IZOELEKTRO

Katalog izdelkov
Product catalogue

10/2017

Dejavnost

Splošno

Predmet našega poslovanja je razvoj, proizvodnja in prodaja opreme za izgradnjo elektroenergetskih sistemov do 52 kV. Naši najpomembnejši proizvodi so:

- odvodniki prenapetosti,
- indikatorji stanja odvodnikov prenapetosti,
- natezni in podporni kompozitni izolatorji,
- sistemi izgradnje daljnovodov,
- spojna in obesna oprema,
- koncentrični material.

Poleg prodaje lastnih izdelkov dobavljamo vso ostalo opremo, ki jo kupci pri nas zahtevajo.

Visokonapetostni laboratorij

Imamo lasten visokonapetostni laboratorij, ki ga nenehno dograjujemo v skladu z najnovejšimi zahtevami standardov. Omogoča izvajanje večine preizkusov na srednjenapetostnih odvodnikih po standardu IEC 60099-4. Za potrebe razvoja in proizvodnje lahko preizkušamo izolatorje do 60 kV obratovalne napetosti. Meritve izvajamo tudi za zunanje naročnike.

Certifikati

Zavedamo se, da je za naše odjemalce najpomembnejša kakovost proizvodov. Od leta 2000 imamo v podjetju vzpostavljen in ustrezno vzdrževan sistem vodenja, ki izpolnjuje zahteve standarda ISO 9001. Leta 2007 pridobljen certifikat ISO 14001 pa potrjuje odgovorno načrtovanje novih proizvodov in ekološko ravnanje z okoljem.

Inovativnost

V naših proizvodih je vgrajenih sedem lastnih patentov, ki smo jih razvili v lastnem razvojno-raziskovalnem inštitutu. Prvi v svetu smo razvili, patentirali in leta 2004 pričeli s prodajo kompozitnih podpornih izolatorjev z izolacijsko glavo in inovativnim načinom pritrditve vodnika. V letu 2017 smo razvili novo vzmetno sponko.

Novost

SN odvodnik razreda DH - tip SNO je preizkušen v skladu z najnovejšo izdajo standarda IEC 60099-4:2014. PKI - E nova različica zgornjega PA priključka z vzmetno sponko za vodnike premera Φ15 do Φ30. PKIL IZO - nov tip izolatorja za ločilnike v petih višinskih izvedbah za različne napetostne sisteme.

Cilji

Naš cilj je razviti in prijaviti vsaj dva patenta letno in postati v svetu prepoznaven proizvajalec izdelkov z vgrajenimi lastnimi patenti.

Vizija

Nadaljnji razvoj je usmerjen v proizvodnjo srednjenapetostnih odvodnikov prenapetosti s silikonskim plaščem, kompozitnih podpornih izolatorjev z uporabo priključkov iz izolacijskega materiala in kompozitnih izolatorjev s kapacitivnim kazalnikom.

IZOELEKTRO - KORAK PRED ČASOM

Activity

General

The subject of our business is development, production and sale of power transport equipment intended for constructions of electro systems up to 52 kV. Our most important products are:

- *surge arresters,*
- *surge arresters' condition indicators,*
- *tension and post composite insulators,*
- *overhead power lines construction systems,*
- *junction and suspension equipment,*
- *connecting sleeves.*

Within the supply of own products we supply all other equipment that customers request from us.

High voltage laboratory

We have our own high voltage laboratory which is being continuously developed in line with the latest standard requirements. It allows performing most of the tests for medium voltage surge arresters according to standard IEC 60099-4. For the purposes of development and production we can test insulators up to 60 kV operating voltage. We also perform tests for customers.

Certificates

We are aware that the quality of products is most important for our customers. Since 2000 we have established and suitably maintained a system of guidance which fulfils the demands of standard ISO 9001. Certificate ISO 14001 gained year 2007 confirms responsible development of new products and eco-environmental management.

Innovativeness

In our products are embedded seven patents which were developed in our own Research and Development Institute. First in the world we have developed, patented and in 2004 began to sale post composite insulators with insulated top fitting and innovative method for attachment of wire conductor. In 2017 we developed a new spring clamp.

Innovation

Class DH surge arrester - SNO type is tested according to the latest edition of the IEC 60099-4:2014 standard. PKI E - new version of PA upper fitting with spring clamp for conductor with cross sections *Φ15 to Φ30.* PKIL IZO - new type of insulator for switch disconnector in five height versions for different voltage systems.

Goals

Our goal is to develop and apply at least two patents per year and to become a world recognized producer of products with its own patents installed.

Vision

Further development is focused on the production of medium voltage surge arresters with silicone coat and with an indication of leakage current, post line composite insulators with end fittings made of insulating material and composite insulators with a capacitive pointer.

IZOELEKTRO - AHEAD OF IT'S TIME

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Seznam ikon *List of icons*

Hidrofobnost silikona		*Silicone hydrophobic*
Odporno na UV sevanje		*UV resistance*
Samočistilnost		*Self-cleaning*
IP zaščita		*IP protection*
Odklopna naprava		*Disconecting Device*
Ozemljitveni vodnik H07V-K		*Earthning connductor H07V-K*
Kabeljski čevelj		*Cable lug*
Votlica		*Therminal tube*
Varovalo		*Safety tie*
100% kontrola		*100% control*
Montaža: zgoraj		*Mounting: top*
Montaža: spodaj		*Mounting: bottom*
Izolacijska glava		*Insulated upper fitting*
Najkrajši časi izdobave		*Short lead times*
Narejeno v Sloveniji		*Made in Slovenia*
Proizvedeno po EU standardih		*Conformité Européenne*

Seznam kratic

µs	– mikrosekunda
°C	– stopinj celzija
AD	– preskočna razdalja
AgL	– tip varovalke
Al	– aluminij
CD	– plazilna pot
d	– premer
D_{min}	– minimalna razdalja
DOPPS	– Društvo za opazovanje in preučevanje ptic
DV	– daljnovod
E	– električna poljska jakost
F_h	– horizontalna sila
F_v	– vertikalna sila
H	– višina
IEC	– Mednarodna komisija za elektrotehniko
I_{imp}	– impulzni odvodni tok
I_{max}	– maksimalni odvodni tok
I_n	– nazivni odvodni tok
IP	– stopnja zaščite
kg	– kilogram
kJ	– kilo joule
kV	– kilo volt
l	– dolžina
L	– faza
m	– meter
mA	– miliamper
mm	– milimeter
mm^2	– kvadratni milimeter
M	– moment
M_t	– torzijski moment
M_u	– upogibni moment
N	– newton
Nm	– newton meter
NN	– nizka napetost
ns	– nanosekunda
PA	– poliamid
PIV	– polizoliran vodnik
s	– sekunda
SCL	– nazivna upogibna sila
SN	– srednja napetost
ST	– jeklo
t	– čas
T	– temperatura
tA	– odzivni čas
U_c	– trajna obratovalna napetost
UL 94	– standard gorljivosti
U_{max}	– maksimalna napetost
U_p	– napetostni zaščitni nivo
U_r	– nazivna napetost
U_{res}	– preostala napetost
UV	– ultravijolična zaščita
v	– hitrost širjenja udarnega vala
V-0	– stopnja gorljivosti
W	– energijska absorpcija

