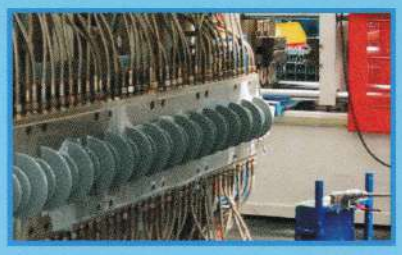


IPROEB

Composite Insulators & Insulator strings

izolatoare compozite si lanturi de izolatoare

IPROEB SA Bistrita Romania
Composite Insulators Division

Electromontaj SA Bucharest
Clamps & Fittings Factory Campina

Iproeb's mission is to create energy transmission lines to new light horizons in order to completely satisfy its customers and to become a successful company.

Our professional team's goal is to continuously improve performances, by implementing strategic development programs, with a view to increasing the efficiency and the quality of work.

IPROEB

Since 1997, when IPROEB was set up, this company has had an important role in the Romanian electrotechnical industry, with a definite ascending way which continued after 1989, so that in 1996 IPROEB has become a private integral capital company of shareholders.

The aim of IPROEB is to continuously improve its performances, to increase the qualitative and quantitative level of its production, to extend its range of products. The strategy of reinvesting a big part of the profit shows the decision of the shareholders to maintain the company's competitiveness to the highest levels.

The activity field of IPROEB includes the manufacturing and sales of PVC, polyethylene and rubber insulated copper and aluminium conductors and cables, aluminium bare conductors, aluminium conductors steel reinforced, galvanized steel wire conductors, electro insulating materials in form of sheets and layered rolled tubes, composite insulators, automatic facilities and electrical equipments, wood reels and die blocks

As leaders in the electrotechnical field we are permanently aware of the global development course and those specific to the Romanian economy. The specialists from our own R&D departments are concerned to extend the range of products and to find new technical solutions, in order to meet the demands of our customers

IPROEB, by its representatives in the in the technical and standardizational committees has an active contribution to the eleboration and revision of the national and international standards for different electrotechnical products.

The plant of electro-insulating materials manufactures a wide range of products which includes: insulators and composite insulator strings for stations and LEA for a tension between U=24÷420 kV, for suspension and tension composite strings, with SML=70÷210 kN, composite post line insulators for LEA and electrical devices U=24 kV, hollow composite insulators for electrical devices for 110 kV; other electro-insulating materials, industrial rigid laminated sheets based on thermosetting resins for electrical purposes including plates, tubes and bars.

These are made in accordance with the quality and technical requirements given in national and international standards: SR CEI, CEI, SR EN, EN, HD. In order to acomplish this task we pay great attention in using quality raw materials, in professional training of the staff and in increasing the efficiency of the technologies and the manufacturing process.

Physical, mechanical, chemical and electrical testing are made into the IPROEB laboratory, accredited by Romanian Acreditation Association RENAR, according to the SR EN ISO /CEI 17025-2005 standard and authorised by AFER and ISCIR.

One of the goals of the quality management has been reached in 1995 by obtaining the Quality Insurance System certification by TUV Bayern Sachsen from Germany. Nowadays this certificate grants the implementation and aplication of the Quality Management System in designing, manufacturing, control and sales according to the SR EN ISO 9001-2001 reference standard.

With a view to adapting our company to EU demands, in 2005, we managed to obtain the Enviromental Management System Certification according to SR EN ISO 14001-2001.

The electrotechnical products manufactured by IPROEB are designated to important clients of the Romanian market of which: The Electricity Distribution Companies Electrica and Transelectrica by their branches and subsidiaries, National Railway Company, Bucharest Metro Metrorex, Public Electric Trams Company.

Thus IPROEB has succeded in obtaining its recognition as a licensed provider for Electrica and Transelectrica, to get a railroad provider license, issued by the Romanian Railway Authority AFER, the acceptance and technical agreement of ICECON as well as INSEMEX and ISCIR licenses

The sales department is organized in such a way as to offer the best quality-price ratio and to answer in the shortest time to the orders and demands of our customers, any purchase being the beginning of a long term collaboration

Besides the significant position the company has on the Romanian market, IPROEB has exported an important part of its production to many other countries: Hungary, Poland, Slovakia, Slovenia, Austria, Moldavia, Albania, Turkey, Bulgary , Ukraine, China, Sudan, Egypt, Iraq, Germany, Israel and Nigeria

Observing with confidence our evolution, we shall keep on to completely satisfy our customers in the future, as well as our providers and other business partners, employees and last but not least IPROEB shareholders in order to maintain the good reputation of the company.

CERTIFICATE

The TÜV CERT Certification Body
of TÜV SÜD Management Service GmbH

certifies in accordance
with TÜV CERT procedures that

IPROEB S. A.

Str. Drumul Cetatii, 19
RO-420063 BISTRITA

has established and applies
a Quality Management System for

Designing, Manufacturing, Control and Sales of Aluminium Conductors, Aluminium Conductors Steel Reinforced, Galvanized Steel Wire Conductors and Traction Conductors, PVC, Polyethylene and Rubber Insulated Copper and Aluminium Cables, Electro Insulating Materials in Form of Sheets and Layerd Rolled Tubes, Composite insulators, Automatic Facilities and Miscellaneous Electrical Equipments, Wood Drums for Conductors and Die Blocks

An audit was performed, Report No. **70007207**

Proof has been furnished that the requirements
according to

ISO 9001: 2000

are fulfilled. The certificate is valid until **2010-06-25**

Certificate Registration No. **12 100 5780**

Deutscher Akkreditierungs Rat
DAR
TGA-ZM-18-96

Munich, 2007-06-28

TÜV SÜD
Management Service

M. Nagel

TÜV CERT Certification Body
of TÜV SÜD Management Service GmbH
Ridlerstraße 65
D-80339 München

Table of Contents

IPROEB SA Bistrita
Composite Insulators Division

Electromontaj SA Bucharest
Clamps & Fittings Factory
Campina

Technical data

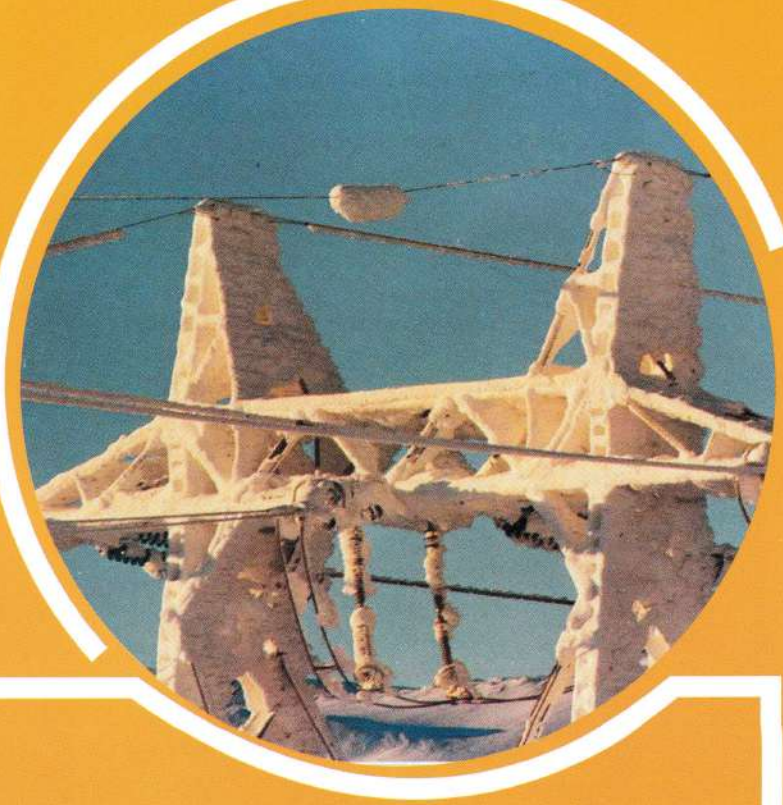
Chapter 1

IPROEB SA Bistrita
Composite Insulators Division

Electromontaj SA Bucharest
Clamps & Fittings Factory
Campina

Technical data

Chapter 1



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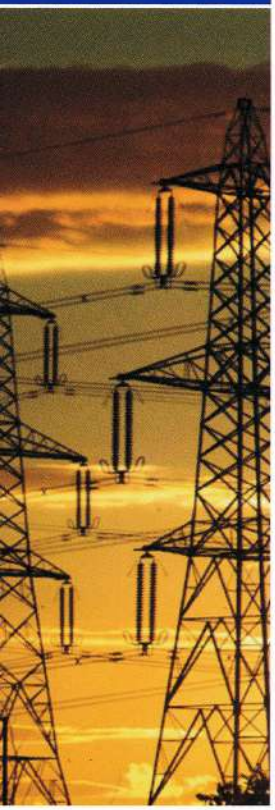
Electromontaj SA Bucharest Clamps & Fittings Factory Campina, phone 40(0)244-336781 fax 40(0)244-334045



Composite suspension and tension insulators type CI

Application

Composite insulators are designed for the equipment of overhead lines and stations with nominal tensions of 20, 110, 220 and 400 kV that are a component part of the single, double (parallel 'V' type) or multiple suspension and tension strings of conductors for the II, III, IV pollution areas.

They consist of performant materials of a high technology such as: liquid silicon rubber LSR, fiber glass rods etc. and are manufactured using a modern technology based on processing equipment, raw materials and components achieved from recognised producers which are certified by acknowledged competence in the field.

The advantages of LSR liquid silicon rubber use

The advantages of the liquid silicon rubber for the manufacturing of the composite insulators are that they:

- present a very good behavior at ageing process and resistance on severe climates
- have a high hydrophibicity, even in the most polluted areas
- present excellent dielectric properties, superior electric arc behavior
- are fireproof
- present a good adherence of the core and end-fitting on the insulator
- are easily pigmentable
- present shock resistance properties (strikings, shooting)

The mechanical resistivity structure of the composite insulators is provided by the inner fiber glass rod.

Metal end fittings are made of hot-dip galvanized drop forge steel. They are applied on the fibre glass rod by crimping (under pressure control) in a special automatized crimping machinery with controlled and checked parameters.

The insulating housing is out of silicon rubber. This covers the fibre glass core and the endings of the fittings providing waterproofing. By its shape having sheds, it reaches for the required creepage distance specific to pollution areas.

Silicon housing is cast under pressure in mould. The composite of the casting is prepared in an automatized programmatically controlled installation and following prescribed technological parameters.

Rated life- time

The lifetime of composite insulators is 30 years.

Symbolistic of insulators

Specific and complete symbolistic for the insulators:

ex: CI - 220- III/Z- 120- BY- 1050

1 2 3 4 5 6

1 Composite insulator (CI) with suspension and tension appliance
2 Nominal voltage (kV)
3 Pollution area / insulator constructive variant (depending on the case)
4 SML- Specific Mechanical Load
5 Type of end-fitting
6 Dry lightning impulse voltage withstand

Symbolistic of end-fittings

B	Ball
S	Socket
T	Tongue
E	Eye
C	C-Clevis
Y	Y-Clevis

If requested, we manufacture the end-fittings as specified.

Symbolistic of pollution area

IV pollution area- creepage distance minimum 3.1 cm/kV
III pollution area- creepage distance minimum 2.5 cm/kV
II pollution area - creepage distance minimum 2.0 cm/kV
I pollution area - creepage distance minimum 1.6 cm/kV
Data are in compliance with IEC 60815:1993

Mounting specifications:

CI 110 kV can be delivered with protective fittings (arcing horns or guarding rings) that are to be mounted on the end-fittings of the insulator or on the string component parts keeping the spark gap K values in accordance with the specifications of insulation co-ordination standards.

The insulators having Un>110 kV are furnished with Aluminium or Steel guarding rings incorporated in insulator strings so that they respect the required spark gap K. Function of the applicability, the guarding rings can be fixed on the end fittings of the insulators, too.

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Verification and test sets:

The designed models as well as the manufacturing technology are validated by the product and type design carried out acknowledged laboratories from Romania (Bucharest Polytechnic University, ICMET Craiova), from Czech Republic (EGU-HV Laboratory Prague) or from Sweden (STRI Ludvika) according to the standards:

- IEC 1109/CEI 61109
- 1 st Ammendment to IEC 61109
- IEC 60060-1
- IEC 60383-1
- IEC 60383-2
- IEC 60437
- IEC 61467
- IEC 60695-11-10

Mechanical sampling and routine tests are carried out on a horizontal traction stand having test diagram registering options.

I Design tests
Test carried on interfaces and metallic fittings
Tests specimens and preliminary tests
Visual check and dimensions (drawing) : Identification
Mechanical routine test
Dry power frequency voltage test: reference
Prestressing
Sudden load release test
Thermal mechanical test
Water immersion test
Verification tests
Visual examination
Steep front impulse voltage
Dry power frequency flashover voltage test
Assembled core load-time tests:
Test specimens:
Visual check and dimensions (drawing): Identification

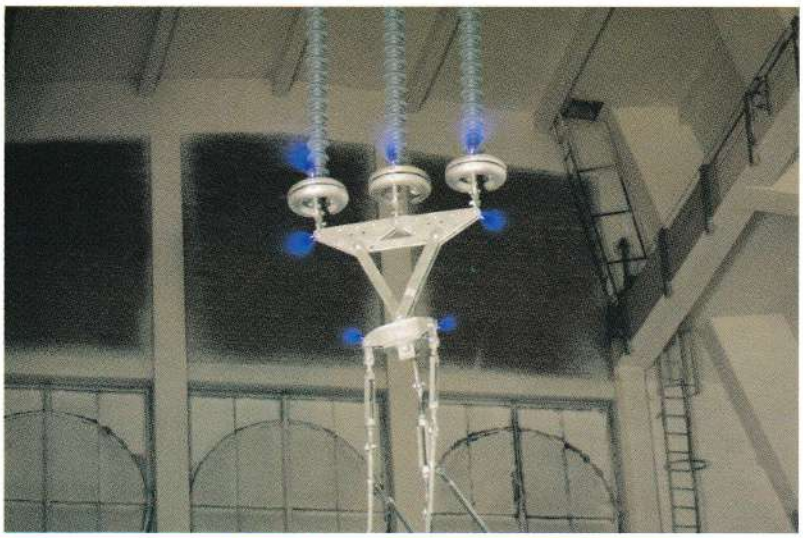
Mechanical load test:
Determination of the average failing load of the core of the assembled insulator
Control of the slope of the strength-time curve of the insulator
Test housing: tracking and erosion test
1000 h non-cyclic (according to 5.3.3 IEC 61109)
5000 h cyclic (according to appendix C)
Tests for the core material
Dye penetration test
Water diffusion test
Flammability test

II Type tests
Dry lightning impulse withstand voltage test
Wet power frequency test
Wet switching impulse withstand voltage test
Mechanical load-time test and test of the tightness of the interface between end fittings and insulator housing
Power arc test
Radio interference test

III Sampling tests
Verification of dimensions
Verification of the locking system
Verification of tightness of the interface between end fittings and insulator housing and the specified mechanical load, (SML)
Galvanizing test

IV Routine tests
Identification of the composite insulators
Visual examination
Mechanical routine test

Strings of insulators for 400 kV during overload tests carried out in Czech Republic **EGU HV Laboratory CS** Prague



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Composite post line insulators type CIS 20

Application

Composite insulators are designed for the equipment of overhead lines and stations with Umax=24 kV as well as a component part of electric devices with Umax=24 kV (switches and safety frames)

Rated life- time The lifetime of composite post line insulators is 30 years.

Symbolistic of post line insulators

Specific and complete symbolistic for the post line insulators: e.g. **CI - 20- II- X- Y n- L**

1 2 3 4 5 6 7

1 Composite post line insulator
2 Nominal voltage (kV)
3 Pollution area
4 SCL Specific Mechanical Cantilever Load
5 Type of head couplings (C, R, A)
6 Index of the constructive variant
7 Mounting bolt's length - on the fixing structure (40, 80, 120, 160, 180, 200, 210, 240, 360 mm)

Symbolistic of the head couplings

C C clamp mounting head
R rounded head for Aluminum Steel conductor attachment (50/8, 70/12, 120/21)
A head for electrical equipment mounting

If requested, we apply the head couplings as required.

Symbolistic of the mechanical characteristics

Specified Cantilever Load **SCL**
Maximum Design Cantilever Load **MDCL**
Specified Tensile Load **STL**

Verification and test sets:

Composite post line insulators have been subjected to sampling and routine design tests in compliance with:
IEC 61952
IEC 60383-1
IEC 60060-1
IEC 60695-11-10
Mechanical sampling and routine tests are carried out on a horizontal traction stand having test diagram registering options.

I Design tests

Test carried on interfaces and metallic fittings
Prestressing
Thermal mechanical test
Water immersion test
Verification tests
Visual examination
Steep front impulse voltage
Dry power frequency flashover voltage test
Assembled core load-time tests:
Maximum design cantilever load MDCL
Tension test
Tests for the shed and housing material
Ball test
Accelerated weathering test
Tracking and erosion test : 1000 h
Flammability test
Tests for the core material
Dye penetration test
Water diffusion test

II Type tests

Verification of dimensions
Electrical load test sets
Dry lightning impulse withstand voltage test
Wet power frequency test
Wet switching impulse withstand voltage test
Mechanical load test
Specified cantilever load SCL

III Sampling tests

Verification of dimensions
Verification of the SCL
Galvanizing test

IV Routine tests

Visual examination
Traction test

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Techical data

Hollow composite insulators for 110 kV type Clc

Hollow composite insulators for 110 kV type Clc are designed and executed in compliance with CEI 62217:2005, and CEI 61462:2005

Application

Hollow composite insulators are used for the equipping of voltage transformers with a capacity of 110 kV TEClc-123 designed for the supply of metering instruments of the protection devices for high frequency trunk connections, for outdoor installments having the highest accepted nominal voltage for electric equipments Um=123 kV and a frequency of 50 or 60 Hz.

Conditions referring to corrosion control

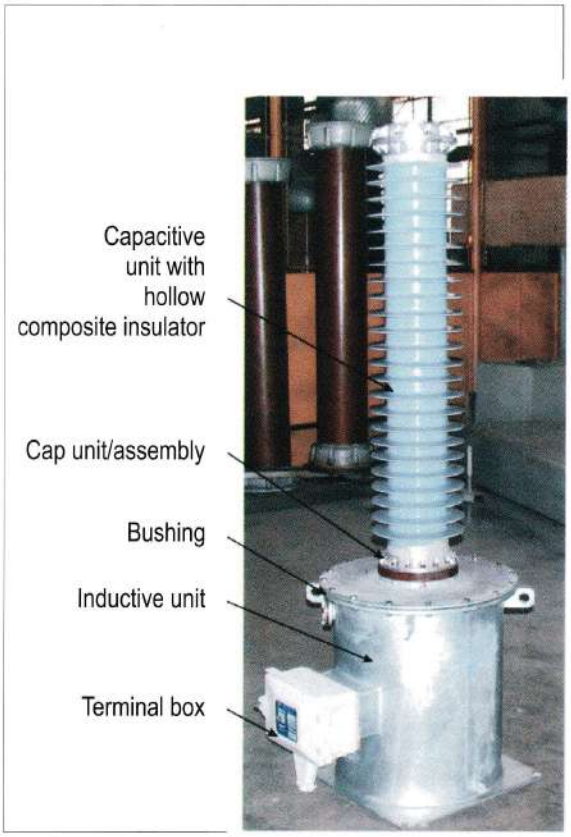
Protection against metallic parts corrosion is provided by hot-dip galvanizing (minimal thickness of 86 μm)

Advantages

The technical-economical advantages of the hollow composite insulators use for the equipping of voltage transformers with a capacity of 123 (110) kV compared to those that use porcelain insulators are the following:

- reduce weight - at least 30 %
- high solutions concerning the operation in polluting environment
- much higher stability to mechanical stresses (transport, installing, overstressing breakdown)
- special resistance to seismic disturbance or vandalism (impossible to be solved out for the porcelain insulator)
- inner active parts redimensioning in conformity with its high mechanical resistivity and the considering that the composite insulator tollerances are more limited
- the capacity to outstand high internal stressing in normal operating conditions or overstressing conditions specific to equipment with insulating gaseous medium (Sulphur Hexa Fluoride), regarding especially those operating with oil, with the reduction of the explosion risk and the limiting of the damage effects only to the hereof device, thus reducing the causing of human victims.

The advantages presented explain the concern of the electric fitting manufacturers towards this type of insulation in order to produce competitive products.



Capacitive voltage transformer with hollow insulator 110 kV

Conclusions

The main advantages of the composite insulators are:

- a much better resistance to polluting agents reflected by reduced maintaining operations
- much higher electrical strength due to the fiber glass rod
- thermic and dynamics shocks resistivity
- vibration strength
- a much reduced weight compared to the equivalent glass or porcelain insulation weight
- an unrivall better behavior to vandalism acts (terorism)
- easiness of processing, with much reduced range deviations (tolerances)
- reduced general costs of composite insulators

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Suspension and tension strings with composite insulators

Application

The strings of insulators are used for the equipping of overhead lines and stations with a nominal voltage ranging from 20 kV to 400 kV.

Symbolistic of composite insulator strings

LSS	Single suspension string
LDS	Double suspension string
LSV	V suspension string
LSI	Single tension string
LDI	Double tension string
LDIV	Double 'V' tension string
LDSV	Double 'V' suspension string
LTI	Triple tension string

Specific symbolistic for insulator strings:

ex: LDS- 2 - CI- 400 - II/ Z- 120 kN- BS
1 2 3 4 5 6 7 8

1 Double suspension string
2 Number of conductors per phase
3 Composite insulator with suspension and tension working for stations and LEA
4 Nominal voltage (kV)
5 Pollution area
6 Insulator constructive variant (depending on the case)
7 SML- Specific Mechanical Load
8 Ball-socket end fitting

Description

At the elaboration stage of the component parts of the insulator strings, nominal voltage of the network, pollution area type of string and coupling and so on, have been considered. This catalogue includes the most common types of insulator strings.

Nominal voltage of 20 kV

Thus, single and double suspension and strain strings are presented for one conductor per phase for OTL with a nominal voltage of 20 kV.
To this voltage also apply 'V' suspension strings utilized in case of using cantilevers of CIE type .

Nominal voltage of 110 kV

For electrical installations with rated voltages of 110 kV, there are presented single and double suspension strings for a single conductor. Tension strings for this voltage are of single, double or triple type. "V" tension strings, with or without adjustment for the two arms, are also presented for use in transformer stations.

Nominal voltage of 220 and 400

For OTL and transformer stations of 220 and 400 kV there are presented single and double suspension strings for one or two conductors per phase. For tension, single, double or triple strings apply. There are also presented "V" tension strings for one or many conductors with or without adjustment for the two arms.

The clamps and fittings that make a component part of the insulator strings are designed and executed by experts of S.C.Electromontaj S.A. FCA Factory from Campina or others.
Mechanical and electrical testing for clamps and fittings has been executed in local plant laboratories or in those of the specialized institutions like ICEMENERG, ICPE, Bucharest Polytechnic University. The products comply with the specifications of IEC 61284 and BS 3288 p1 standards.
For the manufacturing of the insulators strings for nominal voltages of 20, 110, 220 and 400 kV there have been used the most common types of couplings for composite insulators TT and BS (Tongue-Tongue and Ball - Socket), but on request from the beneficiary, the strings can be made up in such a way that other types of string end-fitting combinations can also be used.

CT	C Clevis-Tongue
BE	Ball - Eye
EE	Eye - Eye
BY	Ball - Y Clevis
SS	Socket - Socket

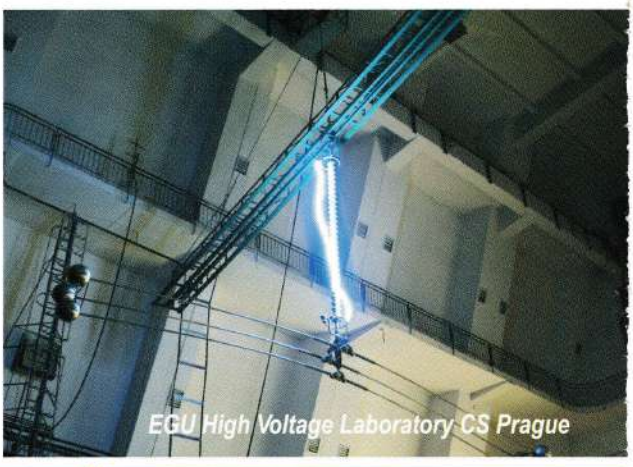
The behavior under **electrical stress** has been checked by testing carried out in accordance with the specifications of IEC 61109 and IEC 60383 in accordance with the specifications of Transelectrica, in the laboratories of ICMET Craiova, Bucharest Polytechnic University and EGU HV Laboratory Praga, Czech Republic.
Insulator strings for 20 kV are not furnished with safety arc devices.
Insulator strings for 110 kV are provided with arc devices against overvoltages, and the strings for network with 220 kV and 400 kV nominal voltages are provided with protective rings.

Arcing horns

The arcing horns system (C1, C2, C3) is made up of an assembly of arcing horn I and II. The arcing horns are mounted on the endings of the insulator or on the suspension end fittings. The arc devices are out of steel and protected against corrosion by a zinc coating.

Guarding rings

Guarding rings system (IPI, IPS) is made up of a upper and a bottom protective ring.
The Aluminum or galvanized steel rings are mounted on the string end fittings in accordance with the accepted spark gap distance foreseen for composite insulators.


EGU High Voltage Laboratory CS Prague

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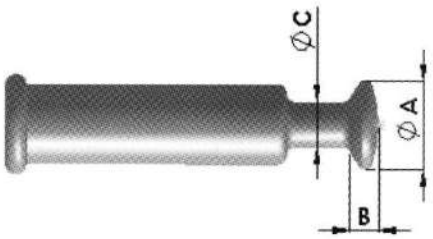
Techical data

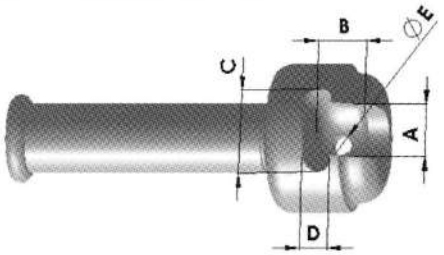
End-fittings for suspension and tension composite insulators

End-fittings type Ball



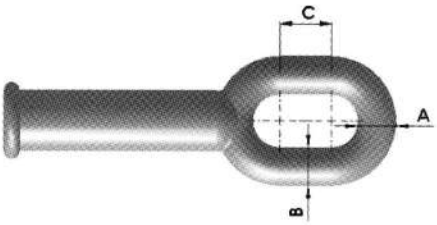
Dimensions, mm			
70 kN	120 kN	160 kN	210 kN
$A=33,3^{0}_{-1,5}$	$A=33,3^{0}_{-1,5}$	$A=41^{0}_{-1,6}$	$A=41^{0}_{-1,6}$
$B=13,4^{0}_{-1,3}$	$B=13,4^{0}_{-1,3}$	$B=19,5^{0}_{-1,4}$	$B=19,5^{0}_{-1,4}$
$C=17^{0}_{-1,2}$	$C=17^{0}_{-1,2}$	$C=21^{0}_{-1,3}$	$C=21^{0}_{-1,3}$

End -fittings type Socket



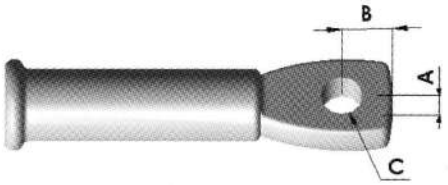
Dimensions, mm			
70 kN	120 kN	160 kN	210 kN
$A=19,2^{+1}_{0}$	$A=19,2^{+1}_{0}$	$A=23^{\pm2,1}_{0}$	$A=23^{\pm2,1}_{0}$
$B=21,5^{+1}_{0}$	$B=21,5^{+1}_{0}$	$B=30^{\pm0,5}$	$B=30^{\pm0,5}$
$C=34,5^{+1}_{0}$	$C=34,5^{+1}_{0}$	$C=42,5^{+1}_{0}$	$C=42,5^{+1}_{0}$
$D=14,5^{+1}_{0}$	$D=14,5^{+1}_{0}$	$D=20^{+1}_{0}$	$D=20^{+1}_{0}$
$E=Ø\,9,5^{\pm0,5}$	$E=Ø\,9,5^{\pm0,5}$	$E=Ø10^{\pm0,5}$	$E=Ø10^{\pm0,5}$

End-fittings type Eye



Dimensions, mm		
70 kN	120 kN	160 kN
A=18	$A=20^{0}_{-2}$	$A=26^{+1}_{0}$
$B=15^{0}_{-1}$	$B=19^{0}_{-1}$	$B=24^{0}_{-2}$
C=16	C=26	C=26

End-fittings type Tongue



Dimensions, mm			
70 kN	120 kN	160 kN	210 kN
$A=16^{\pm1}$	$A=16^{\pm1}$	$A=19^{\pm1}$	A=19
$B=22^{+3}_{0}$	$B=22^{+3}_{0}$	$B=23^{+3}_{0}$	B=29,8
$C=Ø17,5^{\pm0,8}$	$C=Ø17,5^{\pm0,8}$	C= Ø21	C= Ø23

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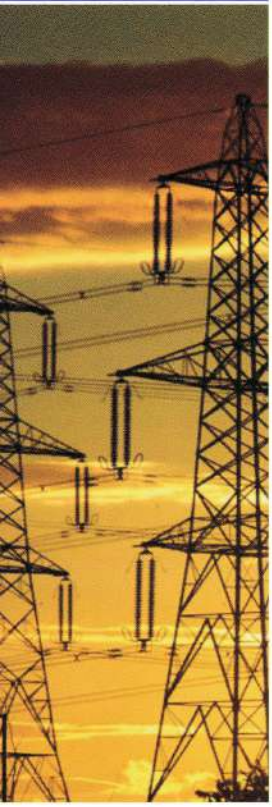
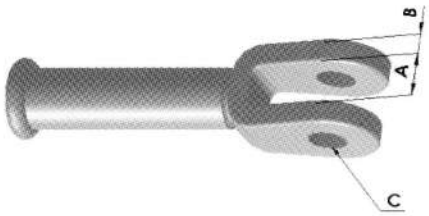


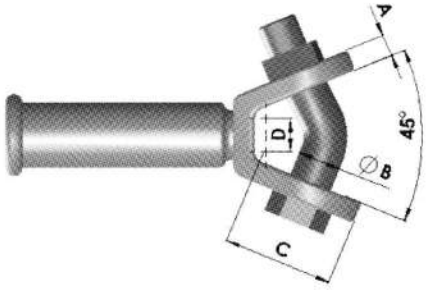
Techical data

End-fittings type C-clevis



Dimensions, mm		
70 kN	120 kN	160 kN
A=18	$A=18^{+2}_{0}$	$A=20^{+2}_{0}$
B=8	$B=10^{+1}_{0}$	$B=12^{+1}_{0}$
$C=17,5^{\pm0,8}$	$C=R17,5^{\pm0,8}$	$C=R20^{\pm0,8}$

End-fittings type Y-clevis



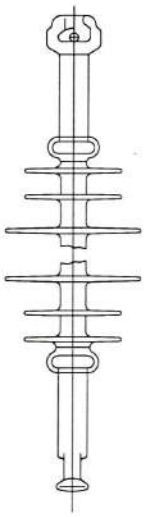
Dimensions, mm		
70 kN	120 kN	160 kN
$A=8^{+1}_{0}$	$A=10^{+1}_{0}$	$A=12^{+2}_{0}$
$B=19^{\pm0,5}$	$B=23^{\pm0,5}$	B=27
C=60	C=60	C=75
$D=8^{+1}_{0}$	$D=8^{+1}_{0}$	$D=10^{+1}_{0}$

If requested, the end-fittings of the composite insulators can be executed in other combinations too.

BS	Ball-Socket
CT	C Clevis-Tongue
BE	Ball-Eye
EE	Eye-Eye
BY	Ball-Y Clevis
SS	Socket-Socket

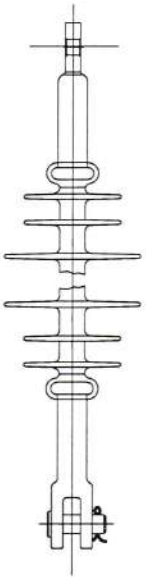
BS

Ball -Socket



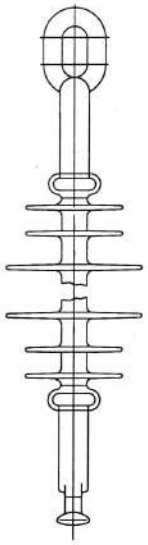
CT

C-clevis -Tongue



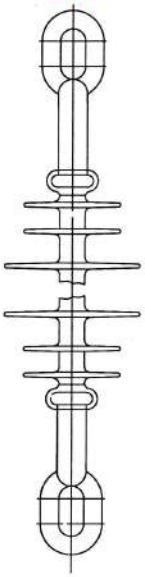
BE

Ball -Eye



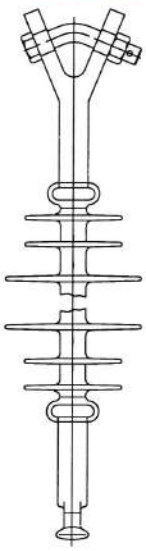
EE

Eye- Eye



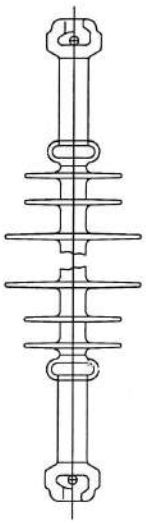
BY

Ball- Y-Clevis



SS

Socket- Socket



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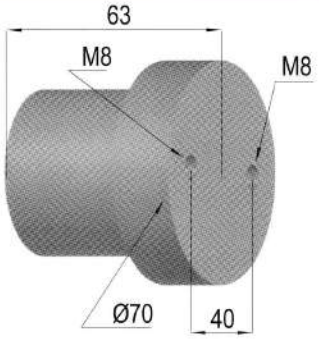
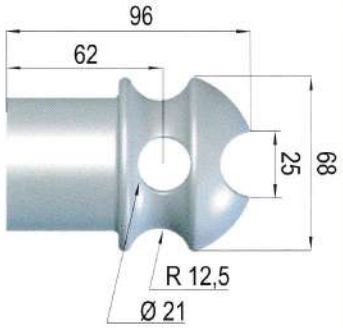
End-fittings for suport composite insulators

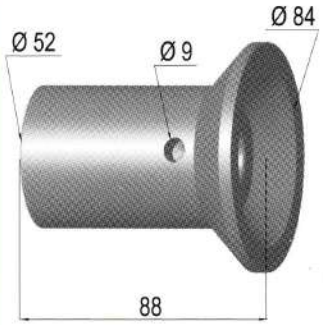
A type end fittings



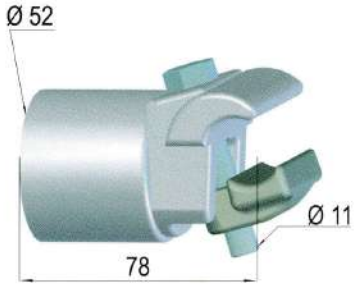
R type end fittings



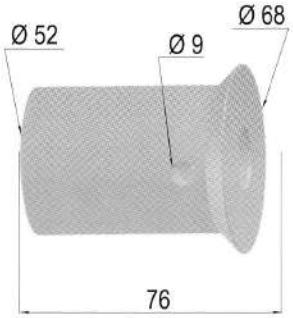
Suport end fittings



Type C end fittings



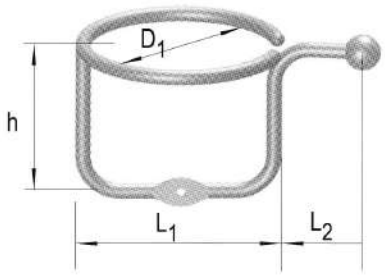
Suport end fittings for apparatus



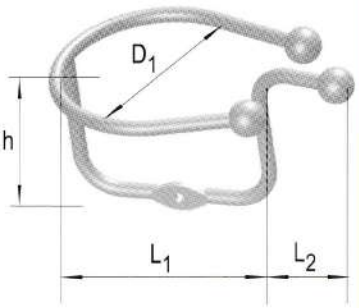
A type reinforcement to the devices can change diameter holes M8 and M10 and height (63 or 76 mm) depending on specific applications. Reinforcement can support variable height between 75 and 100 mm.

Arcing devices and rings

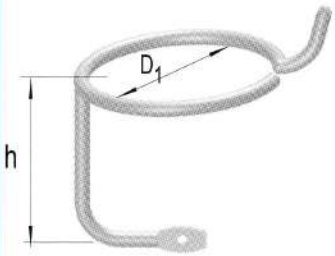
Bottom Guarding Ring



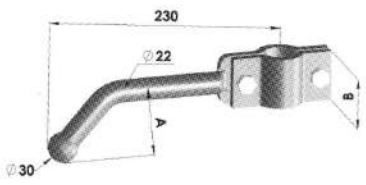
Bottom Guarding Ring



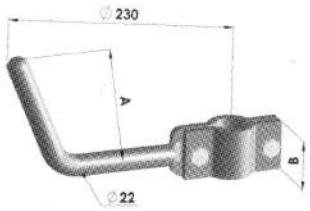
Upper Guarding Ring



Arcing horn I



Arcing horn II



Note: data for h, D1, L1, L2, L, A and B are correlated with the type of requested string and the spark gap distance given in the technical specification data of the insulator.

IPROEB SA Bistrita
Composite Insulators Division

Electromontaj SA Bucharest
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Campina

Suspension / tension composite insulators for overhead power lines and power stations

Chapter 2

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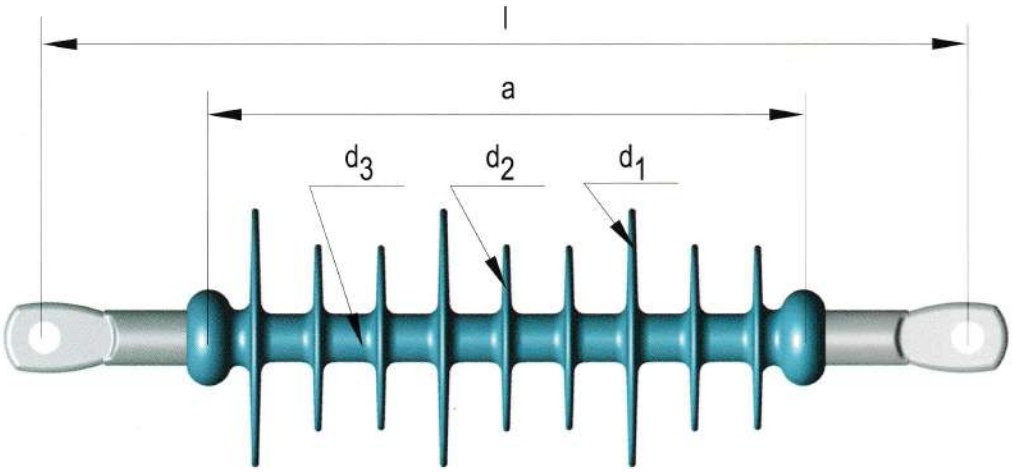
Composite insulators for OHTL and power stations

CI 20 kV, 70 kN



Dimensional Characteristics	Unit	Zone II	Zone III	Zone IV
Distance between the end fittings a	mm	190	242	264
Number of large sheds / small sheds		3/4	3/6	3/7
Diameter of insulating parts				
Core (central rod) d3	mm	24	24	24
Large sheds / small sheds d1/d2	mm	84/70	84/70	84/70
Creepage distance	cm	50,8	65,8	75
Arcing distance	mm	238	290	312

Electrical and mechanical characteristics

24 kV	Maximum system voltage
50 Hz	Nominal frequency
50 kV	Withstand voltage 50 Hz 1 min., dry/wet
105 kVmax	Switching impulse withstand voltage, wet 250-2500 µs
20 kA	Short-circuit current
70 kN	Specified Mechanical Load SML
35 (42) kN	Routine Test Load RTL
>125 kVmax	Lightning impulse withstand voltage, dry 1,2/50 µs
≤160 kVmax	50% lightning impulse flashover voltage 1,2/50 µs

Symbols for end assemblies	Anchoring distance l (± 3) mm	Unit	Quoted weight II	III	IV
BS Ball - Socket	a + 177	kg	1,4	1,4	1,4
CT C-clevis - Tongue	a + 192	kg	1,6	1,7	1,7
BE Ball - Eye	a + 189	kg	1,2	1,3	1,3
EE Eye - Eye	a + 204	kg	1,4	1,4	1,5
BY Ball - Y-clevis	a + 187	kg	1,7	1,7	1,8
TT Tongue - Tongue	a + 190	kg	1,25	1,4	1,4
SS Socket - Socket	a + 180	kg	1,7	1,7	1,8

Upon demand, the end assemblies (fittings) of the composite insulators are manufactured in the required combinations, with the adequate modifications of the anchoring distances.

