,7
TKLC(M)-24-1250-51	24	1250	51	20	53,7	43,8	120,7	175,2		50×12	600	345×120	585×355	82,3
TKLC(M)-24-1600-81		1600	81	31,5	33,5	28,5	109,3	178,3		100×10	1100	345×160	585×395	112,0
TKLC(M)-24-2000-161		2000	161	63	18,2	25,0	85,2	248,3		100×12	1200	345×160	585×395	116,3
TKLC(M)-24-2500-204		2500	204	80	12,6	17,5	83,2	280,3		150×12	1800	345×210	585×445	149,0
TKLC(M)-24-3150-255		3150	255	100	10	13,6	81,9	338,9		200×12	2400	345×260	585×495	184,3
TKLC(M)-24-4000-312		4000	312	120	8,2	11,1	81,9	399,4		250×12	3000	345×310	585×545	252,7



**** Upon request is possible to produce bus bars with other specifications***

Reference list
Bus bar type TPL

Bus bar type	The object name	Location	Year
TPL(A)	Substation Volkhov-Severnaya	Saint-Peterburg, Russia	2010
TPL(A)	Substation №1	Petrozavodsk, Russia	2010
TPL(A)	Substation 220 kV Vichuga	Vichuga, Russia	2010
TPL(A)	Heat Power Plant Krasnodar	Krasnodar, Russia	2010
TPL(A)	Substation 220 kV	Far East, Russia	2011
TPL(A)	Substation 220 kV Central Mining and processing plant	Birobidzhan, Russia	2011
TPL(A)	Substation Zlatoyst	Zlatoust, Russia	2011
TPL(A)	HPS 110 kV Krasnopolyanskaya	Sochi, Russia	2011
TPL(A)	HPS Gotsatlinskaya	The Republic of Dagestan, Russia	2011
TPL(M)	HPS Sayano-Shushenskaya	The Republic of Khakassia, Russia	2011
TPL(A)	HPS Saratov	Balakovo, Russia	2011
TPL(A)	Substation 500 kV Trubino	Moscow, Russia	2011
TPL(A)	Substation 220 kV Ferrosplavnaya	Novokuznetsk, Russia	2011
TPL(A)	Substation Bocharov Stream	Sochi, Russia	2011
TPL(A)	Heat Power Plant «GSR Energo»	Kolpino, Russia	2012
TPL(A)	Substation Zharnikovo	The Republic of Karelia, Russia	2012
TPL(A)	HPS Mainskaya GA №3	The Republic of Khakassia, Russia	2012
TPL(A)	Substation «Poltava city»	Ukraine	2012
TPL(A)	Substation 212	Saint-Peterburg, Russia	2012
TPL(A)	HPS Novosibirsk GA 1	Novosibirsk, Russia	2012
TPL(A)	Substation 330 kV Vladikavkaz-2	Vladikavkaz, Russia	2012
TPL(A)	Substation Sergievskaya	Samara, Russia region, Russia	2012
TPL(A)	Heat Power Plant Omsk	Omsk, Russia	2012
TPL(M)	HPS Sayano-Shushenskaya	The Republic of Khakassia, Russia	2012
TPL(A)	HPS Mainskaya GA №1	The Republic of Khakassia, Russia	2012
TPL(M)	Factory	The Republic of Vietnam	2012
TPL(A)	Substation Bocharov Stream	Sochi, Russia	2013
TPL(M)	Substation 220 kV №378 Central	Moscow, Russia	2013
TPL(A)	Heat Power Plant Abakan	The Republic of Khakassia, Russia	2013
TPL(A)	Substation Volga-1	Samara, Russia	2013
TPL(A)	Substation Krasnoglinskaya	Samara, Russia	2013
TPL(M)	HPS Sayano-Shushenskaya	The Republic of Khakassia, Russia	2013
TPL(M)	Substation Hovrino	Moscow, Russia	2014
TPL(A)	Substation 110/ 35/10 kV Visla	Samara, Russia	2014
TPL(A)	Substation Kryazhskaya	Samara, Russia	2014
TPL(A)	Substation Volgskaya	Samara, Russia	2014
TPL(A)	Heat Power Plant-1	Kazakhstan, Russia	2014
TPL(A)	Kuibyshevskiy Oil-refinery plant	Samara, Russia	2014
TPL(A)	Substation Stupino	Moscow, Russia	2014
TPL(M)	HPS Sayano-Shushenskaya	The Republic of Khakassia, Russia	2014