List of abbreviations

µs	*– microsecond*
°C	*– degrees celsius*
AD	*– arcing distance*
AgL	*– type fuse*
Al	*– aluminium*
CD	*– creepage distance*
d	*– diameter*
D_{min}	*– minimum distance*
DOPPS	*– Association for the observation and study of birds*
PV	*– power line*
E	*– electric field strength*
F_h	*– horizontal load*
F_v	*– vertical load*
H	*– height*
IEC	*– International Electrotechnical Commimisson*
I_{imp}	*– discharge current*
I_{max}	*– maximal discharge current*
In	*– nominal discharge current*
IP	*– Ingress protection level*
kg	*– kilogram*
kJ	*– kilo joule*
kV	*– kilo volt*
l	*– length*
L	*– line*
m	*– meter*
mA	*– milliampere*
mm	*– millimetre*
mm^2	*– square millimetre*
M	*– torque*
M_t	*– Terminal torque*
M_u	*– Cantilever strength*
N	*– newton*
Nm	*– newton metre*
LV	*– low voltage*
ns	*– nanosecond*
PA	*– polyamide*
CC	*– covered conductor*
s	*– second*
SCL	*– specified cantilever load*
MV	*– medium voltage*
ST	*– steel*
t	*– time*
T	*– temperature*
tA	*– response time*
U_c	*– continuous operating voltage*
UL 94	*– flammability standard*
U_{max}	*– maximum voltage*
U_p	*– voltage protection level*
U_r	*– rated voltage*
U_{res}	*– residual voltage*
UV	*– ultra-violet protection*
v	*– speed of shock wave*
V-0	*– burning rate*
W	*– energy absorption*

1

NN odvodniki
prenapetosti

LV surge arresters

1.1 NNO in MOSIPO splošno

Proizvod

NNO in MOSIPO so nizkonapetostni kovinsko oksidni odvodniki prenapetosti s silikonskim plaščem. Namenjeni so za vgradnjo v NN vode ali razdelilne omarice do 1 kV kot prva stopnja zaščite pred direktnim udarom strele.

Lastnosti

Odklopna naprava reagira:

- po določenem številu udarov, ko v normalnem obratovanju tok skozi odvodnik naraste nad 1 mA,
- v primeru atmosferske praznitve (tok večji od 65 kA).

Po delovanju odklopne naprave je potrebno zamenjati odvodnik prenapetosti. Odklopna naprava je vidno ločena vendar povezana z odvodnikom prenapetosti.

Vgradnja

Mesto montaže odvodnikov prenapetosti NNO in MOSIPO, določajo pravilniki in tehnični predpisi.

Obvezno se vgradijo na:

- vse odcepe in zaključke nizkonapetostnih prostih vodov,
- medsebojni razdalji maksimalno do 1000 m,
- razdalji manjši od 500 m, kjer so nevihte pogostejše,
- vseh prehodih prostih vodov na kable in obratno.

Splošni podatki

- Odzivni čas: **tA < 25 ns**
- Temperaturno območje okolja: **T = -40 °C ... +85 °C**
- Stopnja zaščite: **IP 67**
- Plašč: **silikon LSR**
- Barva silikona: **siva**
- Napetostni nivoji: **275, 280, 440, 500, 690 V**
- Testirani po standardu: **IEC 61643-1 in IEC 61643-11**
- IEC razred: **II**
- Ozemljitveni vodnik: **H07V-K**

1.1 *NNO and MOSIPO generally*

Product

NNO and MOSIPO are low voltage metal oxide surge arresters with silicone coating. They are designed to be installed in LV power lines or in junction boxes up to 1 kV as the first level of protection against direct lightning strikes.

Characteristics

The disconnecting device reacts:

- *after a certain number of strokes when in normal operation the current through the surge arrester increases over 1 mA,*
- *in case of atmospheric discharge (current bigger than 65 kA).*

After the disconnecting device has been actived it is necessary to replace the surge arrester. The disconnecting device is visibly separated but still attached to the surge arrester.

Installation

The position for installing NNO and MOSIPO surge arresters is decided by directives and technical regulations.

They must be installed:

- *on all branches and ends of low voltage overhead power lines,*
- *at a maximum mutual distance up to 1000 m,*
- *at a distance smaller than 500 m, where storms occur more often,*
- *in all passages from free conductors to cables and vice versa.*

General data

- *Response time:* ***tA < 25 ns***
- *Ambient temperature range:* ***T = -40 °C ... +85 °C***
- *Ingress protection level:* ***IP 67***
- *Coat:* ***silicone LSR***
- *Silicone colour:* ***grey***
- *Voltage levels:* ***275, 280, 440, 500, 690 V***
- *Tested according to standard:* ***IEC 61643-1 and IEC 61643-11***
- *IEC class:* ***II***
- *Earthning connductor:* ***H07V-K***

Prednosti pred konkurenco

NNO in MOSIPO odvodniki prenapetosti za zunanjo in notranjo montažo imajo:

- stopnjo zaščite IP 67,
- silikonski plašč,
- certifikat akreditiranega laboratorija,
- dobro vidno ločen ozemljitveni vodnik po delovanju odklopne naprave.

Na zahtevo kupca izdelamo odvodnike prenapetosti NNO in MOSIPO:

- brez ozemljitvenega vodnika,
- s poljubno dolžino ozemljitvenega vodnika,
- s poljubnim zaključkom ozemljitvenega vodnika,
- s poljubno barvo ozemljitvenega vodnika,
- kot tovarniški komplet po izbiri kupca,
- z integriranim ozemljitvenim vodnikom poljubne dolžine.

Competitive advantages

NNO and MOSIPO surge arresters for indoor and outdoor installation have:

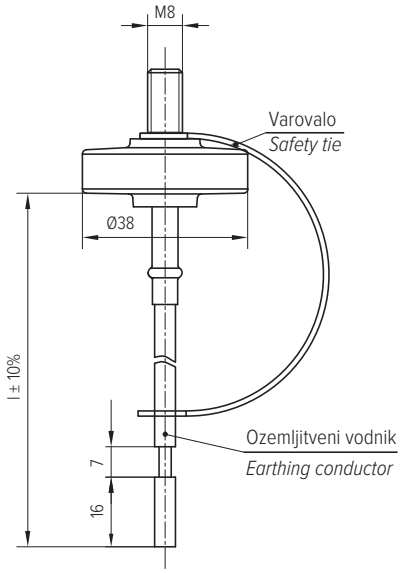
- *ingress protection level IP 67,*
- *silicone coating,*
- *certificate from an accredited laboratory,*
- *well visible seperated conductor after operation of the disconnecting device.*

At the customer's request we produce surge arresters NNO and MOSIPO:

- *without earthing conductor,*
- *with any earthing conductor length,*
- *with any end fitting on earthing conductor,*
- *with any colour of earthing conductor,*
- *as a factory set by customer's choice,*
- *with integrated earthing conductor of any length.*