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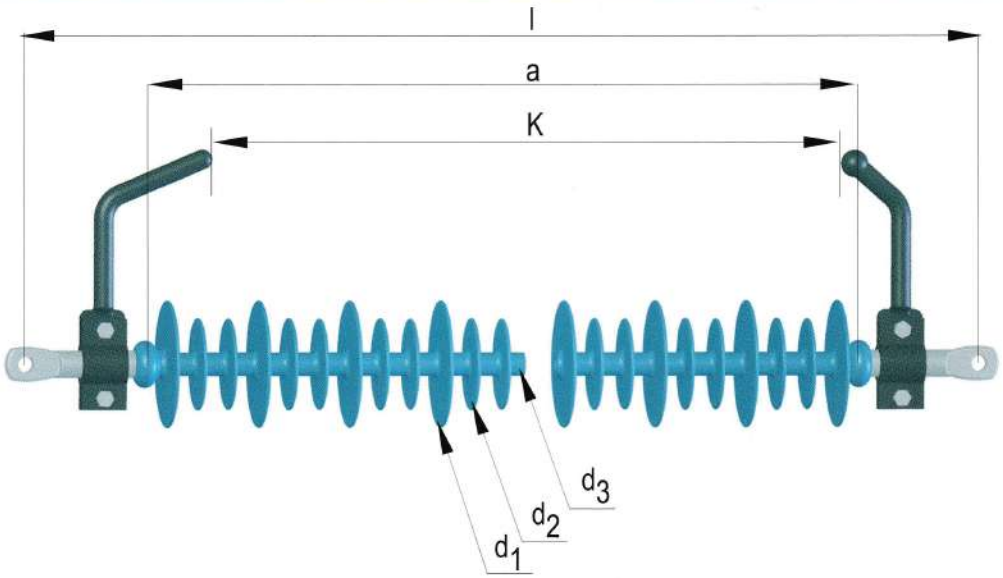
Composite insulators for OHTL and power stations

Cl 110 kV, 70 kN



Dimensional Characteristics	Unit	Zone II	Zone III	Zone IV
Distance between the end fittings a	mm	952	1020	1122
Number of large sheds / small sheds		10/18	10/20	11/22
Diameter of insulating parts				
Core (central rod) d3	mm	26	26	26
Large sheds / small sheds d1/d2	mm	140/100	140/100	140/100
Creepage distance	cm	323	342	382
Spark-gap distance	mm	900-920	930-950	950-1005
Arcing distance	mm	1062	1130	1232
Arcing horns system for the adjustment of the Spark-gap		C3	C1	C2

Electrical and mechanical characteristics	
123 kV	Maximum system voltage
50 Hz	Nominal frequency
230 kV	Withstand voltage 50 Hz 1 min., dry/wet
440 kVmax	Switching impulse withstand voltage, wet 250- 2500 µs
31,5 kA	Short-circuit current
70 kN	Specified Mechanical Load SML
35 (42) kN	Routine Test Load RTL
>550 kVmax	Lightning impulse withstand voltage, dry 1,2/50 µs
≤690 kVmax	50% lightning impulse flashover voltage 1,2/50 µs

Symbols for end assemblies	Anchoring distance l (± 6) mm	Unit	Quoted weight, without the arcing horns		
			II	III	IV
BS Ball - Socket	a + 177	kg	3,5	3,6	4,5
CT C-clevis - Tongue	a + 192	kg	3,6	3,8	4,0
BE Ball - Eye	a + 189	kg	3,3	3,5	3,7
EE Eye - Eye	a + 204	kg	3,5	3,6	3,9
BY Ball - Y-clevis	a + 187	kg	3,8	3,9	4,2
TT Tongue - Tongue	a + 190	kg	3,5	3,6	3,8
SS Socket - Socket	a + 180	kg	3,8	3,9	4,2

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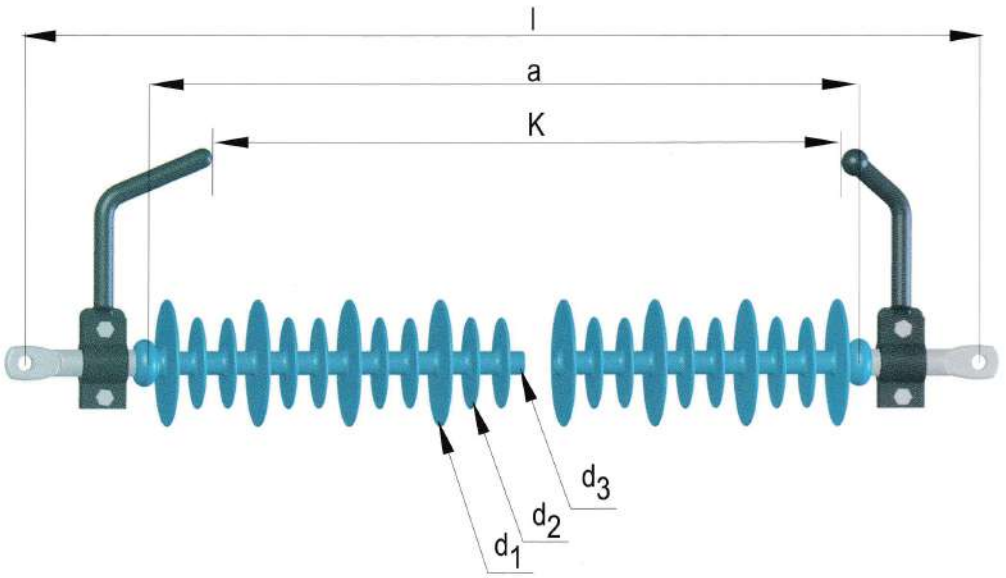
Composite insulators for OHTL and power stations

CI 110 kV, 120 kN



Dimensional Characteristics	Unit	Zone II	Zone III	Zone IV
Distance between the end fittings a	mm	952	1020	1122
Number of large sheds / small sheds		10/18	10/20	11/22
Diameter of insulating parts				
Core (central rod) d3	mm	26	26	26
Large sheds / small sheds d1/d2	mm	140/100	140/100	140/100
Creepage distance	cm	323	342	382
Spark-gap distance	mm	900-920	930-950	950-1005
Arcing distance	mm	1062	1130	1232
Arcing horns system for the adjustment of the Spark-gap		C1	C1	C2

Electrical and mechanical characteristics

123 kV	Maximum system voltage
50 Hz	Nominal frequency
230 kV	Withstand voltage 50 Hz 1 min., dry/wet
440 kVmax	Switching impulse withstand voltage, wet 250- 2500 µs
31,5 kA	Short-circuit current
120 kN	Specified Mechanical Load SML
60 (72) kN	Routine Test Load. RTL
>550 kVmax	Lightning impulse withstand voltage, dry 1,2/50 µs
≤690 kVmax	50% lightning impulse flashover voltage 1,2/50 µs

Symbols for end assemblies	Anchoring distance l (± 6) mm	Unit	Quoted weight, without the arcing horns II	III	IV
BS Ball - Socket	a + 265	kg	3,8	4,0	4,2
CT C-clevis - Tongue	a + 285	kg	4,2	4,3	4,6
BE Ball - Eye	a + 293	kg	3,9	4,0	4,3
EE Eye - Eye	a + 326	kg	4,3	4,4	4,7
BY Ball - Y-clevis	a + 275	kg	4,2	4,3	4,6
TT Tongue - Tongue	a + 280	kg	3,9	4,0	4,3
SS Socket - Socket	a + 270	kg	4,2	4,3	4,6

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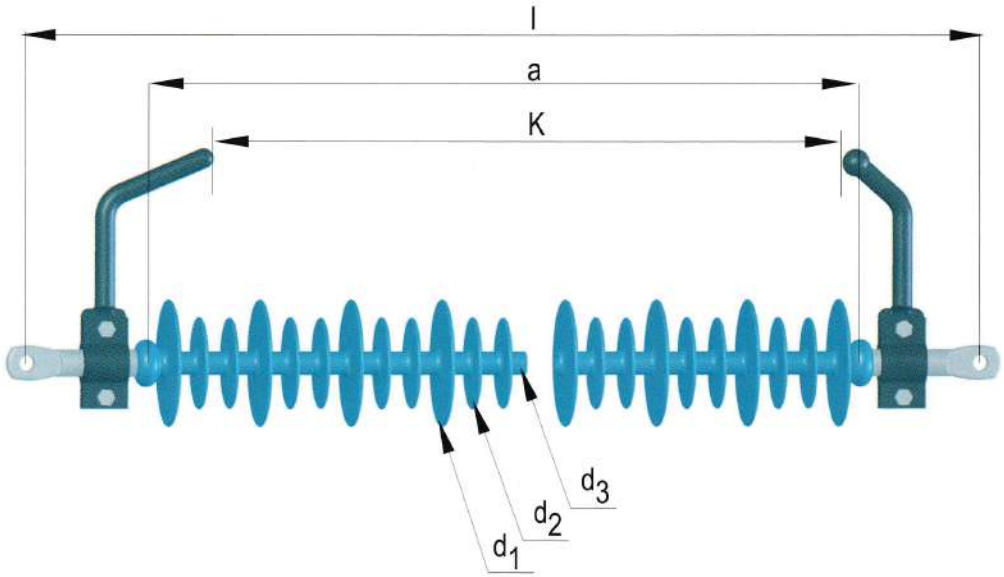
Composite insulators for OHTL and power stations

CI 110 kV, 160 kN



Dimensional Characteristics	Unit	Zone II	Zone III	Zone IV
Distance between the end fittings a	mm	952	1020	1122
Number of large sheds / small sheds		10/18	10/20	11/22
Diameter of insulating parts				
Core (central rod) d3	mm	26	26	26
Large sheds / small sheds d1/d2	mm	140/100	140/100	140/100
Creepage distance	cm	323	342	382
Spark-gap distance	mm	900-920	930-950	950-1005
Arcing distance	mm	1062	1130	1232
Arcing horns system for the adjustment of the Spark-gap		C1	C1	C2

Electrical and mechanical characteristics	
123 kV	Maximum system voltage
50 Hz	Nominal frequency
230 kV	Withstand voltage 50 Hz 1 min., dry/wet
440 kVmax	Switching impulse withstand voltage, wet 250- 2500 µs
31,5 kA	Short-circuit current
160 kN	Specified Mechanical Load SML
80 (96) kN	Routine Test Load RTL
>550 kVmax	Lightning impulse withstand voltage, dry 1,2/50 µs
≤690 kVmax	50% lightning impulse flashover voltage 1,2/50 µs

Symbols for end assemblies	Anchoring distance l (± 6) mm	Unit	Quoted weight, without the arcing horns		
			II	III	IV
BS Ball - Socket	a + 306	kg	4,4	4,5	4,8
CT C-clevis - Tongue	a + 325	kg	4,7	4,8	4,5
BE Ball - Eye	a + 333	kg	4,5	4,6	4,9
EE Eye - Eye	a + 366	kg	5,0	5,2	5,5
BY Ball - Y-clevis	a + 316	kg	5,0	5,1	5,4
TT Tongue - Tongue	a + 320	kg	4,1	4,3	4,5
SS Socket - Socket	a + 312	kg	5,0	5,0	5,3

Upon demand, the end assemblies (fittings) of the composite insulators are manufactured in the required combinations, with the adequate modifications of the anchoring distances.

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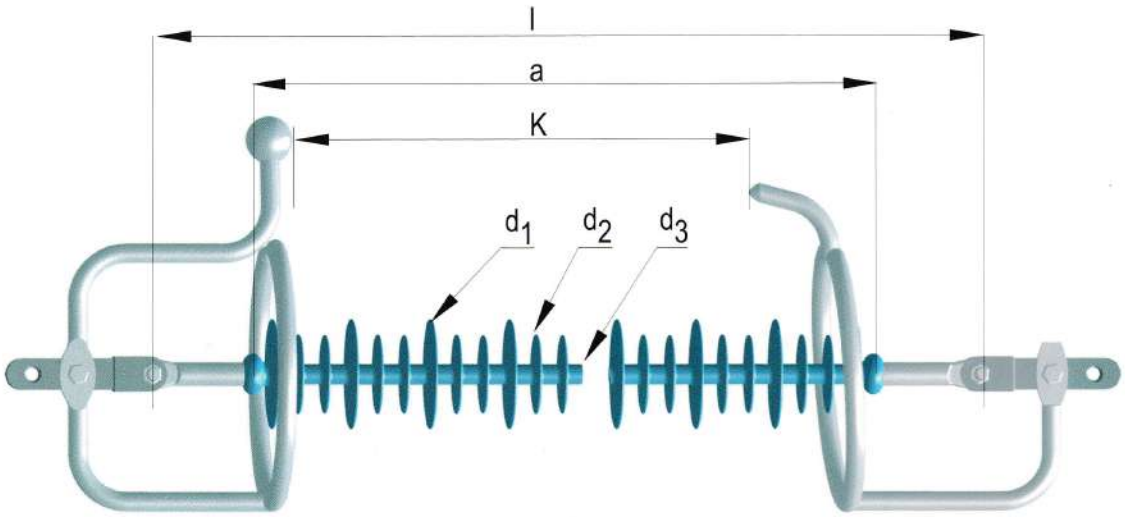
Composite insulators for OHTL and power stations

CI 220 kV, 120 kN



Dimensional Characteristics	Unit	Zone II	Zone III	Zone IV
Distance between the end fittings a	mm	1870	1972	1996
Number of large sheds / small sheds		19/36	20/38	20/38
Diameter of insulating parts				
Core (central rod) d3	mm	26	26	26
Large sheds / small sheds d1/d2	mm	140/100	140/100	164/124
Creepage distance	cm	618	653	779
Spark-gap distance	mm	1800-1820	1810-1835	1835-1860
Arcing distance	mm	1980	2082	2156

Electrical and mechanical characteristics	
245 kV	Maximum system voltage
50 Hz	Nominal frequency
460 kV	Withstand voltage 50 Hz 1 min., dry/wet
750 kVmax	Switching impulse withstand voltage, wet 250-2500 µs
31,5 kA	Short-circuit current
120 kN	Specified Mechanical Load SML
60 (72) kN	Routine Test Load RTL
>1050 kVmax	Lightning impulse withstand voltage, dry 1,2/50 µs
≤1310 kVmax	50% lightning impulse flashover voltage 1,2/50 µs

Symbols for end assemblies	Anchoring distance l (± 10) mm	Unit	Quoted weight, without the arcing rings		
			II	III	IV
BS Ball - Socket	a + 265	kg	6,1	6,4	8,7
CT C-clevis - Tongue	a + 285	kg	6,3	6,6	8,9
BE Ball - Eye	a + 293	kg	6,2	6,4	8,8
EE Eye - Eye	a + 326	kg	6,6	6,8	9,2
BY Ball - Y-clevis	a + 275	kg	6,2	6,4	8,8
TT Tongue - Tongue	a + 280	kg	6,2	6,4	8,8
SS Socket - Socket	a + 270	kg	6,4	6,7	9,0

Upon demand, the end assemblies (fittings) of the composite insulators are manufactured in the required combinations, with the adequate modifications of the anchoring distances.

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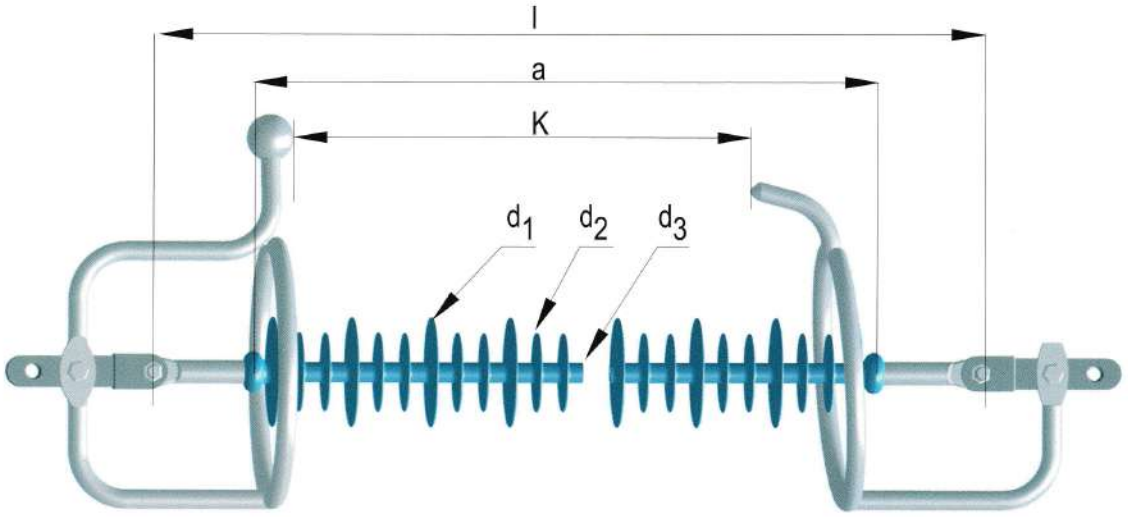
Composite insulators for OHTL and power stations

CI 220 kV, 160 kN



Dimensional Characteristics	Unit	Zone II	Zone III	Zone IV
Distance between the end fittings **a**	mm	1870	1972	1996
Number of large sheds / small sheds		19/36	20/38	20/38
Diameter of insulating parts				
Core (central rod) **d3**	mm	26	26	26
Large sheds / small sheds **d1/d2**	mm	140/100	140/100	164/124
Creepage distance	cm	618	653	779
Spark-gap distance - **K**	mm	1800-1820	1810-1835	1835-1860
Arcing distance	mm	1980	2082	2156

Electrical and mechanical characteristics

245 kV	Maximum system voltage
50 Hz	Nominal frequency
460 kV	Withstand voltage 50 Hz 1 min., dry/wet
750 kVmax	Switching impulse withstand voltage, wet 250- 2500 µs
40 kA	Short-circuit current
160 kN	Specified Mechanical Load SML
80 (96) kN	Routine Test Load RTL
>1050 kVmax	Lightning impulse withstand voltage, dry 1,2/50 µs
≤1310 kVmax	50% lightning impulse flashover voltage 1,2/50 µs

Symbols for end assemblies	Anchoring distance l (± 10) mm	Unit	Quoted weight, without the arcing rings II	III	IV
BS Ball - Socket	a + 306	kg	6,7	6,9	9,3
CT C-clevis - Tongue	a + 325	kg	6,8	7,0	9,4
BE Ball - Eye	a + 333	kg	6,8	7,0	9,4
EE Eye - Eye	a + 366	kg	7,4	7,6	10,0
BY Ball - Y-clevis	a + 316	kg	6,8	7,1	9,4
TT Tongue - Tongue	a + 320	kg	6,4	6,7	9,0
SS Socket - Socket	a + 312	kg	7,2	7,4	9,8

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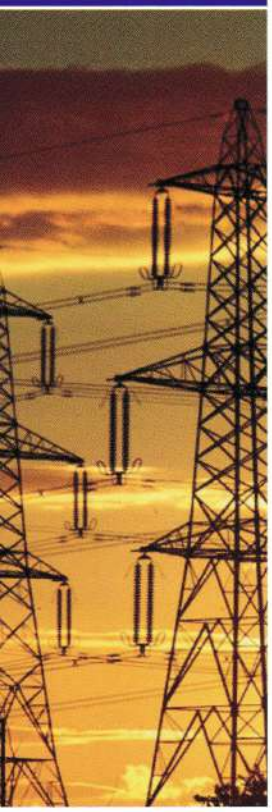
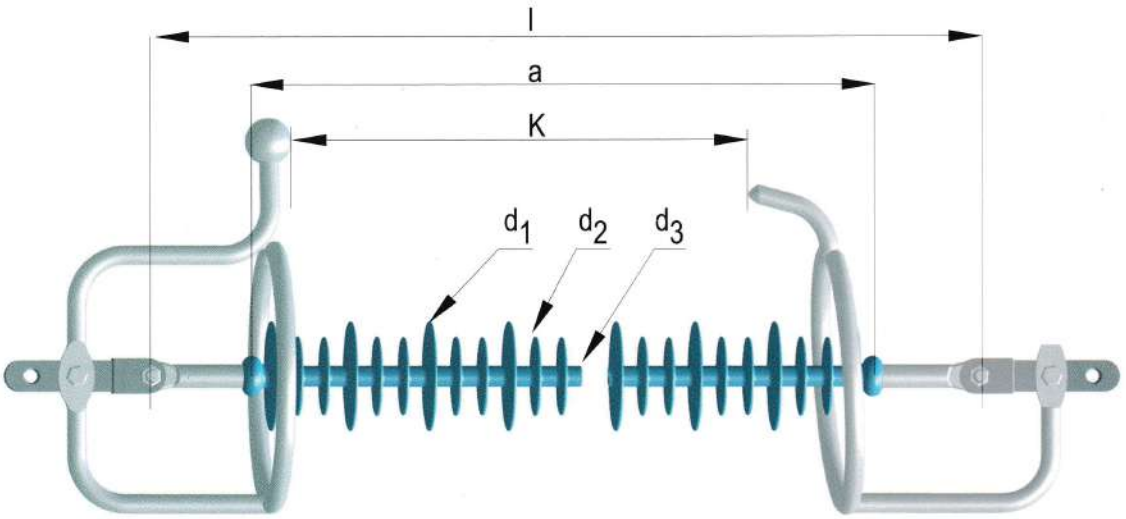


Composite insulators for OHTL and power stations

CI 220 kV, 210 kN



Dimensional Characteristics	Unit	Zone III
Distance between the end fittings **a**	mm	1972
Number of large sheds / small sheds		20 / 38
Diameter of insulating parts		
Core (central rod) **d3**	mm	34
Large sheds / small sheds **d1/d2**	mm	144 / 106
Creepage distance	cm	669,4
Spark-gap distance - **K**	mm	1810 - 1835
Arcing distance	mm	2082

Electrical and mechanical characteristics	
245 kV	Maximum system voltage
50 Hz	Nominal frequency
460 kV	Withstand voltage 50 Hz 1 min., dry/wet
750 kVmax	Switching impulse withstand voltage, wet 250- 2500 µs
31,5 kA	Short-circuit current
210 kN	Specified Mechanical Load SML
105 (110) kN	Routine Test Load RTL
>1050 kVmax	Lightning impulse withstand voltage, dry 1,2/50 µs
≤1310 kVmax	50% lightning impulse flashover voltage 1,2/50 µs

Symbols for end assemblies		Anchoring distance l (± 15) mm	Unit	Quoted weight, without the arcing rings III
BS	Ball-Socket	a+323	kg	9,00
TT	Tongue - Tongue	a+340	kg	9,05
SS	Socket-Socket	a+330	kg	9,45

Upon demand, the end assemblies (fittings) of the composite insulators are manufactured in the required combinations, with the adequate modifications of the anchoring distances.

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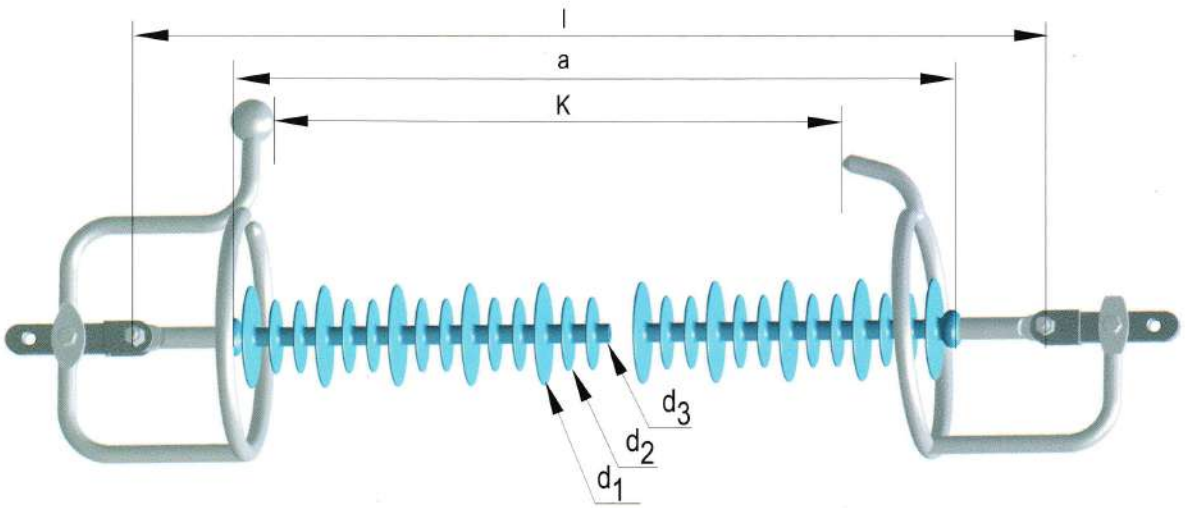
Composite insulators for OHTL and power stations

CI 400 kV, 120 kN



Dimensional Characteristics	Unit	Zone II	Zone II var A	Zone III	Zone IV
Distance between the end fittings **a**	mm	2890	3094	3196	3322
Number of large sheds / small sheds		29/56	31/60	32/62	33/64
Diameter of insulating parts					
Core (central rod) **d3**	mm	26	26	26	26
Large sheds / small sheds **d1/d2**	mm	140/100	140/100	140/100	164/124
Creepage distance	cm	956	1024	1058	1302
Spark-gap distance - **K**	mm	2700-2740	2900	2950-2990	3050-3090
Arcing distance	mm	3000	3204	3306	3482

Electrical and mechanical characteristics

420 kV	Maximum system voltage
50 Hz	Nominal frequency
680 kV	Withstand voltage 50 Hz 1 min., dry/wet
1050 kVmax	Switching impulse withstand voltage, wet 250- 2500 µs
31,5 kA	Short-circuit current
120 kN	Specified Mechanical Load SML
60 (72) kN	Routine Test Load RTL
>1550 kVmax	Lightning impulse withstand voltage, dry 1,2/50 µs
≤1930 kVmax	50% lightning impulse flashover voltage 1,2/50 µs

Symbols for end assemblies	Anchoring distance l (± 10) mm	Unit	Quoted weight, without the arcing rings			
			II	II var A	III	IV
BS Ball - Socket	a + 265	kg	8,5	9,0	9,3	13,4
CT C-clevis - Tongue	a + 285	kg	8,7	9,2	9,5	13,6
BE Ball - Eye	a + 293	kg	8,6	9,1	9,3	13,5
EE Eye - Eye	a + 326	kg	9,0	9,5	9,7	13,9
BY Ball - Y-clevis	a + 275	kg	8,6	9,1	9,4	13,5
TT Tongue - Tongue	a + 280	kg	8,6	9,1	9,3	13,5
SS Socket - Socket	a + 270	kg	8,8	9,3	9,6	13,7

Upon demand, the end assemblies (fittings) of the composite insulators are manufactured in the required combinations, with the adequate modifications of the anchoring distances.

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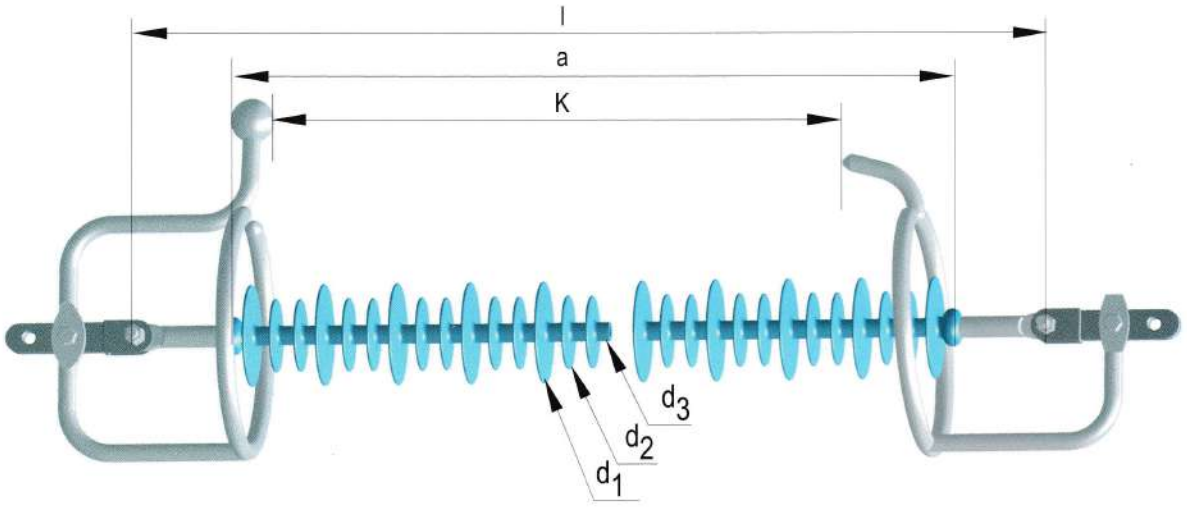
Composite insulators for OHTL and power stations

CI 400 kV, 160 kN



Dimensional Characteristics	Unit	Zone II	Zone II var A	Zone III	Zona IV
Distance between the end fittings **a**	mm	2890	3094	3196	3322
Number of large sheds / small sheds		29/56	31/60	32/62	33/64
Diameter of insulating parts					
Core (central rod) **d3**	mm	26	26	26	26
Large sheds / small sheds **d1/d2**	mm	140/100	140/100	140/100	164/124
Creepage distance	cm	956	1024	1058	1302
Spark-gap distance - **K**	mm	2700-2740	2900	2950-2990	3050-3090
Arcing distance	mm	3000	3204	3306	3482

Electrical and mechanical characteristics

420 kV	Maximum system voltage
50 Hz	Nominal frequency
680 kV	Withstand voltage 50 Hz 1 min., dry/wet
1050 kVmax	Switching impulse withstand voltage, wet 250-2500 µs
40 kA	Short-circuit current
160 kN	Specified Mechanical Load SML
80 (72) kN	Routine Test Load RTL
>1550 kVmax	Lightning impulse withstand voltage, dry 1,2/50 µs
≤1930 kVmax	50% lightning impulse flashover voltage 1,2/50 µs

Symbols for end assemblies	Anchoring distance l (± 10) mm	Unit	Quoted weight, without the arcing rings			
			II	II var A	III	IV
BS Ball - Socket	a + 306	kg	9,1	9,6	9,8	14,0
CT C-clevis - Tongue	a + 325	kg	9,2	9,7	9,9	14,1
BE Ball - Eye	a + 333	kg	9,2	9,7	9,9	14,1
EE Eye - Eye	a + 366	kg	9,8	10,3	10,5	14,7
BY Ball - Y-clevis	a + 316	kg	9,2	9,7	10,0	14,1
TT Tongue - Tongue	a + 320	kg	8,8	9,3	9,6	13,7
SS Socket - Socket	a + 312	kg	9,6	10,1	13,7	14,5

Upon demand, the end assemblies (fittings) of the composite insulators are manufactured in the required combinations, with the adequate modifications of the anchoring distances.

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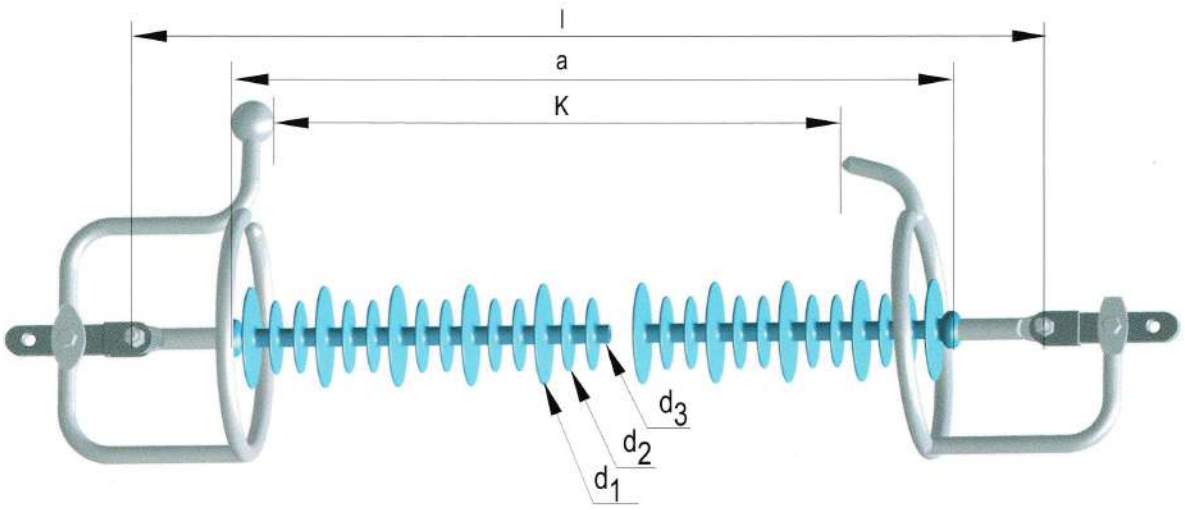
Composite insulators for OHTL and power stations

CI 400 kV, 210 kN



Dimensional Characteristics	Unit	Zone II	Zone III
Distance between the end fittings **a**	mm	3094	3298
Number of large sheds / small sheds		31/60	33/64
Diameter of insulating parts			
Core (central rod) **d3**	mm	34	34
Large sheds / small sheds **d1/d2**	mm	144/106	144/106
Creepage distance	cm	1024	1076
Spark-gap distance - **K**	mm	2900	2950-2990
Arcing distance	mm	3204	3458

Electrical and mechanical characteristics	
420 kV	Maximum system voltage
50 Hz	Nominal frequency
680 kV	Withstand voltage 50 Hz 1 min., dry/wet
1050 kVmax	Switching impulse withstand voltage, wet 250-2500 µs
31,5 kA	Short-circuit current
210 kN	Specified Mechanical Load SML
105 (110) kN	Routine Test Load RTL
>1550 kVmax	Lightning impulse withstand voltage, dry 1,2/50 µs
≤1930 kVmax	50% lightning impulse flashover voltage 1,2/50 µs

Symbols for end assemblies		Anchoring distance l (± 15) mm	Unit	Quoted weight, without the arcing rings II	III
BS	Ball-Socket	a+323	kg	13,7	14,2
TT	Tongue-Tongue	a+340	kg	13,8	14,3
SS	Socket-Socket	a+330	kg	14	14,5

Upon demand, the end assemblies (fittings) of the composite insulators are manufactured in the required combinations, with the adequate modifications of the anchoring distances.

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Composite Insulators Division

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Composite post line insulators and hallow insulators

Chapter 3

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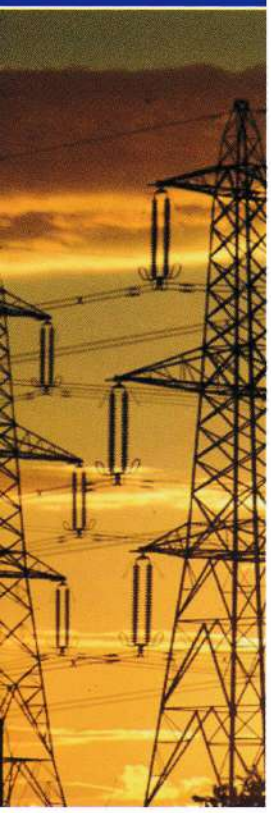
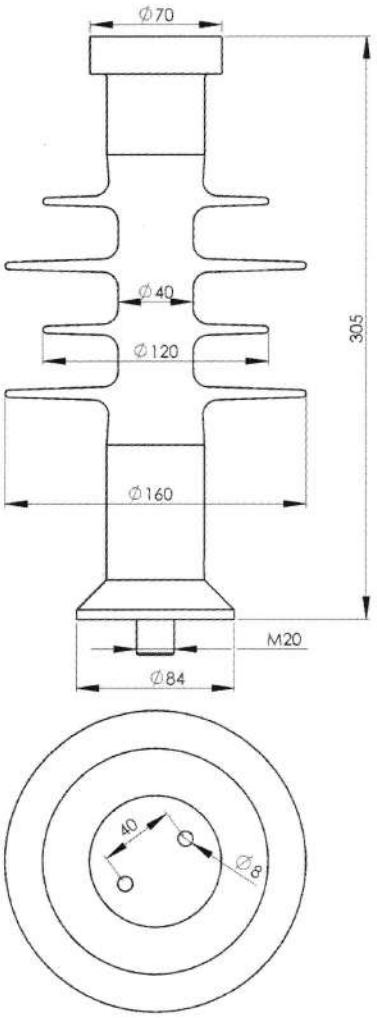


Composite post line insulators and hallow insulators

Post line composite insulators



Electrical characteristics:	Value
Maximum system voltage:	*24 kV*
Dry lightning impulse withstand voltage (wave 1,2/50 µs) :	*min. 125 kV*
Wet power-frequency withstand (1 minute, 50 Hz)	*min. 55 kV*
Dry lightning impulse flashover voltage (50 % conturnari) :	*160 kV*
Wet switching impulse withstand voltage test 250-2500 µs :	*105 kV*
Length of creepage distance	*50 cm*
Pollution level	*II*

Mechanical charasteristics:		UM		Value		
SCL	**S**pecified **C**antilever **L**oad:	*kN*	*7*	*8*	*9*	*10*
MDCL	**M**echanical **D**esign **C**antilever **L**oad:	*kN*	*4*	*5*	*5,5*	*7,5*
STL	**S**pecific **T**ensile **L**oad:	*kN*	*6 ÷ 30*	*6 ÷ 30*	*6 ÷ 30*	*6 ÷ 40*

Mounting bolt's length on the fixing structure is as requested by the client and function of the constructive variant.

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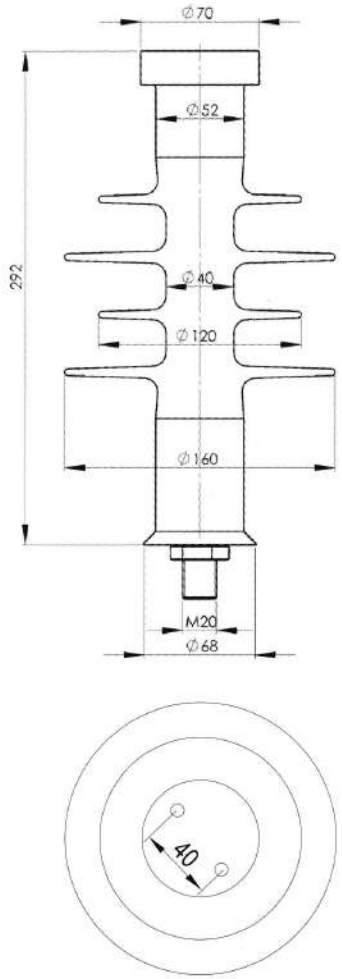
Composite post line insulators and hallow insulators

Post line composite insulators



Electrical characteristics:	Value
Maximum system voltage:	*24 kV*
Dry lightning impulse withstand voltage (wave 1,2/50 μs) :	*min. 125 kV*
Wet power-frequency withstand (1 minute, 50 Hz)	*min. 55 kV*
Dry lightning impulse flashover voltage (50 % conturnari) :	*160 kV*
Wet switching impulse withstand voltage test 250-2500 μs :	*105 kV*
Length of creepage distance	*50 cm*
Pollution level	*II*

Mechanical charasteristics:		UM		Value		
SCL	Specified Cantilever Load:	*kN*	*7*	*8*	*9*	*10*
MDCL	Mechanical Design Cantilever Load:	*kN*	*4*	*5*	*5,5*	*7,5*
STL	Specific Tensile Load:	*kN*	*6 ÷ 30*	*6 ÷ 30*	*6 ÷ 30*	*6 ÷ 40*

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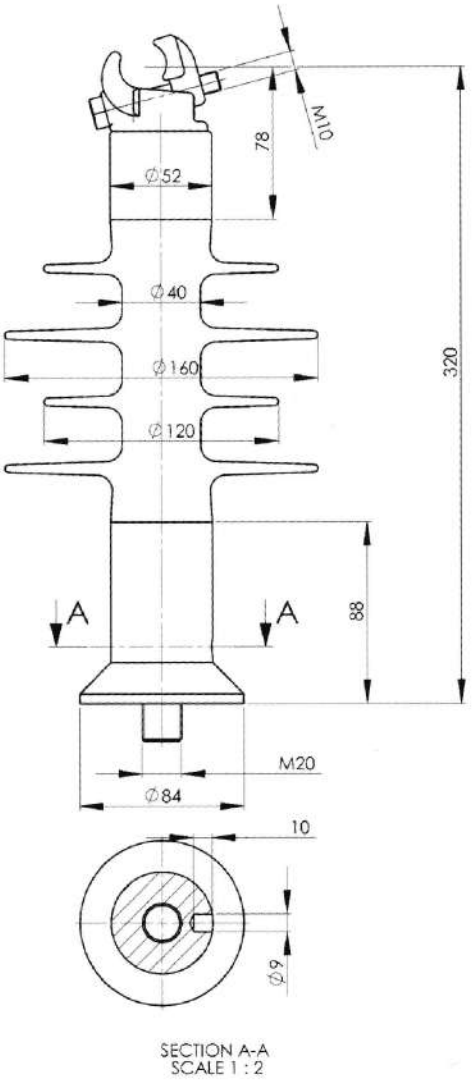
Composite post line insulators and hallow insulators

Post line composite insulators



SECTION A-A
SCALE 1 : 2

Electrical characteristics:	Value
Maximum system voltage:	*24 kV*
Dry lightning impulse withstand voltage (wave 1,2/50 µs) :	*min. 125 kV*
Wet power-frequency withstand (1 minute, 50 Hz)	*min. 55 kV*
Dry lightning impulse flashover voltage (50 % conturnari) :	*160 kV*
Wet switching impulse withstand voltage test 250-2500 µs :	*105 kV*
Length of creepage distance	*50 cm*
Pollution level	*II*

Mechanical charasteristics:		UM	Value			
SCL	**S**pecified **C**antilever **L**oad:	*kN*	*7*	*8*	*9*	*10*
MDCL	**M**echanical **D**esign **C**antilever **L**oad:	*kN*	*4*	*5*	*5,5*	*7,5*
STL	**S**pecific **T**ensile **L**oad:	*kN*	*6 ÷ 30*	*6 ÷ 30*	*6 ÷ 30*	*6 ÷ 40*

Mounting bolt's length on the fixing structure is as requested by the client and function of the constructive variant.

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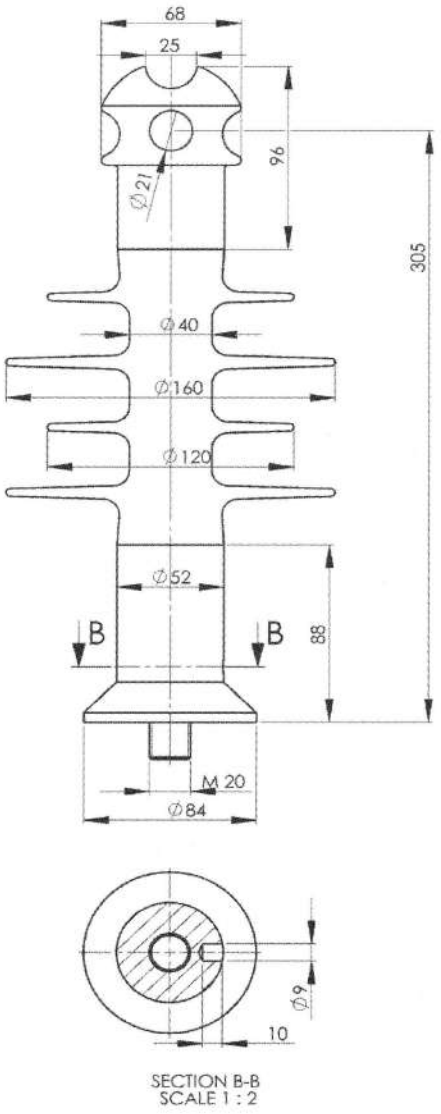
CIS 20-II-X-R-L

Composite post line insulators and hallow insulators

Post line composite insulators



SECTION B-B
SCALE 1 : 2

Electrical characteristics:	Value
Maximum system voltage:	*24 kV*
Dry lightning impulse withstand voltage (wave 1,2/50 µs) :	*min. 125 kV*
Wet power-frequency withstand (1 minute, 50 Hz)	*min. 55 kV*
Dry lightning impulse flashover voltage (50 % conturnari) :	*160 kV*
Wet switching impulse withstand voltage test 250-2500 µs :	*105 kV*
Length of creepage distance	*50 cm*
Pollution level	*II*

Mechanical charasteristics:		UM				
SCL	Specified Cantilever Load:	*kN*	*7*	*8*	*9*	*10*
MDCL	Mechanical Design Cantilever Load:	*kN*	*4*	*5*	*5,5*	*7,5*
STL	Specific Tensile Load:	*kN*	*6 ÷ 30*	*6 ÷ 30*	*6 ÷ 30*	*6 ÷ 40*

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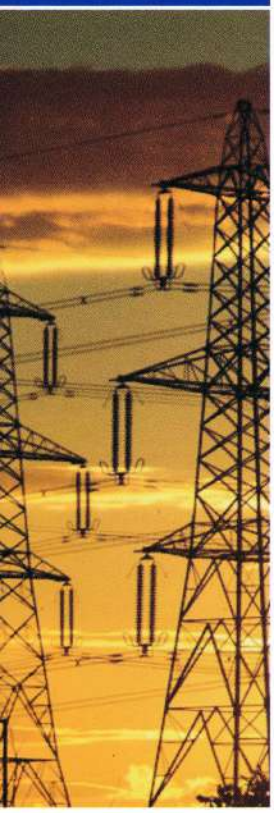
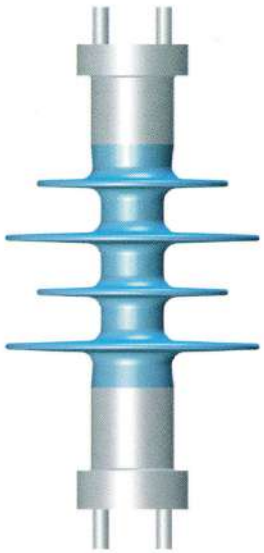
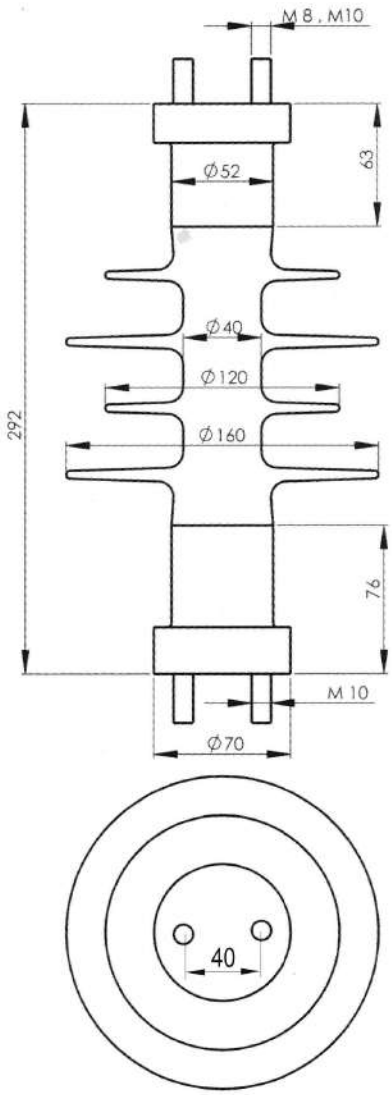
CIS 20-II-X-A3-L



Composite post line insulators and hallow insulators

Post line composite insulators





Electrical characteristics:	Value
Maximum system voltage:	*24 kV*
Dry lightning impulse withstand voltage (wave 1,2/50 µs) :	*min. 125 kV*
Wet power-frequency withstand (1 minute, 50 Hz)	*min. 55 kV*
Dry lightning impulse flashover voltage (50 % conturnari) :	*160 kV*
Wet switching impulse withstand voltage test 250-2500 µs :	*105 kV*
Length of creepage distance	*50 cm*
Pollution level	*II*

Mechanical charasteristics:		UM		Value		
SCL	**S**pecified **C**antilever **L**oad:	*kN*	*7*	*8*	*9*	*10*
MDCL	**M**echanical **D**esign **C**antilever **L**oad:	*kN*	*4*	*5*	*5,5*	*7,5*
STL	**S**pecific **T**ensile **L**oad:	*kN*	*6 ÷ 30*	*6 ÷ 30*	*6 ÷ 30*	*6 ÷ 40*

Mounting bolt's length on the fixing structure is as requested by the client and function of the constructive variant.