Bus bar type	The object name	Location	Year
TPL(A)	Substation 122 Lebedinsky Mining and processing plant	Gubkin-11, Belgorod, Russia	2014
TPL(A)	Omsk Heat Power Plant -5	Omsk, Russia	2014
TPL(M)	Heat Power Plant NLMK	Lipetsk, Russia	2014
TPL(M)	Factory	Chelyabinsk, Russia	2015
TPL(A)	HPS Gotsatlinskaya	The Republic of Dagestan, Russia	2015
TPL(M)	HPS Ust'-Khantaiskaya	Snezhnegorsk, Russia	2015
TPL(A)	Heat Power Plant Kaluga	Kaluga, Russia	2015
TPL(M)	Substation Novaya derevnya	Yuzhno-Sakhalinsk, Russia	2015
TPL(M)	Substation Nauka	Yuzhno-Sakhalinsk, Russia	2015
TPL(M)	Substation Lastochka	Yuzhno-Sakhalinsk, Russia	2015
TPL(A)	Substation 110/35/6 "KNS-1"	Yugra, Russia	2015
TPL(A)	Substation 110/10 Nikolaevka	Samara, Russia	2015
TPL(A)	Syzranskyi Oil refinery	Syzran, Russia	2015
TPL(A)	Substation Akbulak	Almaty, the Republic of Kazakhstan	2015
TPL(M)	Substation Bersenevskaya	Moscow, Russia	2015
TPL(A)	Talnah Concentrator (RP-9T)	Talnah, Russia	2015
TPL(M)	Substation Tajga	Krasnoyarsk, Russia	2015
TPL(M)	HPS Nizhne-Bureyskaya	Amur region, Russia	manufacturing
TPL(M)	Chelyabinsk electrometallurgical plant	Chelyabinsk, Russia	manufacturing
TPL(M)	HPS Ust'-Khantaiskaya	Snezhnegorsk, Russia	manufacturing
TPL(A)	Substation Kotlovka	Moscow, Russia	manufacturing
TPL(A)	Heat Power Plant-16	Moscow, Russia	manufacturing
TPL(A)	Substation 93	Saint-Peterburg, Russia	manufacturing

Reference list
Bus bar type TKL

Bus bar type	The object name	Location	Year
TKLN (A)	Boiler building	Sosnovy Bor, Russia	2013
TKLC (M)	Substation Kozhevnicheskaya	Moscow, Russia	2013
TKLN (M)	HPS Kolymskaya	Sinegorye, Russia	2014
TKLC (M)	Heat Power Plant Chelyabinskaya	Chelyabinsk, Russia	2014
TKLC (M)	HPS Zelenchukskaya	The Republic of Karachay-Cherkessia, Russia	2015
TKLC (A)			
TKLN (A)			
TKLC (M)	Byelorussian Gas Processing Plant	The Republic of Belarus	2015
TKLC (A)	Substation Kustarevskaya	Ufa, Russia	2015
TKLN (A)	HPS Sayano–Shushenskaya	The Republic of Khakassia, Russia	2015
TKLC (M)	Heat Power Plant №12	Moscow, Russia	2015
TKLC (A)	Substation Nadymkaya	Nadym, Russia	2015
TKLC (A)	Substation Industrialnaya	Nizhnevartovsk, Russia	2015
TKLC (A)	Substation Teplovskaya	Nefteyugansk, Russia	2015
TKLC (M)	HPS Nizhne-Bureyskaya	Amur region, Russia	manufacturing

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