1.2 NNO, I_n = 10 kA

Ozemljitveni vodnik: H07V-K 6 mm²



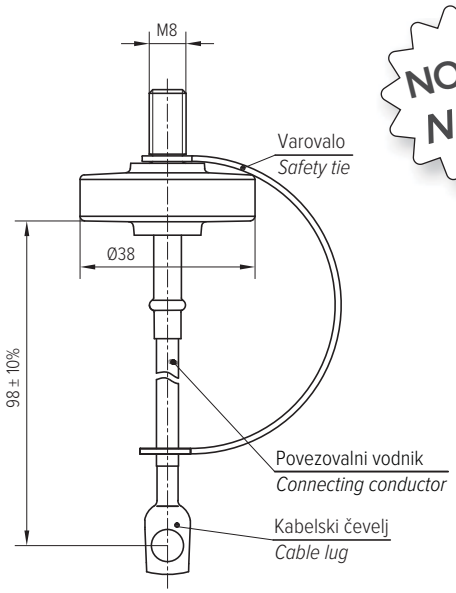
1.2 NNO, I_n = 10 kA

*Earthing conductor: **H07V-K 6 mm²***

Naziv	NNO 10/280	NNO 10/440	*Name*
Koda (l = 0,5 m)	**20 60 50**	**20 60 60**	*Code (l = 0,5 m)*
Koda (l = 1,0 m)	**20 60 51**	**20 60 61**	*Code (l = 1,0 m)*
U_c (AC/DC)	280/350 V	440/585 V	*U_c (AC/DC)*
U_p	< 1,10 kV	< 1,80 kV	*U_p*
W	2450 J	3504 J	*W*
Masa (l = 0,5 m)	0,0608 kg	0,0971 kg	*Mass (l = 0,5 m)*
Masa (l = 1,0 m)	0,0967 kg	0,1037 kg	*Mass (l = 1,0 m)*

1.3 NNO, I_n = 10 kA brez ozemljitvenega vodnika, kabelski čevelj

Povezovalni vodnik: H07V-K 6 mm²
Kabelski čevelj: Cu 6/8 mm



NOVO! NEW!

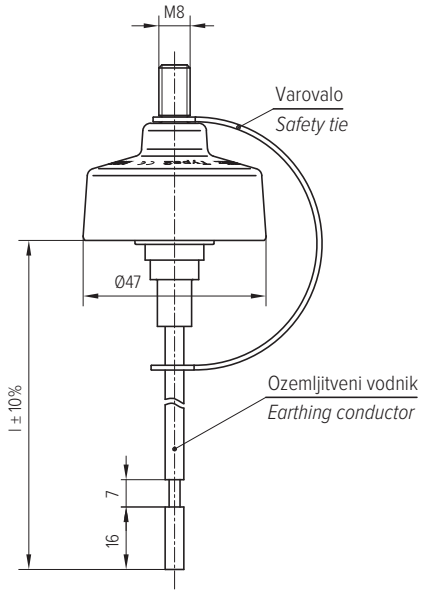
1.3 NNO, I_n = 10 kA without earthing conductor, cable lug

*Connecting conductor: **H07V-K 6 mm²***
*Cable lug: **Cu 6/8 mm***

Naziv	NNO 10/280	NNO 10/440	*Name*
U_c (AC/DC)	280/350 V	440/585 V	*U_c (AC/DC)*
U_p	< 1,10 kV	< 1,80 kV	*U_p*
W	2450 J	3504 J	W
Masa	0,0408 kg	0,0571 kg	*Mass*

1.4 MOSIPO, I_n = 15 kA

Ozemljitveni vodnik: H07V-K 6 mm²



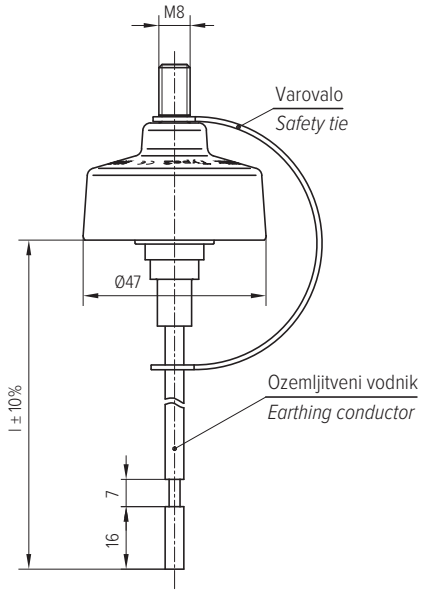
1.4 MOSIPO, I_n = 15 kA

Earthing conductor: H07V-K 6 mm²

Naziv	**MOSIPO 15/275**	**MOSIPO 15/440**	**MOSIPO 15/690**	***Name***
Koda (l = 0,5 m)	**20 66 10**	**20 66 20**	**20 66 27**	*Code (l = 0,5 m)*
Koda (l = 1,0 m)	**20 66 11**	**20 66 21**	**20 66 32**	*Code (l = 1,0 m)*
U_c (AC/DC)	275/350 V	440/585 V	690/910 V	*U_c (AC/DC)*
U_p	< 1,86 kV	< 2,24 kV	< 2,48 kV	*U_p*
W	2450 J	3200 J	3960 J	*W*
Masa (l = 0,5 m)	0,0870 kg	0,0950 kg	0,1000 kg	*Mass (l = 0,5 m)*
Masa (l = 1,0 m)	0,1170 kg	0,1230 kg	0,1300kg	*Mass (l = 1,0 m)*

1.5 MOSIPO, I_n = 10 kA

Ozemljitveni vodnik: H07V-K 6 mm²



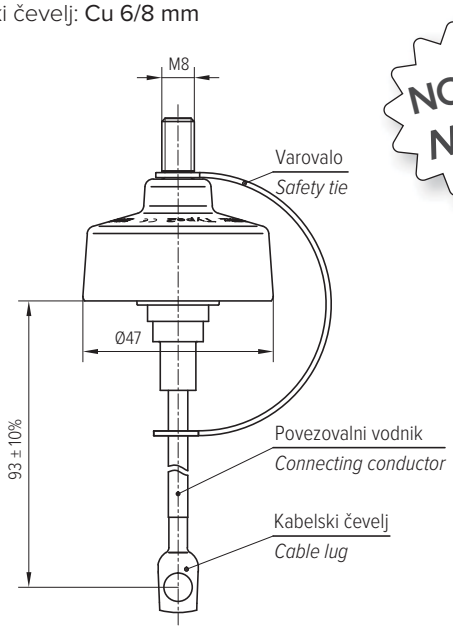
1.5 MOSIPO, I_n = 10 kA

Earthing conductor: H07V-K 6 mm²

Naziv	**MOSIPO 10/275**	**MOSIPO 10/440**	***Name***
Koda (l = 0,5 m)	**20 60 11**	**20 60 21**	*Code (l = 0,5 m)*
Koda (l = 1,0 m)	**20 60 12**	**20 60 22**	*Code (l = 1,0 m)*
U_c (AC/DC)	275/350 V	440/585 V	*U_c (AC/DC)*
U_p	< 1,00 kV	< 1,80 kV	*U_p*
W	2450 J	3200 J	*W*
Masa (l = 0,5 m)	0,1000 kg	0,1300 kg	*Mass (l = 0,5 m)*
Masa (l = 1,0 m)	0,1300 kg	0,1600 kg	*Mass (l = 1,0 m)*

1.6 MOSIPO, In = 10 kA brez ozemljitvenega vodnika, kabelski čevelj

Povezovalni vodnik: H07V-K 6 mm²
Kabelski čevelj: Cu 6/8 mm



NOVO! NEW!