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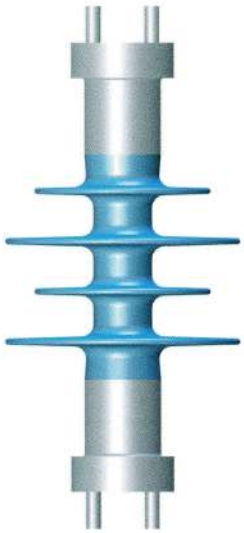
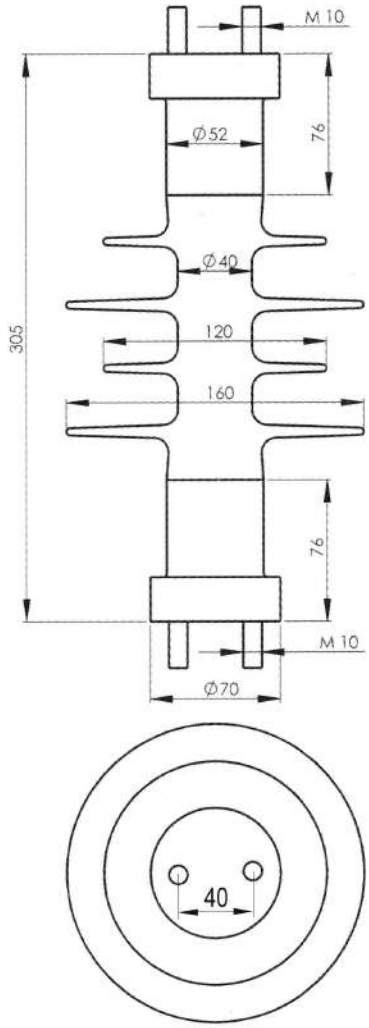
CIS 20-II-X-A4-L

Composite post line insulators and hallow insulators

Post line composite insulators





Electrical characteristics:	Value
Maximum system voltage:	*24 kV*
Dry lightning impulse withstand voltage (wave 1,2/50 µs) :	*min. 125 kV*
Wet power-frequency withstand (1 minute, 50 Hz)	*min. 55 kV*
Dry lightning impulse flashover voltage (50 % conturnari) :	*160 kV*
Wet switching impulse withstand voltage test 250-2500 µs :	*105 kV*
Length of creepage distance	*50 cm*
Pollution level	*II*

Mechanical charasteristics:		UM		Value		
SCL	**S**pecified **C**antilever **L**oad:	*kN*	*7*	*8*	*9*	*10*
MDCL	**M**echanical **D**esign **C**antilever **L**oad:	*kN*	*4*	*5*	*5,5*	*7,5*
STL	**S**pecific **T**ensile **L**oad:	*kN*	*6 ÷ 30*	*6 ÷ 30*	*6 ÷ 30*	*6 ÷ 40*

Mounting bolt's length on the fixing structure is as requested by the client and function of the constructive variant.

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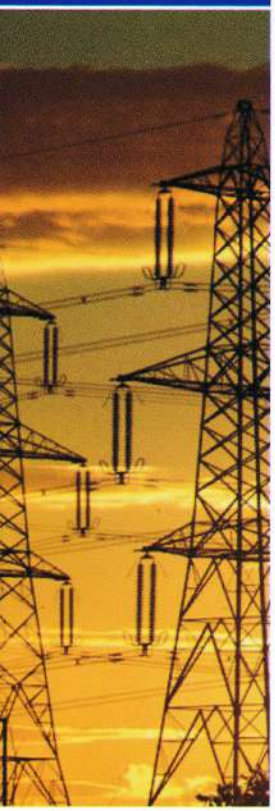
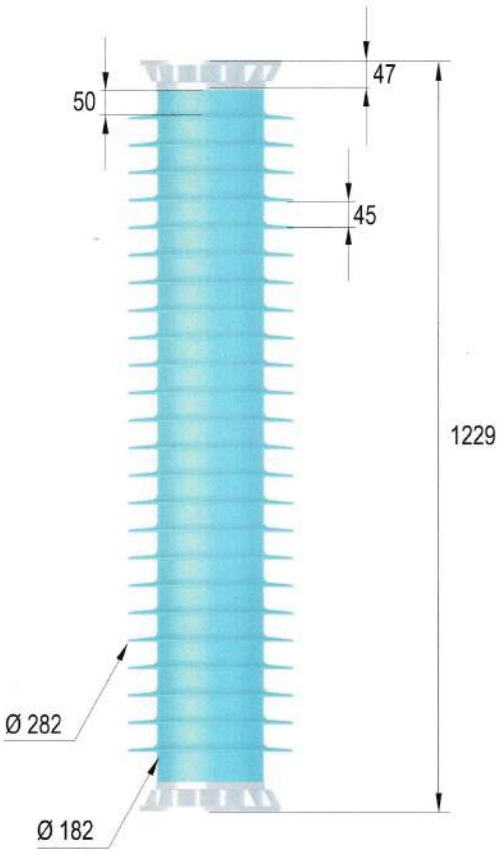


Composite post line insulators and hallow insulators

Hallow insulators for 110 kV Clc-110



Dimensional charcteristics

Number of sheds	pcs.	24
Height of insulators	mm	1229
Diameter of sheds	mm	282
Diameter of insulating parts	mm	182
Diameter of flange (16 hols of Ø11 mm)	mm	240
Weight of insulator	kg	18,2

Electrical characteristics

Nominal voltage:	kV	110
Maximum sistem voltage :	kV	123
Wet power-frequency withstand 1 min. 50 Hz	kVef	230
Dry lighting impulse withstand wave 1,2/50µs :	kVmax	550
Lenght of creepage distance :	mm	3285
Arc gap :	mm	1130

Mechanical characteristics

Maximal Service Cantilever Moment	kNm	4,8
Specified Mechanical Load ***SML***	kN	9,75
Maximal Mechanical Load ***MML***	kN	3,9
Maximal deflection at MML	mm	10
Maximal deflection at SML	mm	25
Pressure test-oil or SF_6 at 20 °C ***MSP***	Mpa	0,6
Burst pressure ***SIP***	Mpa	1,5
Service Temperature	°C	-35 ... +80
Insulation indoor medium	-	oil or SF_6

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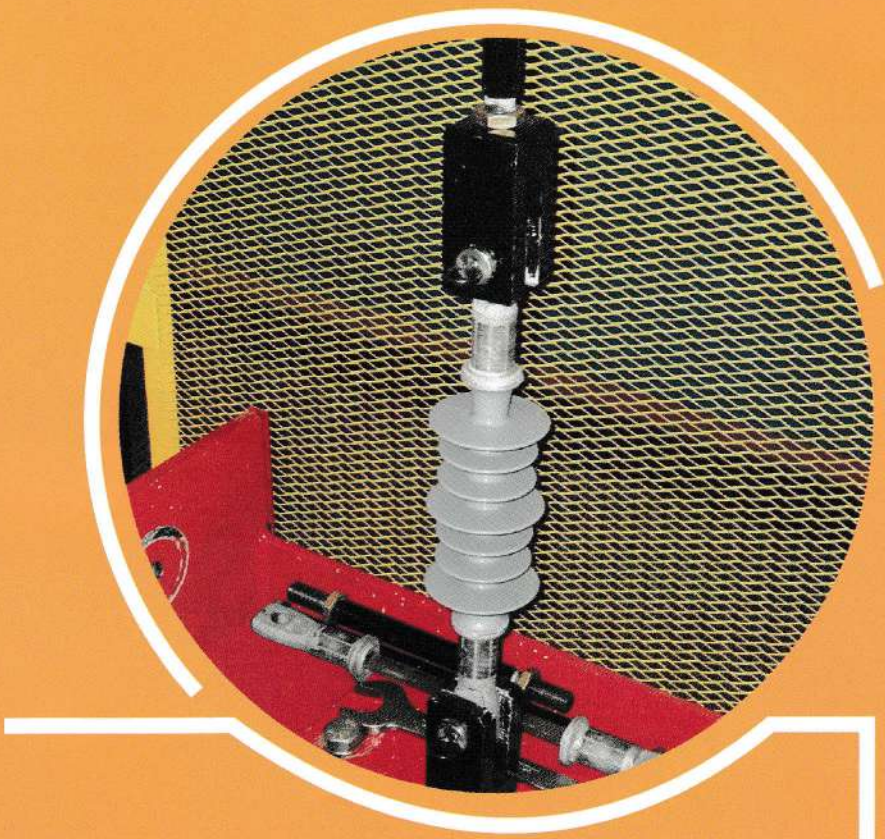
Insulator strings with composite insulators and Tongue-Tongue end-fittings, 20 kV

Chapter 4



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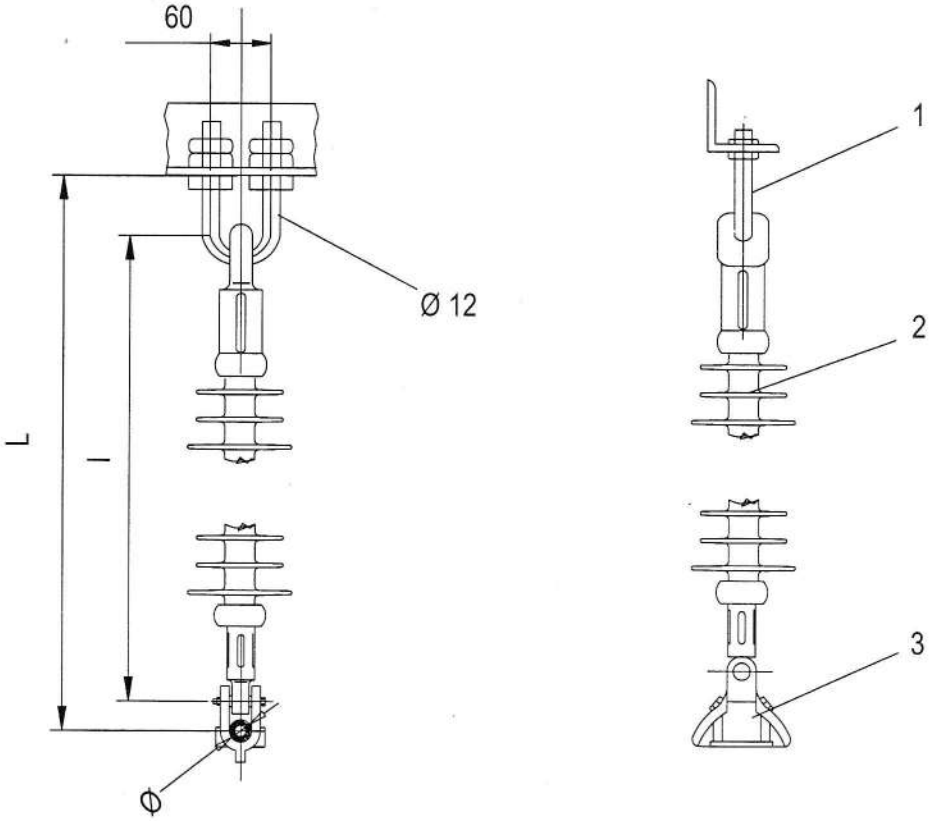
Single suspension string for 20 kV

LSS
70 kN



Component	
1 U - bolt A 2 m	1 pcs.
2 Composite insulator 70 kN, TT	1 pcs.
3 Suspension clamp CSA 2	1 pcs.

Note: If solicited, the strings can be equipped with clamps type CLAMS

Type of insulator	l	L	Ø
CI-20-II-70-TT	380	440	10-15
CI-20-III-70-TT	432	492	10-15
CI-20-IV-70-TT	454	514	10-15

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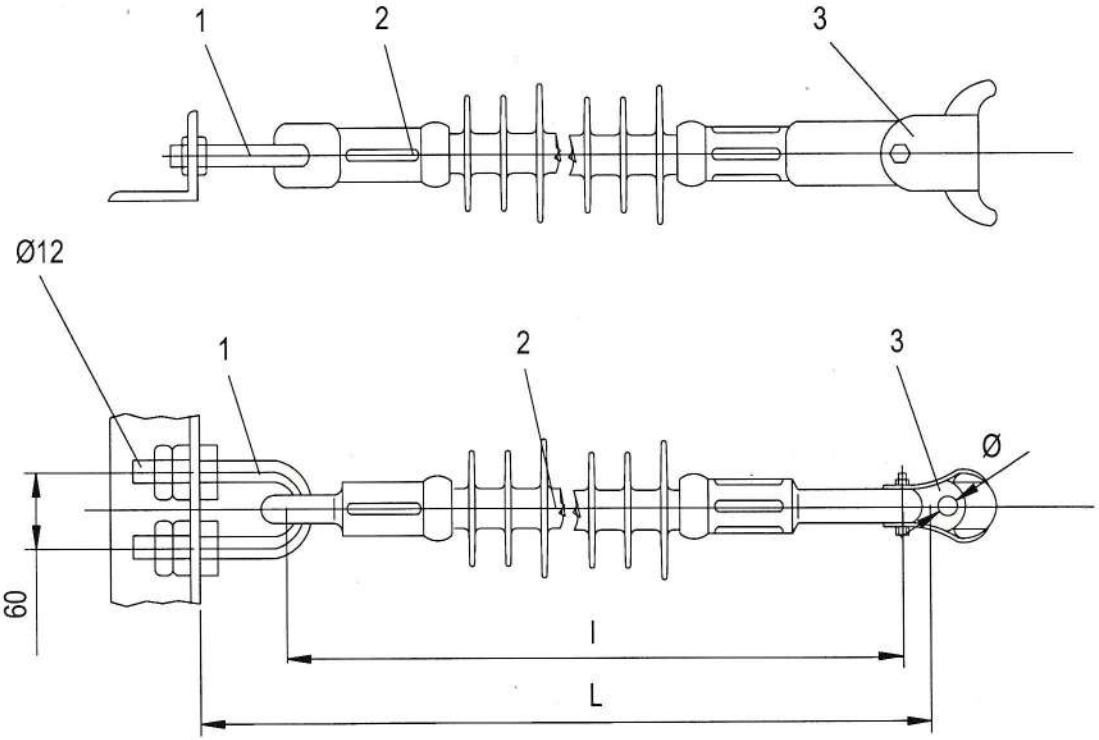
Single tension string for 20 kV

LSI
70 kN



Component

1. U - bolt A 2 m	1 pcs.
2. Composite insulator 70 kN, TT	1 pcs.
3. Tension clamp CTPF 120	1 pcs.

Note: If solicited, the strings can be equipped with clamps type CLAMI

Type of insulator	l	L	Ø
CI-20-II-70-TT	380	517	10-15
CI-20-III-70-TT	432	569	10-15
CI-20-IV-70-TT	454	591	10-15

Note:

When using the insulator string, in the middle, the U bolt A 2 m shall be replaced by a swivel type B1.
For the above presented component part there will be added a grove clamp (CC) and a CLEAL clamp.
Minimal tensile strength 95% UTS.

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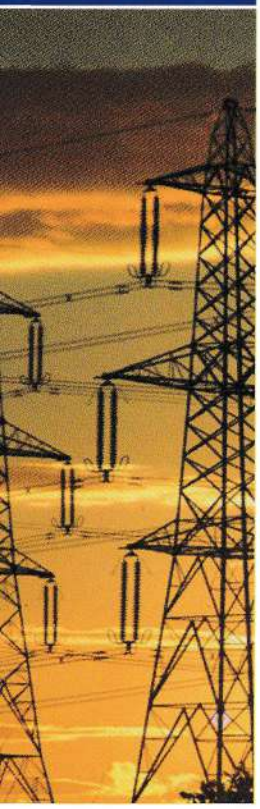

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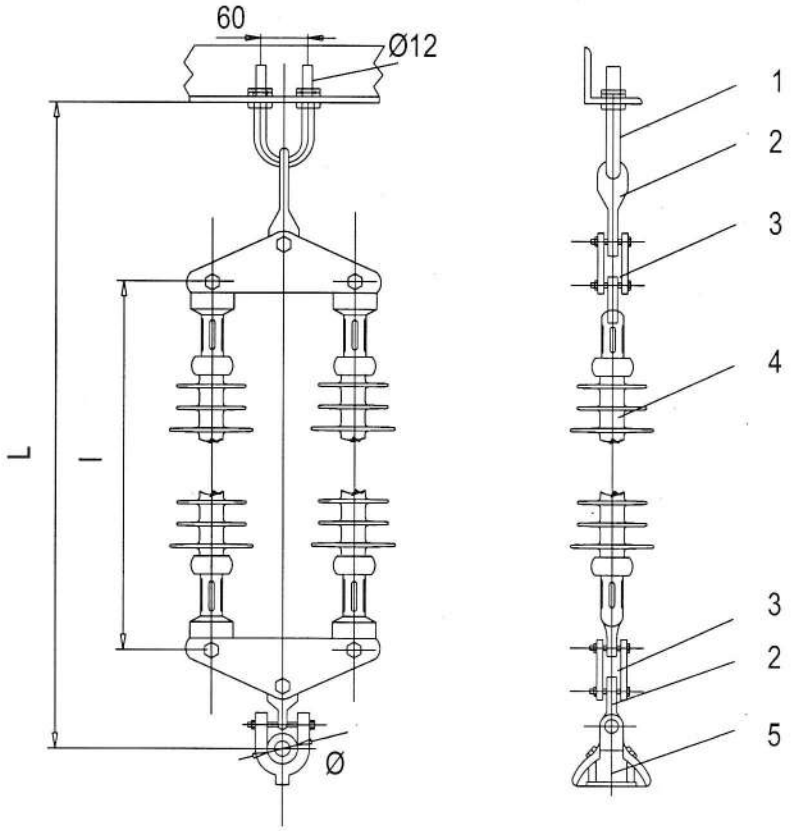
Double suspension string for 20 kV

LDS
70 kN



Component	
1 U - bolt A 2 m	1 pcs.
2 Double twisted eye OD8	2 pcs.
3 Single yoke JS 140/8	2 pcs.
4 Composite insulator 70 kN, TT	2 pcs.
5 Suspension clamp CSA 2	1 pcs.

Note: If solicited, the strings can be equipped with clamps type CLAMS

Insulator type	l	L	Ø
CI-20-II-70-TT	380	700	10-15
CI-20-III-70-TT	432	752	10-15
CI-20-IV-70-TT	454	774	10-15

Composite insulator strings with Tongue-Tongue end-fittings

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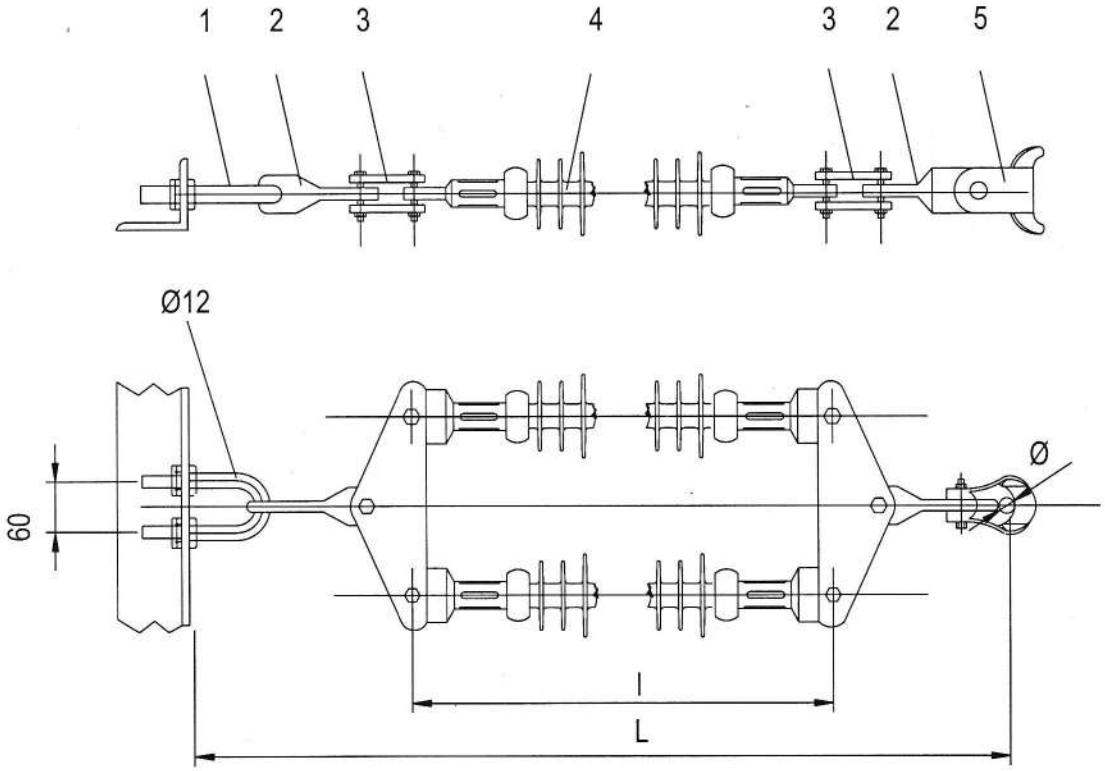
Double tension string for 20 kV

LDI
70 kN



Component	
1 U - bolt A 2 m	1 pcs.
2 Double twisted eye OD8	2 pcs.
3 Single yoke JS 140/8	2 pcs.
4 Composite insulator 70 kN type TT	2 pcs.
5 Tension clamp CTPF 120	1 pcs.

Note: If solicited, the strings can be equipped with clamps type CLAMI

Insulator type	l	L	Ø
CI-20-II-70-TT	380	707	10-15
CI-20-III-70-TT	432	759	10-15
CI-20-IV-70-TT	454	781	10-15

Note:

When using the insulator string, in the middle , the U-bolt A 2 m shall be replaced by a swivel type B 1.
For the above presented component part there will be added a grove clamp(CC) and a CLEAL(LEPC) clamp. Minimal unload tensile strength 95% UTS.

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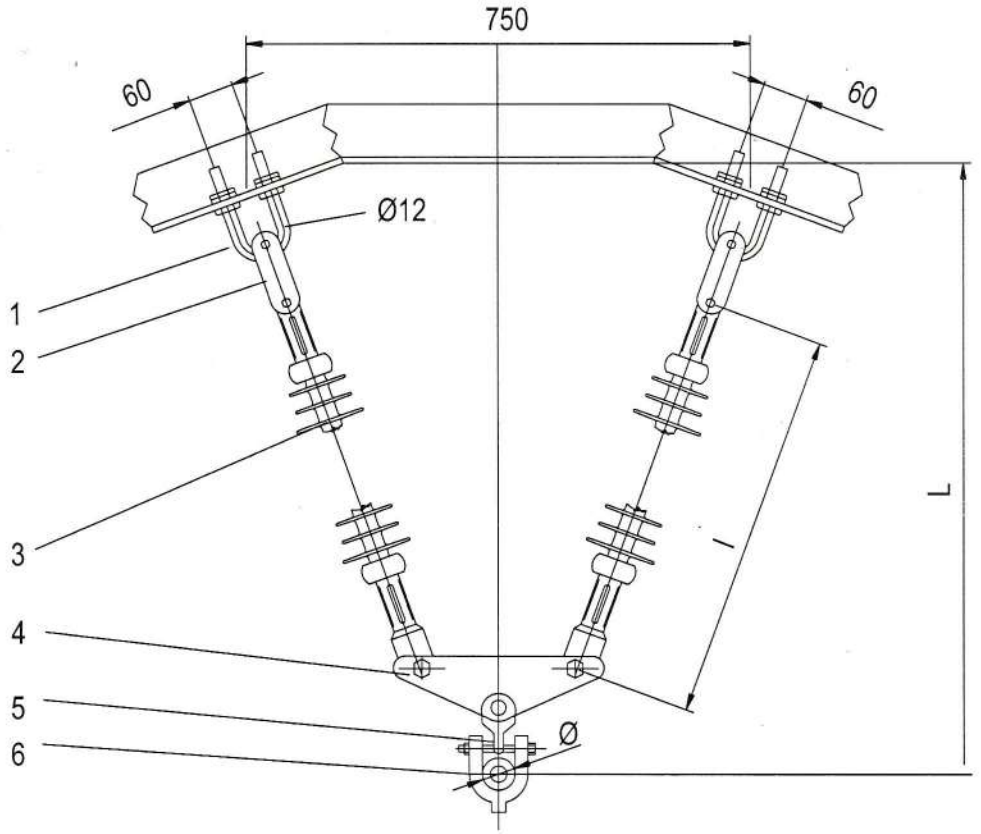
Double "V"suspension string for 20 kV

LDSV
70 kN



Component	
1 U - bolt A 2 m	2 pcs.
2 Double spacing piece PDD 7.5 / 55	2 pcs.
3 Composite insulator 70 kN type TT	2 pcs.
4 Single yoke JS 140/8	1 pcs.
5 Double twisted eye OD 8	1 pcs.
6 Suspension clamp CSA2	1 pcs.

Note: If solicited, the strings can be equipped with clamps type CLAMS

Insulator type	l	L	Ø
CI-20-II-70-TT	380	668	10-15
CI-20-III-70-TT	432	720	10-15
CI-20-IV-70-TT	454	742	10-15

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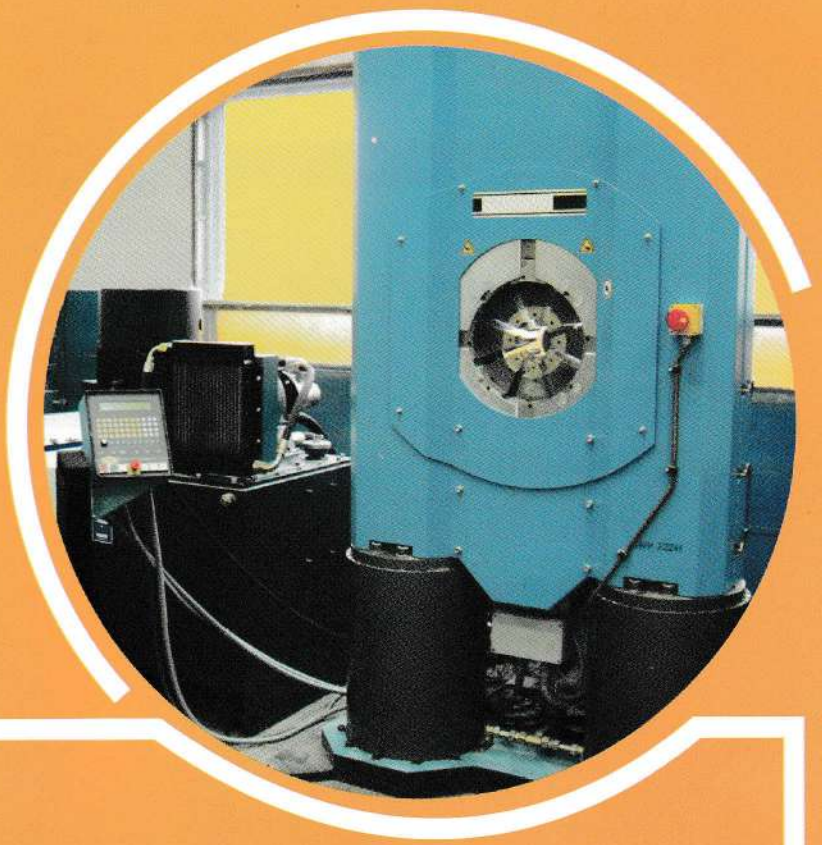
Insulator strings with composite insulators and Tongue-Tongue end-fittings, 110 kV

Chapter 5



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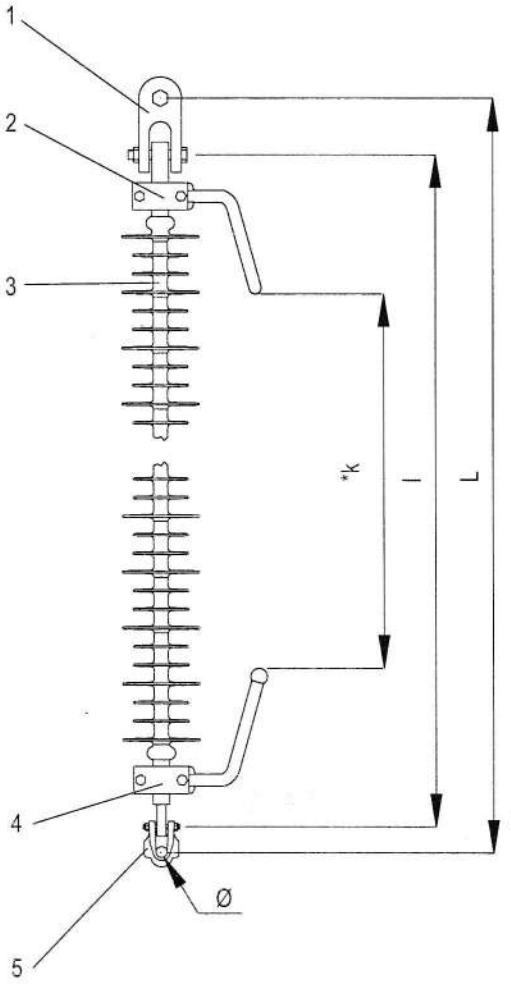
Composite insulator strings with Tongue-Tongue end-fittings

Single suspension string for 110 kV

LSS 70 kN
120 kN
160 kN



No	Component	Unload tensile strength	Quantity
1	Shackle CS4A	160 kN	1 pcs
2	Arcing horn II	-	1 pcs
3	Composite insulator 110 kV ,TT	according to table below	1 pcs
4	Arcing horn I	-	1 pcs
5	Suspension clamp CSA2	90 kN	1 pcs

Insulator type	l	L	Ø
CI-110-II-70-TT	1142	1270	10-15
CI-110-III-70-TT	1210	1338	10-15
CI-110-IV-70-TT	1312	1440	10-15
CI-110-II-120-TT	1232	1360	10-15
CI-110-III-120-TT	1300	1428	10-15
CI-110-IV-120-TT	1402	1530	10-15
CI-110-II-160-TT	1272	1400	10-15
CI-110-III-160-TT	1340	1468	10-15
CI-110-IV-160-TT	1442	1570	10-15

Note : *the spark gap is in conformity with the lightning and switching overloads set by the network designer (beneficiary)

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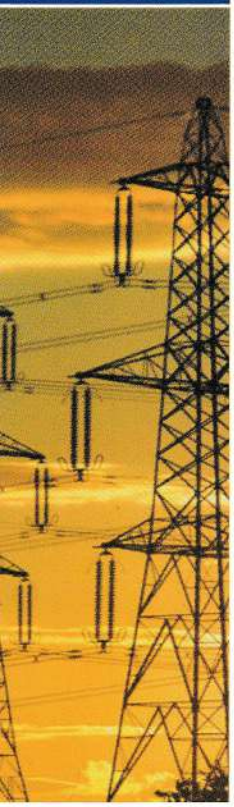
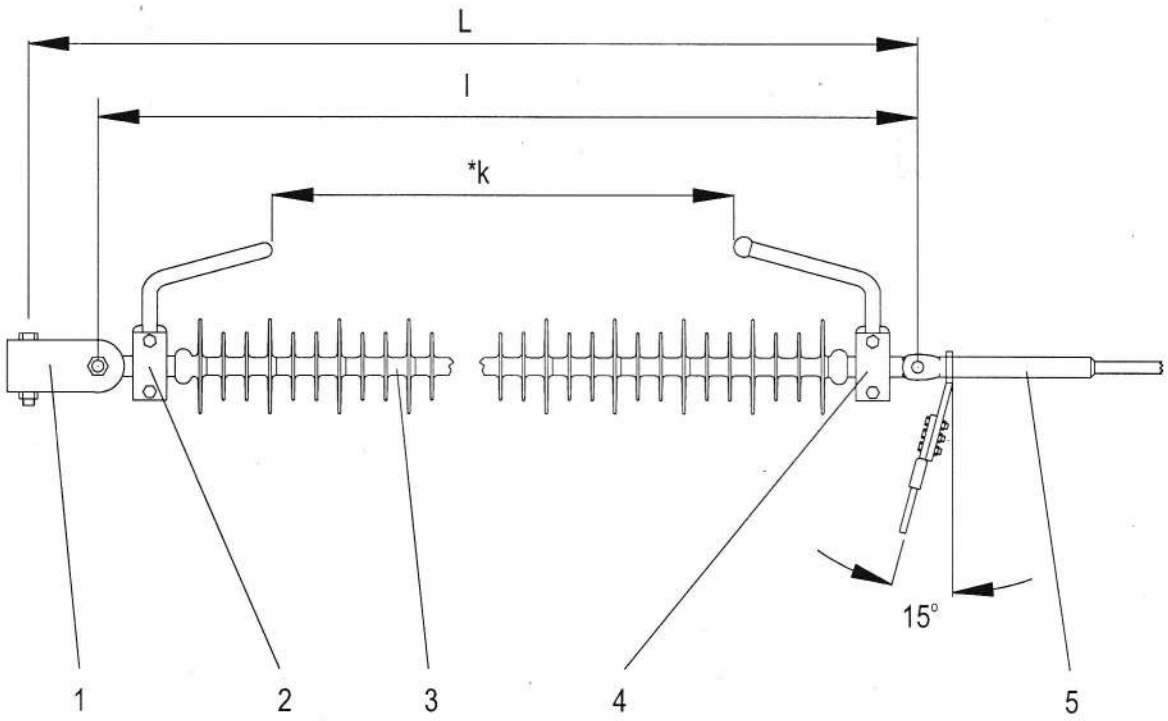


Composite insulator strings with Tongue-Tongue end-fittings

Single tension string for 110 kV

LSI 70 kN
120 kN
160 kN



No	Component	Unload tensile strength	Quantity
1	Swivel B 6,5/16 (B6/16)	160 kN	1 pcs.
2	Arcing horn II	-	1 pcs.
3	Composite insulator 110 kV, TT	according to table below	1 pcs.
4	Arcing horn I	-	1 pcs.
5	Tension clamp TPDFc	95 %UTS	1 pcs.

Insulator type	l	L
CI-110-II-70-TT	1142	1202
CI-110-III-70-TT	1210	1270
CI-110-IV-70-TT	1312	1372
CI-110-II-120-TT	1232	1292
CI-110-III-120-TT	1300	1360
CI-110-IV-120-TT	1402	1462
CI-110-II-160-TT	1272	1332
CI-110-III-160-TT	1340	1400
CI-110-IV-160-TT	1442	1502

Note. : * the spark gap is in conformity with the lightning and switching overloads set by the network designer(beneficiary)

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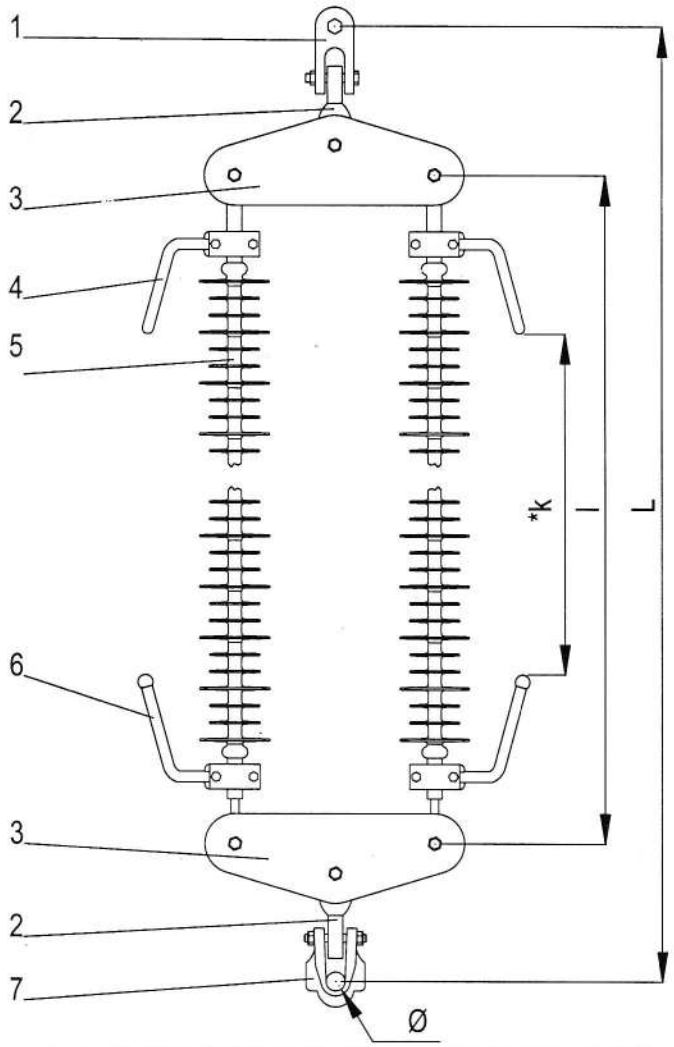
Composite insulator strings with Tongue-Tongue end-fittings

Double suspension string for 110 kV

LDS 70 kN
120 kN
160 kN



No	Component	Unload tensile strength	Quantity
1	Shackle CS4A	160 kN	1 pcs.
2	Double twisted eye OD 16	160 kN	2 pcs.
3	Single yoke JS200/16 (JS250/16)	160 kN	2 pcs.
4	Arcing horn II	-	2 pcs.
5	Composite insulator 110 kV , TT	according to table below	2 pcs.
6	Arcing horn I	-	2 pcs.
7	Suspension clamp CSA2	90 kN	1 pcs.

Insulator type	l	L	Ø
CI-110-II-70-TT	1142	1570	15-21
CI-110-III-70-TT	1210	1638	15-21
CI-110-IV-70-TT	1312	1740	15-21
CI-110-II-120-TT	1232	1660	15-21
CI-110-III-120-TT	1300	1728	15-21
CI-110-IV-120-TT	1402	1830	15-21
CI-110-II-160-TT	1272	1700	15-21
CI-110-III-160-TT	1340	1768	10-15
CI-110-IV-160-TT	1442	1870	10-15

Note. : * the spark gap is in conformity with the lightning and switching overloads set by the network designer(beneficiary)

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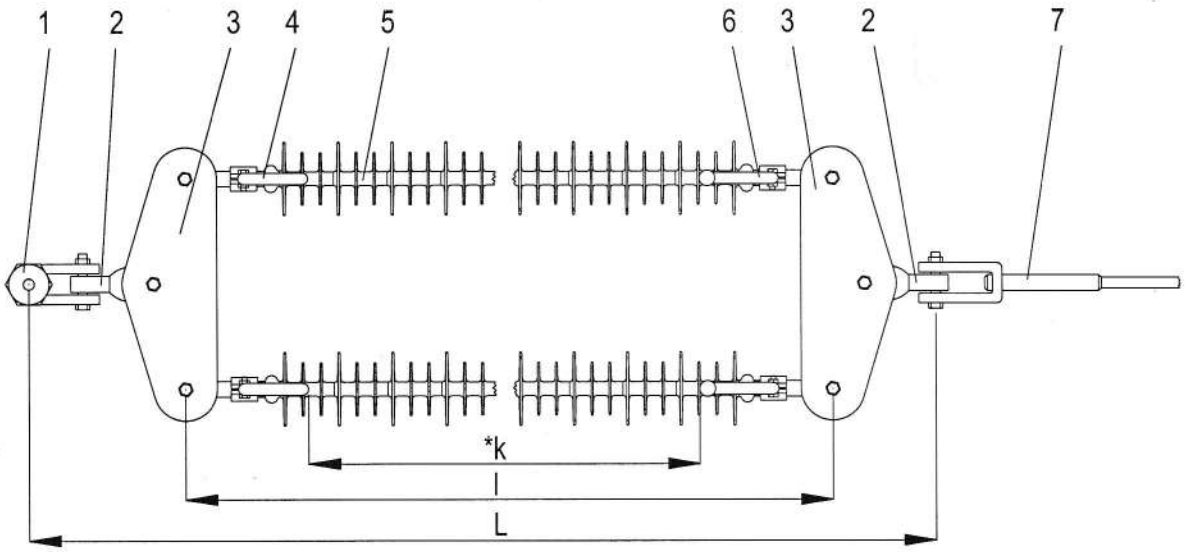
Composite insulator strings with Tongue-Tongue end-fittings

Double tension string for 110 kV

LDI 70 kN
120 kN
160 kN



No	Component	Unload tensile strength	Quantity
1	Swivel B 6,5/16(B8/16)	160 kN	1 pcs.
2	Double twisted eye OD 16	160 kN	2 pcs.
3	Single yoke JS200/16 (JS250/16)	160 kN	2 pcs.
4	Arcing horn II	-	2 pcs.
5	Composite insulator 110 kV , TT	according to table below	2 pcs.
6	Arcing horn I	-	2 pcs.
7	Tension clamp TPDFc	95% UTS	1 pcs.