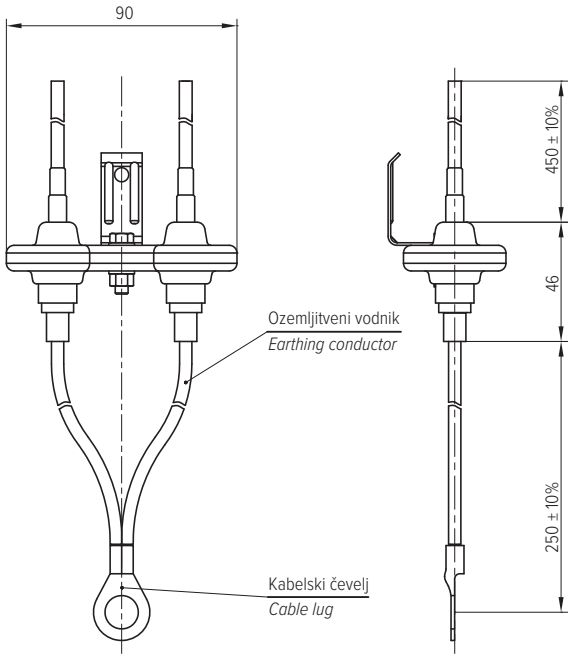
1.6 MOSIPO, In = 10 kA without earthing conductor, cable lug

Connecting conductor: H07V-K 6 mm²
Cable lug: Cu 6/8 mm

Naziv	MOSIPO 10/275	MOSIPO 10/440	*Name*
U_c (AC/DC)	275/350 V	440/585 V	*U_c (AC/DC)*
U_p	< 1,00 kV	< 1,80 kV	*U_p*
W	2450 J	3200 J	*W*
Masa	0,0800 kg	0,0900 kg	*Mass*

1.7 MOSIPO, I_n = 2x15 kA dvojni

Ozemljitveni vodnik: H07V-K 6 mm²
Kabelski čevelj: Cu 16/12 mm

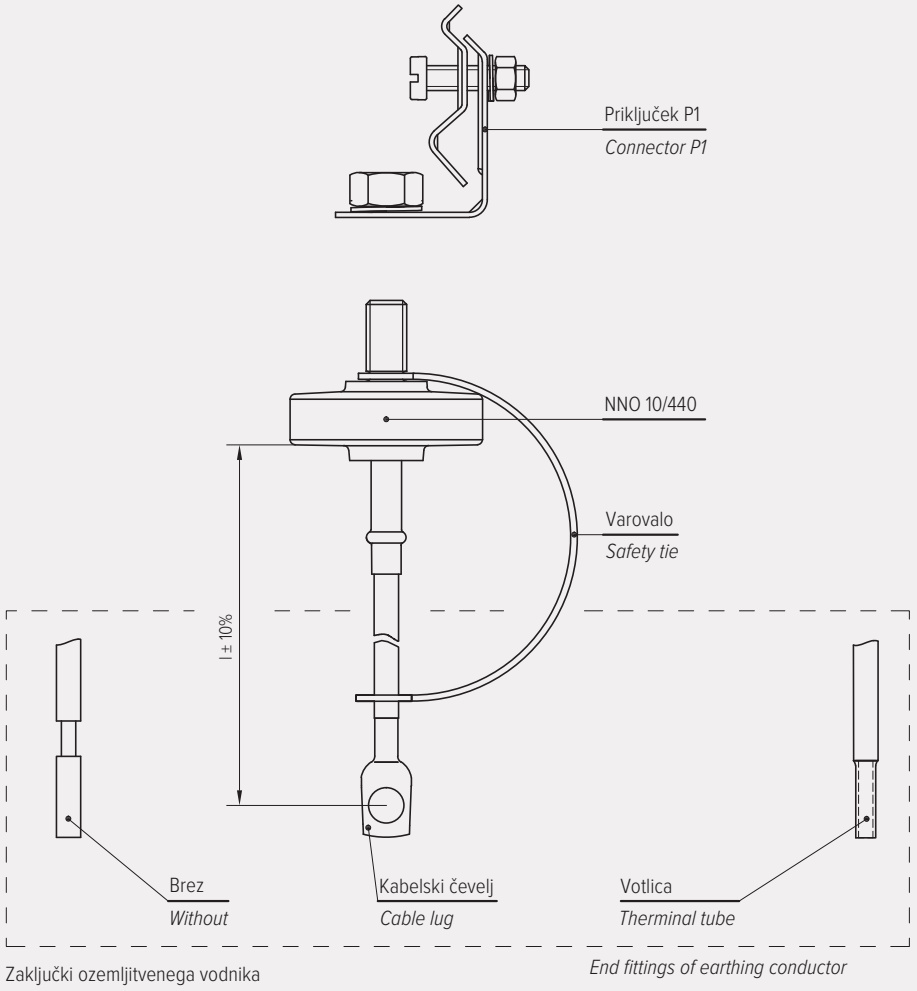


1.7 MOSIPO, I_n = 2x15 kA double

Earthing conductor: H07V-K 6 mm²
Cable lug: Cu 16/12 mm

Naziv	MOSIPO 15/275 x 2	MOSIPO 15/360 x 2	MOSIPO 15/440 x 2	*Name*
Koda	**20 66 33**	**20 66 13**	**20 66 42**	*Code*
U_c (AC/DC)	275/350 V	360/465 V	440/585 V	*U_c (AC/DC)*
I_{max}	40 kA	40 kA	40 kA	*I_{max}*
U_p	< 1,86 kV	< 2,0 kV	< 2,24 kV	*U_p*
W	2450 J	3200 J	3504 J	*W*

1.8 NNO in MOSIPO - primer naročila *1.8 NNO and MOSIPO - order example*



Naziv: **NNO 10/440 - 1,0 m + KČ 6/8 + Priključek P1**
Name: ***NNO 10/440 - 1,0 m + CL 6/8 + Connector P1***

Razlaga naziva

NNO	- Tip NN odvodnika
10	- Nazivni odvodni tok I_n (kA)
440	- Trajna obratovalna napetost U_c (V)
1,0	- Dolžina ozemljitvenega vodnika
m	- Merska enota
KČ 6/8	- Oznaka zaključka ozemljitvenega vodnika
Priključek P1	- Priključek

Name explanation

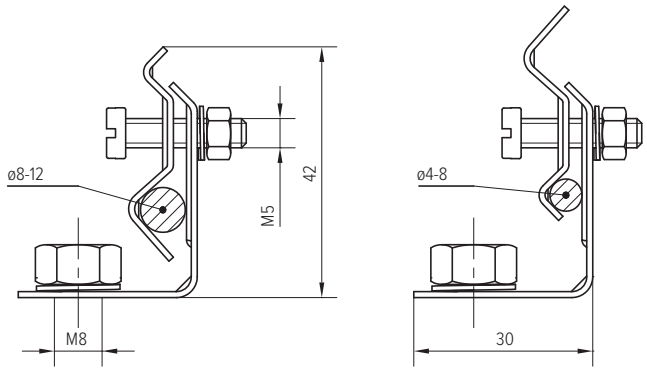
NNO	*- Type of LV surge arrester*
10	*- Nominal discharge current I_n (kA)*
440	*- Continuous operating voltage U_c (V)*
1,0	*- Length of earthing conductor*
m	*- Measuring unit*
CL 6/8	*- Mark of end fitting of earthing conductor*
Connector P1	*- Connector*

1.9 Priključek P1

Namen: priključek za goli vodnik ø4-12
Koda: **20 66 01**

1.9 Connector P1

Purpose: connector for bare conductor ø4-12
*Code: **20 66 01***



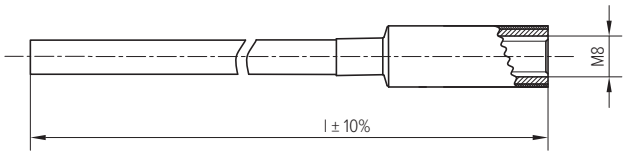
1.10 Priključek P2

Namen: priključek za izoliran vodnik
- 0,5 m; koda: **20 66 02**
- 1,0 m; koda: **20 66 05**

Opomba: dolžina priključka P2 po izbiri

1.10 Connector P2

Purpose: connector for covered conductor
*- 0,5 m; code: **20 66 02***
*- 1,0 m; code: **20 66 05***
Note: length of connector P2 by choice

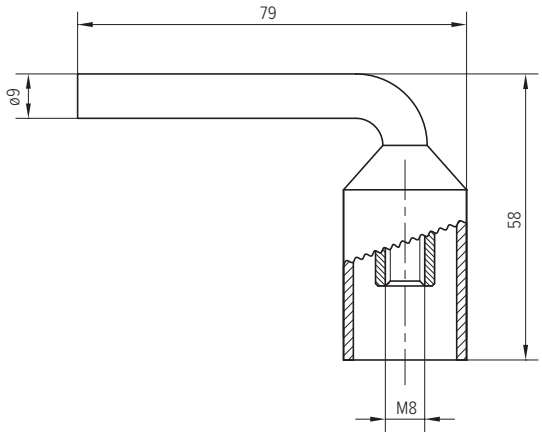


1.11 Priključek P3

Namen: priključek za izoliran vodnik
Koda: **20 66 03**

1.11 Connector P3

Purpose: connector for covered conductor
*Code: **20 66 03***

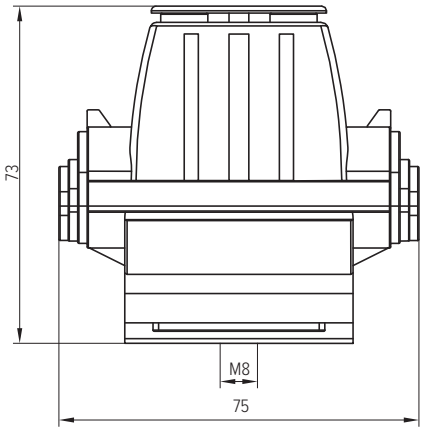


1.12 Priključek P4

Namen: priključek za izoliran vodnik ø16-95
Koda: **20 66 09**

1.12 Connector P4

Purpose: connector for covered conductor ø16-95
*Code: **20 66 09***

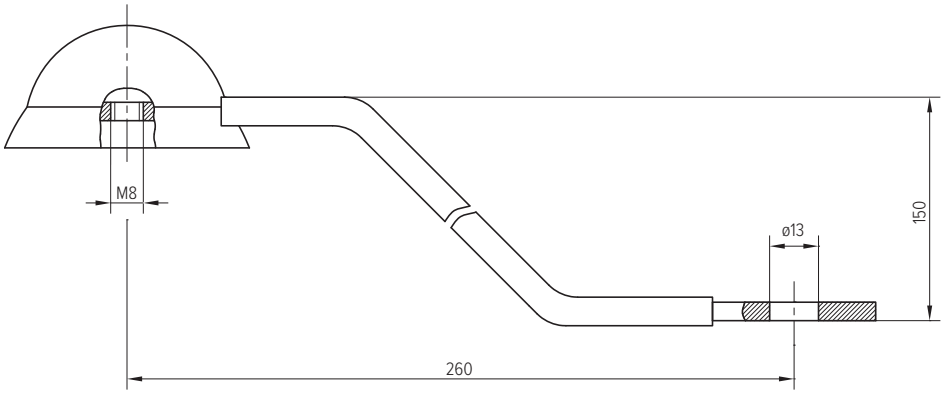


1.13 Priključek P5

Namen: izolacijski priključek
Koda: **20 66 04**

1.13 Connector P5

Purpose: insulated connector
*Code: **20 66 04***

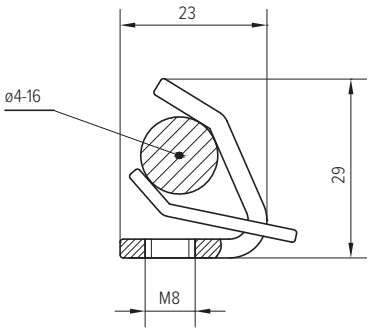


1.14 Priključek P6

Namen: priključek za goli vodnik ø4-16
Koda: **20 66 08**

1.14 Connector P6

Purpose: connector for bare conductor ø4-16
*Code: **20 66 08***



1.15 TY1 in TY1-F splošno

Proizvod

TY1 so kovinsko oksidni odvodniki prenapetosti v modularnem ohišju. TY1-F so kompaktni kovinsko oksidni odvodniki prenapetosti z varovalko. Namenjeni so za vgradnjo v glavno razdelilno omarico kot prva stopnja zaščite pred direktnim udarom strele.

Lastnosti

Odklopna naprava reagira:

- ko v normalnem obratovanju tok skozi odvodnik naraste nad 1 mA,
- v primeru atmosferske praznitve (tok večji od 100 kA).

Po delovanju odklopne naprave se vidno polje obarva rdeče. V tem primeru je potrebno pri TY1 zamenjati modul, pri TY1-F pa celoten odvodnik prenapetosti.

Vgradnja

Mesto montaže TY1 in TY1-F odvodnikov prenapetosti določajo pravilniki in tehnični predpisi.
Obvezno se vgradijo v razdelilne omare.

Splošni podatki

- Odzivni čas: **tA < 25 ns**
- Glavna predvarovalka pri TY1: **100 AgL**
- Temperaturno območje okolja: **T = -40 °C.. +80 °C**
- Stopnja zaščite: **IP 20**
- Material ohišja: **termoplast V-0 (UL 94)**
- Možnost daljinskega upravljanja
- Montaža na klobučno letev 35 mm^2
- Presek priključnega vodnika:
  - enožilni 35 mm^2
  - večžilni 25 mm^2
- Testirani po standardu: **IEC 61643-11**
- IEC razred: **I, II**

1.15 *TY1 and TY1-F generally*

Product

TY1 are metal oxide surge arresters in modular housing. TY1-F are compact metal oxide surge arresters with integrated backup fuse. They are designed to be installed into the main junction box as the first level of protection against direct lightning strikes.

Characteristics

The disconnecting device reacts:

- *when in a normal operation the current through the surge arrester increases over 1 mA,*
- *In case of an atmospheric discharge (current higher than 100 kA).*

After the disconnecting device has been active the visual field shows red colour. In this case it is necessary to replace the TY1 module or in case of TY1-F a complete surge arrester.