Insulator type	l	L
CI-110-II-70-TT	1142	1502
CI-110-III-70-TT	1210	1570
CI-110-IV-70-TT	1312	1672
CI-110-II-120-TT	1232	1592
CI-110-III-120-TT	1300	1660
CI-110-IV-120-TT	1402	1762
CI-110-II-160-TT	1272	1632
CI-110-III-160-TT	1340	1700
CI-110-IV-160-TT	1442	1802

Note. : * the spark gap is in conformity with the lightning and switching overloads set by the network designer(beneficiary)

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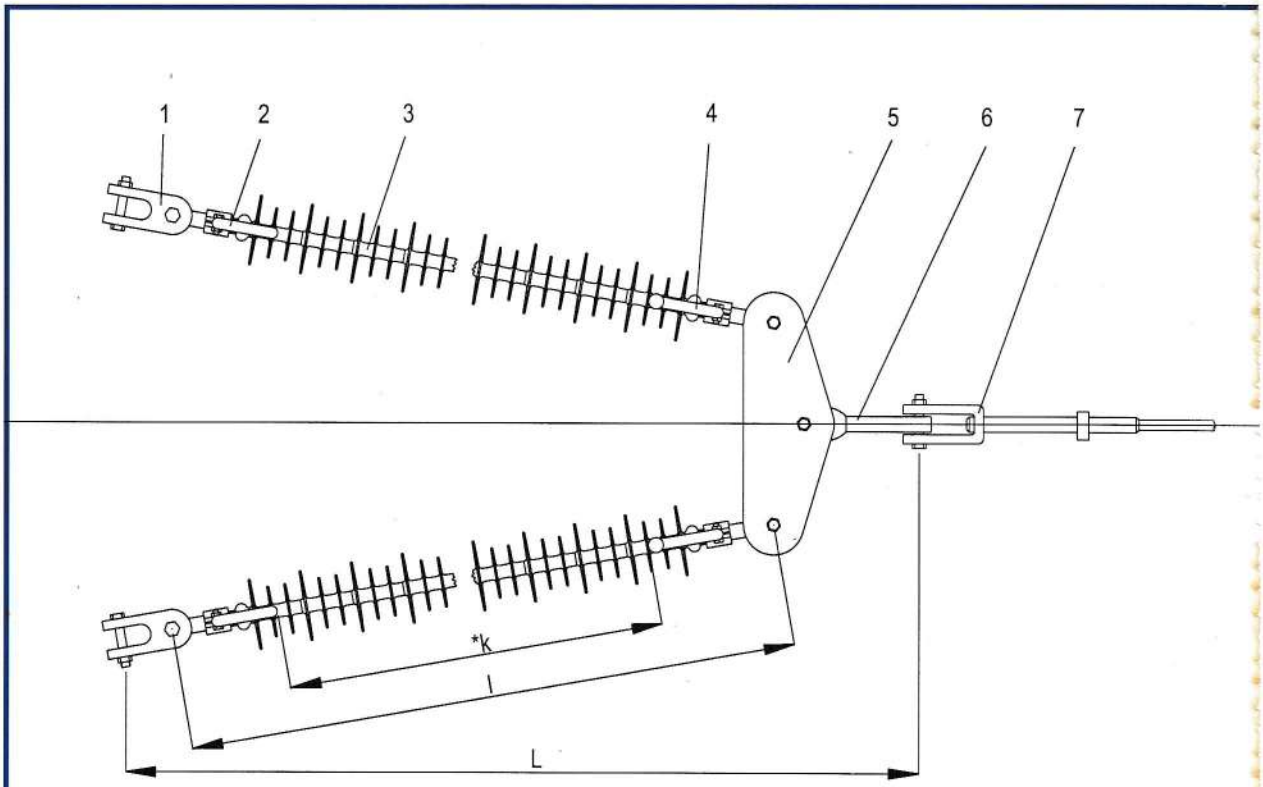
Composite insulator strings with Tongue-Tongue end-fittings

Double "V" tension string without turnbuckle 110 kV

LDIV 70 kN
120 kN
160 kN



No	Component	Unload tensile strength	Quantity
1	Shackle CS4A	160 kN	2 pcs.
2	Arcing horn II	-	2 pcs.
3	Composite insulator 110 kN, TT	according to table below	2 pcs.
4	Arcing horn I	-	2 pcs.
5	Single yoke JS200/16 (JS250/16)	160 kN	1 pcs.
6	Double twisted eye OD 16	160 kN	1 pcs.
7	Tension clamp TPDFc	95% UTS	1 pcs.

Insulator type	l	L
CI-110-II-70-TT	1142	1349
CI-110-III-70-TT	1210	1417
CI-110-IV-70-TT	1312	1519
CI-110-II-120-TT	1232	1439
CI-110-III-120-TT	1300	1507
CI-110-IV-120-TT	1402	1609
CI-110-II-160-TT	1272	1479
CI-110-III-160-TT	1340	1547
CI-110-IV-160-TT	1442	1649

Note. : * the spark gap is in conformity with the lightning and switching overloads set by the network designer(beneficiary)

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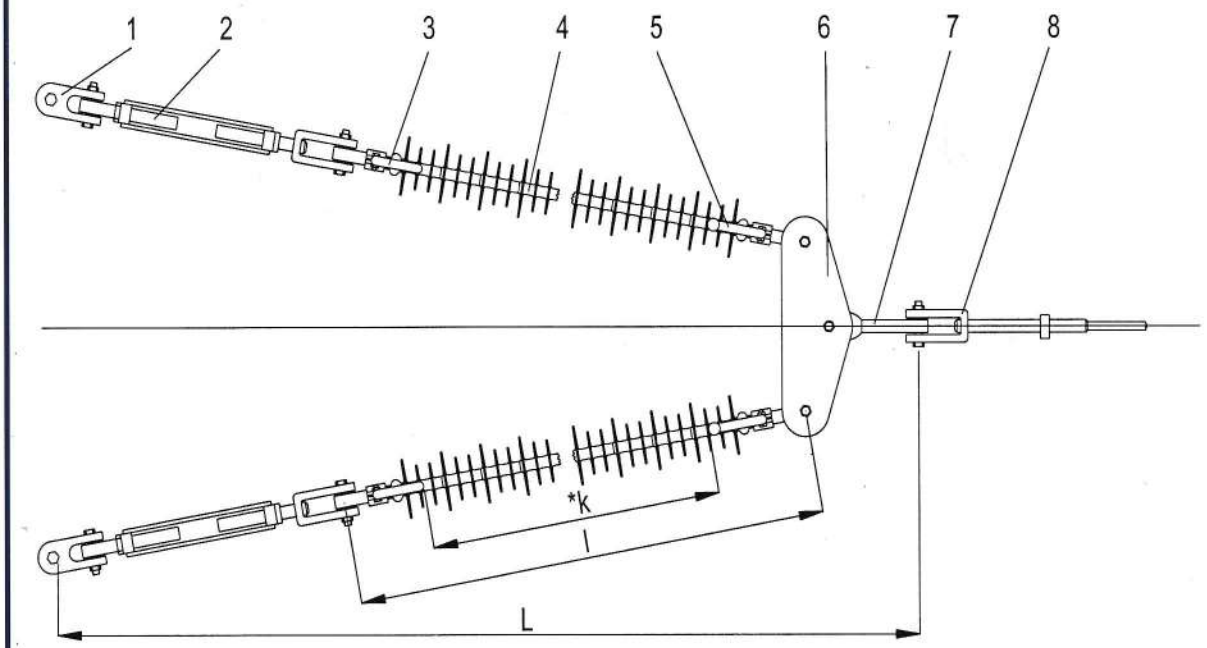
Composite insulator strings with Tongue-Tongue end-fittings

Double "V" tension string with turnbuckle 110 kV

LDIV 70 kN
120 kN
160 kN



No	Component	Unload tensile strength	Quantity
1	Shackle CS4A	160 kN	2 pcs.
2	Turnbuckle IROF 12	120 kN	2 pcs.
3	Arcing horn II	-	2 pcs.
4	Composite insulator 110 kN, TT	according to table below	2 pcs.
5	Arcing horn I	-	2 pcs.
6	Single yoke JS200/16 (JS250/16)	160 kN	1 pcs.
7	Doble twisted eye OD 16	160 kN	1 pcs.
8	Tension clamp TPDFc	95% UTS	1 pcs.

Insulator type	l	L
CI-110-II-70-TT	1142	1946
CI-110-III-70-TT	1210	2014
CI-110-IV-70-TT	1312	2116
CI-110-II-120-TT	1232	2034
CI-110-III-120-TT	1300	2102
CI-110-IV-120-TT	1402	2204
CI-110-II-160-TT	1272	2075
CI-110-III-160-TT	1340	2143
CI-110-IV-160-TT	1442	2245

Note. : * the spark gap is in conformity with the lightning and switching overloads set by the network designer(beneficiary)

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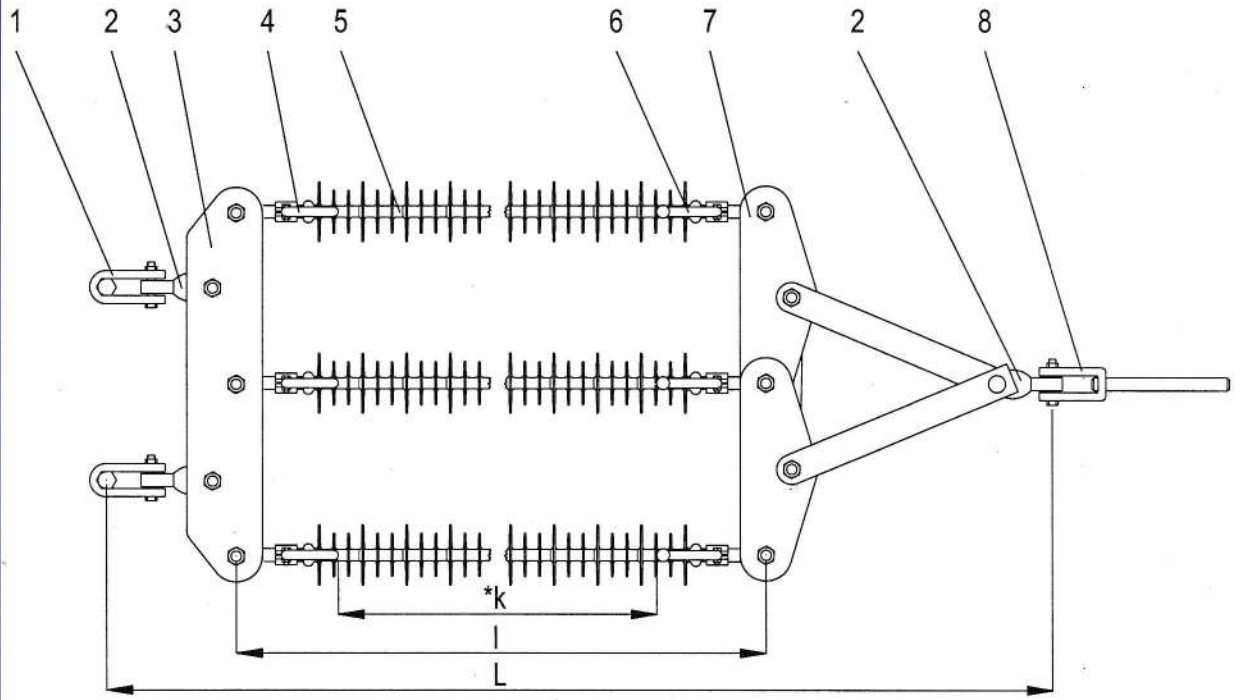
Composite insulator strings with Tongue-Tongue end-fittings

Triple tension string for 110 kV

LTI 70 kN
120 kN
160 kN



No	Component	Unload tensile strength	Quantity
1	Swivel B 6,5/16 (B8/16)	160 kN	2 pcs.
2	Double twisted eye OD16	160 kN	2 pcs.
3	Double yoke JD 1000/500-30	300 kN	1 pcs.
4	Arcing horn II	-	3 pcs.
5	Composite insulator 110 kN, TT	according to table below	3 pcs.
6	Arcing horn I	-	3 pcs.
7	Device for triple insulator string DLT 25 M	250	1 pcs.
8	Tension clamp TPDFc	95% UTS	1 pcs.

Insulator type	l	L
CI-110-II-70-TT	*1142*	*2102*
CI-110-III-70-TT	1210	2170
CI-110-IV-70-TT	1312	2272
CI-110-II-120-TT	1232	2192
CI-110-III-120-TT	1300	2260
CI-110-IV-120-TT	1402	2362
CI-110-II-160-TT	1272	2232
CI-110-III-160-TT	1340	2300
CI-110-IV-160-TT	1442	2402

Note. : * the spark gap is in conformity with the lightning and switching overloads set by the network designer(beneficiary)

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Insulator strings with composite insulators and Tongue-Tongue end-fittings, 220 kV

Chapter 6

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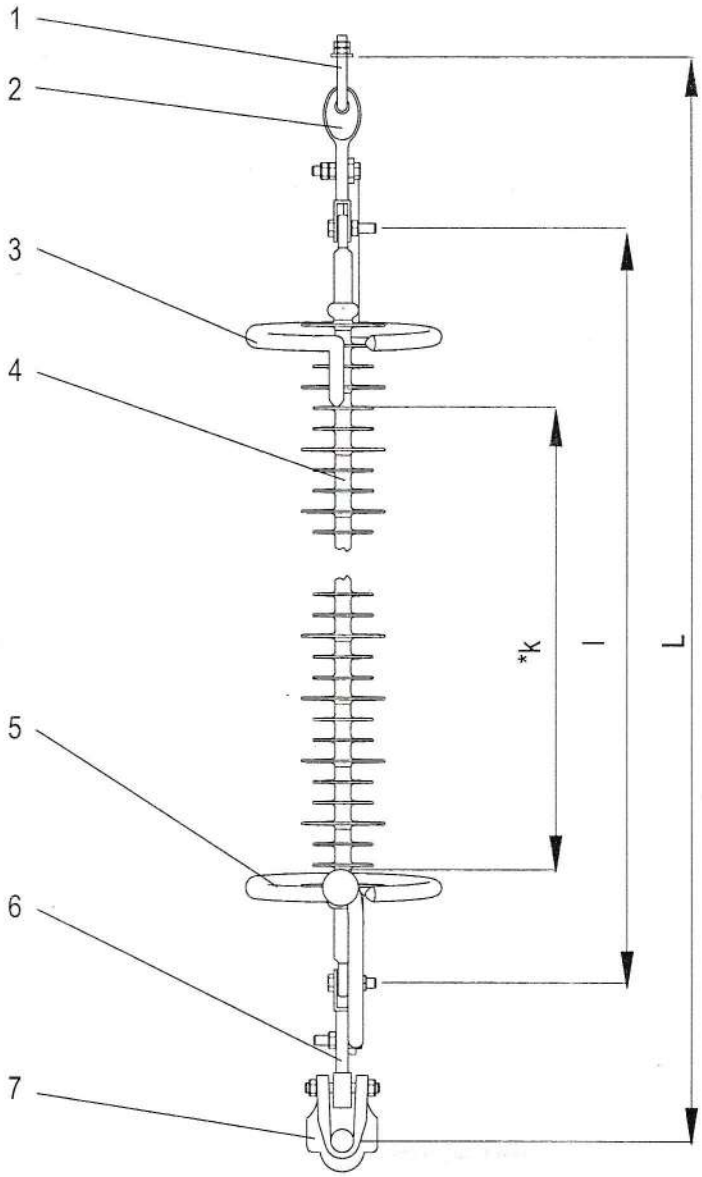
Single suspension string, variant A 220 kV

LSS
120 kN
160 kN



Area	II	II
SML (kN)	120	160
l	2150	2190
L	2650	2670
Guarding rings type	IPS-3-TT IPI-2-TT	IPS-2-TT IPI-3-TT

Area	III	III	IV	IV
SML (kN)	120	160	120	160
l	2252	2292	2276	2316
L	2752	2772	2776	2796
Guarding rings type	IPS-1-TT IPI-1-TT	IPS-15-TT IPI-3-TT	IPS-15-TT IPI-3-TT	IPS-11-TT IPI-1-TT

Composite insulator strings with Tongue-Tongue end-fittings

No	Component	Quantity (pcs.)	Material	Designation
1	Shackle A	1	Zn-steel	A**, 120/160 kN
2	Clevis eye	1	Zn-steel	FORS 12(16) 120/160 kN
3	Upper guarding ring	1	Zn-steel	IPS
4	Composite insulator, 220 kV	1	Silicone rubber	CI-220-II-120/160-TT CI-220-III-120/160-TT CI-220-IV-120/160-TT
5	Bottom guarding ring	1	Zn-steel	IPI
6	Clevis eye	1	Zn-steel	FODSG 12(16)/43 , 120/160 kN
7	Suspension clamp	1	Aluminum alloy	CSA 4

Note :

* the spark gap is in conformity with the lightning and switching overloads set by the network designer(beneficiary)
**the dimension of the hook vary depending on the pole or land type.

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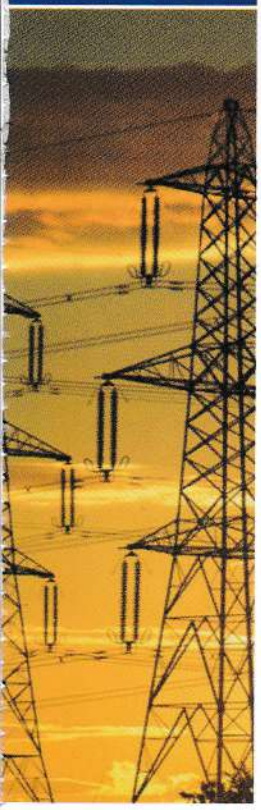
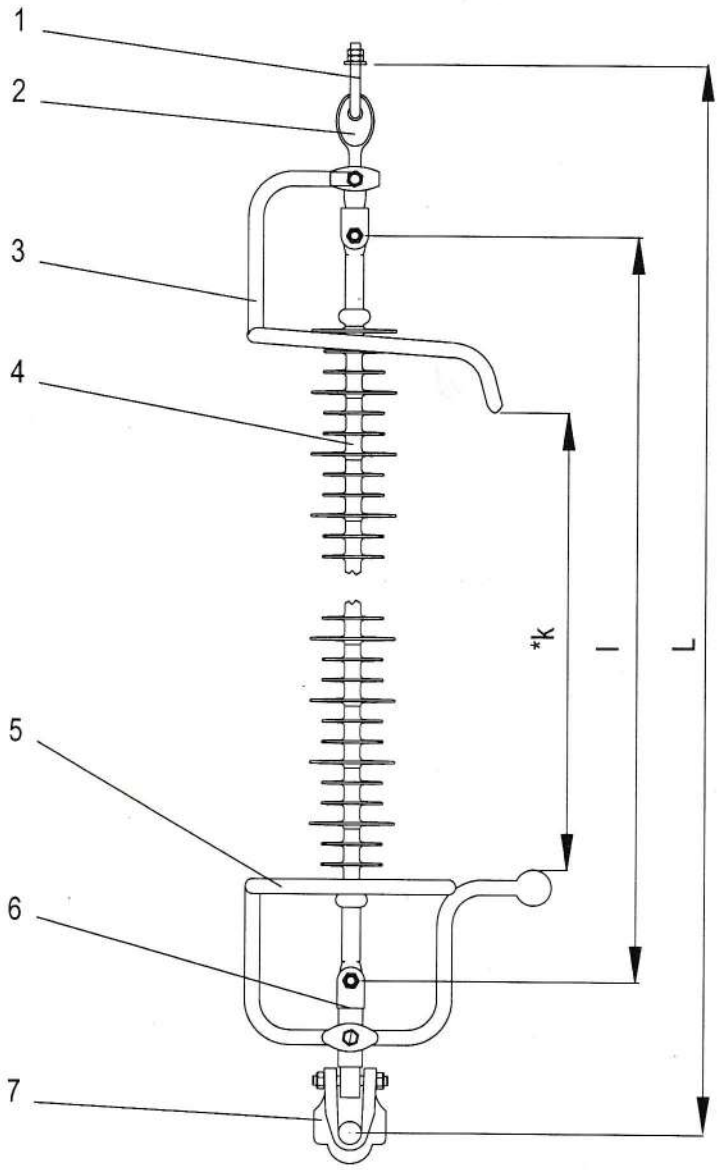


Single suspension string variant B 220 kV

LSS
120 kN
160 kN



Area	II	II	III	III
SML (kN)	120	160	120	160
l	2150	2190	2252	2292
L	2650	2670	2752	2772
Guarding Rings type	IPS-3-TT IPI-2-TT	IPS-2-TT IPI-3-TT	IPS-1-TT IPI-1-TT	IPS-15-TT IPI-3-TT

Area	IV	IV
SML (kN)	120	160
l	2276	2316
L	2776	2796
Guarding Rings type	IPS-15-TT IPI-3-TT	IPS-11-TT IPI-1-TT

Composite insulator strings with Tongue-Tongue end-fittings

No	Component	Quantity(Pcs.)	Material	Designation
1	Shackle A	1.	Zn-steel	A**, 120/160 kN
2	Clevis eye	1	Zn-steel	FODS 12(16) 120/160 kN
3	Upper guarding ring	1	Zn-steel	IPS
4	Composite insulator, 220 kV	1	Silicone rubber	CI-220-II-120/160-TT CI-220-III-120/160-TT CI-220-IV-120/160-TT
5	Bottom guarding ring	1	Zn-steel	IPI
6	Clevis eye	1	Zn-steel	FORSG 12(16)/43 , 120/160 kN
7	Suspension clamp	1	Aluminum alloy	CSA 4

Note :

* the spark gap is in conformity with the lightning and switching overloads set by the network designer(beneficiary)
**the dimension of the hook vary depending on the pole or land type.

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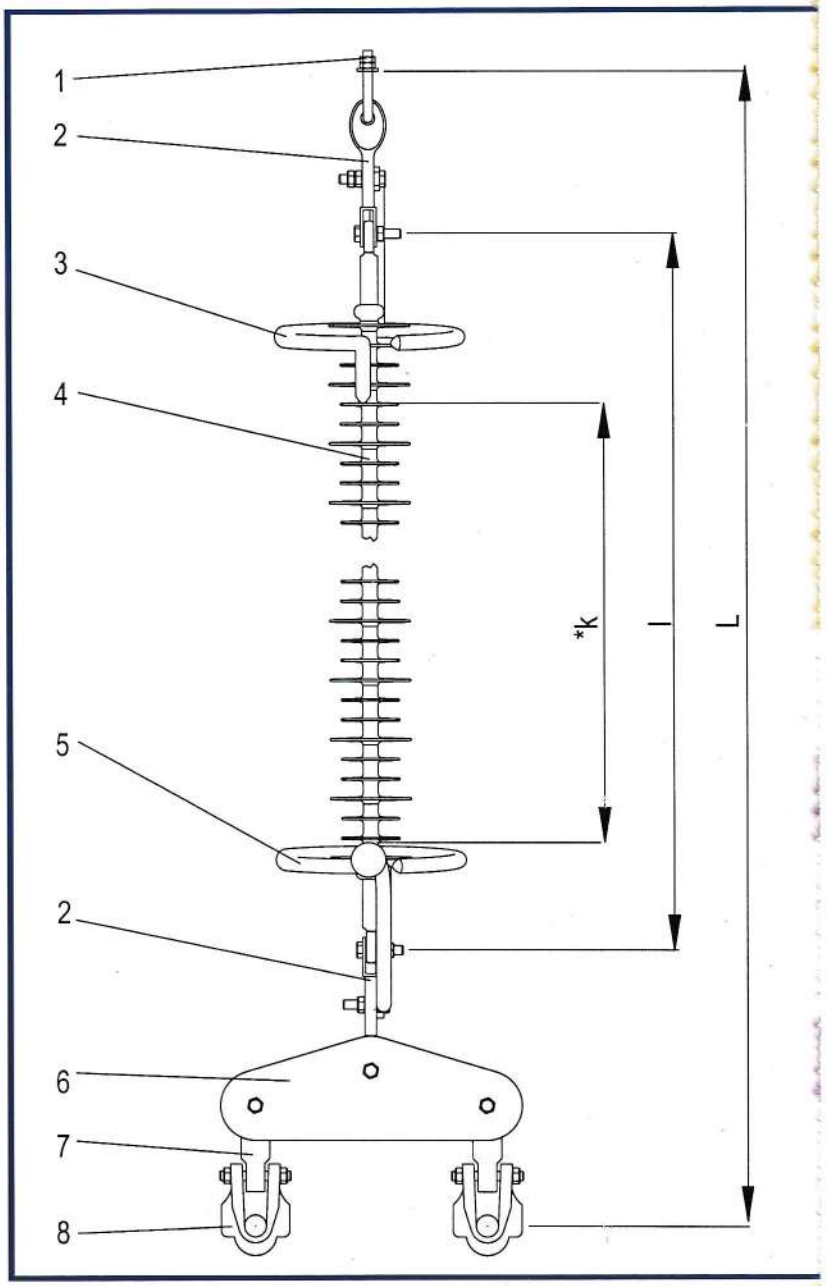
Single suspension string, variant A, two conductors per phase 220 kV

LSS
120 kN
160 kN



Area	II	II	III	III
SML (kN)	120	160	120	160
l (mm)	2150	2190	2252	2292
L (mm)	2760	2760	2862	2862
Guarding	IPS-3-TT	IPS-3-TT	IPS-1-TT	IPS-1-TT
Rings type	IP-2-TT	IPI-2-TT	IPI-1-TT	IPI-1-TT

Area	IV	IV
SML (kN)	120	160
l (mm)	2276	2316
L (mm)	2886	2886
Guarding	IPS-15-TT	IPS-15-TT
Rings type	IPI-3-TT	IPI-3-TT

Composite insulator strings with Tongue-Tongue end-fittings

Pos.	Component	Quantity (Pcs.)	Material	Designation
1	U - bolt	1	Zn-steel	A**, 120/160 kN
2	Clevis eye	2	Zn-steel	FORS-12(16) , 120/160 kN
3	Upper guarding ring	1	Zn-steel	IPS
4	Composite insulator, 220 kV	1	Silicon rubber	CI-220-II-120/160-TT CI-220-III-120/160-TT CI-220-IV-120/160-TT
5	Bottom guarding ring	1	Zn-steel	IPI
6	Single yoke	1	Zn-steel	Js 400/12(16) , 120/160 kN
7	Double twisted piece	2	Zn-steel	PR 43 , 120 kN
8	Suspension clamp	2	Aluminum alloy	CSA 4, 120 kN

Note :

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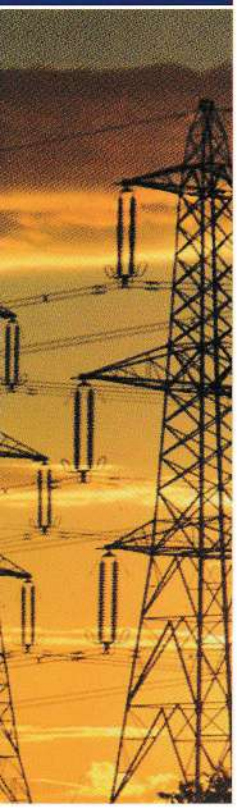
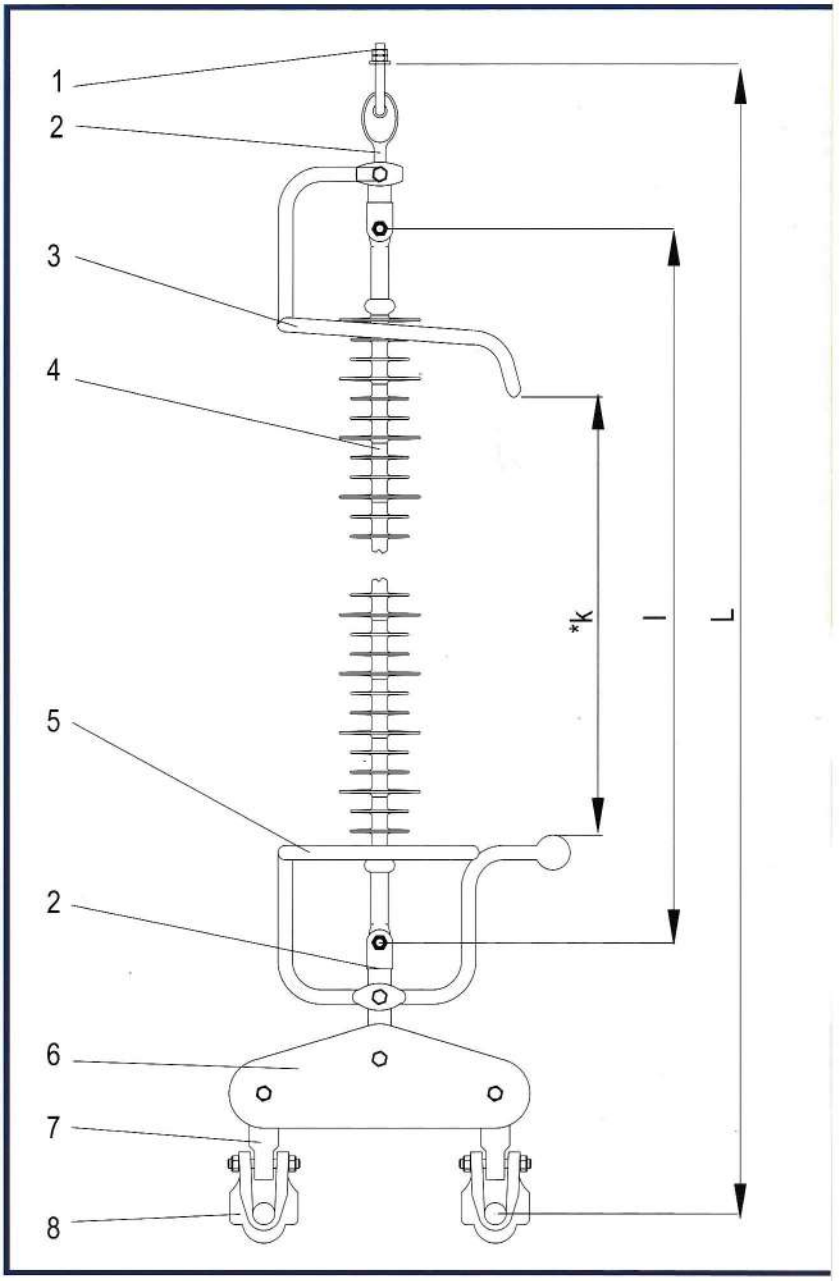


Single suspension string, variant B, two conductors per phase 220 kV

LSS
120 kN
160 kN



Area	II	II	III	III
SML (kN)	120	160	120	160
l (mm)	2150	2190	2252	2292
L (mm)	2740	2780	2842	2882
Guarding	IPS-3-TT	IPS-7-TT	IPS-1-TT	IPS-4-TT
Rings type	IPI-2-TT	IPI-1-TT	IPI-1-TT	IPI-3-TT

Area	IV	IV
SML (kN)	120	160
l (mm)	2276	2316
L (mm)	2866	2906
Guarding	IPS-15-TT	IPS-15-TT
Rings type	IPI-3-TT	IPI-1-TT

Composite insulator strings with Tongue-Tongue end-fittings

No	Component	Quantity (Pcs.)	Material	Designation
1	U - bolt	1	Zn-steel	A**, 120/160 kN
2	Clevis eye	2	Zn-steel	FODS-12(16) , 120/160 kN
3	Upper guarding ring	1	Zn-steel	IPS
4	Composite insulator, 220 kV	1	Silicone rubber	CI-220-II-120/160-TT CI-220-III-120/160-TT CI-220-IV-120/160-TT
5	Bottom guarding ring	1	Zn-steel	IPI
6	Single yoke	1	Zn-steel	Js 400/12(16) , 120/160 kN
7	Double twisted piece	2	Zn-steel	PR 43 , 120 kN
8	Suspension clamp	2	Aluminum alloy	CSA 4, 120 kN

Note :

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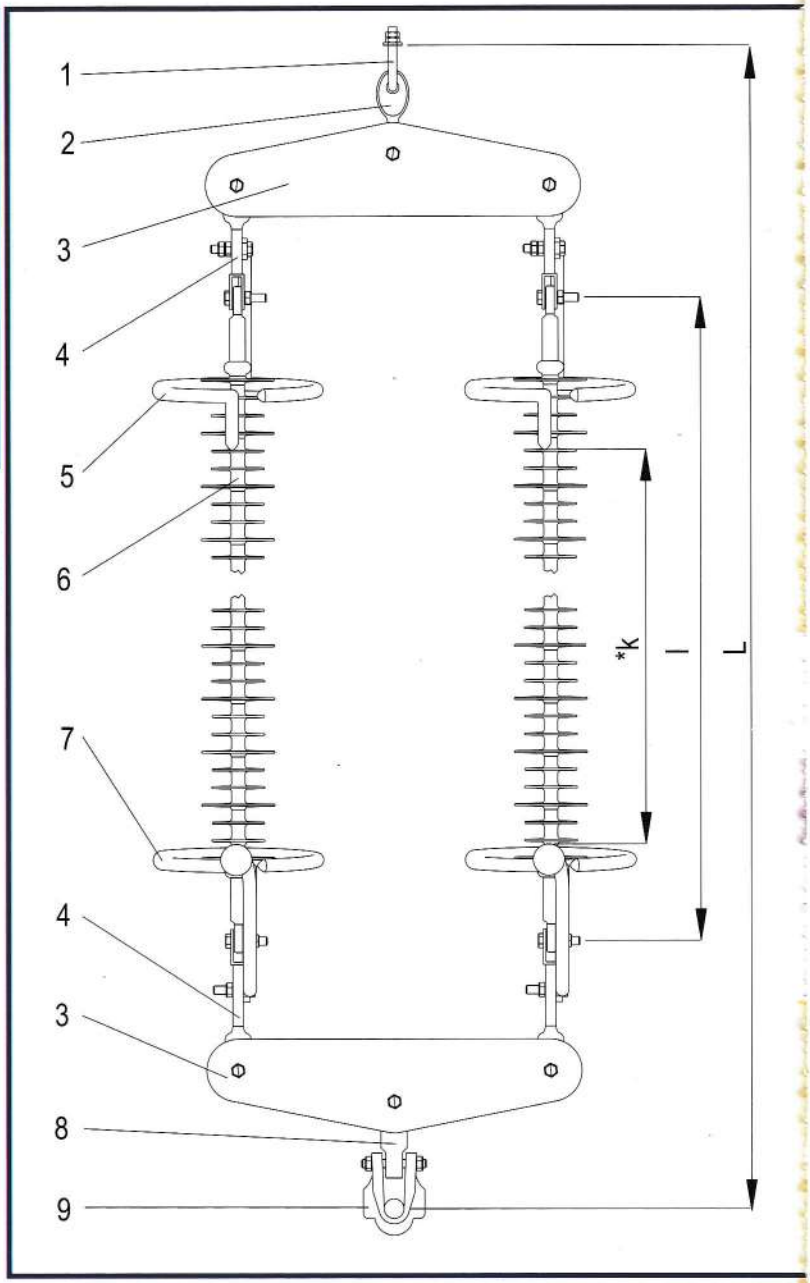
Double suspension string variant A 220 kV

LDS
120 kN



Area	II	III	IV
SML (kN)	120	120	120
l (mm)	2150	2252	2276
L (mm)	2990	3092	3116
Guarding Rings type	IPS-3-TT IPI-2-TT	IPS-1-TT IPI-1-TT	IPS-15-TT IPI-3-TT

Composite insulator strings with Tongue-Tongue end-fittings

No	Component	Quantity (Pcs.)	Material	Designation
1	U - bolt	1	Zn-steel	A **, 160 kN
2	Extension piece	1	Zn-steel	PD-16, 160 kN
3	Single yoke	2	Zn-steel	Js 500/16, 160 kN
4	Clevis twisted eye	4	Zn-forged steel	FORS 120 kN
5	Upper guarding ring	2	Zn-steel	IPS
6	Composite insulator, 220 kV	2	Silicone rubber	CI-220-II-120-TT CI-220-III-120-TT CI-220-IV-120-TT
7	Bottom guarding ring	2	Zn-steel	IPI
8	Double twisted piece	1	Zn-steel	PR-43, 120 kN
9	Suspension clamp	1	Aluminum alloy	CSA 4, 120 kN

Note :

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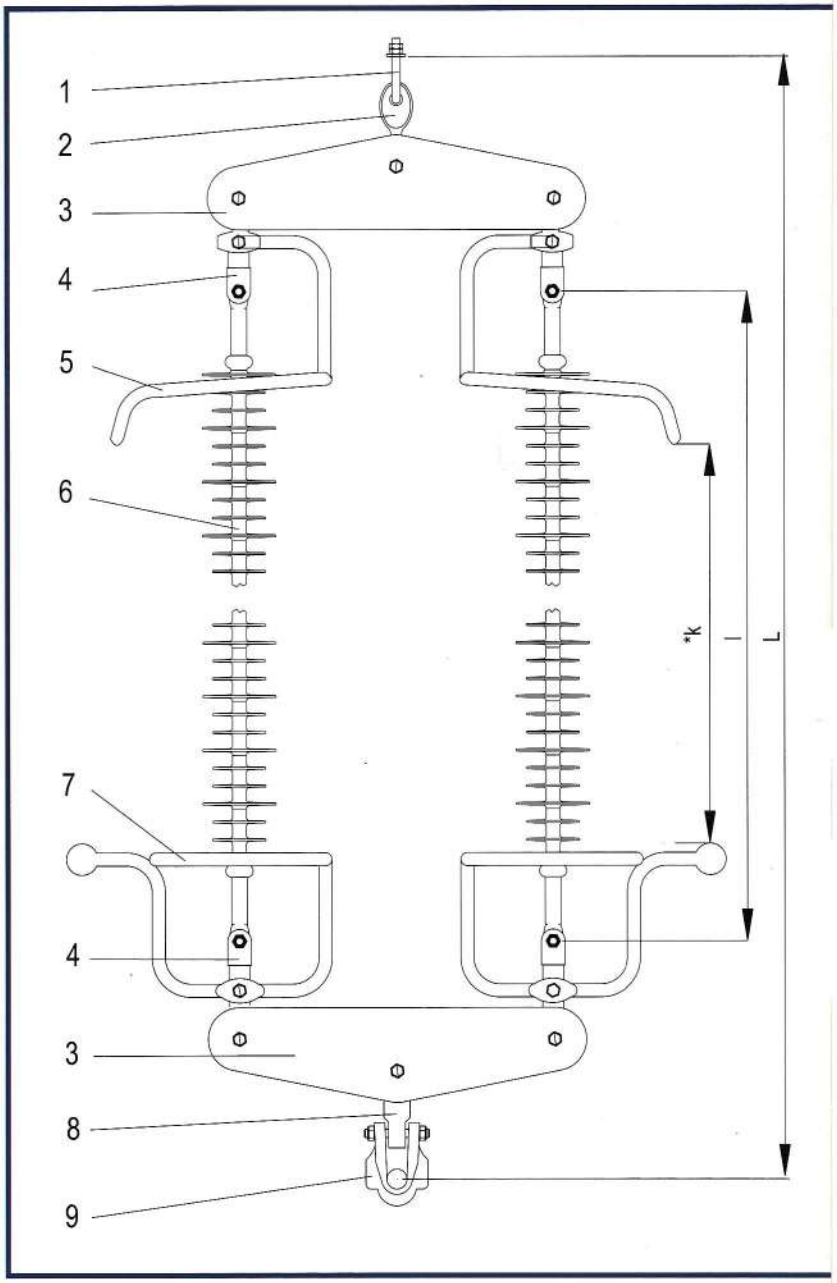
Double suspension string variant B 220 kV

LDS
120 kN



Area	II	III	IV
SML (kN)	120	120	120
l (mm)	2150	2252	2276
L (mm)	2950	3052	3076
Guarding Rings type	IPS-3-TT IPI-2-TT	IPS-1-TT IPI-1-TT	IPS-15-TT IPI-3-TT

Composite insulator strings with Tongue-Tongue end-fittings

No	Component	Quantity (Pcs.)	Material	Designation
1	U - bolt	1	Zn-steel	A**, 160 kN
2	Extension piece	1	Zn-steel	PD-16, 160 kN
3	Single yoke	2	Zn-steel	Js 500/16, 160 kN
4	Clevis straight eye	4	Zn-steel	FODS-12, 120 kN
5	Upper guarding ring	2	Zn-steel	IPS
6	Composite insulator, 220 kV	2	Silicone rubber	CI-220-II-120-TT CI-220-III-120-TT CI-220-IV-120-TT
7	Bottom guarding ring	2	Zn-steel	IPI
8	Double twisted piece	1	Zn-steel	PR-43, 120 kN
9	Suspension clamp	1	Aluminum alloy	CSA 4, 120 kN

Note :

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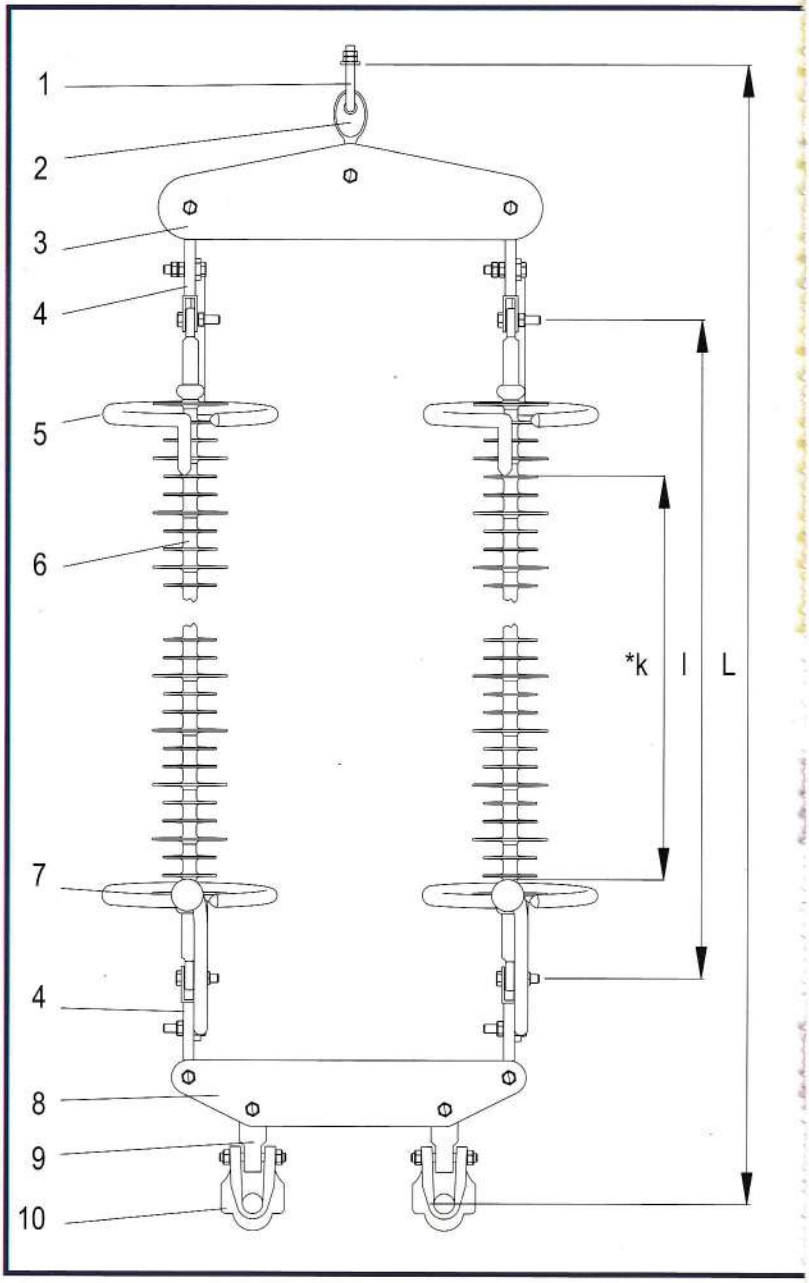
Double suspension string, variant A, two conductors per phase 220 kV