Installation

The position for installing TY1 and TY1-F surge arresters is determined by directives and technical regulations. They must be installed into junction boxes.

General data

- *Response time: **tA < 25 ns***
- *Main Backup fuse: **100 AgL***
- *Ambient temperature range: **T = -40 °C ... +80 °C***
- *Ingress protection level: **IP 20***
- *Housing material: **thermoplastic V-0 (UL 94)***
- *Possibility of remote control*
- *Mounting on top hat rail 35 mm^2*
- *Cross-section of connection conductor:*
  - *single-strand 35 mm^2*
  - *multi-strand 25 mm^2*
- *Tested according to standard: **IEC 61643-11***
- *IEC class: **I, II***

Prednosti pred konkurenco

TY1-F odvodniki prenapetosti za notranjo montažo imajo vgrajeno predvarovalko. Zato vgradnja predvarovalke (glavna > 100 A) 100 AgL ni potrebna.

TY1 in TY1-F odvodniki prenapetosti za notranjo montažo imajo:

- certifikat akreditiranega laboratorija,
- visok odvodni tok,
- visoko stopnjo zaščite,
- ugodno ceno,
- zanesljivo delovanje.

Competitive advantages

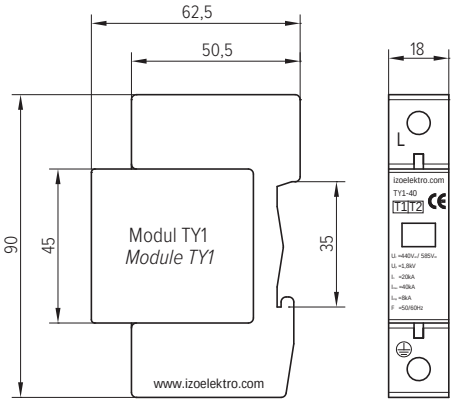
TY1-F surge arresters for indoor installation have an integrated backup fuse. Therefore the installation of a backup fuse (if main > 100 A) 100 AgL is not necessary.

TY1 and TY1-F surge arresters for indoor installation have:

- *a certificate by an accredited laboratory,*
- *high discharge current,*
- *high level of protection,*
- *favourable price,*
- *reliable performance.*

1.16 TY1 enopolni

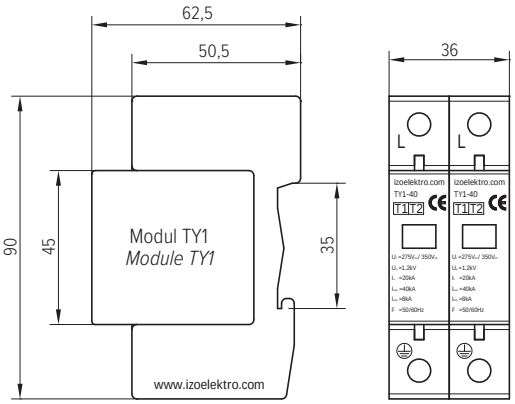
1.16 TY1 single pole



Naziv kompleta	Modul TY1	U_c	I_n	I_{imp}	I_{max}	U_p
Name of set	*Module TY1*	(V)	(kA)	(kA)	(kA)	(kV)
TY1-1-275-40	M1-275-40	275	20	8	40	< 1,2
TY1-1-320-40	M1-320-40	320	20	8	40	< 1,5
TY1-1-385-40	M1-385-40	385	20	8	40	< 1,8
TY1-1-440-40	M1-440-40	440	20	8	40	< 1,8
TY1-1-275-60	M1-275-60	275	30	12,5	60	< 1,5
TY1-1-320-60	M1-320-60	320	30	12,5	60	< 1,8
TY1-1-385-60	M1-385-60	385	30	12,5	60	< 2,0
TY1-1-440-60	M1-440-60	440	30	12,5	60	< 2,0
TY1-1-275-80	M1-275-80	275	40	20	80	< 2,0
TY1-1-320-80	M1-320-80	320	40	20	80	< 2,2
TY1-1-385-80	M1-385-80	385	40	20	80	< 2,4
TY1-1-440-80	M1-440-80	440	40	20	80	< 2,5
TY1-1-275-100	M1-275-100	275	50	25	100	< 2,4
TY1-1-320-100	M1-320-100	320	50	25	100	< 2,8
TY1-1-385-100	M1-385-100	385	50	25	100	< 3,0
TY1-1-440-100	M1-440-100	440	50	25	100	< 3,2
TY1-1-320-140	M1-320-140	320	80	25	140	< 3,0
TY1-1-385-140	M1-385-140	385	80	25	140	< 3,3
TY1-1-440-140	M1-440-140	440	80	25	140	< 3,5

1.17 TY1 dvopolni

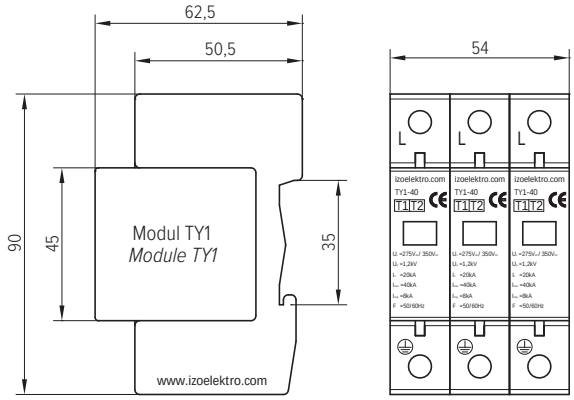
1.17 TY1 double pole



Naziv kompleta	Modul TY1	U_c	I_n	I_{imp}	I_{max}	U_p
Name of set	*Module TY1*	(V)	(kA)	(kA)	(kA)	(kV)
TY1-2-275-40	M2-275-40	275	20	8	40	< 1,2
TY1-2-320-40	M2-320-40	320	20	8	40	< 1,5
TY1-2-385-40	M2-385-40	385	20	8	40	< 1,8
TY1-2-440-40	M2-440-40	440	20	8	40	< 1,8
TY1-2-275-60	M2-275-60	275	30	12,5	60	< 1,5
TY1-2-320-60	M2-320-60	320	30	12,5	60	< 1,8
TY1-2-385-60	M2-385-60	385	30	12,5	60	< 2,0
TY1-2-440-60	M2-440-60	440	30	12,5	60	< 2,0
TY1-2-275-80	M2-275-80	275	40	20	80	< 2,0
TY1-2-320-80	M2-320-80	320	40	20	80	< 2,2
TY1-2-385-80	M2-385-80	385	40	20	80	< 2,4
TY1-2-440-80	M2-440-80	440	40	20	80	< 2,5
TY1-2-275-100	M2-275-100	275	50	25	100	< 2,4
TY1-2-320-100	M2-320-100	320	50	25	100	< 2,8
TY1-2-385-100	M2-385-100	385	50	25	100	< 3,0
TY1-2-440-100	M2-440-100	440	50	25	100	< 3,2
TY1-2-320-140	M2-320-140	320	80	25	140	< 3,0
TY1-2-385-140	M2-385-140	385	80	25	140	< 3,3
TY1-2-440-140	M2-440-140	440	80	25	140	< 3,5

1.18 TY1 tripolni

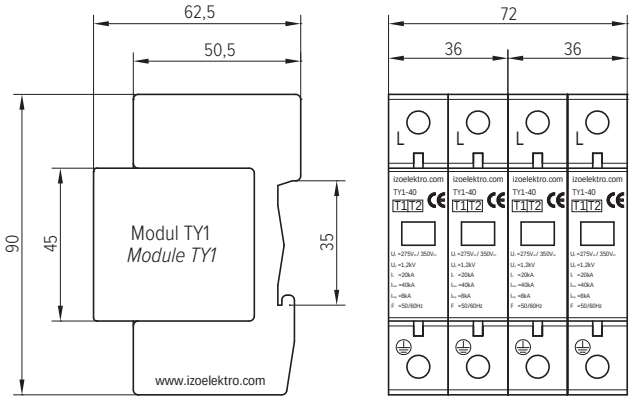
1.18 TY1 triple pole



Naziv kompleta	Modul TY1	U_c	I_n	I_{imp}	I_{max}	U_p
Name of set	*Module TY1*	(V)	(kA)	(kA)	(kA)	(kV)
TY1-3-275-40	M3-275-40	275	20	8	40	< 1,2
TY1-3-320-40	M3-320-40	320	20	8	40	< 1,5
TY1-3-385-40	M3-385-40	385	20	8	40	< 1,8
TY1-3-440-40	M3-440-40	440	20	8	40	< 1,8
TY1-3-275-60	M3-275-60	275	30	12,5	60	< 1,5
TY1-3-320-60	M3-320-60	320	30	12,5	60	< 1,8
TY1-3-385-60	M3-385-60	385	30	12,5	60	< 2,0
TY1-3-440-60	M3-440-60	440	30	12,5	60	< 2,0
TY1-3-275-80	M3-275-80	275	40	20	80	< 2,0
TY1-3-320-80	M3-320-80	320	40	20	80	< 2,2
TY1-3-385-80	M3-385-80	385	40	20	80	< 2,4
TY1-3-440-80	M3-440-80	440	40	20	80	< 2,5
TY1-3-275-100	M3-275-100	275	50	25	100	< 2,4
TY1-3-320-100	M3-320-100	320	50	25	100	< 2,8
TY1-3-385-100	M3-385-100	385	50	25	100	< 3,0
TY1-3-440-100	M3-440-100	440	50	25	100	< 3,2
TY1-3-320-140	M3-320-140	320	80	25	140	< 3,0
TY1-3-385-140	M3-385-140	385	80	25	140	< 3,3
TY1-3-440-140	M3-440-140	440	80	25	140	< 3,5

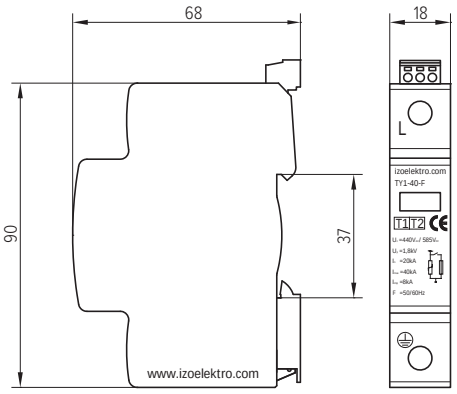
1.19 TY1 štiripolni

1.19 TY1 quadruple pole



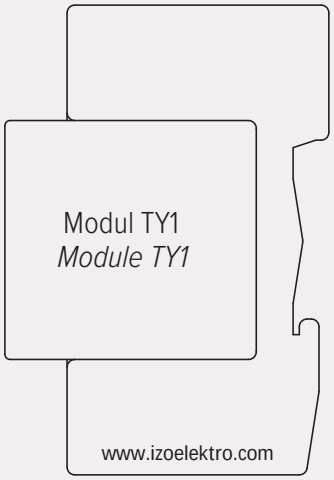
Naziv kompleta	Modul TY1	U_c	I_n	I_{imp}	I_{max}	U_p
Name of set	*Module TY1*	(V)	(kA)	(kA)	(kA)	(kV)
TY1-4-275-40	M4-275-40	275	20	8	40	< 1,2
TY1-4-320-40	M4-320-40	320	20	8	40	< 1,5
TY1-4-385-40	M4-385-40	385	20	8	40	< 1,8
TY1-4-440-40	M4-440-40	440	20	8	40	< 1,8
TY1-4-275-60	M4-275-60	275	30	12,5	60	< 1,5
TY1-4-320-60	M4-320-60	320	30	12,5	60	< 1,8
TY1-4-385-60	M4-385-60	385	30	12,5	60	< 2,0
TY1-4-440-60	M4-440-60	440	30	12,5	60	< 2,0
TY1-4-275-80	M4-275-80	275	40	20	80	< 2,0
TY1-4-320-80	M4-320-80	320	40	20	80	< 2,2
TY1-4-385-80	M4-385-80	385	40	20	80	< 2,4
TY1-4-440-80	M4-440-80	440	40	20	80	< 2,5
TY1-4-275-100	M4-275-100	275	50	25	100	< 2,4
TY1-4-320-100	M4-320-100	320	50	25	100	< 2,8
TY1-4-385-100	M4-385-100	385	50	25	100	< 3,0
TY1-4-440-100	M4-440-100	440	50	25	100	< 3,2
TY1-4-320-140	M4-320-140	320	80	25	140	< 3,0
TY1-4-385-140	M4-385-140	385	80	25	140	< 3,3
TY1-4-440-140	M4-440-140	440	80	25	140	< 3,5

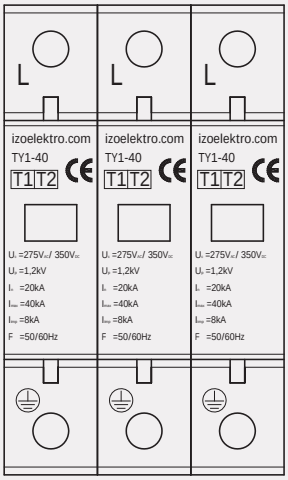
1.20 **TY1-F enopolni** *1.20 **TY1-F single pole***



Naziv kompleta *Name of set*	U_c (V)	I_n (kA)	I_{imp} (kA)	I_{max} (kA)	U_p (kV)
TY1-F-1-275-40	275	20	8	40	< 1,2
TY1-F-1-320-40	320	20	8	40	< 1,5
TY1-F-1-385-40	385	20	8	40	< 1,8
TY1-F-1-440-40	440	20	8	40	< 1,8
TY1-F-1-275-60	275	30	12,5	60	< 1,5
TY1-F-1-320-60	320	30	12,5	60	< 1,8
TY1-F-1-385-60	385	30	12,5	60	< 2,0
TY1-F-1-440-60	440	30	12,5	60	< 2,2
TY1-F-1-275-80	275	40	20	80	< 2,0
TY1-F-1-320-80	320	40	20	80	< 2,2
TY1-F-1-385-80	385	40	20	80	< 2,4
TY1-F-1-440-80	440	40	20	80	< 2,5
TY1-F-1-320-100	320	50	25	100	< 2,8
TY1-F-1-385-100	385	50	25	100	< 3,0
TY1-F-1-440-100	440	50	25	100	< 3,2
TY1-F-1-320-140	320	80	25	140	< 3,0
TY1-F-1-385-140	385	80	25	140	< 3,3
TY1-F-1-440-140	440	80	25	140	< 3,5