LDS
120 kN
160 kN



Area	II	II	III	III
SML (kN)	120	160	120	160
l (mm)	2150	2190	2252	2292
L (mm)	2930	2970	3030	3072
Guarding rings type	IPS-3-TT IPI-2-TT	IPS-7-TT IPI-1-TT	IPS-1-TT IPI-1-TT	IPS-4-TT IPI-3-TT

Area	IV	IV
SML (kN)	120	160
l (mm)	2276	2316
L (mm)	3056	3096
Guarding Rings type	IPS-15-TT IPI-3-TT	IPS-15-TT IPI-1-TT

Composite insulator strings with Tongue-Tongue end-fittings

No	Component	Quantity (Pcs.)	Material	Designation
1	U - bolt	1	Zn-steel	A**, 200 kN
2	Extension piece	1	Zn-steel	PD-20, 200 kN
3	Single yoke	1	Zn-steel	Js 500/20, 200 kN
4	Clevis twisted eye	4	Zn-steel	FORS-12(16), 120(160) kN
5	Upper guarding ring	2	Zn-steel	IPS
6	Composite insulator, 220 kV	2	Silicone rubber	CI-220-II-120/160-TT CI-220-III-120/160-TT CI-220-IV-120/160-TT
7	Bottom guarding ring	2	Zn-steel	IPI
8	Double yoke	1	Zn-steel	Jd 500/400-24, 240 kN
9	Double twisted piece	2	Zn-steel	PR-43, 120 kN
10	Suspension clamp	2	Aluminum alloy	CSA 4, 120 kN

Note :

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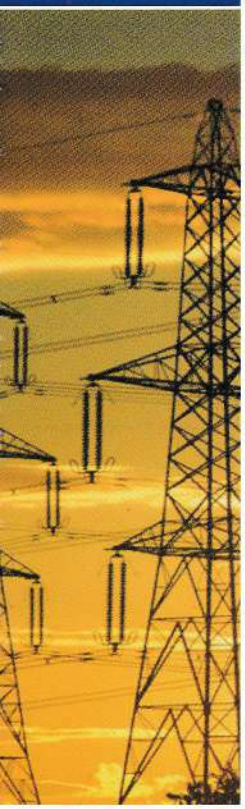
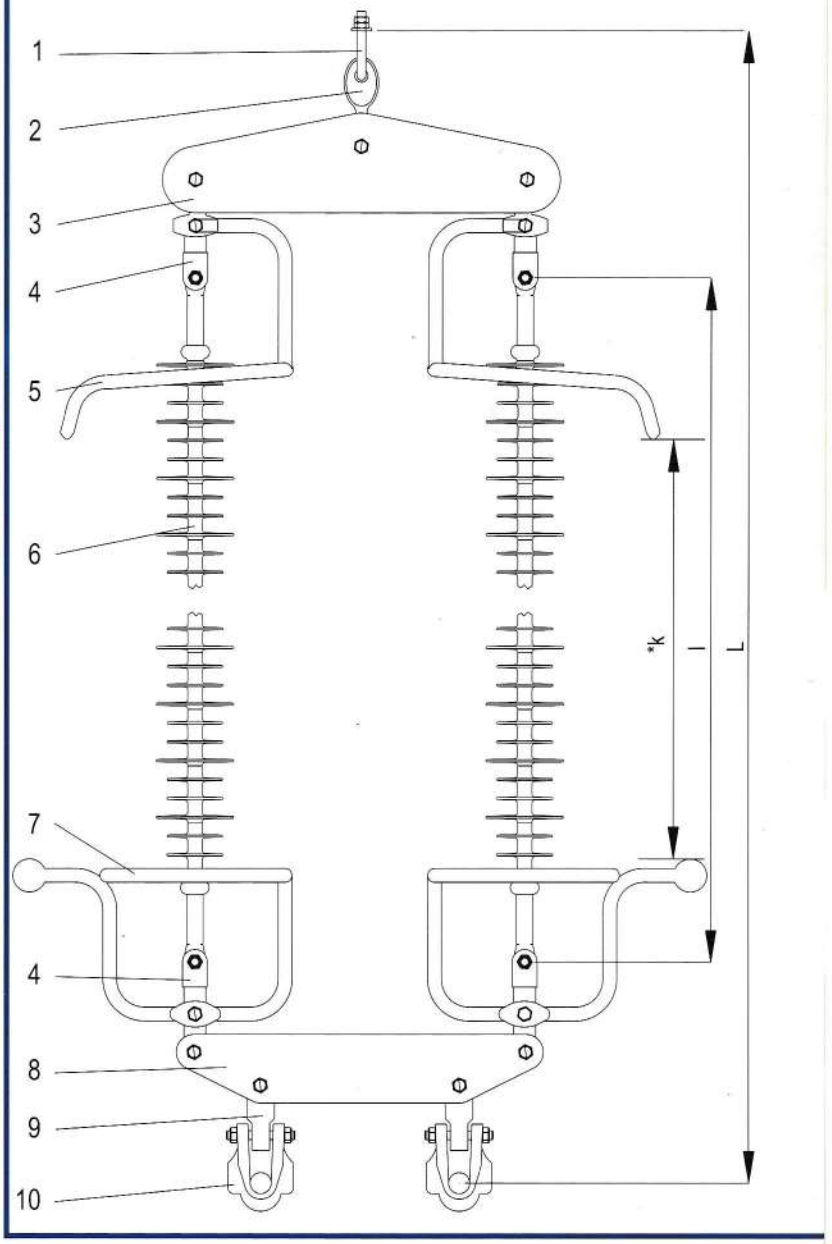


Double suspension string, variant B, two conductors per phase 220 kV

LDS
120 kN
160 kN



Area	II	II	III	III
SML (kN)	120	160	120	160
l (mm)	2150	2190	2252	2292
L (mm)	2980	3020	3082	3122
Guarding	IPS-3-TT	IPS-7-TT	IPS-1-TT	IPS-4-TT
Rings type	IPI-2-TT	IPI-1-TT	IPI-1-TT	IPI-3-TT

Area	IV	IV
SML (kN)	120	160
l (mm)	2276	2316
L (mm)	3106	3146
Guarding	IPS-15-TT	IPS-15-TT
Rings type	IPI-3-TT	IPI-1-TT

Composite insulator strings with Tongue-Tongue end-fittings

No	Component	Quantity (Pcs.)	Material	Designation
1	U - bolt	1	Zn-steel	A**, 200 kN
2	Extension piece	1	Zn-steel	PD-20, 200 kN
3	Single yoke	1	Zn-steel	Js 500/20, 200 kN
4	Clevis straight eye	4	Zn-steel	FODS-12(16), 120(160) kN
5	Upper guarding ring	2	Zn-steel	IPS
6	Composite insulator, 220 kV	2	Silicone rubber	CI-220-II-120/160-TT CI-220-III-120/160-TT CI-220-IV-120/160-TT
7	Bottom guarding ring	2	Zn-steel	IPI
8	Double yoke	1	Zn-steel	Jd 500/400-24, 240 kN
9	Double twisted piece	2	Zn-steel	PR-43, 120 kN
10	Suspension clamp	2	Aluminum alloy	CSA 4, 120 kN

Note :

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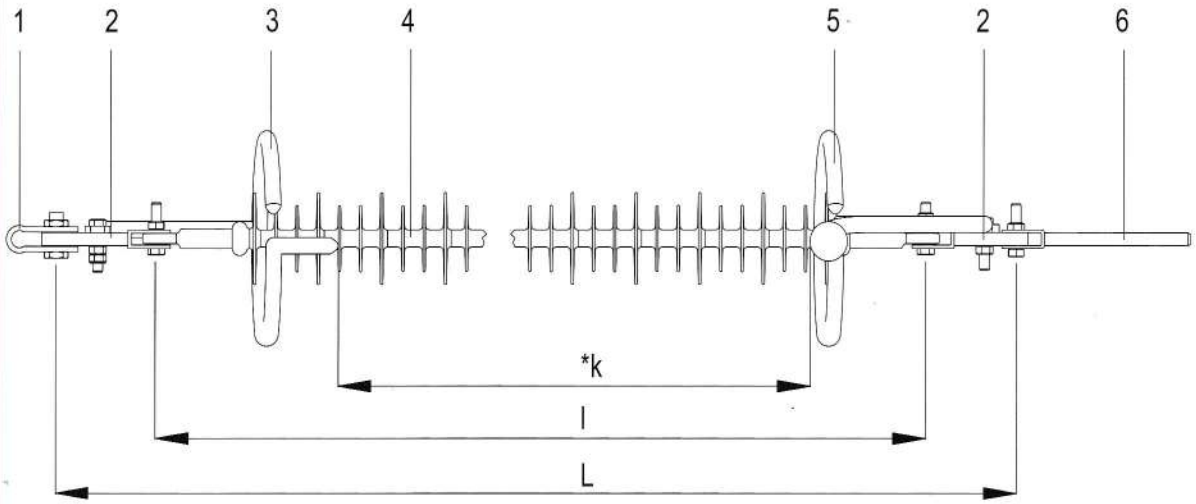
Composite insulator strings with Tongue-Tongue end-fittings

Single tension string 220 kV

LSI
120 kN
160 kN



No	Component	Quantity (Pcs.)	Material	Designation
1	Shackle A	1	Zn-steel	A**, 120/160 kN
2	Clevis eye	2	Zn-steel	FODS 12(16) 120/160 kN
3	Upper guarding ring	1	Zn-steel	IPS
4	Composite insulator, 220 kV	1	Silicone rubber	CI-220-II-120/160-TT CI-220-III-120/160-TT CI-220-IV-120/160-TT
5	Bottom guarding ring	1	Zn-steel	IPI
6	Tension clamp	1	Al+Zn-steel alloy	TPDFc

Area	II	II	III	III	IV	IV
SML (kN)	120	160	120	160	120	160
l (mm)	2150	2190	2252	2292	2276	2316
L (mm)	2650	2670	2752	2772	2776	2796
Guarding Rings type	IPS-3-TT IPI-2-TT	IPS-2-TT IPI-3-TT	IPS-1-TT IPI-1-TT	IPS-15-TT IPI-3-TT	IPS-15-TT IPI-3-TT	IPS-11-TT IPI-1-TT

Note :

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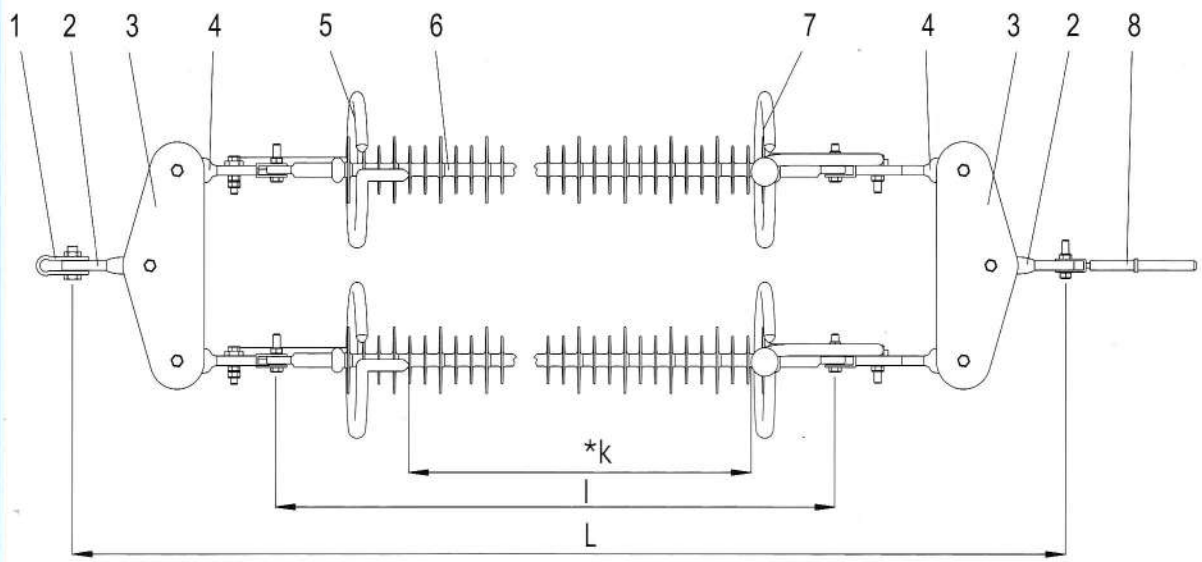
Composite insulator strings with Tongue-Tongue end-fittings

Double tension string 220 kV

LDI
120 kN



No	Component	Quantity (Pcs.)	Material	Designation
1	Swivel B	1	Zn-steel	B10/20, 200 kN (BA 10/20)
2	Twisted eye	2	Zn-steel	OD-20, 200 kN
3	Single yoke	2	Zn-steel	Js 500/20, 200 kN
4	Clevis twisted eye	4	Zn-forged steel	FORS-12 120 kN
5	Upper guarding ring	2	Zn-steel	IPS
6	Composite insulator, 220 kV	2	Silicone rubber	CI-220-II-120-TT CI-220-III-120-TT CI-220-IV-120-TT
7	Bottom guarding ring	2	Zn-steel	IPI
8	Tension clamp	1	Alloy Al+Zn-steel	TPDFc 450

Area	II	III	IV
SML (kN)	120	120	120
l (mm)	2150	2252	2276
L (mm)	2820	2922	2946
Guarding rings type	IPS-3-TT IPI-2-TT	IPS-1-TT IPI-1-TT	IPS-15-TT IPI-3-TT

Note :

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Insulator strings with composite insulators and Tongue-Tongue end-fittings, 400 kV

Chapter 7

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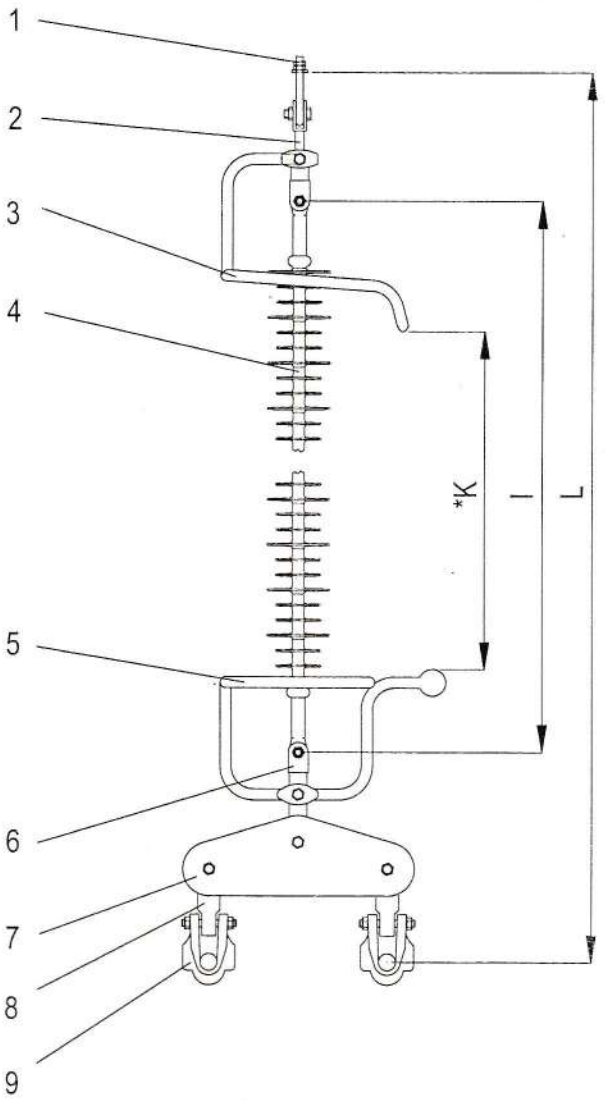
Single suspension string, variant B, two conductors per phase 400 kV

LSS
160 kN
210 kN



Area	II/A	II	III	IV
SML	160	210	160	160
I	3414	3434	3516	3642
L	4004	4026	4106	4232
Guarding rings type	IPS-9-TT IPI-2-TT	IPS-12-TT IPI-3-TT	IPS-4-TT IPI-6-TT	IPS-8-TT IPI-6-TT

Note:

* the spark gap is in conformity with the lightning and switching overloads set by the network designer(beneficiary)
** the dimension of the hooks vary depending on the pole or land type.

No	Component	Quantity(Pcs.)	Material	Designation
1	Shackle **	1	Zn-steel	A 16/20, 240 kN
2	Clevis twisted eye	1	Zn-steel	FORS 16(21), 160 (210) kN
3	Upper guarding ring	1	Zn-steel	IPS
4	Composite insulator, 400 kV	1	Silicone rubber	CI-400-II/A-160-TT CI-400-II-210-TT CI-400-III-160-TT CI-400-IV-160-TT
5	Bottom guarding ring	1	Zn-steel	IPI
6	Clevis straight eye	1	Zn-steel	FODS 16(21), 160(210) kN
7	Single yoke	1	Zn-steel	Js 400/24, 240 kN
8	Double twisted piece	2	Zn-steel	PR 43, 120 kN
9	Suspension clamp	2	Aluminum alloy	CSA 4, 120 kN

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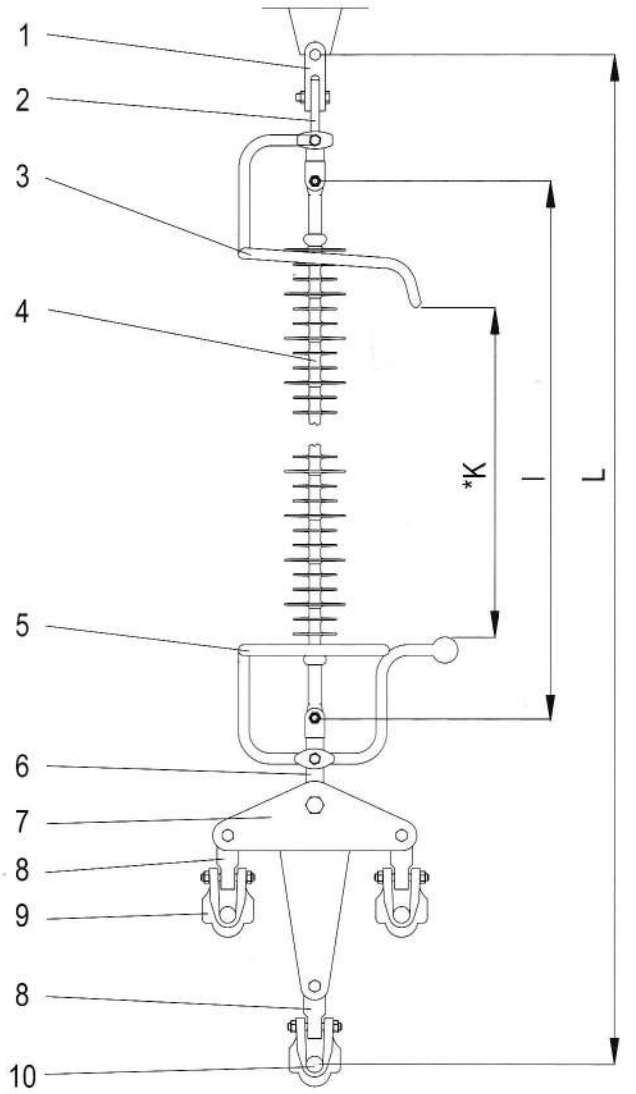
Single suspension string, variant B, three conductors per phase 400 kV

LSS 120 kN
160 kN
210 kN

Area	II/A	II/A	II
SML	120	160	210
I	3374	3414	3434
L	4379	4399	4472
Guarding rings type	IPS-4-TT IPI-3-TT	IPS-9-TT IPI-2-TT	IPS-12-TT IPI-3-TT

Area	III	III	IV	IV
SMS	120	160	120	160
I	3476	3516	3602	3642
L	4481	4501	4607	4627
Guarding rings type	IPS-6-TT IPI-1-TT	IPS-4-TT IPI-6-TT	IPS-5-TT IPI-6-TT	IPS-8-TT IPI-6-TT



Composite insulator strings with Tongue-Tongue end-fittings

No	Component	Quantity (Pcs.)	Material	Designation
1	Shackle**	1	Zn-steel	CS 4 A(D) 160(240;320) kN
2	Clevis twisted eye	1	Zn-steel	FORS 12 (16;21) 120 (160;210) kN
3	Upper guarding ring	1	Zn-steel	IPS
4	Composite insulator, 400 kV	1	Silicone rubber	CI-400-II/A-120/160-TT CI-400-II-210-TT CI-400-III-120/160-TT CI-400-IV-120/160-TT
5	Bottom guarding ring	1	Zn-steel	IPI
6	Clevis straight eye	1	Zn-steel	FODS 12(16;21) 120(160;210) kN
7	Single yoke	1	Zn-steel	Js 400/3 210 kN
8	Double twisted piece	3	Zn-steel	PR 43
9	Suspension clamp	3	Aluminum alloy	CSA- 4B
10	Armour rod	3	Aluminum alloy	AAR 162-1144

Note:

* the spark gap is in conformity with the lightning and switching overloads set by the network designer(beneficiary)
** the dimension of the hooks vary depending on the pole or land type.

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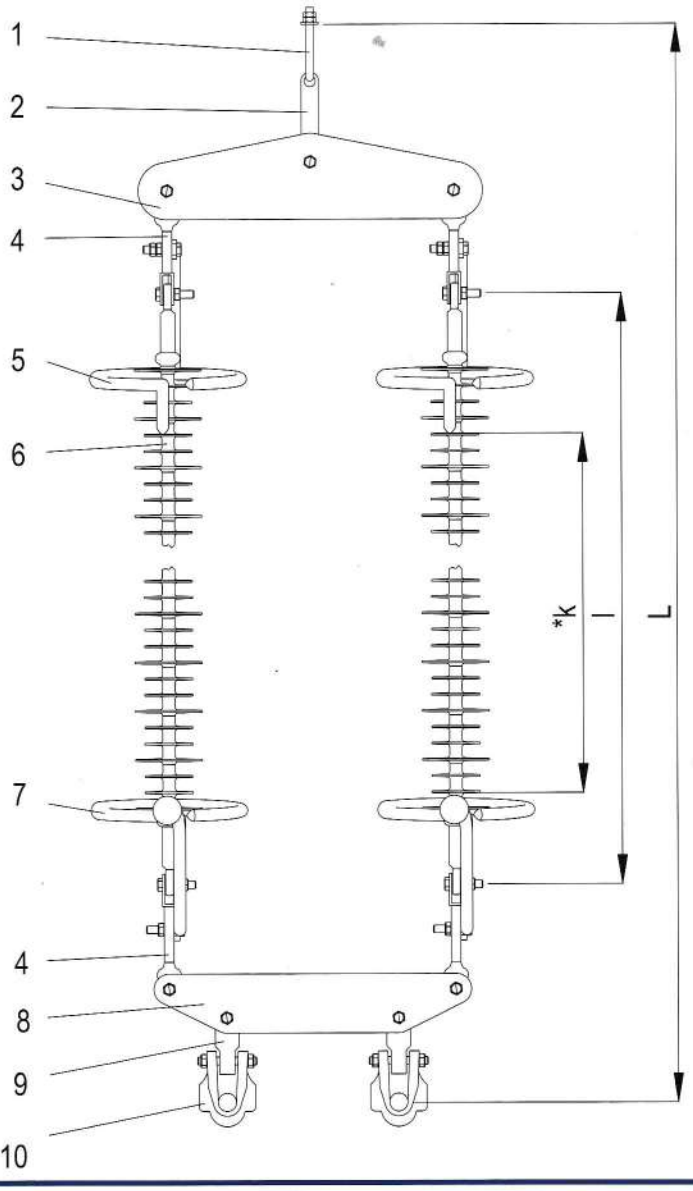
Double suspension string, variant A, two conductors per phase 400 kV

LDS
120 kN
160 kN



Area SML	II/A 120	II/A 160
l	3374	3414
L	4214	4214
Guarding rings type	IPS-4-TT IPI-3-TT	IPS-4-TT IPI-3-TT

Area SMS	III 120	III 160	IV 120	IV 160
l	3476	3516	3602	3642
L	4316	4316	4442	4442
Guarding rings type	IPS-6-TT IPI-1-TT	IPS-5-TT IPI-3-TT	IPS-5-TT IPI-6-TT	IPS-5-TT IPI-6-TT

Composite insulator strings with Tongue-Tongue end-fittings

No	Component	Quantity (Pcs.)	Material	Designation
1	Shackle**	1	Zn-steel	A, 200 kN
2	Extension piece	1	Zn-steel	PD-20 , 200 kN
3	Single yoke	1	Zn-steel	Js 500/20 , 200 kN
4	Clevis straight eye	4	Zn-steel	FORS-12(16) , 120(160) kN
5	Upper guarding ring	2	Zn-steel	IPS
6	Composite insulator, 400 kV	2	Silicone rubber	CI-400-II/A-120/160-TT CI-400-III-120/160-TT CI-400-IV-120/160-TT
7	Bottom guarding ring	2	Zn-steel	IPI
8	Double yoke	1	Zn-steel	Jd 500/400-24 , 240 kN
9	Double twisted piece	2	Zn-steel	PR 43 , 120 kN
10	Suspension clamp	2	Aluminum alloy	CSA- 4, 120 kN

Note:

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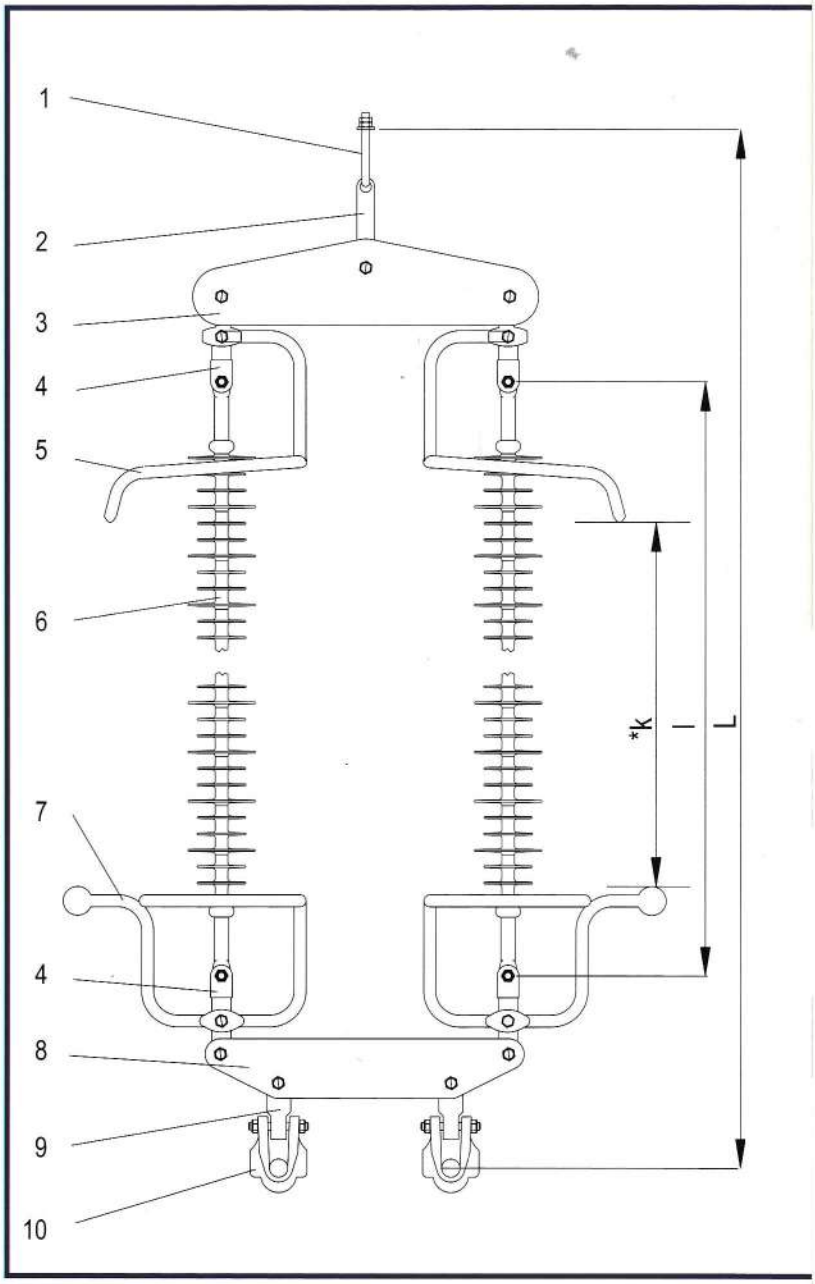
Double suspension string, variant B, two conductors per phase 400 kV

LDS
120 kN
160 kN



Area	II/A	II/A
SML	120	160
I	3374	3414
L	4174	4214
Guarding	IPS-4-TT	IPS-4-TT
rings type	IPI-3-TT	IPI-1-TT

Area	III	III	IV	IV
SMS	120	160	120	160
I	3476	3516	3602	3642
L	4276	4316	4402	4442
Guarding	IPS-6-TT	IPS-5-TT	IPS-5-TT	IPS-17-TT
rings type	IPI-1-TT	IPI-1-TT	IPI-6-TT	IPI-6-TT

Composite insulator strings with Tongue-Tongue end-fittings

No	Component	Quantity (Pcs.)	Material	Designation
1	Shackle**	1	Zn-steel	A16/20 , 200 kN
2	Extension piece	1	Zn-steel	PD-20 , 200 kN
3	Single yoke	1	Zn-steel	Js 500/20 , 200 kN
4	Clevis straight eye	4	Zn-steel	FODS-12(16) , 120(160) kN
5	Upper guarding ring	2	Zn-steel	IPS
6	Composite insulator, 400 kV	2	Silicone rubber	CI-400-II-120/160-TT CI-400-III-120/160-TT CI-400-IV-120/160-TT
7	Bottom guarding ring	2	Zn-steel	IPI
8	Double yoke	1	Zn-steel	Jd 500/400-24 , 240 kN
9	Double twisted piece	2	Zn-steel	PR 43 , 120 kN
10	Suspension clamp	2	Aluminum alloy	CSA- 4, 120 kN

Note:

* the spark gap is in conformity with the lightning and switching overloads set by the network designer(beneficiary)
** the dimension of the hooks vary depending on the pole or land type.

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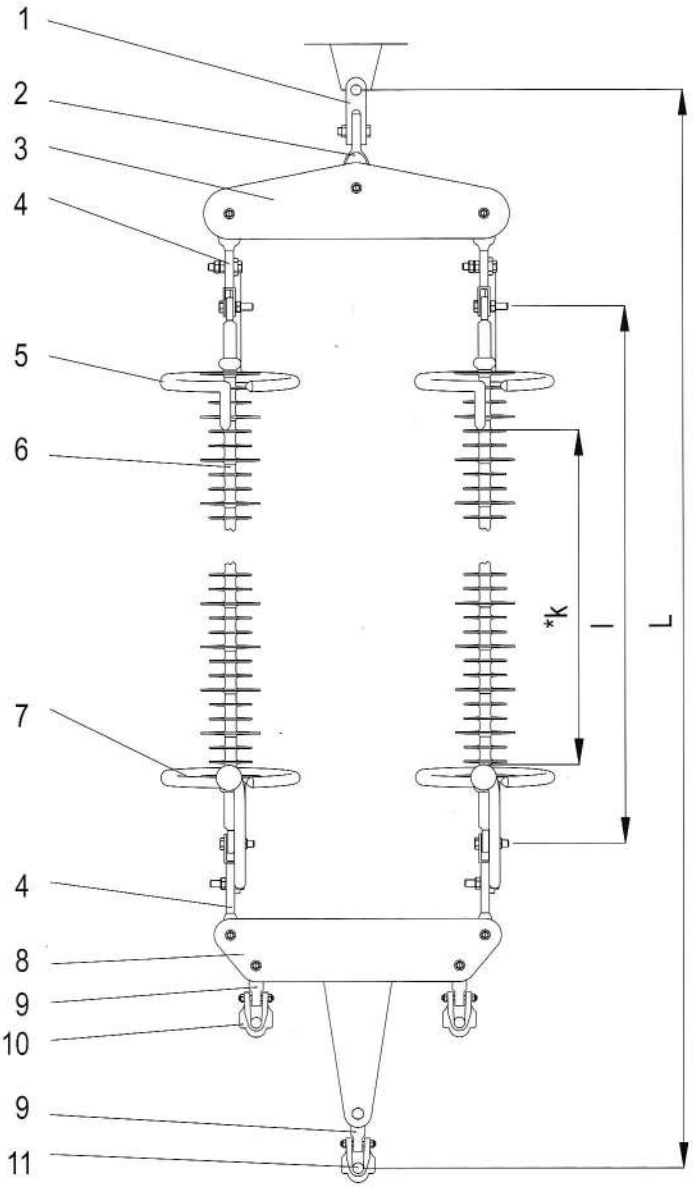
Double suspension string, variant A, three conductors per phase 400 kV

LDS
120 kN
160 kN

Area SML	II/A 120	II/A 160	II 210
I	3374	3414	3434
L	4539	4579	4650
Guarding rings type	IPS-4-TT IPI-3-TT	IPS-11-TT IPI-1-TT	IPS-15-TT IPI-1-TT

Area SMS	III 120	III 160	IV 120	IV 160
I	3476	3516	3602	3642
L	4641	4681	4767	4807
Guarding rings type	IPS-6-TT IPI-1-TT	IPS-5-TT IPI-3-TT	IPS-5-TT IPI-6-TT	IPS-5-TT IPI-6-TT



Composite insulator strings with Tongue-Tongue end-fittings

No	Component	Quantity (Pcs.)	Material	Designation
1	Shackle**	1	Zn-steel	CS4B(D)240(320) kN
2	Extension piece	1	Zn-steel	PD-24(32), 240 (320) kN
3	Single yoke	1	Zn-steel	Js 500/24, (500/32) 200 (320) kN
4	Clevis straight eye	4	Zn-steel	FORS-12(16; 21) , 120(160; 210) kN
5	Upper guarding ring	2	Zn-steel	IPS
6	Composite insulator, 400 kV	2	Silicone rubber	CI-400-II-120/160-TT CI-400-II-210-TT CI-400-III-120/160-TT CI-400-IV-120/160-TT
7	Bottom guarding ring	2	Zn-steel	IPI
8	Double yoke	1	Zn-steel	Jd 400/3-30 , 300 kN
9	Double twisted piece	3	Zn-steel	PR 43 , 120 kN
10	Suspension clamp	3	Aluminum alloy	CSA- 4, 120 kN
11	Armour rod	3	Aluminum alloy	AAR 162-1144

Note :
* the spark gap is in conformity with the lightning and switching overloads set by the network designer(beneficiary)
** the dimension of the hooks vary depending on the pole or land type.

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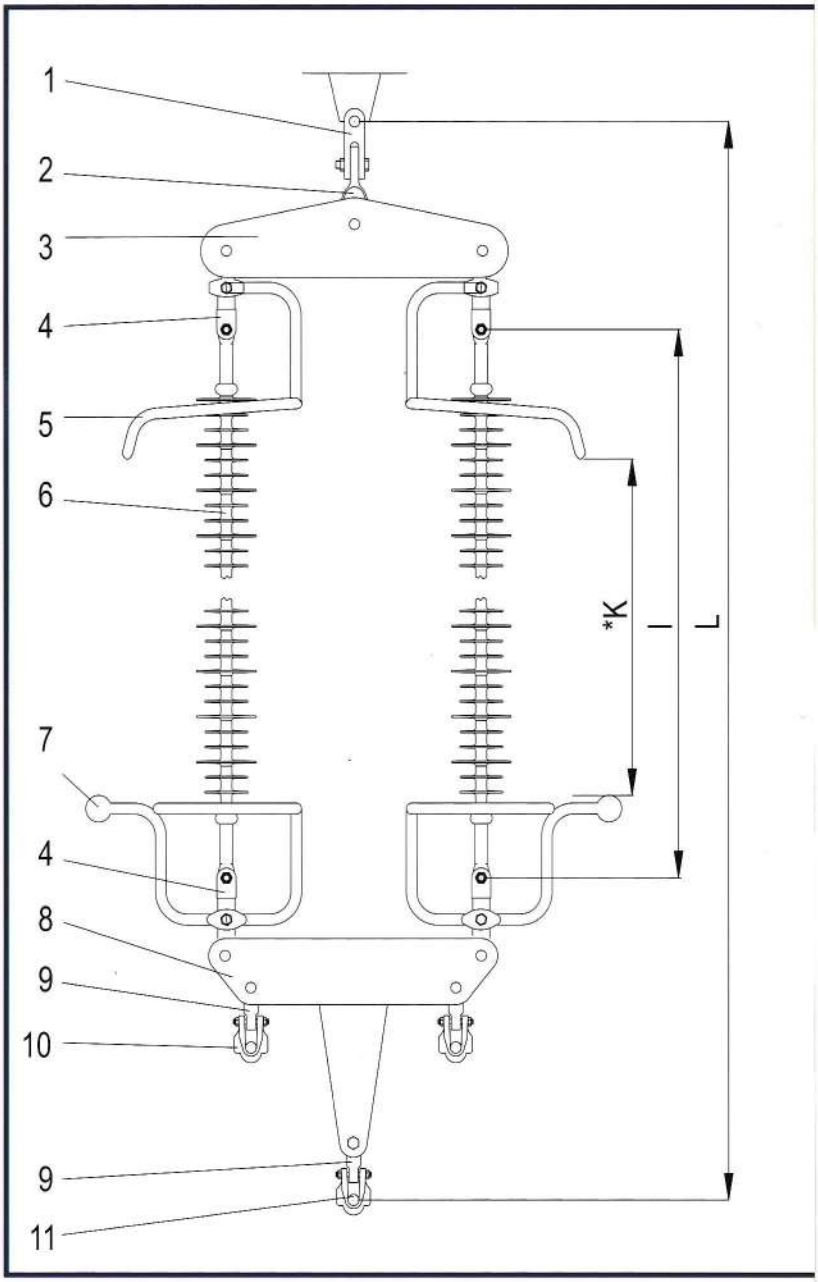
Double suspension string, variant B, three conductors per phase 400 kV

LDS
120 kN
160 kN



Area SML	II/A 120	II/A 160	II 210
I	3374	3414	3434
L	4539	4579	4650
Guarding rings type	IPS-4-TT IPI-3-TT	IPS-4-TT IPI-1-TT	IPS-1-TT IPI-6-TT

Area SMS	III 120	III 160	IV 120	IV 160
I	3476	3516	3602	3642
L	4641	4681	4767	4807
Guarding rings type	IPS-6-TT IPI-1-TT	IPS-5-TT IPI-1TT	IPS-5-TT IPI-6-TT	IPS-17-TT IPI-6-TT

Composite insulator strings with Tongue-Tongue end-fittings

No	Component	Quantity (Pcs.)	Material	Designation
1	Shackle**	1	Zn-steel	CS 4 A(D) 160(240,320) kN
2	Double eye	1	Zn-steel	OD-35
3	Single yoke	1	Zn-steel	Js 500/24(32) 240(320)
4	Clevis straight eye	4	Zn-steel	FODS 12 (16,21)
5	Upper guarding ring	2	Zn-steel	IPS
6	Composite insulator, 400 kV	2	Silicone rubber	CI-400-II-120/160-TT CI-400-II-210-TT CI-400-III-120/160-TT CI-400-IV-120/160-TT
7	Bottom guarding ring	2	Zn-steel	IPI
8	Double yoke	1	Zn-steel	Jd 400/3-30
9	Double twisted piece	3	Zn-steel	PR 43
10	Suspension clamp	3	Aluminum alloy	CSA- 4B
11	Armour rod	3	Aluminum alloy	AAR 162-1144

Note :

* the spark gap is in conformity with the lightning and switching overloads set by the network designer(beneficiary)
** the dimension of the hooks vary depending on the pole or land type.

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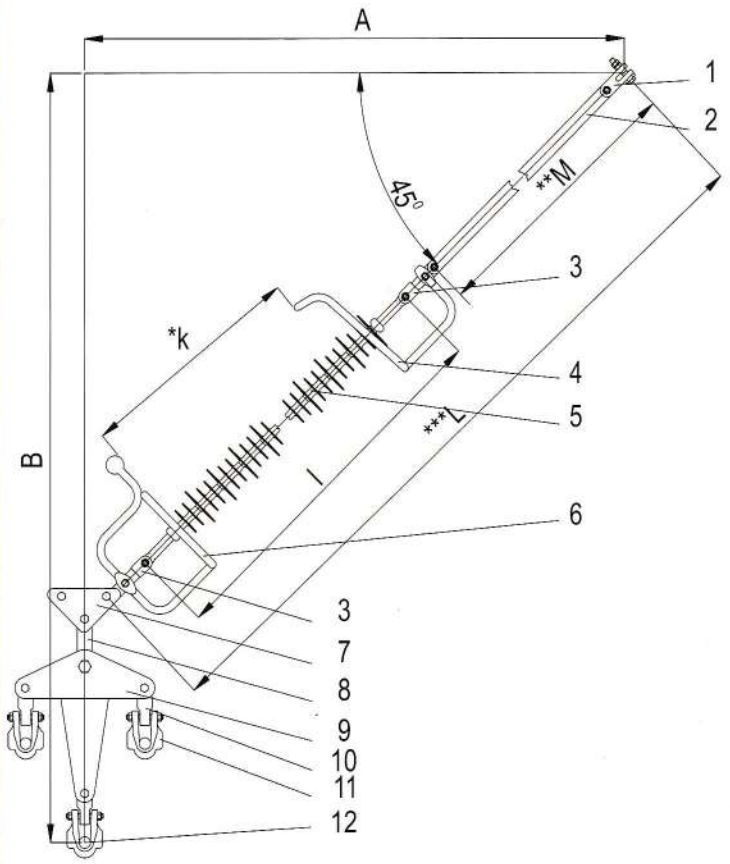
Composite insulator strings with Tongue-Tongue end-fittings

Double "V" tension string with three conductors per phase 400 kV

LDIV 120 kN
160 kN
210 kN



No	Component	Quantity (Pcs.)	Material	Designation
1	Shackle	2	Zn-steel	CS- 4A(D) 160(240) kN
2	Clevis piece	2	Zn-steel	PDF 25/M 250kN**
3	Clevis straight eye	4	Zn-steel	FODS- 12(16;21) 120(160;210) kN
4	Upper guarding ring	2	Zn-steel	IPS
5	Composite insulator, 400 kV	2	Silicone rubber	CI-400-II/A-120/160-TT CI-400-II-210-TT CI-400-III-120/160-TT CI-400-IV-120/160-TT
6	Bottom guarding ring	2	Zn-steel	IPI
7	Special yoke	1	Zn-steel	Jss 260/130
8	Extension piece	1	Zn-steel	PD 35/2M
9	Triple yoke	1	Zn-steel	JS 400/3
10	Double twisted piece	3	Zn-steel	PR 43
11	Suspension clamp	3	Aluminum alloy	CSA 4B
12	Armour rod	3	Aluminum alloy	AAR 162-1144

Area SML	II/A 120	II/A 160	II 210	III 120	III 160	IV 120	IV 160
l L***	3374	3414	3434	3476	3516	3602	3642
Guarding rings type	IPS-4-TT IPI-3-TT	IPS-4-TT IPI-1-TT	IPS-1-TT IPI-6-TT	IPS-6-TT IPI-1-TT	IPS-5-TT IPI-1-TT	IPS-5-TT IPI-6-TT	IPS-17-TT IPI-6-TT

Note:

* the spark gap is in conformity with lightning and switching overloads set by the network designer(beneficiary)
** the dimension M of the PDF 25 piece shall be established by the network designer depending on the pole.
*** Dimension L depends of M.

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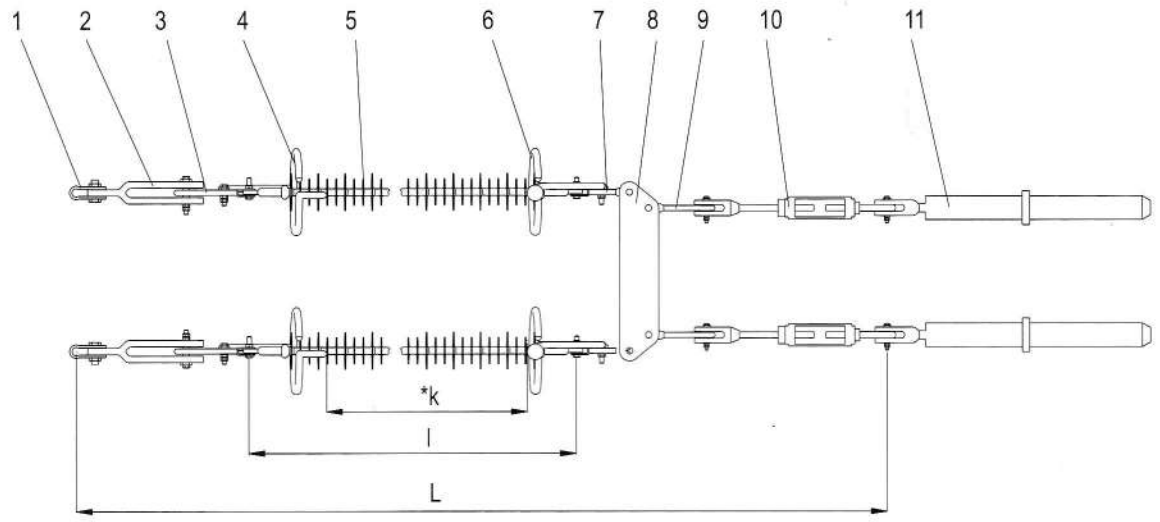
Composite insulator strings with Tongue-Tongue end-fittings

Double tension string with two conductors per phase 400 kV

LDI
160 kN
210 kN



No	Component	Quantity (Pcs.)	Material	Designation
1	Swivel	2	Zn-steel	B10/25, 250 kN
2	Extension piece	2	Zn-steel	PDf-25/1, 250 kN
3	Clevis straight eye	2	Zn-steel	FODS-16(21), 160(210) kN
4	Upper guarding ring	2	Zn-steel	IPS
5	Composite insulator, 400 kV	2	Silicone rubber	CI-400-II-160/210-TT CI-400-III-160-TT CI-400-IV-160-TT
6	Bottom guarding ring	2	Zn-steel	IPI
7	Clevis twisted eye	2	Zn-steel	FORS-16(21), 160(210) kN
8	Double yoke	1	Zn-steel	Jd 500/400-32, 320 kN
9	Double twisted eye	2	Zn-steel	ODR-20, 200 kN
10	Turnbuckle	2	Zn-steel	IROF-18, 180 kN
11	Tension clamp	2	Zn-steel	TPDFc 450/75, 95 % UTS

Area SML	II/A 160	II 210	III 160	IV 160
l	3414	3434	3516	3642
L	4764-4924	4786-4946	4866-5026	4992-5152
Guarding rings type	IPS-9-TT IPI-2-TT	IPS-12-TT IPI-3-TT	IPS-4-TT IPI-6-TT	IPS-8-TT IPI-6-TT

Note:

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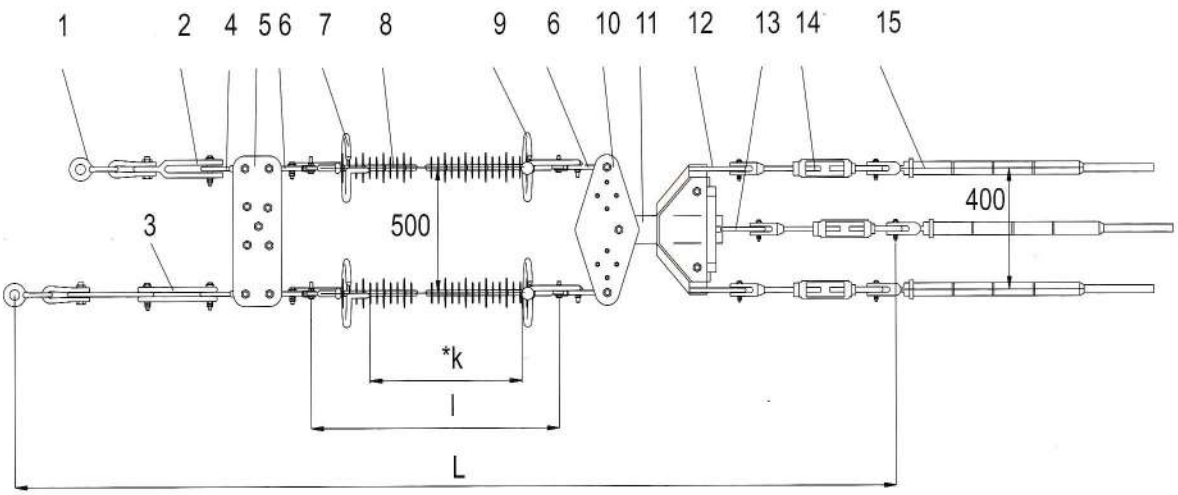
Composite insulator strings with Tongue-Tongue end-fittings

Double tension string with three conductors per phase 400 kV

LDI
160 kN
210 kN



No	Component	Quantity (Pcs.)	Material	Designation
1	Shackle	4	Zn-steel	CS- 3A
2	Clevis piece	1	Zn-steel	PDF-32 , 320 kN
3	Adjustable extension link	1	Zn-steel	PR 32 , 320 kN
4	Double twisted eye	2	Zn-steel	ODR-32
5	Double yoke	1	Zn-steel	Jd 500/500-45
6	Clevis twisted eye	4	Zn-steel	FORS-16(21) 160(210) kN
7	Upper guarding ring	2	Zn-steel	IPS
8	Composite insulator, 400 kV	2	Silicone rubber	CI-400-II/A-160-TT CI-400-II-210-TT CI-400-III-160-TT CI-400-IV-160-TT
9	Bottom guarding ring	2	Zn-steel	IPI
10	Single yoke	1	Zn-steel	Js 500/50
11	Star triple yoke	1	Zn-steel	JIS-50-1
12	Extension piece	2	Zn-steel	Pd-20-1M
13	Extension piece	1	Zn-steel	Pd-20-2M
14	Turnbuckle	3	Zn-steel	IROF-18 , 180 kN
15	Tension clamp	3	Aluminum alloy	TPDF 300/69

Area SML	II/A 160	II 210	III 160	IV 160
l	3414	3434	3516	3642
L	5817-6197	5841-6221	5919-6299	6045-6425
Guarding rings type	IPS-11-TT IPI-1-TT	IPS-14-TT IPI-3-TT	IPS-5-TT IPI-3-TT	IPS-5-TT IPI-6-TT

Note : * the spark gap is in conformity with the lightning and switching overloads set by the network designer(beneficiary)

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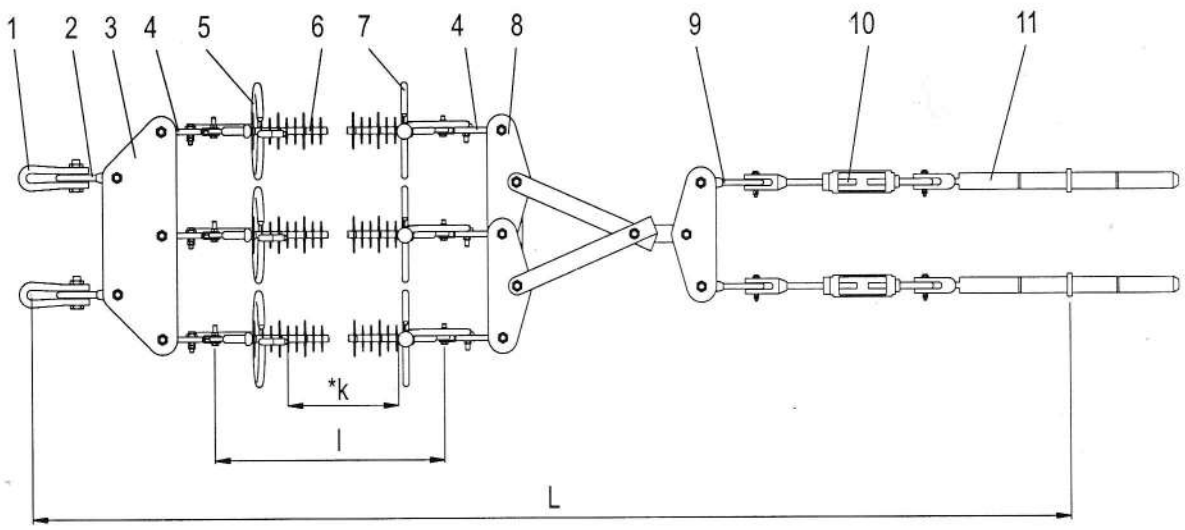
Composite insulator strings with Tongue-Tongue end-fittings

Triple tension string with two conductors per phase 400 kV

LTI
120 kN
160 kN



No	Component	Quantity (Pcs.)	Material	Designation
1	Swivel	2	Zn-steel	B10/25 , 250 kN
2	Double twisted eye	2	Zn-steel	ODR-35/0 , 350 kN
3	Double yoke	1	Zn-steel	Jd 1000/500-45 , 450 kN
4	Clevis twisted eye	6	Zn-steel	FORS 12(16) , 120(160) kN
5	Upper guarding ring	3	Zn-steel	IPS
6	Composite insulator, 400 kV	3	Silicone rubber	CI-400-II/A-120/160-TT CI-400-III-120/160-TT CI-400-IV-120/160-TT
7	Bottom guarding ring	3	Zn-steel	IPI
8	Device for triple insulator string	1	Zn-steel	DLT- 45 , 450 kN
9	Double twisted eye	2	Zn-steel	ODR- 20 , 200 kN
10	Turnbuckle	2	Zn-steel	IROF-18 , 180 kN
11	Tension clamp	2	Zn-steel	TPDFc 450/75 , 95% UTS

Area SML	II/A 120	II/A 160	III 120	III 160	IV 120	IV 160
l	3374	3414	3476	3516	3602	3642
L	5684-5844	5684-5844	5786-5946	5786-5946	5912-6072	5912-6072
Guarding rings type	IPS-4-TT IPI-3-TT	IPS-11-TT IPI-1-TT	IPS-6-TT IPI-1-TT	IPS-5-TT IPI-3-TT	IPS-5-TT IPI-6-TT	IPS-5-TT IPI-6-TT

Note:

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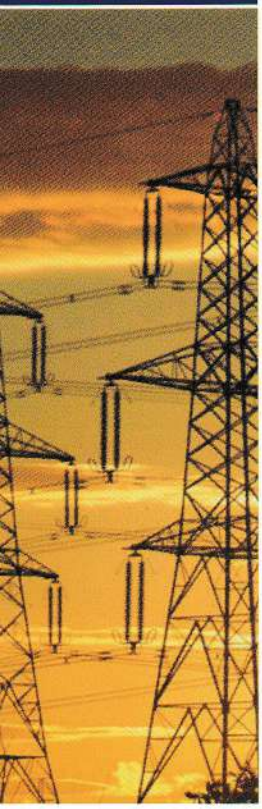
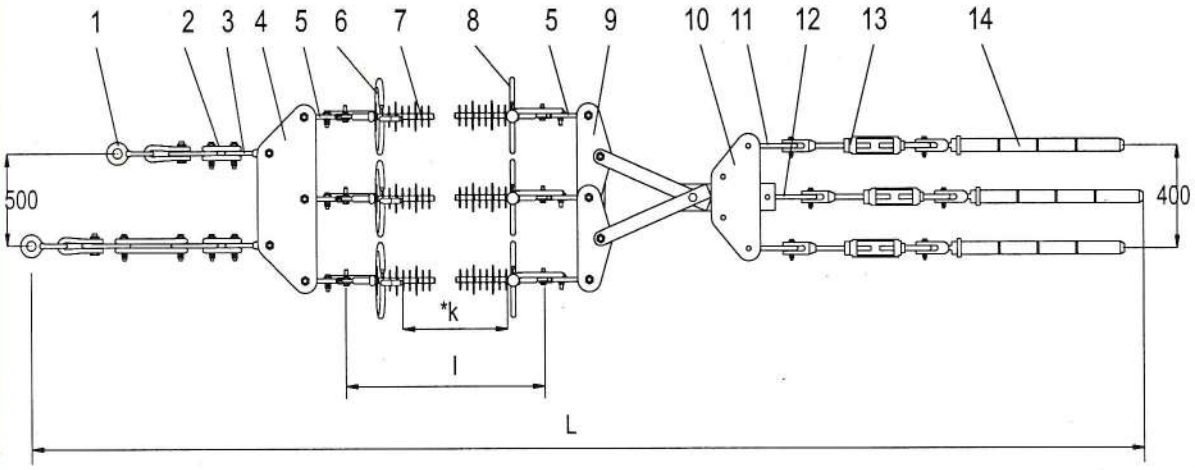


Triple tension string with three conductors per phase 400 kV

LTI
120 kN
160 kN



Pos	Component	Quantity (Pcs)	Material	Designation
1	Shackle	4	Zn-steel	CS 3A 240 kN
2	Adjustable extension link	3	Zn-steel	PRS-25 (240-400)
3	Double twisted eye	2	Zn-steel	ODR-25
4	Double yoke	1	Zn-steel	Jd 1000/500-50
5	Clevis twisted eye	6	Zn-steel	FORS-16(21) 160(210) kN
6	Upper guarding ring	3	Zn-steel	IPS
7	Composite insulator, 400 kV	3	Silicone rubber	CI-400-II/A-160-TT CI-400-II-210-TT CI-400-III-160-TT CI-400-IV-160-TT
8	Bottom guarding ring	3	Zn-steel	IPI
9	Device for triple insulator string	1	Zn-steel	DLTs- 50
10	Star triple yoke	1	Zn-steel	JTS 50-1
11	Extension piece	2	Zn-steel	Pd 20-1M
12	Extension piece	1	Zn-steel	Pd 20-2M
13	Turnbuckle	3	Zn-steel	IROF-18 180 kN
14	Tension clamp	3	Aluminum alloy	TPD 300/68

Area SML	II/A 160	II 210	III 160	IV 160
l	3414	3434	3516	3642
L	6932-7252	6954-7274	7036-7354	7160-7480
Guarding rings type	IPS-11-TT IPI-1-TT	IPS-15-TT IPI-1-TTI	IPS-5-TT IPI-3-TT	IPS-5-TT IPI-6-TT

Note:

* the spark gap is in conformity with the lightning and switching overloads set by the network designer(beneficiary)

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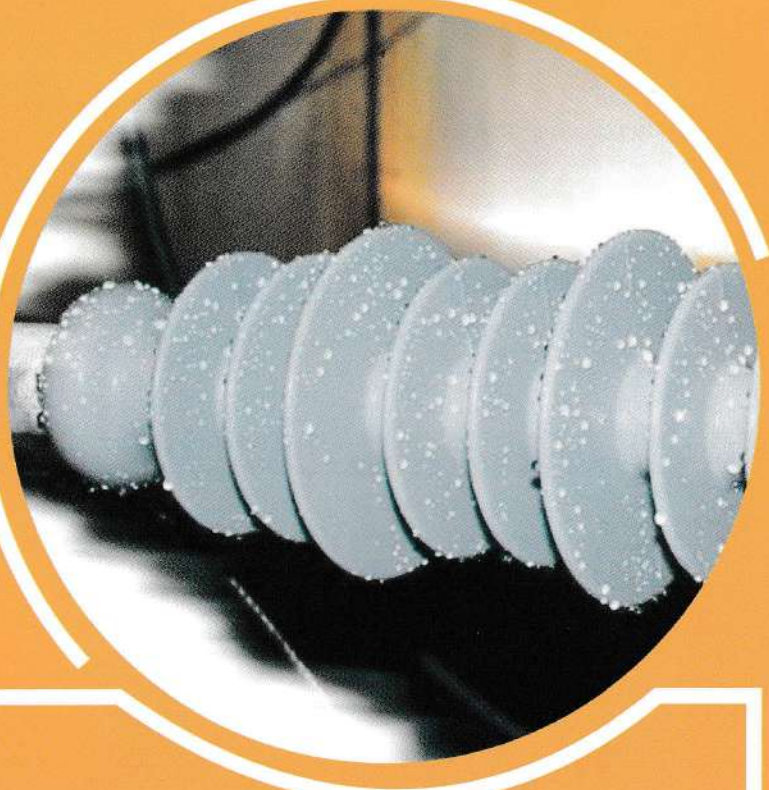
Insulator strings with composite insulators and Ball-Socket end-fittings, 110 kV

Chapter 8



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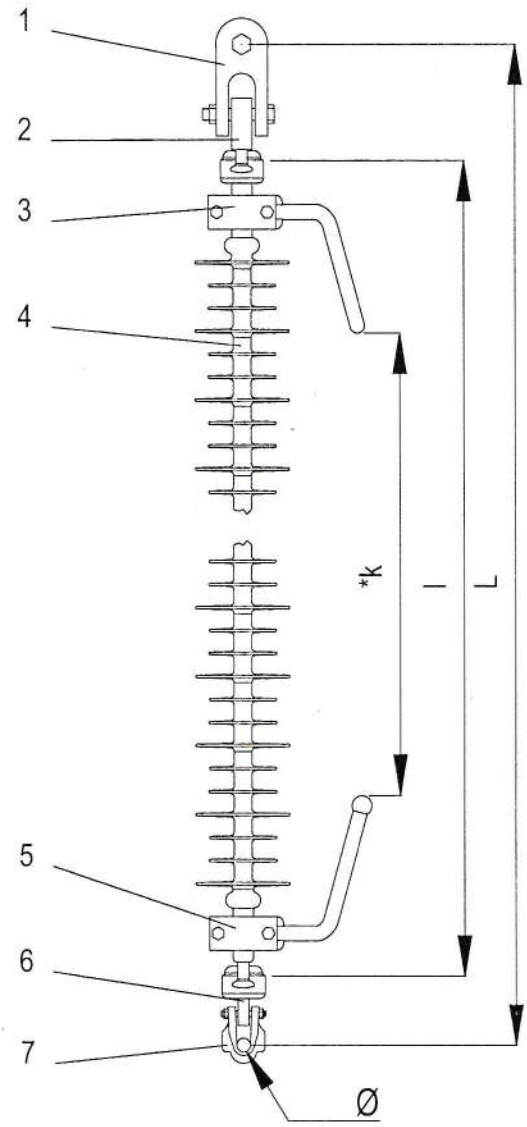
Single suspension string 110 kV

LSS 70 kN
120 kN
160 kN



No.	Component	Designation	Unload Tensile strength	Pcs.
1	Shackle	CS4A	160 kN	1
2	Ball Eye	OSdr16 (OSdr20)	120 (160)	1
3	Arcing Horn II		-	1
4	Composite insulator	110 kV, BS	according to table below	1
5	Arcing Horn I		-	1
6	Socket eye	NSV16 (NSV20)	120 (160)	1
7	Suspension clamp	CSA2	90 kN	1

Area	Composite insulator type	l (mm)	L (mm)	Ø (mm)
II	CI-110-II- 70-BS	1129	1458	15-21
	CI-110-II-120-BS	1217	1546	15-21
	CI-110-II-160-BS	1258	1587	15-21
III	CI-110-III- 70-BS	1197	1526	15-21
	CI-110-III-120-BS	1285	1614	15-21
	CI-110-III-160-BS	1326	1655	15-21
IV	CI-110-IV- 70-BS	1299	1628	15-21
	CI-110-IV-120-BS	1387	1716	15-21
	CI-110-IV-160-BS	1428	1757	15-21

Note : * the spark gap is in conformity with the lightning and switching overloads set by the network designer (beneficiary)

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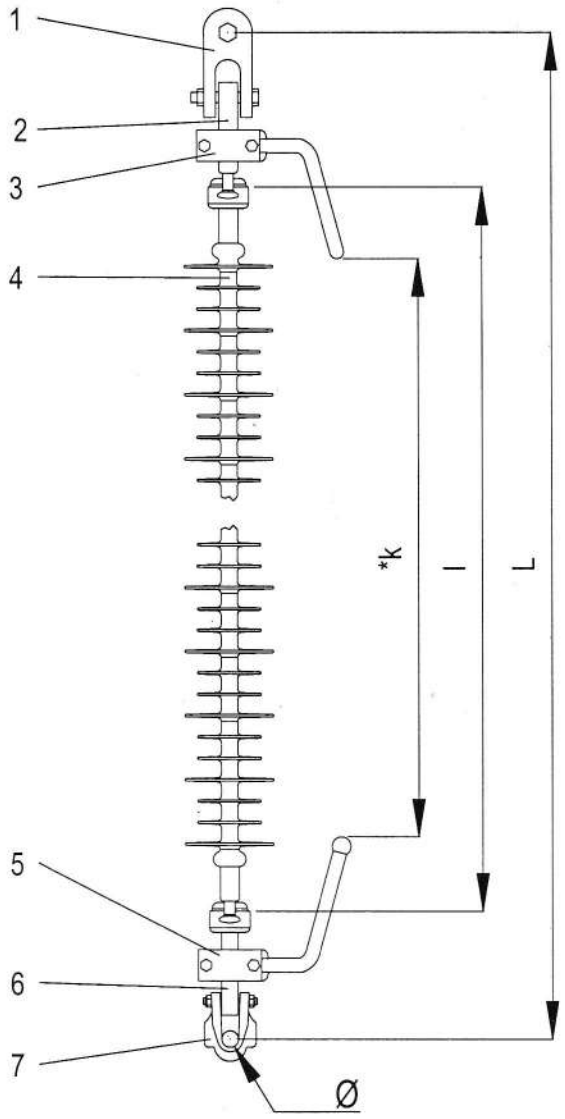
fax 40(0)244-334045

Single suspension string with arcing horns mounted on the string 110 kV

LSS 70 kN
120 kN
160 kN



No.	Component	Designation	Unload Tensile strength	Pcs
1	Shackle	CS4A	160 kN	1
2	Ball Eye	OSr 16 (OSr 20)	120 (160)	1
3	Arcing horn II		-	1
4	Composite insulator	110 kV, BS	according to table below	1
5	Arcing horn I		-	1
6	Socket eye	NORV16 (NORV20)	120 (160)	1
7	Suspension clamp	CSA2	90 kN	1

Area	Composite insulator type	l (mm)	L (mm)	Ø (mm)
II	CI-110-II- 70-BS	1129	1458	15-21
	CI-110-II-120-BS	1217	1546	15-21
	CI-110-II-160-BS	1258	1587	15-21
III	CI-110-III- 70-BS	1197	1526	15-21
	CI-110-III-120-BS	1285	1614	15-21
	CI-110-III-160-BS	1326	1655	15-21
IV	CI-110-IV- 70-BS	1299	1628	15-21
	CI-110-IV-120-BS	1387	1716	15-21
	CI-110-IV-160-BS	1428	1757	15-21

Note : * the spark gap is in conformity with the lightning and switching overloads set by the network designer(beneficiary)

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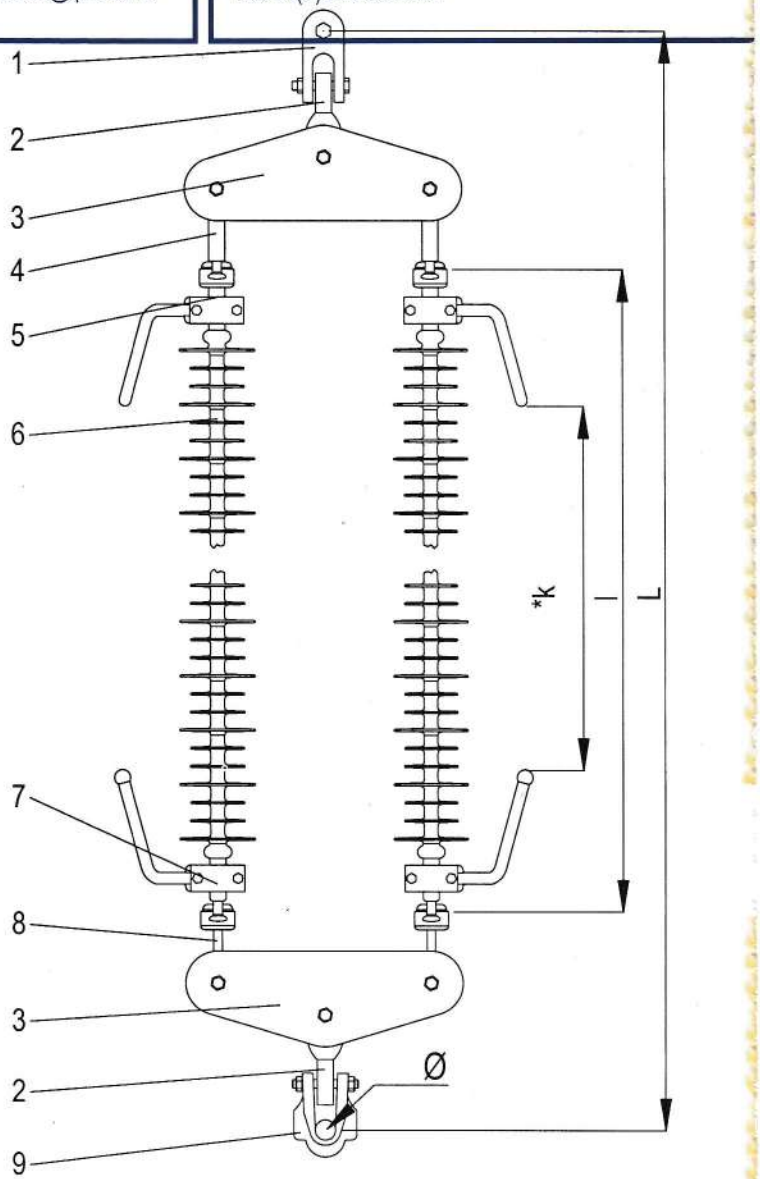
Double suspension string 110 kV

LDS 70 kN
120 kN
160 kN



No.	Component	Designation	Unload Tensile strength	Pcs
1	Shackle	CS4 A	160 kN	1
2	Double twisted eye	OD16	160 kN	2
3	Single yoke	JS 200/16 (JS 250/16)	160 kN	2
4	Ochi simplu de suspensie	OSdr 16 (OSdr20)	120 (160) kN	2
5	Arcing horn II		-	2
6	Composite insulator	110 kV, BS	according to table below	2
7	Arcing horn I		-	2
8	Socket eye	NSV16 (NSV20)	120 (160)	2
9	Suspension clamp	CSA 2	90 kN	1

Area	Composite insulator type	l (mm)	L (mm)	Ø (mm)
II	CI-110-II- 70-BS	1129	1758	15-21
	CI-110-II-120-BS	1217	1846	15-21
	CI-110-II-160-BS	1258	1887	15-21
III	CI-110-III- 70-BS	1197	1826	15-21
	CI-110-III-120-BS	1285	1914	15-21
	CI-110-III-160-BS	1326	1955	15-21
IV	CI-110-IV- 70-BS	1299	1928	15-21
	CI-110-IV-120-BS	1387	2016	15-21
	CI-110-IV-160-BS	1428	2057	15-21

Note : * the spark gap is in conformity with the lightning and switching overloads set by the network designer(beneficiary)

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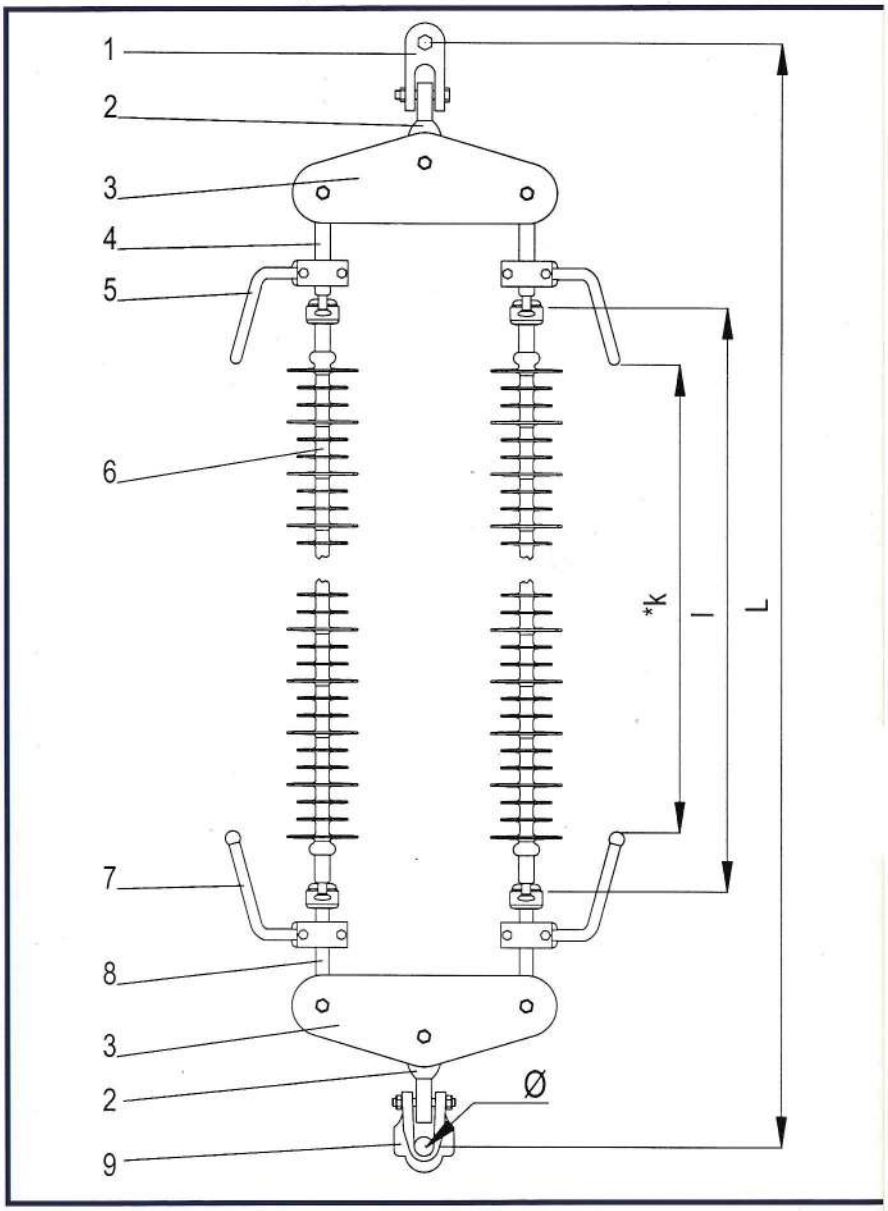
Insulator strings with composite insulators and Ball-Socket end-fittings, 110 kV

Double suspension string with arcing horns mounted on the string 110 kV

LDS 70 kN
120 kN
160 kN



No.	Component	Designation	Unload Tensile strength	Pcs
1	Shackle	CS4 A	160 kN	1
2	Double twisted eye	OD16	160 kN	2
3	Single yoke	JS 200/16 (JS 250/16)	160 kN	2
4	Twisted ball eye	OSr 16 (OSr 20)	120 (160) kN	2
5	Arcing horn II		-	2
6	Composite insulator	110 kV, BS	according to table below	2
7	Arcing horn I		-	2
8	Socket eye	NORV16 (NORV20)	120 (160)	2
9	Suspension clamp	CSA 2	90 kN	1

Area	Composite insulator type	l (mm)	L (mm)	Ø (mm)
II	CI-110-II- 70-BS	1129	1758	15-21
	CI-110-II-120-BS	1217	1846	15-21
	CI-110-II-160-BS	1258	1887	15-21
III	CI-110-III- 70-BS	1197	1826	15-21
	CI-110-III-120-BS	1285	1914	15-21
	CI-110-III-160-BS	1326	1955	15-21
IV	CI-110-IV- 70-BS	1299	1928	15-21
	CI-110-IV-120-BS	1387	2016	15-21
	CI-110-IV-160-BS	1428	2057	15-21

Note : * the spark gap is in conformity with the lightning and switching overloads set by the network designer(beneficiary)

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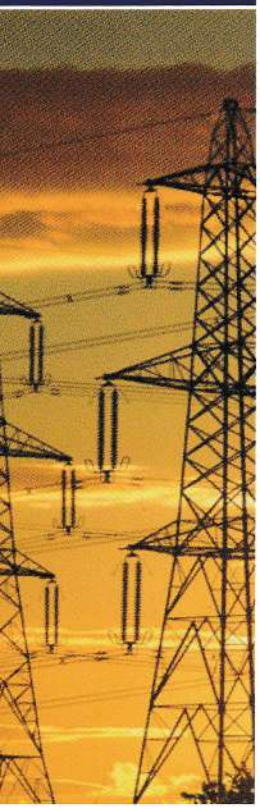
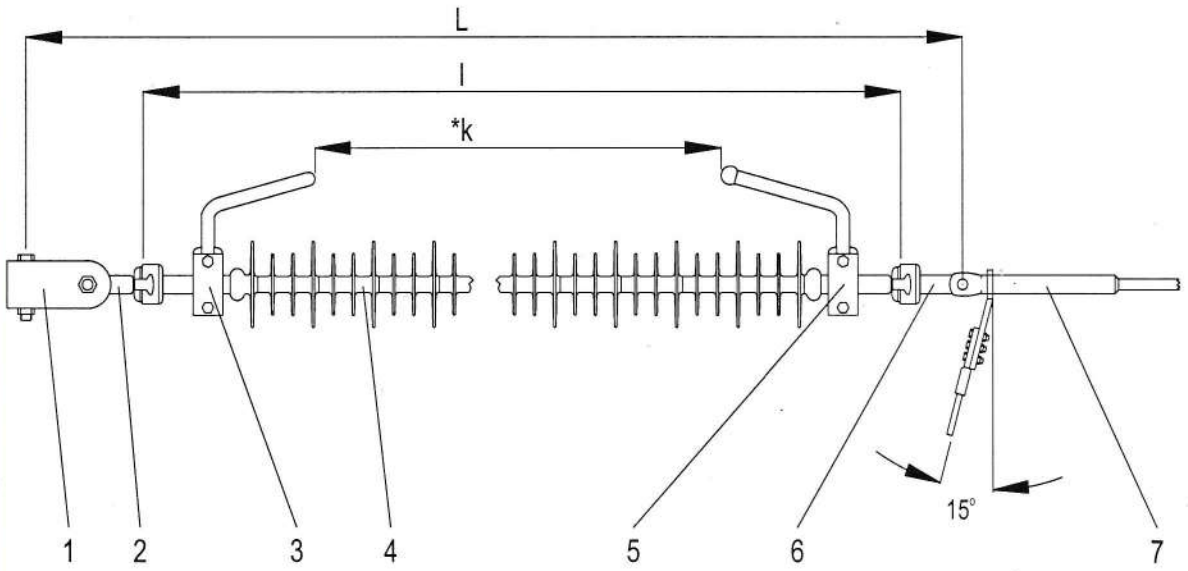


Single tension string 110 kV

LSI 70 kN
120 kN
160 kN



No.	Component	Designation	Unload Tensile strength	Pcs
1	Swivel	B 6,5/16 (B 8/16)	160 kN	1
2	Ball eye	OSDr 16 (OSS 20)	120 (160) kN	1
3	Arcing horn II		-	1
4	Composite insulator	110 kV, BS	according to table below	1
5	Arcing horn I		-	1
6	Socket eye	NSV16 (NSV20)	120 (160)	1
7	Suspension clamp	TPDFc	95 % UTS	1

Area	Composite insulator type	l (mm)	L (mm)
II	CI-110-II- 70-BS	1129	1390
	CI-110-II-120-BS	1217	1478
	CI-110-II-160-BS	1258	1519
III	CI-110-III- 70-BS	1197	1458
	CI-110-III-120-BS	1285	1546
	CI-110-III-160-BS	1326	1587
IV	CI-110-IV- 70-BS	1299	1560
	CI-110-IV-120-BS	1387	1648
	CI-110-IV-160-BS	1428	1689

Note : * the spark gap is in conformity with the lightning and switching overloads set by the network designer(beneficiary)

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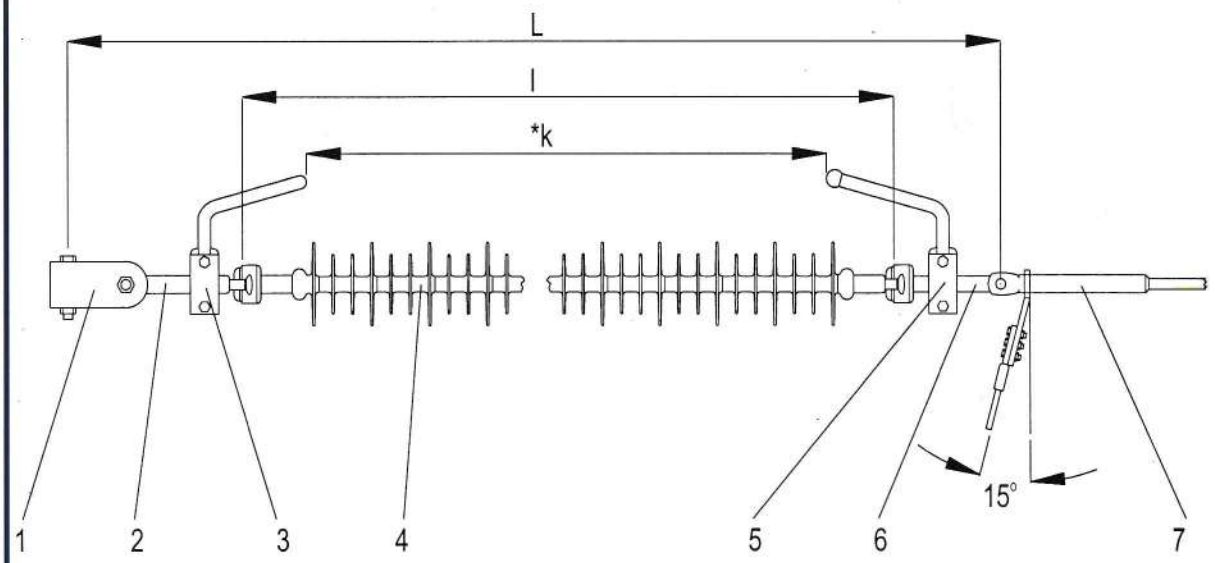
Single tension string with arcing horns mounted on the string110 kV

LSI 70 kN
120 kN
160 kN



No.	Component	Designation	Unload Tensile strength	Pcs
1	Swivel	B 6,5/16 (B 8/16)	160 kN	1
2	Ball eye	OSDr 16 (OSDr 20)	120 (160) kN	1
3	Arcing horn II		-	1
4	Composite insulator	110 kV, BS	according to table below	1
5	Arcing horn I		-	1
6	Socket eye	NSV16 (NSV20)	120 (160)	1
7	Tension clamp	TPDFc	95 % UTS	1

Area	Composite insulator type	l (mm)	L (mm)
II	CI-110-II- 70-BS	1129	1390
	CI-110-II-120-BS	1217	1478
	CI-110-II-160-BS	1258	1519
III	CI-110-III- 70-BS	1197	1458
	CI-110-III-120-BS	1285	1546
	CI-110-III-160-BS	1326	1587
IV	CI-110-IV- 70-BS	1299	1560
	CI-110-IV-120-BS	1387	1648
	CI-110-IV-160-BS	1428	1689

Note : * the spark gap is in conformity with the lightning and switching overloads set by the network designer(beneficiary)

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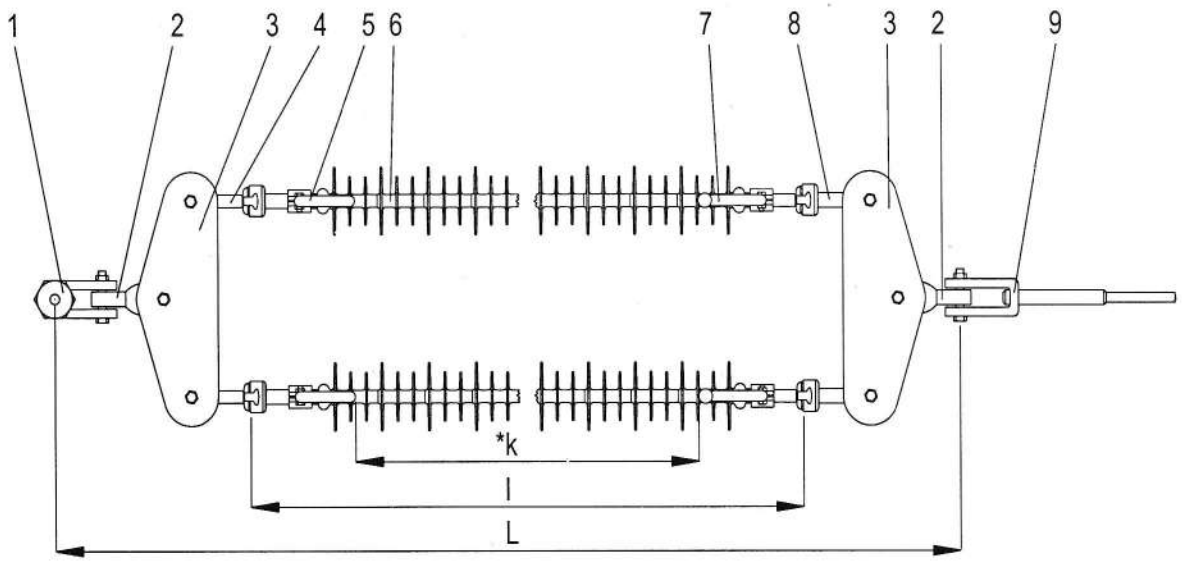
Double tension string 110 kV

LDI 70 kN
120 kN
160 kN



No.	Component	Designation	Unload Tensile strength	Pcs
1	Shackle	B 6,5/16 (B 8/16)	160 kN	1
2	Double twisted eye	OD 16	160 kN	2
3	Single eye	JS 200/16 (JS 250/16)	160 kN	2
4	Ball eye	OSDr 16 (OSDr 20)	120 (160) kN	2
5	Arcing horn II		-	2
6	Composite insulator	110 kV, BS	according to table below	2
7	Arcing horn I		-	2
8	Socket eye	NORV16 (NORV20)	120 (160)	2
9	Tension clamp	TPDFc	95 % UTS	1

Area	Composite insulator type	l (mm)	L (mm)
II	CI-110-II- 70-BS	1129	1690
	CI-110-II-120-BS	1217	1778
	CI-110-II-160-BS	1258	1819
III	CI-110-III- 70-BS	1197	1758
	CI-110-III-120-BS	1285	1846
	CI-110-III-160-BS	1326	1887
IV	CI-110-IV- 70-BS	1299	1860
	CI-110-IV-120-BS	1387	1948
	CI-110-IV-160-BS	1428	1989

Note : * the spark gap is in conformity with the lightning and switching overloads set by the network designer(beneficiary)

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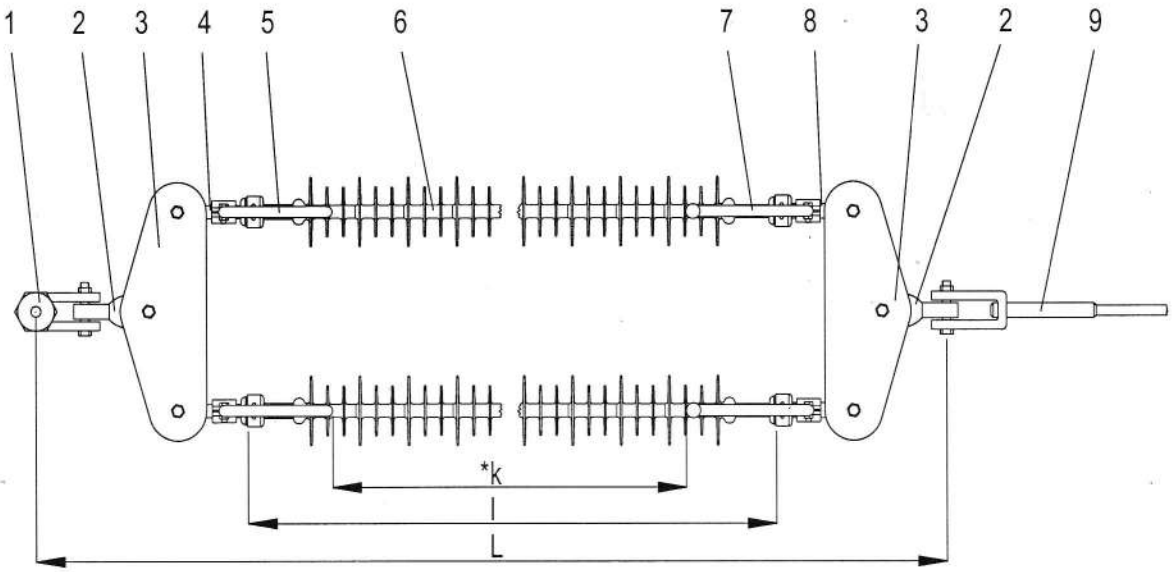
Double tension string with arcing horns mounted on the string110 kV

LDI 70 kN
120 kN
160 kN



No.	Component	Designation	Unload Tensile strength	Pcs
1	Shackle	B 6,5/16 (B 8/16)	160 kN	1
2	Double tension eye	OD 16	160 kN	2
3	Single yoke	JS 200/16 (JS 250/16)	160 kN	2
4	Twisted ball eye	OSr 16 (OSr 20)	120 (160) kN	2
5	Arcing horn II		-	2
6	Composite insulator	110 kV, BS	according to table below	2
7	Arcing horn I		-	2
8	Socket eye	NORV16 (NORV20)	120 (160)	2
9	Tension clamp	TPDFc	95 % UTS	1

Area	Composite insulator type	l (mm)	L (mm)
II	CI-110-II- 70-BS	1129	1690
	CI-110-II-120-BS	1217	1778
	CI-110-II-160-BS	1258	1819
III	CI-110-III- 70-BS	1197	1758
	CI-110-III-120-BS	1285	1846
	CI-110-III-160-BS	1326	1887
IV	CI-110-IV- 70-BS	1299	1860
	CI-110-IV-120-BS	1387	1948
	CI-110-IV-160-BS	1428	1989

Note : * the spark gap is in conformity with the lightning and switching overloads set by the network designer(beneficiary)

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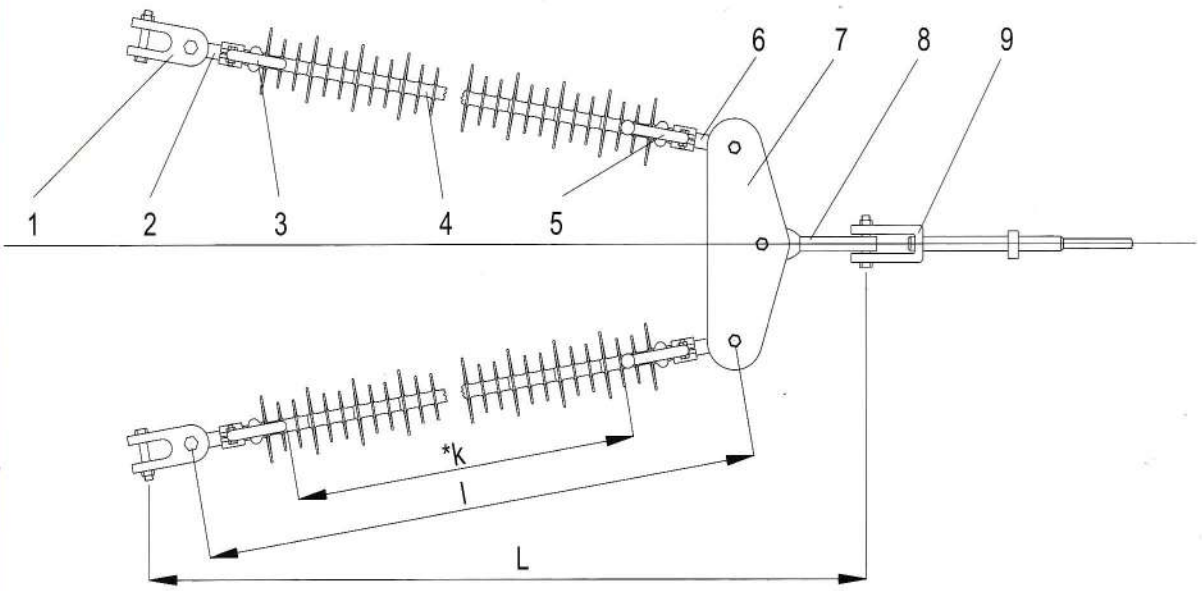
Double "V" tension string 110 kV

LDIV 70 kN
120 kN
160 kN



No.	Component	Designation	Unload Tensile strength	Pcs
1	Shackle	CS 4A	160 kN	2
2	Ball eye	OSDr 16 (OSDr 20)	120 (160) kN	2
3	Arcing horn II		-	2
4	Composite insulator	110 kV, BS	according to table below	2
5	Arcing horn I		-	2
6	Socket eye	NORV16 (NORV20)	120 (160)	2
7	Single yoke	JS 200/16 (JS 250/16)	160 kN	1
8	Double twisted eye	OD 16	160 kN	1
9	Tension clamp	TPDFc	95 % UTS	1

Area	Composite insulator type	l (mm)	L (mm)
II	CI-110-II- 70-BS	1129	1474
	CI-110-II-120-BS	1217	1562
	CI-110-II-160-BS	1258	1603
III	CI-110-III- 70-BS	1285	1630
	CI-110-III-120-BS	1326	1671
	CI-110-III-160-BS	1326	1887
IV	CI-110-IV- 70-BS	1299	1644
	CI-110-IV-120-BS	1387	1732
	CI-110-IV-160-BS	1428	1773

Note : * the spark gap is in conformity with the lightning and switching overloads set by the network designer(beneficiary)

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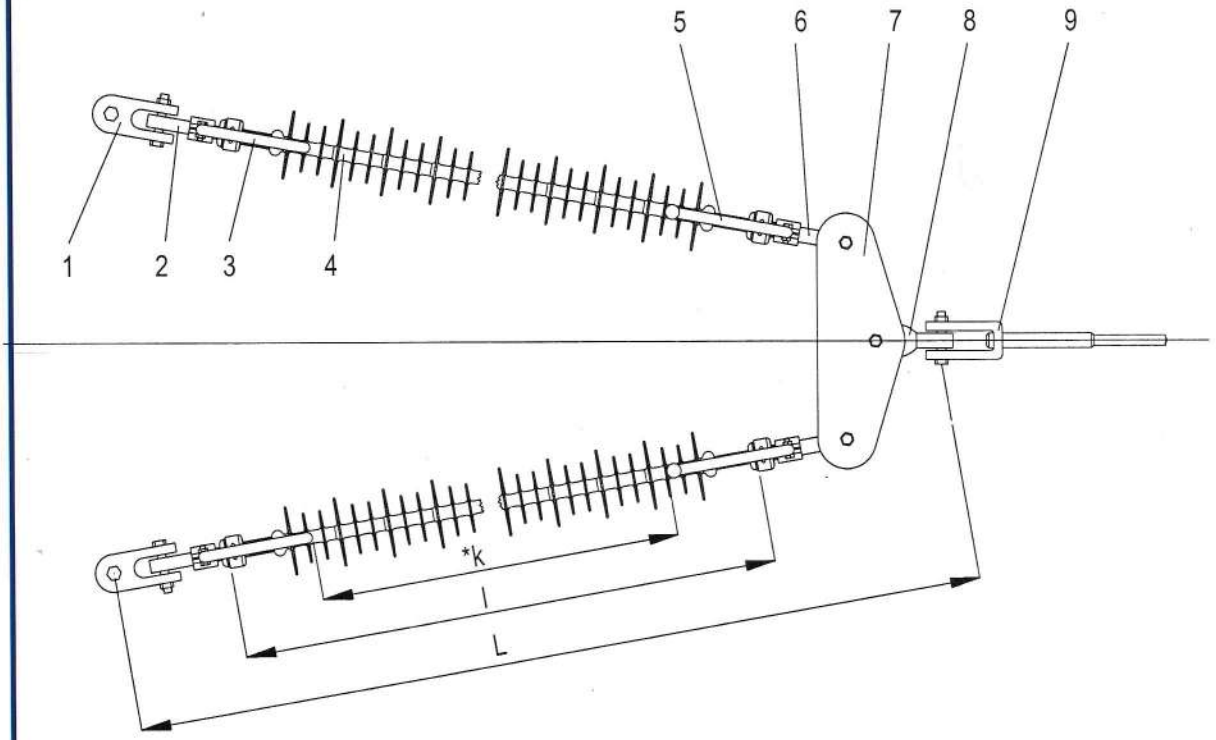
Electromontaj SA Bucharest Clamps & Fittings Factory Campina, phone 40(0)244-336781 fax 40(0)244-334045

Double "V" tension string 110 kV

LDIV 70 kN
120 kN
160 kN



No.	Component	Designation	Unload Tensile strength	Pcs
1	Shackle	CS 4A	160 kN	2
2	Ball eye	OSDr 16 (OSDr 20)	120 (160) kN	2
3	Arcing horn II		-	2
4	Composite insulator	110 kV, BS	according to table below	2
5	Arcing horn I		-	2
6	Socket eye	NORV16 (NORV20)	120 (160)	2
7	Single yoke	JS 200/16 (JS 250/16)	160 kN	1
8	Double twisted eye	OD 16	160 kN	1
9	Tension clamp	TPDFc	95 % UTS	1

Area	Composite insulator type	l (mm)	L (mm)
II	CI-110-II- 70-BS	1129	1474
	CI-110-II-120-BS	1217	1562
	CI-110-II-160-BS	1258	1603
III	CI-110-III- 70-BS	1285	1630
	CI-110-III-120-BS	1326	1671
	CI-110-III-160-BS	1326	1887
IV	CI-110-IV- 70-BS	1299	1644
	CI-110-IV-120-BS	1387	1732
	CI-110-IV-160-BS	1428	1773

Note : * the spark gap is in conformity with the lightning and switching overloads set by the network designer(beneficiary)

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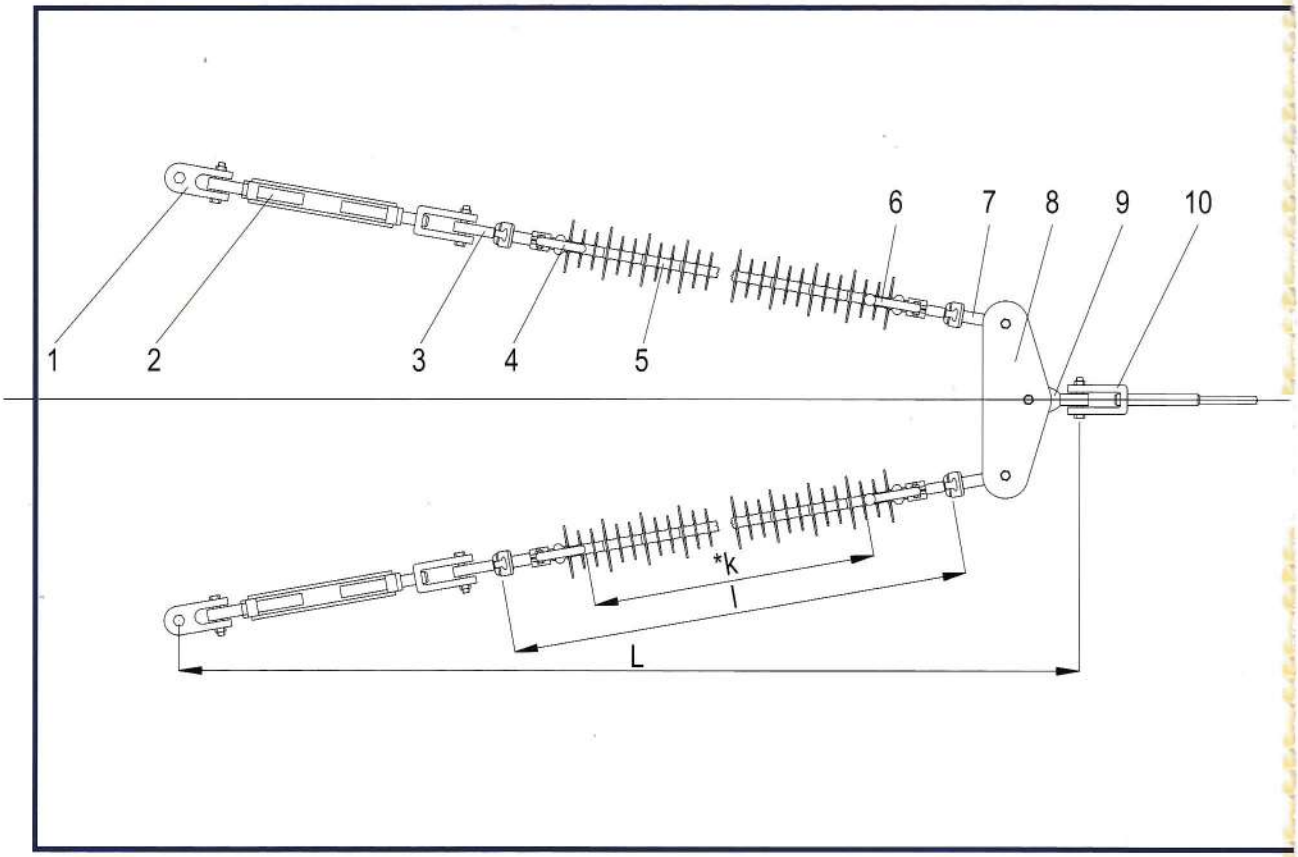
Double "V" tension string, with turnbuckles 110 kV

LDIV 70 kN
120 kN
160 kN



No.	Component	Designation	Unload Tensile strength	Pcs.
1	Shackle	CS 4A	160 kN	2
2	Thurnbuckle	IROF 12	120 kN	2
3	Single suspension eye	OSDr 16 (OSDr 20)	120 (160) kN	2
4	Arcing horn II		-	2
5	Composite insulator	110 kV, BS	according to table below	2
6	Arcing horn I		-	2
7	Socket eye	NORV16 (NORV20)	120 (160)	2
8	Single yoke	JS 200/16 (JS 250/16)	160 kN	1
9	Double twisted eye	OD 16 (OD 20)	120 (160) kN	1
10	Tension clamp	TPDFc	95 % UTS	1

Area	Composite insulator type	l (mm)	L (mm)
II	CI-110-II- 70-BS	1129	1888
	CI-110-II-120-BS	1217	1976
	CI-110-II-160-BS	1258	2017
III	CI-110-III- 70-BS	1197	1956
	CI-110-III-120-BS	1285	2044
	CI-110-III-160-BS	1326	2085
IV	CI-110-IV- 70-BS	1299	2058
	CI-110-IV-120-BS	1387	2146
	CI-110-IV-160-BS	1428	2187

Note : * the spark gap is in conformity with the lightning and switching overloads set by the network designer(beneficiary)

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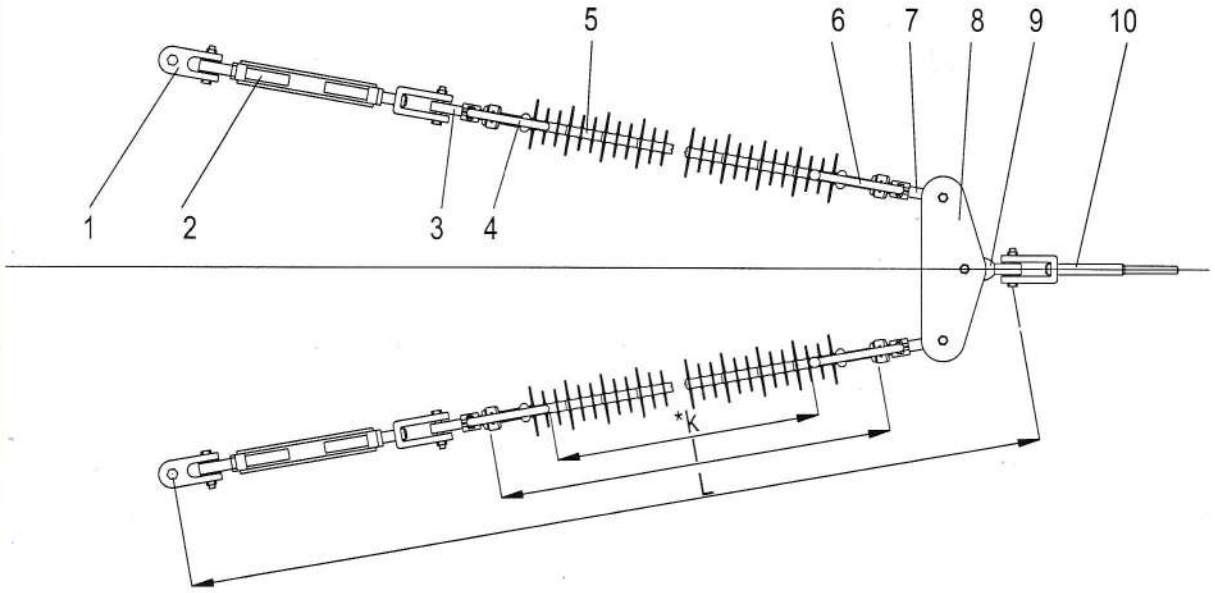
Double "V" tension string, with turnbuckles 110 kV

LDIV 70 kN
120 kN
160 kN



No.	Component	Designation	Unload Tensile strength	Pcs
1	Shackle	CS 4A	160 kN	2
2	Turnbuckle	IROF 12	120 kN	2
3	Ball eye	OSDr 16 (OSDr 20)	120 (160) kN	2
4	Arcing horn II		-	2
5	Composite insulator	110 kV, BS	according to table	2
6	Arcing horn I		-	2
7	Socket eye	NORV16 (NORV20)	120 (160)	2
8	Single yoke	JS 200/16 (JS 250/16)	160 kN	1
9	Double twisted eye	OD 16 (OD 20)	120 (160) kN	1
10	Tension clamp	TPDFc	95 % UTS	1

Area	Composite insulator type	l (mm)	L (mm)
II	CI-110-II- 70-BS	1129	1888
	CI-110-II-120-BS	1217	1976
	CI-110-II-160-BS	1258	2017
III	CI-110-III- 70-BS	1197	1956
	CI-110-III-120-BS	1285	2044
	CI-110-III-160-BS	1326	2085
IV	CI-110-IV- 70-BS	1299	2058
	CI-110-IV-120-BS	1387	2146
	CI-110-IV-160-BS	1428	2187

Note : * the spark gap is in conformity with the lightning and switching overloads set by the network designer(beneficiary)

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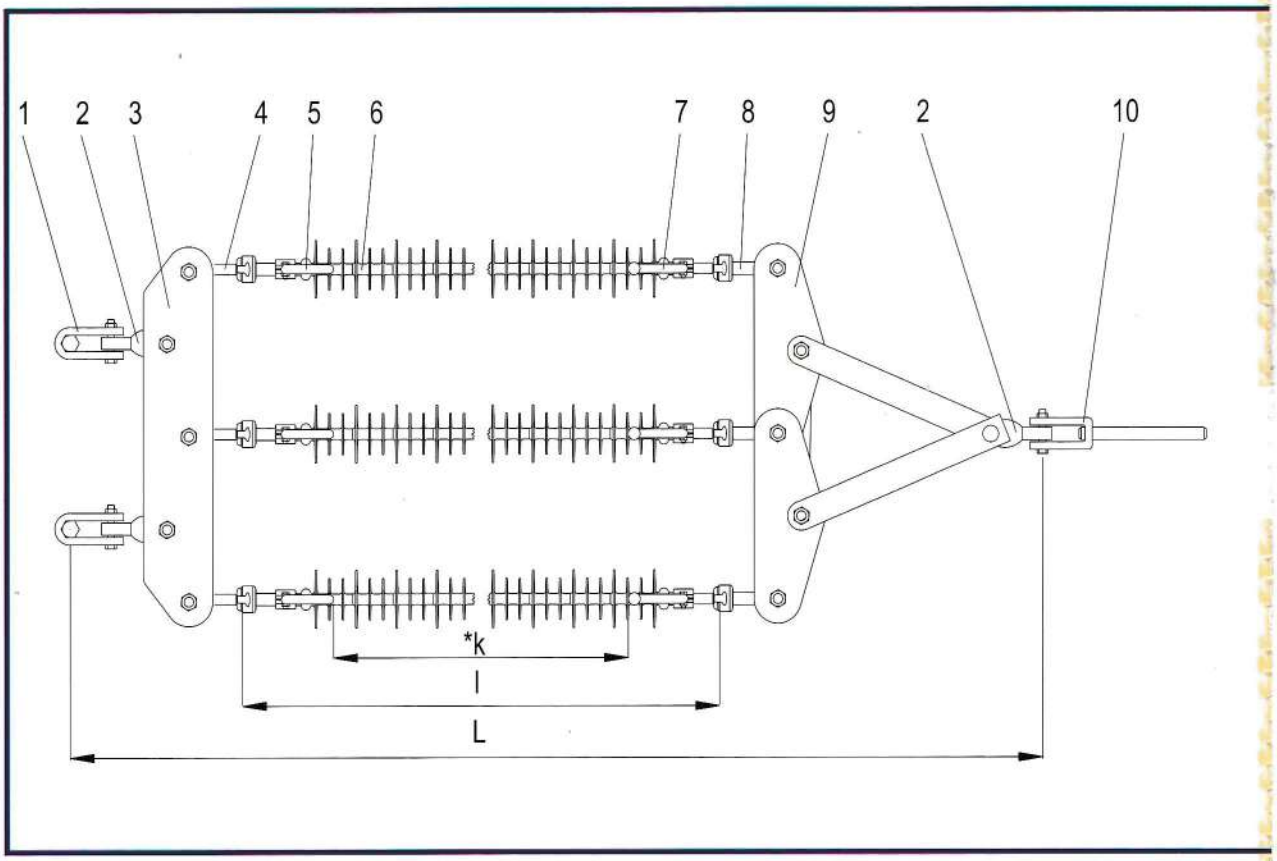
Triple tension string 110 kV

LTI 70 kN
120 kN
160 kN



No.	Component	Designation	Unload Tensile strength	Pcs
1	Shackle	B 6,5/16 (B 8/16)	160 kN	2
2	Double twisted eye	OD 16 (OD 20)	120 (160) kN	2
3	Double yoke	JD 1000/500-30	300 kN	1
4	Single suspension eye	OSR 16 (OSR 20)	120 (160) kN	3
5	Arcing horn II		-	3
6	Composite insualtor	110 kV, BS	according to table below	3
7	Arcing horn I		-	3
8	Eye socket	NORV16 (NORV20)	120 (160)	3
9	Device for triple insulator string	DLT 25 M	250 kN	1
10	Tension clamp	TPDFc	95 % UTS	1

Area	Composite insulator type	l (mm)	L (mm)
II	CI-110-II- 70-BS	1129	2420
	CI-110-II-120-BS	1217	2508
	CI-110-II-160-BS	1258	2549
III	CI-110-III- 70-BS	1197	2488
	CI-110-III-120-BS	1285	2576
	CI-110-III-160-BS	1326	2617
IV	CI-110-IV- 70-BS	1299	2590
	CI-110-IV-120-BS	1387	2678
	CI-110-IV-160-BS	1428	2719

Note : ** the spark gap is in conformity with the lightning and switching* overloads set by the network designer(beneficiary)

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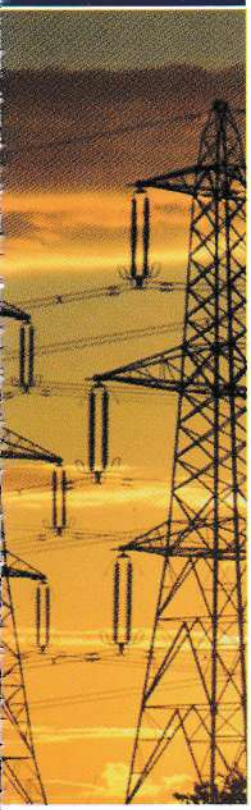
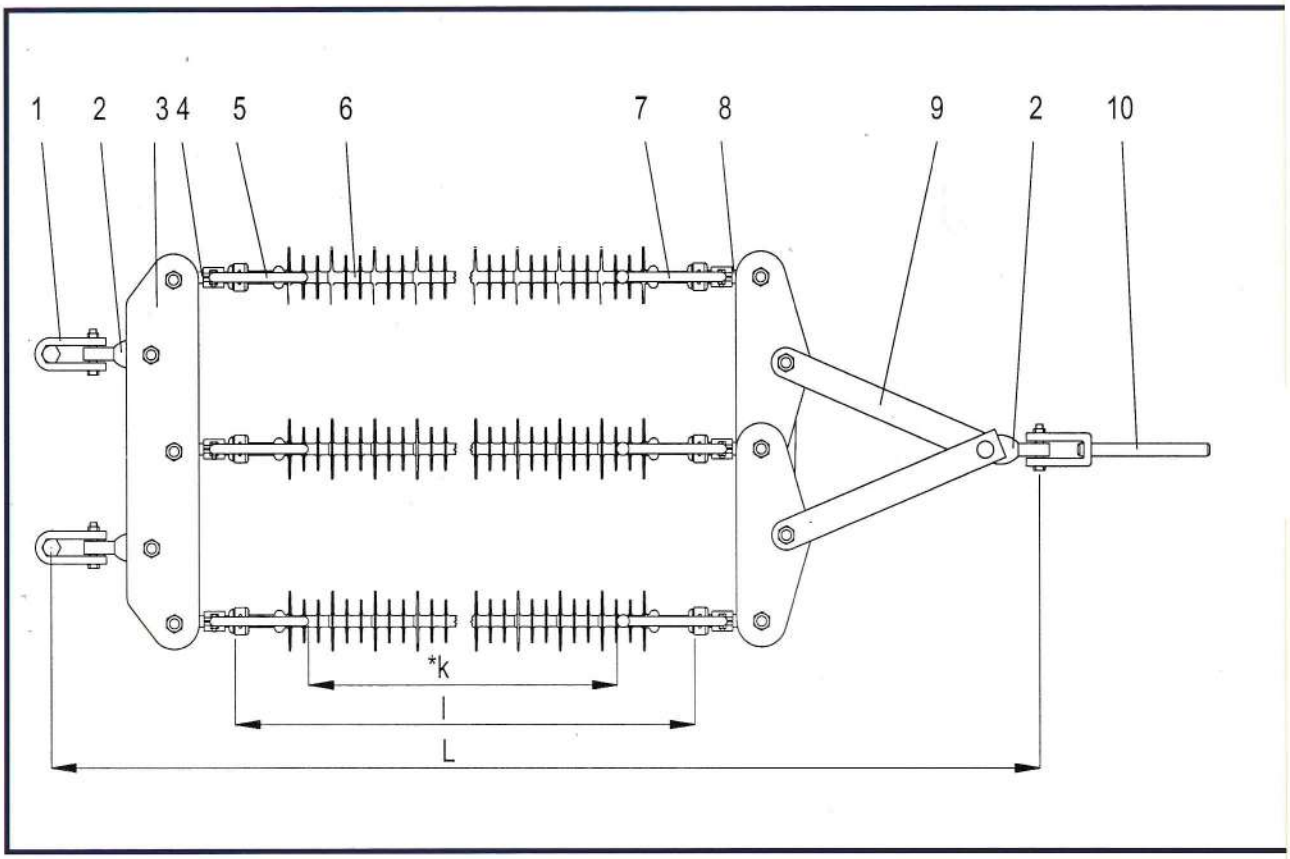


Insulator strings with composite insulators and Ball-Socket end-fittings, 110 kV

Triple tension string with arcing horns mounted on the string110 kV

LTI 70 kN
120 kN
100 kN



No.	Component	Designation	Unload Tensile strength	Pcs
1	Shackle	B 6,5/16 (B 8/16)	160 kN	2
2	Double twisted eye	OD 16 (OD 20)	120 (160) kN	2
3	Double yoke	JD 1000/500-30	300 kN	1
4	Single suspension eye	OSR 16 (OSR 20)	120 (160) kN	3
5	Arcing horn II		-	3
6	Compositye insulator	110 kV, BS	according to table below	3
7	Arcing horn I		-	3
8	Eye socket	NORV16 (NORV20)	120 (160)	3
9	Device for triple insulator string	DLT 25 M	250 kN	1
10	Tension clamp	TPDFc	95 % UTS	1

Area	Composite insulator type	l (mm)	L (mm)
II	CI-110-II- 70-BS	1129	2420
	CI-110-II-120-BS	1217	2508
	CI-110-II-160-BS	1258	2549
III	CI-110-III- 70-BS	1197	2488
	CI-110-III-120-BS	1285	2576
	CI-110-III-160-BS	1326	2617
IV	CI-110-IV- 70-BS	1299	2590
	CI-110-IV-120-BS	1387	2678
	CI-110-IV-160-BS	1428	2719

Note : * the spark gap is in conformity with the lightning and switching overloads set by the network designer(beneficiary)

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Insulator strings with composite insulators and Ball-Socket end-fittings, 220 kV

Chapter 9

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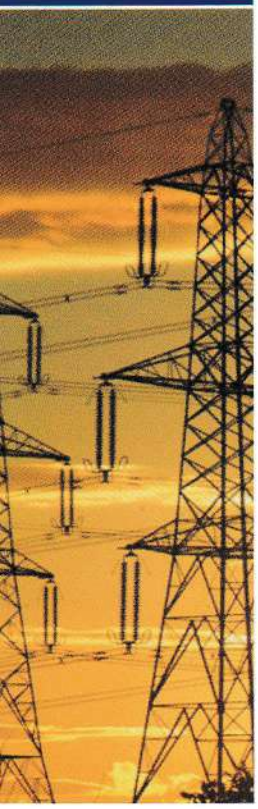
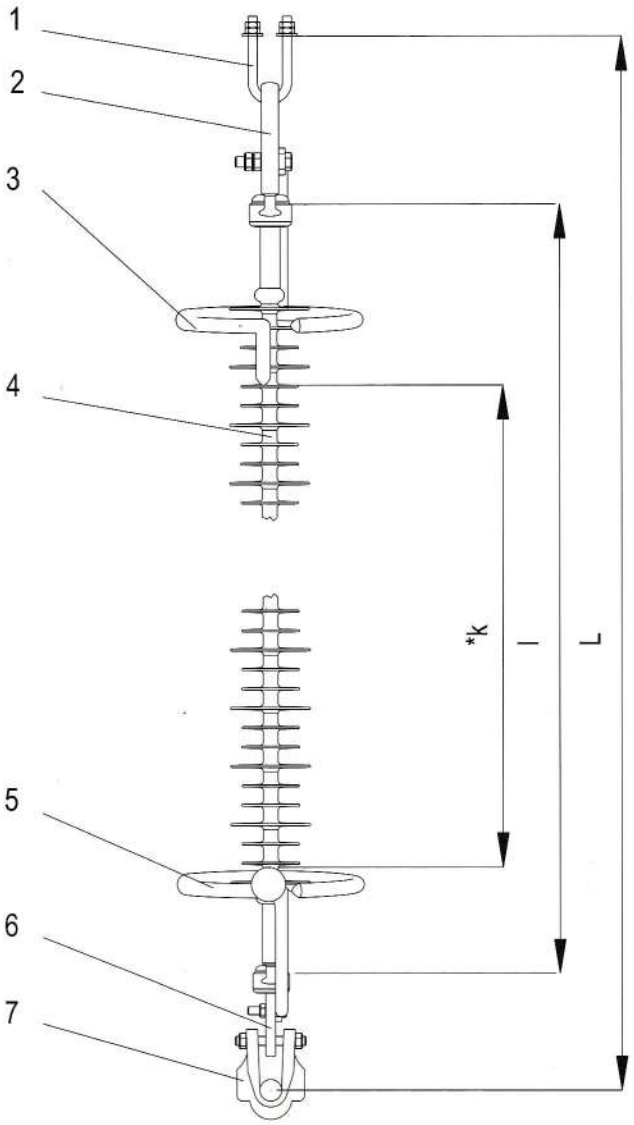


Single suspension string, A variant 220 kV

LSS
120kN
160kN



Area	II	II
SML	120	160
l (mm)	2135	2176
L (mm)	2506	2583
Guarding ring	IPS-2-BS	IPS-16-BS
type	IPI-2-BS	IPI-2-BS

Area	III	III	IV	IV
SML	120	160	120	160
l	2237	2278	2261	2302
L	2608	2685	2632	2709
Guarding ring	IPS-2-BS	IPS-16-BS	IPS-7-BS	IPS-16-BS
type	IPI-5-BS	IPI-5-BS	IPI-3-BS	IPI-1-BS

Insulator strings with composite insulators and Ball-Socket end-fittings, 220 kV

No.	Component	Quantity (Pcs.)	Material	Designation
1	U-bolt	1	Zn-steel	A 2-60, 120/160 kN
2	Ball eye	1	Zn- forged steel	OSdr 16, 120 kN OSdr 20; 160 kN
3	Upper guarding ring	1	Zn-steel	IPS
4	Composite insulator, 220 kV	1	Silicone rubber	CI-220-II-120/160-BS CI-220-III-120/160-BS CI-220-IV-120/160-BS
5	Bottom guarding ring	1	Zn-steel	IPI
6	Thick straight eye socket	1	Zn- forged steel	NSV16A, , 120 NSVG16, 120 kN NVSG 20; 160 kN
7	Suspension clamp	1	Aluminum alloy	CSA 4, 120 kN

Note : * the spark gap is in conformity with the lightning and switching overloads set by the network designer (beneficiary)

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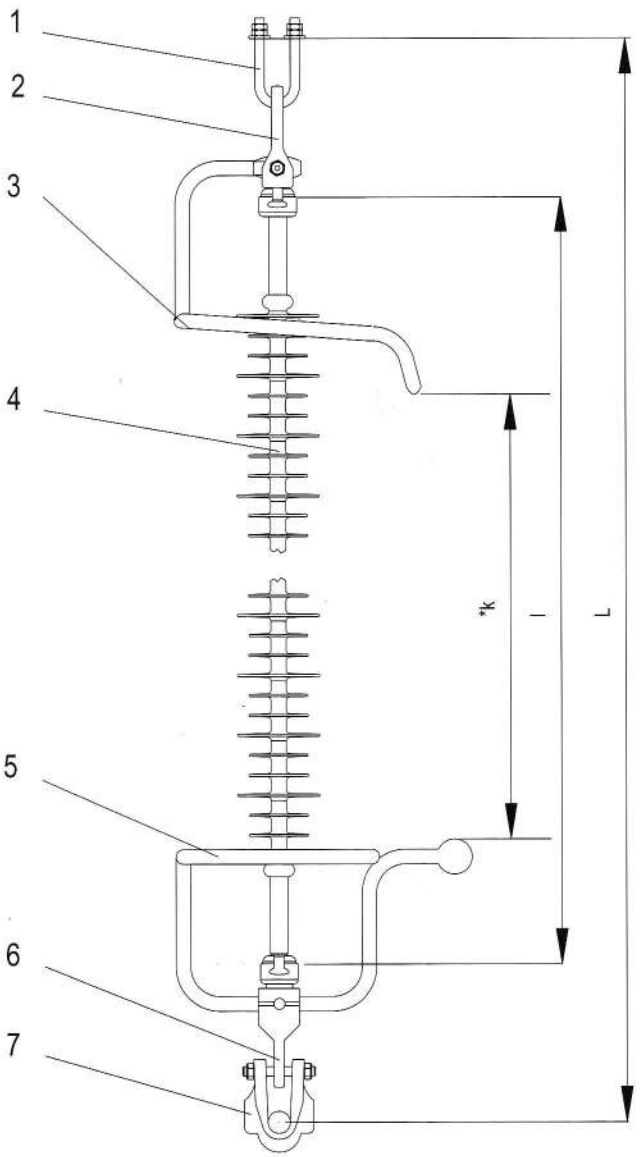
Single suspension string, B variant 220 kV

LSS
120kN
160kN



Area SML	II 120 kN	II 160 kN
l (mm)	2135	2176
L (mm)	2536	2602
Guarding ring type	IPS-2-BS IPI-2-BS	IPS-16-BS IPI-2-BS

Area SML	III 120 kN	III 160 kN	IV 120 kN	IV 160 kN
l (mm)	2237	2278	2261	2302
L (mm)	2638	2704	2662	2728
Guarding ring type	IPS-2-BS IPI-5-BS	IPS-16-BS IPI-5-BS	IPS-2-BS IPI-5-BS	IPS-16-BS IPI-5-BS

No.	Component	Quantity (Pcs.)	Material	Designation
1	U-bolt	1	Zn-steel	A 2-60, 120/160 kN
2	Twisted ball eye	1	Zn- forged steel	OSR 16, 120 kN OSR 20; 160 kN
3	Upper guarding ring	1	Zn-steel	IPS
4	Composite insulator, 220 kV	1	Silicone rubber	CI-220-II-120/160-BS CI-220-III-120/160-BS CI-220-IV-120/160-BS
5	Bottom guarding ring	1	Zn-steel	IPI
6	Thick straight eye socket	1	Zn- forged steel	NORG 16; 120 kN NORG 20; 160 kN
7	Suspension clamp	1	Aluminum alloy	CSA 4, 120 kN

Note : * the spark gap is in conformity with the lightning and switching overloads set by the network designer (beneficiary)

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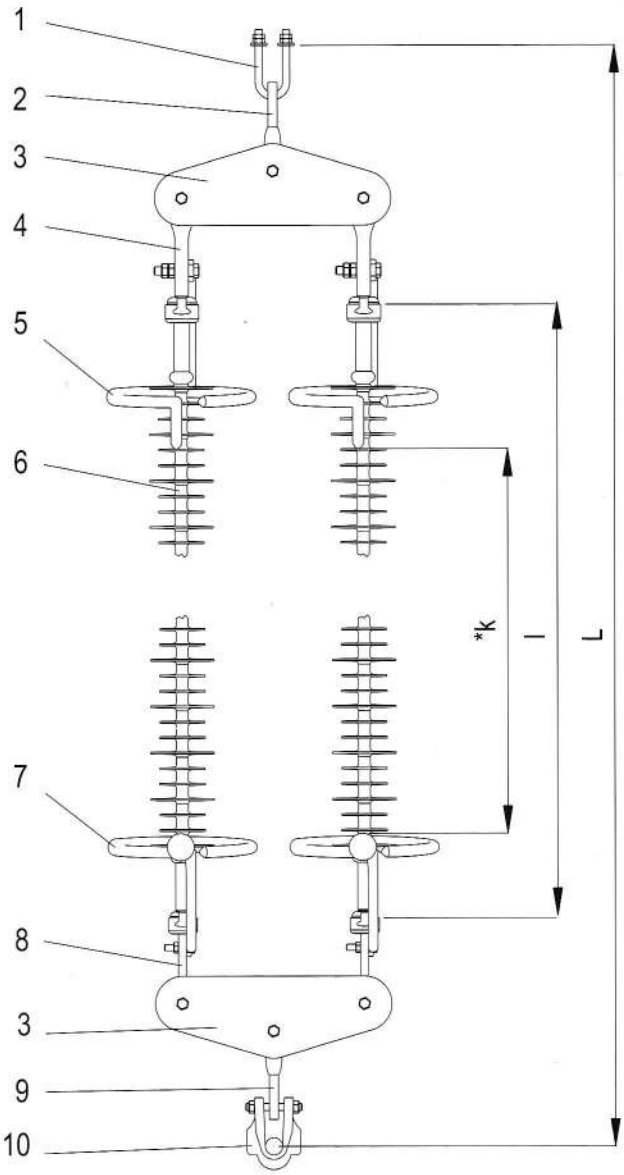
Double suspension string, A variant 220 kV

LDS
120kN
160kN



Area SML	II 120 kN	II 160 kN
l (mm)	2135	2176
L (mm)	2856	2922
Arcing ring	IPS-2-BS	IPS-16-BS
type	IPI-2-BS	IPI-2-BS

Area SML	III 120 kN	III 160 kN	IV 120 kN	IV 160 kN
l (mm)	2237	2278	2261	2302
L (mm)	2958	3024	2982	3048
Guarding ring	IPS-2-BS	IPS-16-BS	IPS-2-BS	IPS-16-BS
type	IPI-5-BS	IPI-5-BS	IPI-1-BS	IPI-1-BS

No.	Component	Quantity (Pcs.)	Material	Designation
1	U-bolt	1	Zn-steel	A -2-60, 160 kN
2	Double twisted eye	1	Zn-steel	OD-16, 160 kN
3	Single yoke	2	Zn-steel	Js 500/16, 160 kN
4	Twisted ball eye	2	Zn- forged steel	OSR 16, 120 kN OSR 20 ; 160 kN
5	Upper guarding ring	2	Zn-steel	IPS
6	Composite insulator, 220 kV	2	Silicone rubber	CI-220-II-120/160-BS CI-220-III-120/160-BS CI-220-IV-120/160-BS
7	Bottom guarding ring	2	Zn-steel	IPI
8	Twisted eye socket	2	Zn- forged steel	NORV 16, 120 kN NORV 20; 160 kN
9	Double twisted piece	1	Zn-steel	PR-43, 120 kN
10	Suspension clamp	1	Aluminum alloy	CSA 4, 120 kN

Note : * the spark gap is in conformity with the lightning and switching overloads set by the network designer (beneficiary)

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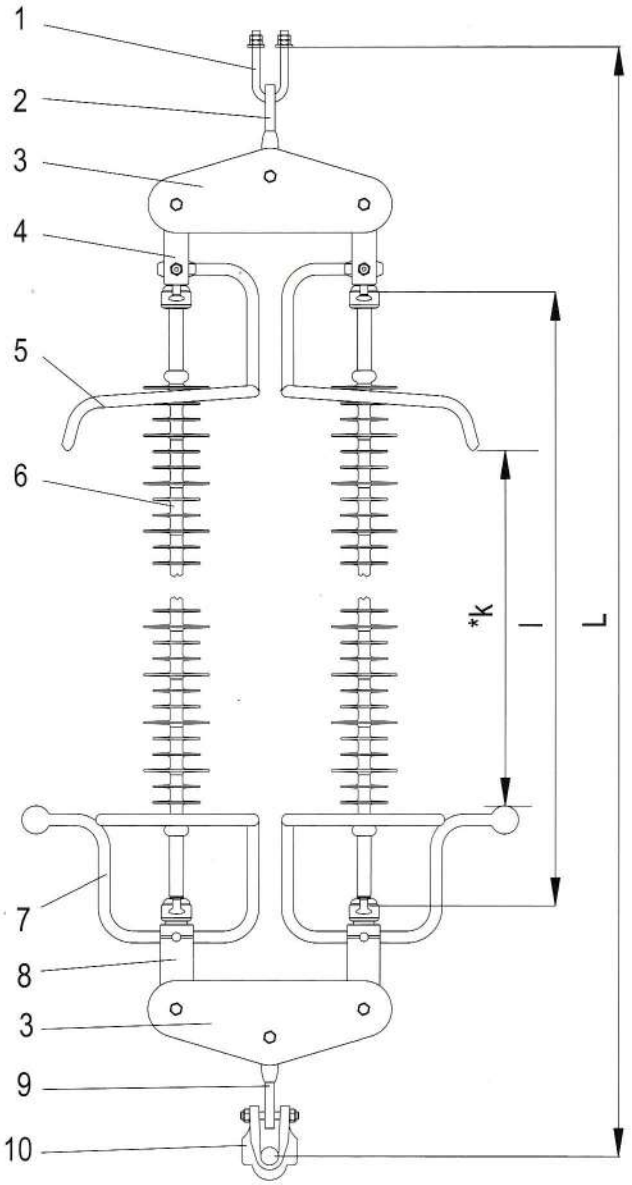
Double suspension string, B variant 220 kV

LDS
120kN
160kN



Area SML	II 120 kN	II 160 kN
l (mm)	2135	2176
L (mm)	2826	2903
Guarding ring type	IPS-2-BS IPI-2-BS	IPS-16-BS IPI-2-BS

Area SML	III 120 kN	III 160 kN	IV 120 kN	IV 160 kN
l (mm)	2237	2278	2261	2302
L (mm)	2928	3005	2952	3029
Guarding ring type	IPS-2-BS IPI-1-BS	IPS-16-BS IPI-5-BS	IPS-2-BS IPI-1-BS	IPS-16-BS IPI-1-BS

No.	Component	Quantity (Pcs.)	Material	Designation
1	U-bolt	1	Zn-steel	A -2-60, 160 kN
2	Double twisted eye	1	Zn-steel	OD-16, 160 kN
3	Single yoke	2	Zn-steel	Js 500/16, 160 kN
4	Ball eye	2	Zn- forged steel	OSdr 16, 120 kN OSdr 20 ; 160 kN
5	Upper guarding ring	2	Zn-steel	IPS
6	Composite insulator, 220 kV	2	Silicone rubber	CI-220-II-120/160-BS CI-220-III-120/160-BS CI-220-IV-120/160-BS
7	Bottom guarding ring	2	Zn-steel	IPI
8	Straight eye socket	2	Zn- forged steel	NSV 16, 120 kN NSV 20; 160 kN
9	Double twisted piece	1	Zn steel	PR-43, 120 kN
10	Suspension clamp	1	Aluminum alloy	CSA 4, 120 kN

Note : * the spark gap is in conformity with the lightning and switching overloads set by the network designer (beneficiary)

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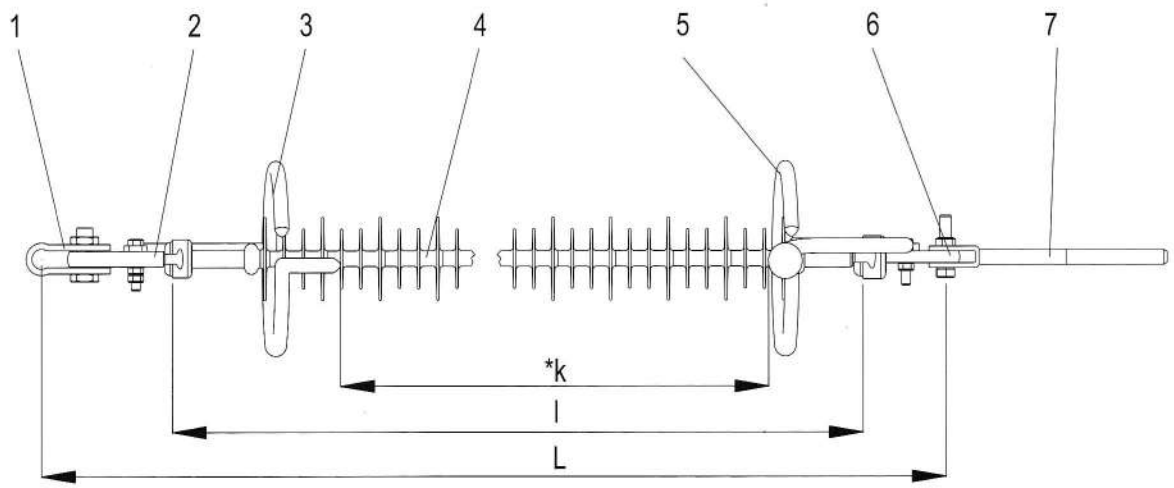
Single tension string 220 kV

LSI
120kN
160kN



No.	Component	Quantity (Pcs.)	Material	Designation
1	Swivel	1	Zn-steel	B 6,5/16, 160 kN
2	Ball eye	1	Zn-steel	OSDr (16)20, 120(160) kN
3	Upper guarding ring	1	Zn-steel	IPS
4	Composite insulator 220 kV	1	Silicone rubber	CI-220-II-120/160-BS CI-220-III-120/160-BS CI-220-IV-120/160-BS
5	Bottom guarding ring	1	Zn-steel	IPI
6	Eye socket	1	Zn -forged steel	NSV (16)20, 120(160) kN
7	Suspension clamp	1	Al Zn-steel alloy	TPDFc 450

Area SML	II 120 kN	II 160 kN	III 120 kN	III 160 kN	IV 120 kN	IV 160 kN
l (mm)	2135	2176	2237	2278	2261	2302
L (mm)	2436	2513	2538	2615	2562	2639
Guarding ring type	IPS-2-BS IPI-2-BS	IPS-16-BS IPI-2-BS	IPS-2-BS IPI-5-BS	IPS-16-BS IPI-5-BS	IPS-7-BS IPI-3-BS	IPS-16-BS IPI-1-BS

Note : * the spark gap is in conformity with the lightning and switching overloads set by the network designer (beneficiary)

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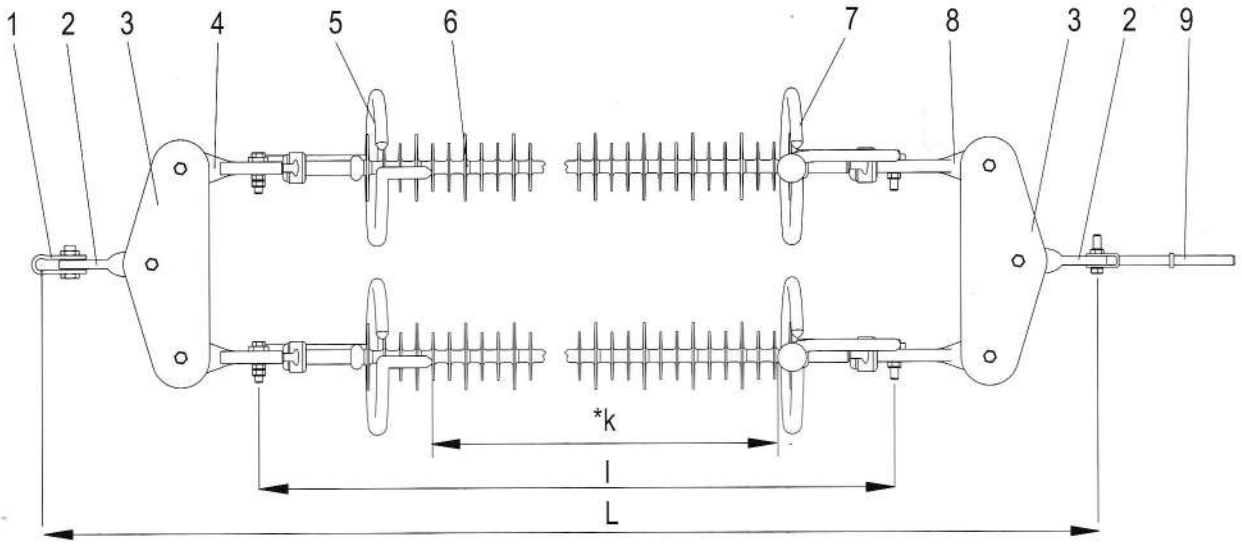
Double tension string 220 kV

LDI
120kN
160kN



No.	Component	Quantity (Pcs.)	Material	Designation
1	Swivel	1	Zn-steel	B10/20, 200 kN
2	Double twisted eye	2	Zn-steel	OD-20, 200 kN
3	Single yoke	2	Zn-steel	Js 500/20, 200 kN
4	Twisted ball eye	2	Zn- forged steel	OSR (16)20, 120(160) kN
5	Upper guarding ring	2	Zn-steel	IPS
6	Composite insulator, 220 kV	2	Silicone rubber	CI-220-II-120/160-BS CI-220-III-120/160-BS CI-220-IV-120/160-BS
7	Bottom guarding ring	2	Zn-steel	IPI
8	Twisted eye socket	2	Zn- forged steel	NORV (16)20, 120(160) kN
9	Tension clamp	1	Al Zn-steel alloy	TPDFc 450

Area SML	II 120 kN	II 160 kN	III 120 kN	III 160 kN	IV 120 kN	IV 160 kN
l (mm)	2135	2176	2237	2278	2261	2302
L (mm)	2856	2922	2958	3024	2982	3048
Guarding ring	IPS-2-BS	IPS-16-BS	IPS-2-BS	IPS-16-BS	IPS-2-BS	IPS-16-BS
type	IPI-2-BS	IPI-2-BS	IPI-5-BS	IPI-5-BS	IPI-1-BS	IPI-1-BS

Note : * the spark gap is in conformity with the lightning and switching overloads set by the network designer (beneficiary)

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Insulator strings with composite insulators and Ball-Socket end-fittings, 400 kV

Chapter 10

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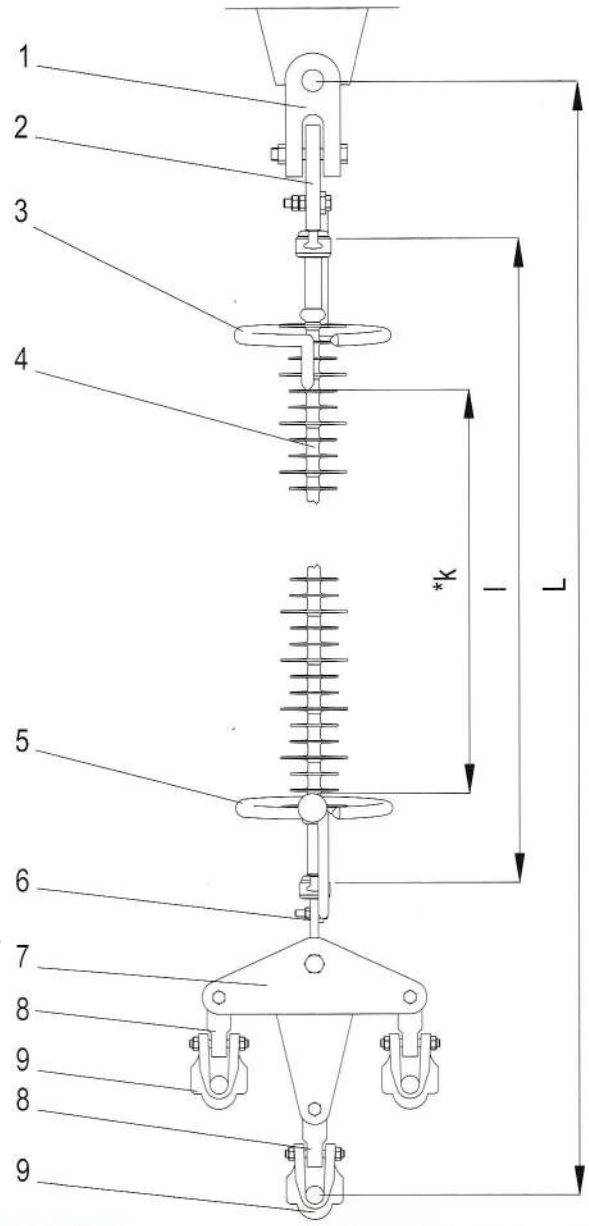
Single suspension string 400 kV, variant A, three conductors per phase

LSS
120 kN
160 kN

Area	II	II	II / A	II / A
SML	120	160	120	160
l (mm)	3155	3196	3359	3400
L (mm)	4009	4077	4213	4281
Guarding ring	IPS-10-BS	IPS-7-BS	IPS-7-BS	IPS-1-BS
type	IPI-4-BS	IPI-4-BS	IPI-1-BS	IPI-1-BS

Area	III	III	IV	IV
SML	120	160	120	160
l (mm)	3461	3502	3587	3628
L (mm)	4315	4383	4441	4509
Guarding ring	IPS-7-BS	IPS-1-BS	IPS-16-BS	IPS-4-BS
type	IPI-3-BS	IPI-3-BS	IPI-3-BS	IPI-1-BS



Insulator strings with composite insulators and Ball-Socket end-fittings, 400 kV

No.	Component	Quantity (Pcs.)	Material	Designation
1	Shackle	1	Zn-steel	CS 4 A
2	Ball eye	1	Zn-steel	OSdr-16, 120 kN OSdr-20, 160 kN
3	Upper guarding ring	1	Zn-steel	IPS
4	Composite insulator, 400 kV	1	Silicon rubber	CI-400-II-120/160-BS CI-400-II/A-120/160-BS CI-400-III-120/160-BS CI-400-IV-120/160-BS
5	Bottom guarding ring	1	Zn-steel	IPI
6	Twisted eye socket	1	Zn-steel	NORV-16; 120 kN NORV-20; 160 kN
7	Single yoke	1	Zn-steel	JS 400/3
8	Double twisted piece	3	Zn-steel	PR 43
9	Suspension clamp	3	Aluminum steel	CSA-4, 120 kN

Note : * the spark gap is in conformity with the lightning and switching overloads set by the network designer (beneficiary)

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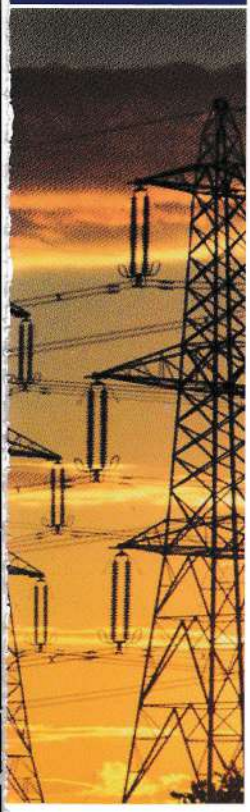
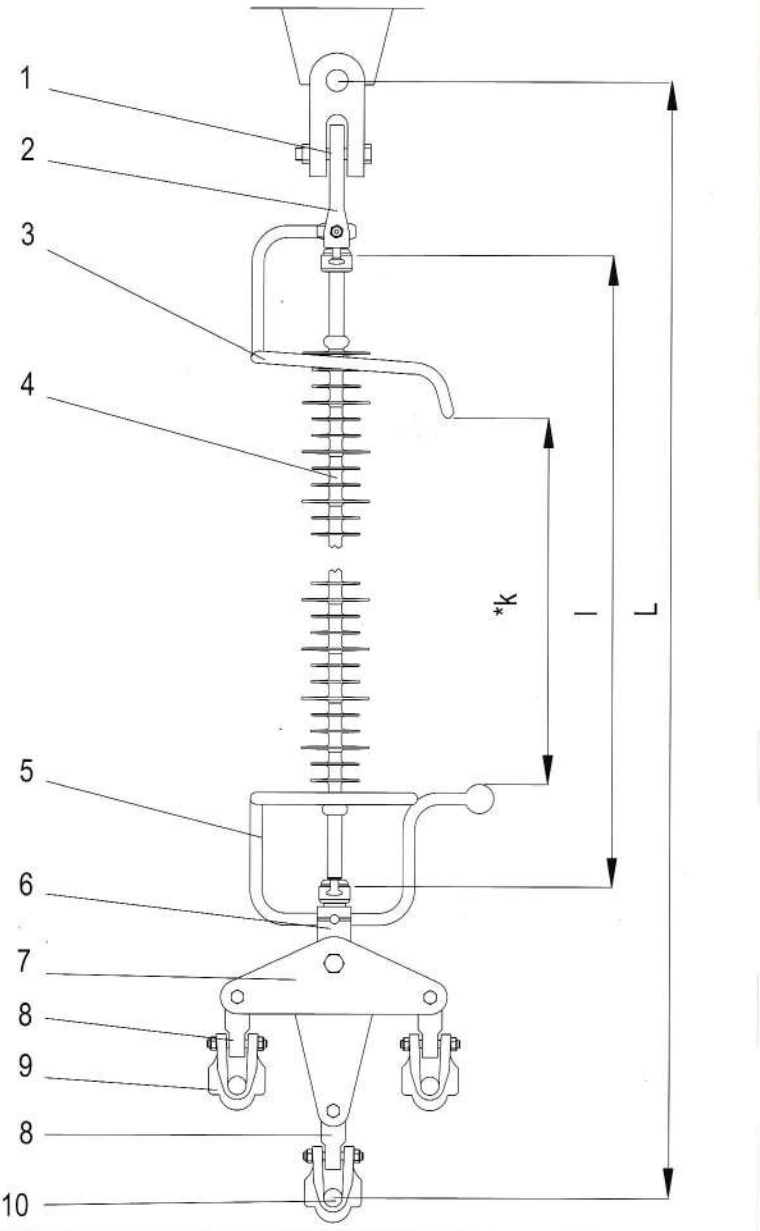


Single suspension string, 400 kV variant B, three conductors per phase

LSS
120 kN
160 kN

Area SML	II 120	II 160	II / A 120	II / A 160
l (mm)	3155	3196	3359	3400
L (mm)	4025	4100	4389	4304
Guarding ring type	IPS-10-BS IPI-4-BS	IPS-7-BS IPI-4-BS	IPS-7-BS IPI-1-BS	IPS-1-BS IPI-1-BS

Area SML	III 120	III 160	IV 120	IV 160
l (mm)	3461	3502	3587	3628
L (mm)	4491	4406	4617	4532
Guarding ring type	IPS-7-BS IPI-3-BS	IPS-1-BS IPI-3-BS	IPS-16-BS IPI-3-BS	IPS4-BS IPI-1-BS



No.	Component	Quantity (Pcs.)	Material	Designation
1	Shackle	1	Zn-steel	CS - 4D
2	Twisted ball eye	1	Zn-steel	OSr-16, 120 kN OSr-20, 160 kN
3	Upper guarding ring	1	Zn-steel	IPS
4	Composite insulator, 400 kV	1	Silicone rubber	CI-400-II-120/160-BS CI-400-II/A-120/160-BS CI-400-III-120/160-BS CI-400-IV-120/160-BS
5	Bottom guarding ring	1	Zn-steel	IPI
6	Straight eye socket	1	Zn-steel	NSV - 16; 120 kN NSV -20; 160 kN
7	Single yoke	1	Zn-steel	JS 400/3
8	Double twisted piece	3	Zn-steel	PR 43
9	Suspension clamp	3	Aluminum alloy	CSA- 4, 120 kN
10	Armour rod	3	Aluminum alloy	AAR 162-1144

Insulator strings with composite insulators and Ball-Socket end-fittings, 400 kV

Note : * the spark gap is in conformity with the lightning and switching overloads set by the network designer (beneficiary)

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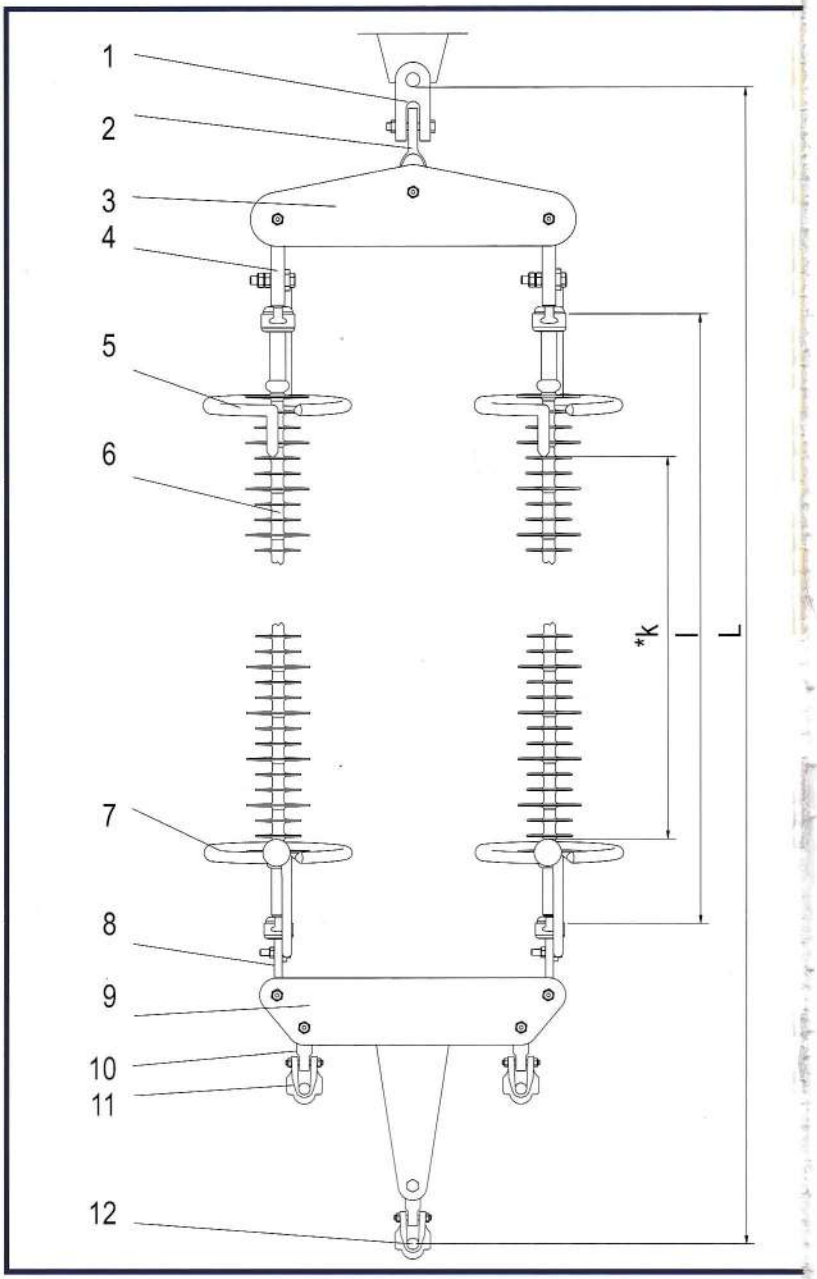
Double suspension string 400 kV variant A, three conductors per phase

LDS
120 kN
160 kN



Area	II	II	II / A	II / A
SML	120	160	120	160
l (mm)	3155	3196	3359	3400
L (mm)	4213	4279	4417	4483
Guarding ring type	IPS-10-BS IPI-4-BS	IPS-7-BS IPI-4-BS	IPS-7-BS IPI-1-BS	IPS-1-BS IPI-1-BS

Area	III	III	IV	IV
SML	120	160	120	160
l (mm)	3461	3502	3587	3628
L (mm)	4519	4585	4645	4711
Guarding ring type	IPS-7-BS IPI-3-BS	IPS-1-BS IPI-3-BS	IPS-16-BS IPI-3-BS	IPS-4-BS IPI-1-BS

Insulator strings with composite insulators and Ball-Socket end-fittings, 400 kV

No.	Component	Quantity (Pcs).	Material	Designation
1	Shackle	1	Zn-steel	CS 4D
2	Double twisted eye	1	Zn-steel	OD-35
3	Single yoke	1	Zn-steel	Js 500/24
4	Twisted ball eye	2	Zn-steel	OSR 16(120 kN)OSR 20 (160 kN)
5	Upper guarding ring	2	Zn-steel	IPS
6	Composite insulator, 400 kV	2	Silicone rubber	CI-400-II-120/160 BS CI-400-II/A-120/160-BS CI-400-III-120/160-BS CI-400-IV-120/160-BS
7	Bottom guarding ring	2	Zn-steel	IPI
8	Twisted eye socket	2	Zn-steel	NORV 16 120 kN NORV 20 160 kN
9	Double yoke	1	Zn-steel	Jd 400/3-30
10	Double twisted piece	3	Zn-steel	PR 43
11	Suspension clamp	3	Aluminum alloy	CSA- 4
12	Armour rod	3	Aluminum alloy	AAR 162-1144

Note : * the spark gap is in conformity with the lightning and switching overloads set by the network designer (beneficiary)

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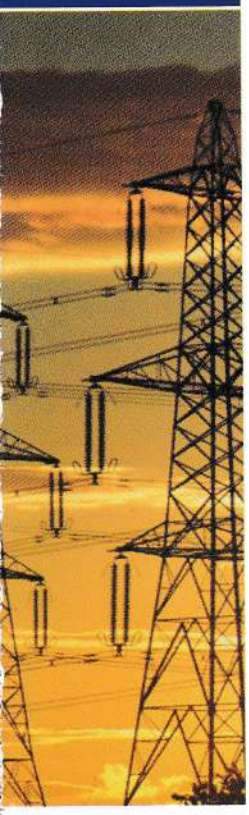
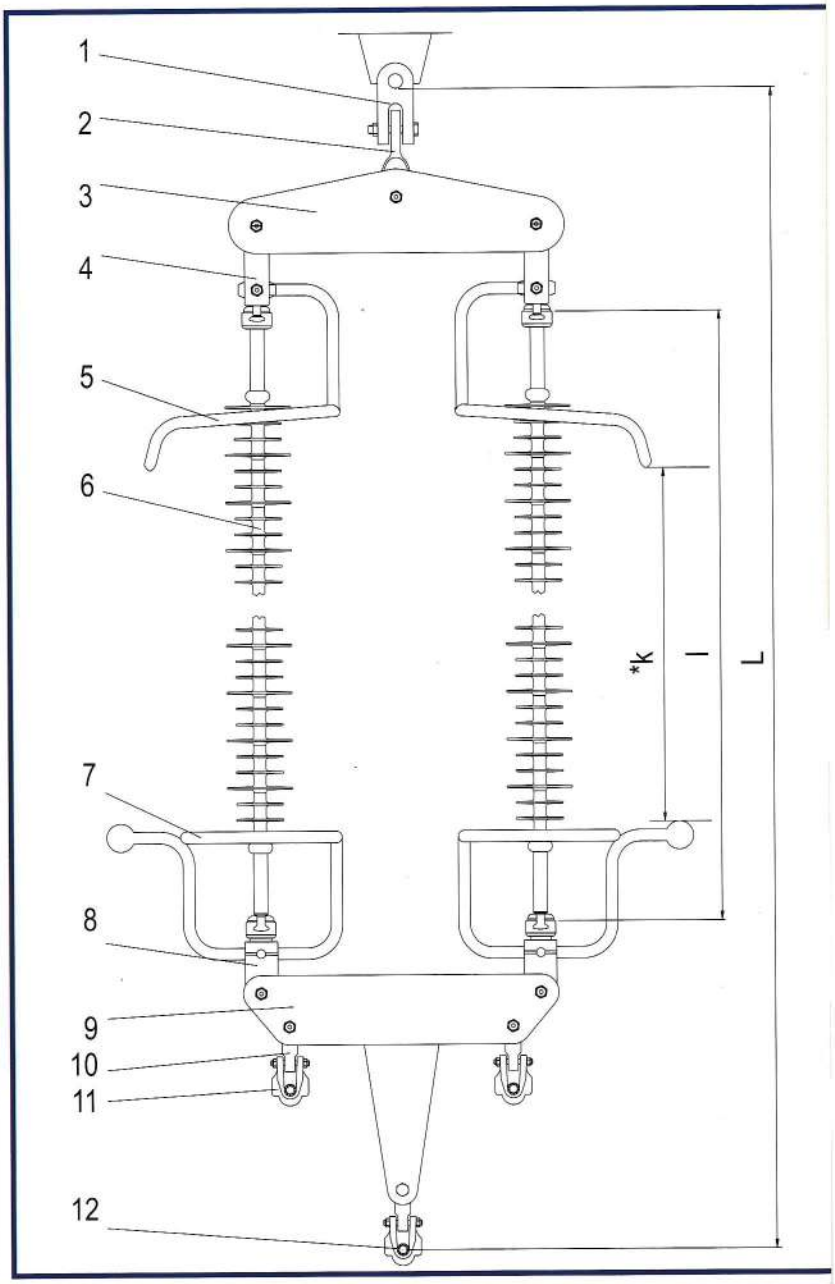


Double suspension string 400 kV variant B, three conductors per phase

LDS
120 kN
160 kN

Area SML	II 120	II 160	II / A 120	II / A 160
l (mm)	3155	3196	3359	3400
L (mm)	4183	4260	4387	4464
Guarding ring type	IPS-10-BS IPI-4-BS	IPS-7-BS IPI-4-BS	IPS-7-BS IPI-1-BS	IPS-1-BS IPI-1-BS

Area SML	III 120	III 160	IV 120	IV 160
l (mm)	3461	3502	3587	3628
L (mm)	4489	4566	4615	4692
Guarding ring type	IPS-7-BS IPI-3-BS	IPS-1-BS IPI-3-BS	IPS-16-BS IPI-3-BS	IPS-4-BS IPI-1-BS



Insulator strings with composite insulators and Ball-Socket end-fittings, 400 kV

No.	Component	Quantity (Pcs.)	Material	Designation
1	Shackle	1	Zn- steel	CS- 4D
2	Double twisted eye	1	Zn- steel	OD-35
3	Single yoke	1	Zn-steel	Js 500/24
4	Ball eye	2	Zn- steel	OSdr 16; 120 kN OSdr 20; 160 kN
5	Upper guarding eye	2	Zn- steel	IPS
6	Composite insulator, 400 kV	2	Silicone rubber	CI-400-II-120/160-BS CI-400-II/A-120/160-BS CI-400-III-120/160-BS CI-400-IV-120/160-BS
7	Bottom guarding ring	2	Zn- steel	IPI
8	Twisted eye socket	2	Zn- steel	NSV 16; 120 kN NSV 20; 160 kN
9	Double yoke	1	Zn- steel	Jd 400/3-30
10	Double twisted piece	3	Zn- steel	PR 43
11	Suspension clamp	3	Aluminum alloy	CSA- 4
12	Armour rod	3	Aluminum alloy	AAR 162-1144

Note : * the spark gap is in conformity with the lightning and switching overloads set by the network designer (beneficiary)

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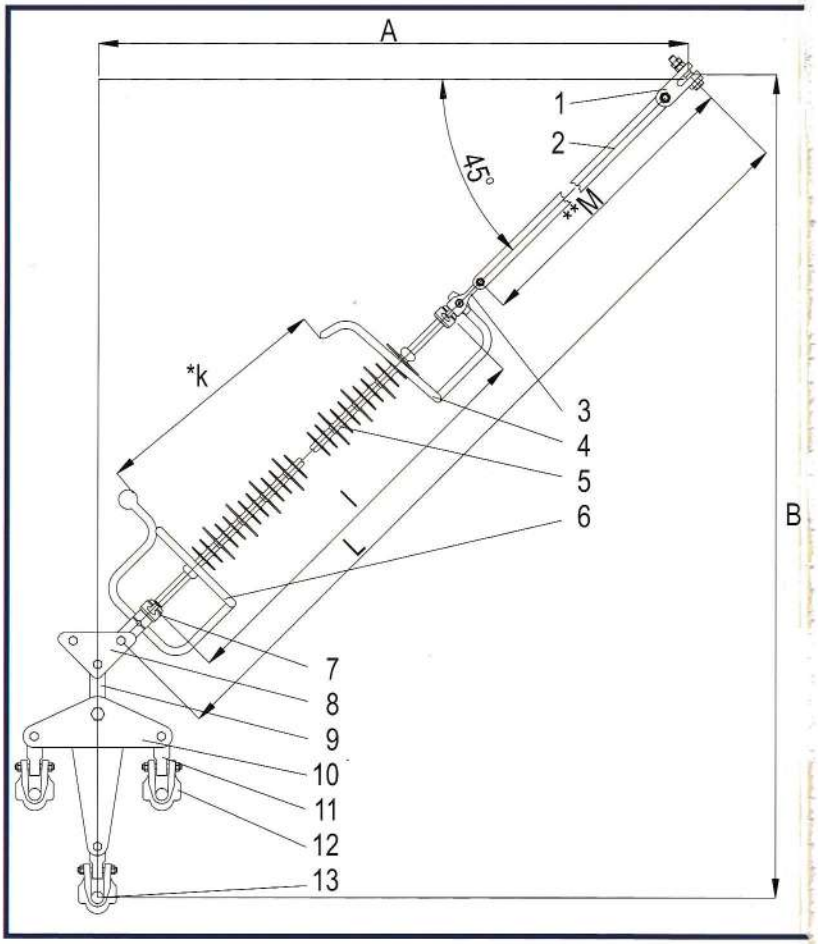
Double "V" suspension string, 400 kV three conductors per phase

LDSV
120 kN
160 kN



No.	Component	Quantity (Pcs.)	Material	Designation
1	Shackle	2	Zn- steel	CS- 4D
2	Clevis extension piece	2	Zn- steel	Pdf 25/1083
3	Ball eye	2	Zn- steel	OSdr 16; 120 kN OSdr 20; 160 kN
4	Upper guarding ring	2	Zn- steel	IPS
5	Compositesinsulator, 400 kV	2	Silicone rubber	CI-400-II-120/160-BS CI-400-II/A-120/160-BS CI-400-III-120/160-BS CI-400-IV-120/160-BS
6	Bottom guarding ring	2	Zn- steel	IPI
7	Straight eye socket	2	Zn- steel	NSV 16; 120 kN NSV 20; 160 kN
8	Special yoke	1	Zn- steel	Js 260/130
9	Extension piece	1	Zn- steel	PD 35/2M
10	Simple yoke	1	Zn- steel	JS 400/3
11	Double twisted piece	3	Zn- steel	PR 43
12	Suspension clamp	3	Aluminum alloy	CSA-4
13	Armour rods	3	Aluminum alloy	AAR 162-1144

Area SML	II 120	II 160	II 120 var A	II 160 var A	III 120	III 160	IV 120	IV 160
l	3155	3196	3359	3400	3461	3502	3587	3628
L	4416	4676	4620	4880	4722	4982	4848	5108
Guarding ring type	IPS-10-BS IPI-4-BS	IPS-7-BS IPI-4-BS	IPS-7-BS IPI-1-BS	IPS-1-BS IPI-1-BS	IPS-7-BS IPI-3-BS	IPS-1-BS IPI-3-BS	IPS-16-BS IPI-3-BS	IPS-4-BS IPI-1-BS

Note : * the spark gap is in conformity with the lightning and switching overloads set by the network designer (beneficiary)

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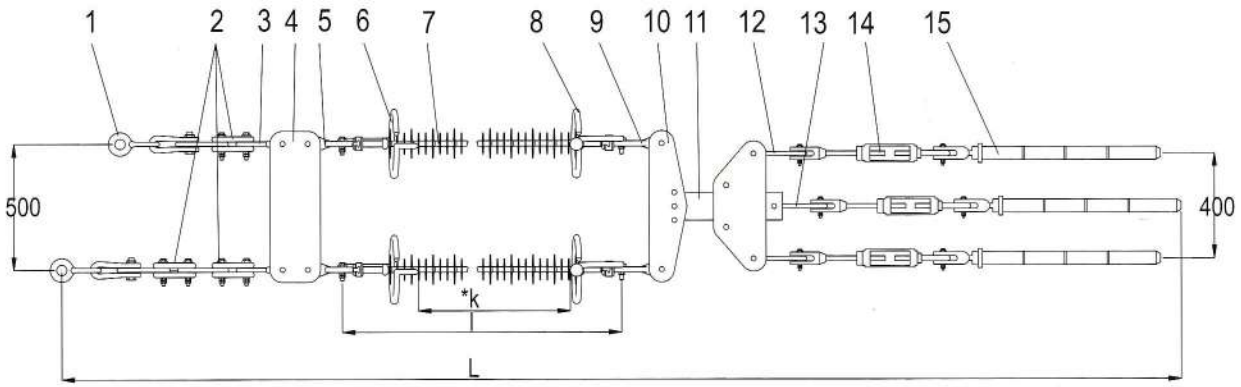
Insulator strings with composite insulators and Ball-Socket end-fittings, 400 kV

Double tension string 400 kV three conductors per phase

LDI
160 kN



No.	Component	Quantity (Pcs.)	Material	Designation
1	Shackle	4	Zn-steel	CS- 3A
2	Adjustable extension link	3	Zn-steel	PR 5/ 25 (395-610)
3	Double twisted eye	2	Zn-steel	ODR-21
4	Double yoke	1	Zn-steel	Jd-500/500-50
5	Twisted ball eye	2	Zn-steel	OSr-20
6	Upper guarding ring	2	Zn-steel	IPS
7	Composite insulator, 400 kV	2	Silicone rubber	CI-400-II-160-BS CI-400-II/A-160-BS CI-400-III-160-BS CI-400-IV-160-BS
8	Bottom guarding ring	2	Zn-steel	IPI
9	Twisted eye socket	2	Zn-steel	NORV 20
10	Single yoke	1	Zn-steel	Js500/50
11	Star triple yoke	1	Zn-steel	JTS -50-1
12	Extension piece	2	Zn-steel	Pd 20-1M
13	Extension piece	1	Zn-steel	Pd 20- 2M
14	Thurnbuckle	3	Zn-steel	IR-18
15	Armour rods	3	Aluminum alloy	TPdf 300/60

Area	II	II / A	III	IV
SML	160	160	160	160
l (mm)	3196	3400	3502	3628
L (mm)	5826-6416	6030-6620	6132-6722	6258-6848
Guarding ring type	IPS-7-BS IPI-4-BS	IPS-1-BS IPI-1-BS	IPS-1-BS IPI-3-BS	IPS-4-BS IPI-1-BS

Note : * the spark gap is in conformity with the lightning and switching overloads set by the network designer (beneficiary)

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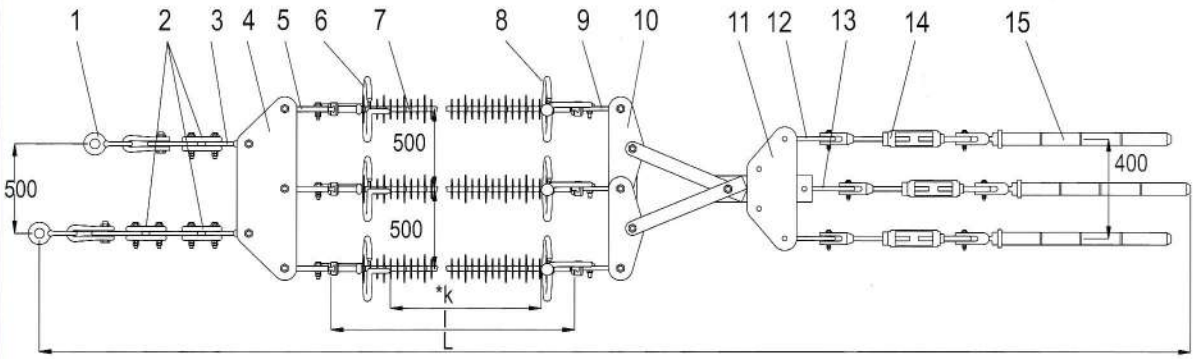
Triple tension string 400 kV three conductors per phase

LTI
120 kN
160 kN



No.	Article	Pcs.	Material	Designation
1	Shackle	4	Zn-steel	CS- 3A
2	Adjustable extension link	3	Zn-steel	PR 5 / 25 (395-610)
3	Double twisted eye	2	Zn-steel	ODR-25
4	Double yoke	1	Zn-steel	Jd-1000/500-50
5	Twisted ball eye	3	Zn-steel	OSr 16; 120 kN OSr 20; 160 kN
6	Upper grading ring	3	Zn-steel	IPS
7	Composite insulator, 400 kV	3	Silicone rubber	CI-400-II-120/160-BS CI-400-II/A-120/160-BS CI-400-III-120/160-BS CI-400-IV-120/160-BS
8	Bottom grading ring	3	Zn-steel	IPI
9	Socket	3	Zn-steel	NORV 16; 120 kN NORV 20; 160 kN
10	Device for triple insulator string	1	Zn-steel	DLTs-50
11	Star triple yoke	1	Zn-steel	JTS -50-1
12	Extension piece	2	Zn-steel	Pd 20-1M
13	Extension piece	1	Zn-steel	Pd 20- 2M
14	Turnbuckle	3	Zn-steel	IR-18
15	Tension clamp	3	Aluminum alloy	TPdf 300/60

Area SML	II 120	II 160	II / A 120	II / A 160	III 120	III 160	IV 120	IV 160
l (mm)	3155	3196	3359	3400	3461	3502	3587	3628
L (mm)	6554-7144	6620-7050	6758-7348	6824-7454	6860-7450	6926-7356	6986-7576	7052-7482
Guarding ring type	IPS-10-BS IPI-4-BS	IPS-7-BS IPI-4-BS	IPS-7-BS IPI-1-BS	IPS-1-BS IPI-1-BS	IPS-1-BS IPI-1-BS	IPS-1-BS IPI-3-BS	IPS-16-BS IPI-3-BS	IPS-4-BS IPI-1-BS

Note : * the spark gap is in conformity with the lightning and switching overloads set by the network designer (beneficiary)

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