1.21 TY1 in TY1-F - primer naročila *1.21 TY1 and TY1-F - order example*





Naziv/*Name*: **TY1-3-275-40**

Razlaga naziva

TY1	- Tip NN odvodnika
3	- Število polov
275	- Trajna obratovalna napetost U_c (V)
40	- Maksimalni odvodni tok I_{max} (kA)

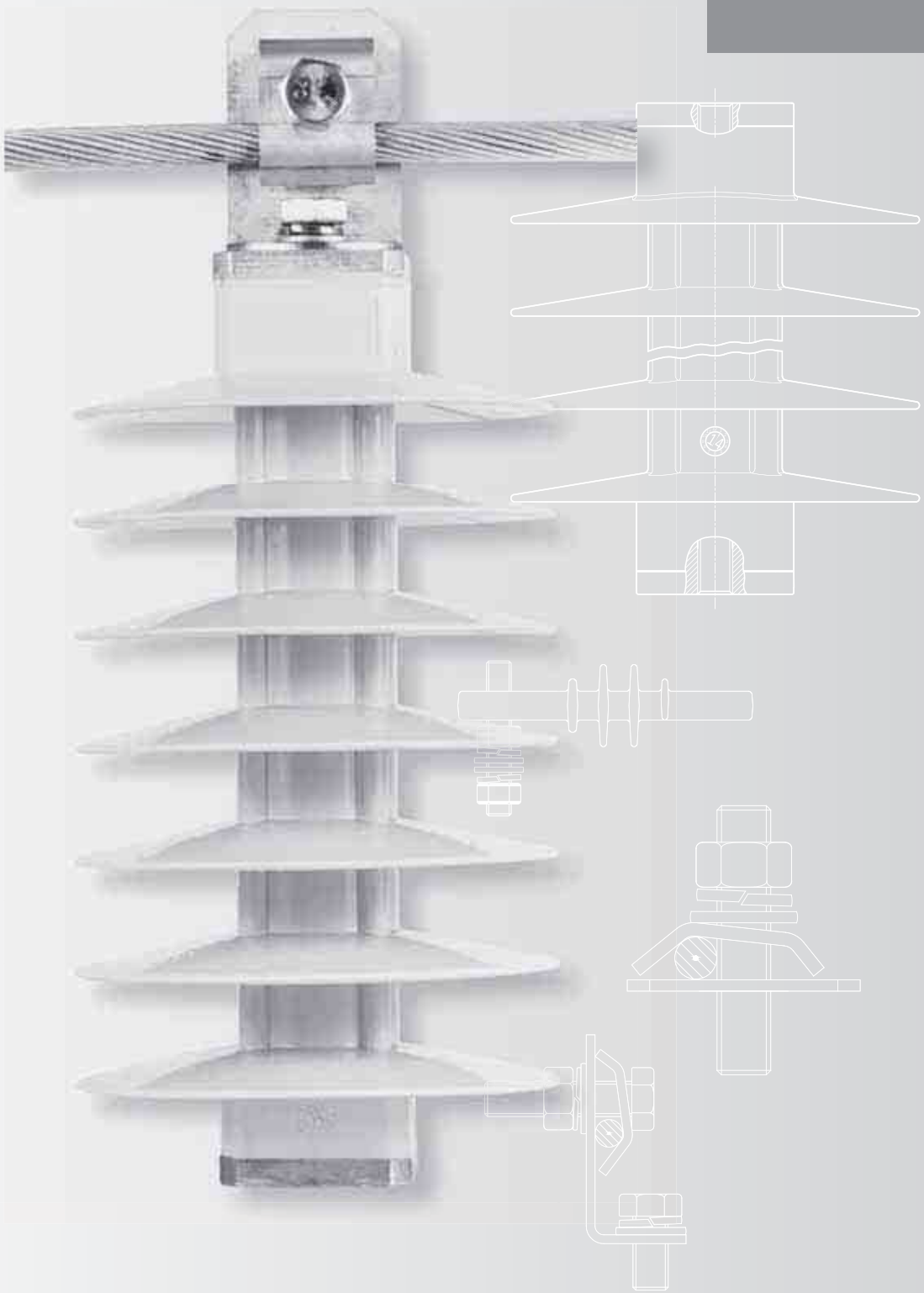
Name explanation

TY1	*- Type of LV surge arrester*
3	*- Number of poles*
275	*- Continuous operating voltage U_c (V)*
40	*- Maximal discharge current I_{max} (kA)*

Beležke

Notes

2



SN odvodniki *prenapetosti*

MV surge arresters

2.1 SNO in 2SS15N splošno

Proizvod

SNO in 2SS15N so tipi srednje napetostnih kovinsko oksidnih odvodnikov prenapetosti s silikonskim plaščem. Namenjeni so za vgradnjo v SN omrežje do 52 kV kot zaščita pred direktnim udarom strele.

Lastnosti

Vrhunsko kvaliteto jim zagotavlja:

- zmogljiv varistorski blok,
- toga konstrukcija,
- plašč odporen na UV sevanje in kemične vplive,
- vgrajen material, obstojen na vremenske vplive in staranje,
- varistorski blok, neposredno zalit s silikonom.

Vgradnja

Mesto montaže odvodnikov prenapetosti SNO in 2SS15N, določajo pravilniki in tehnični predpisi.

Odvodnike prenapetosti SNO in 2SS15N vgrajujemo:

- zunaj in znotraj,
- pri zaščiti elektroenergetskih naprav,
- za zaščito kompenzacijskih naprav,
- na železnicah, rudnikih, ...

Splošni podatki

- Temperaturno območje okolja **T = -60 °C ... +85 °C**
- Plašč: **silikon LSR**
- Barva silikona: **siva**
- Priključni navoj: **M12x20 mm**

Tip	SNO	2SS15N
Testirani po standardu	IEC 60099-4:2014 in IEC 60099-5	*IEC 60099-4:2004 in IEC 60099-5*
IEC razred	DH	*1*

2.1 SNO and 2SS15N generally

Product

SNO and 2SS15N are medium voltage metal oxide surge arresters with silicone coating. They are designed to be installed in MV power networks up to 52 kV as protection against direct lighting strikes.

Characteristics

Their top quality is ensured by:

- *top quality varistor block,*
- *rigid construction,*
- *resistance to UV radiation and chemical influences,*
- *built-in material is resistant to weathering and ageing,*
- *varistors are directly enclosed in silicone.*

Installation

The position for installing SNO and 2SS15N surge arresters is decided by directives and technical regulations.

Surge arresters SNO and 2SS15N are used for:

- *indoor and outdoor installation,*
- *protection of electric devices,*
- *protection of compensation devices,*
- *in railways, mines, ...*

General data

- *Ambient temperature range **T = -60 °C ... +85 °C***
- *Coat: **silicone LSR***
- *Silicone colour: **grey***
- *Connection thread: **M12x20 mm***

Type	*SNO*	*2SS15N*
Tested according to standard:	*IEC 60099-4:2014 and IEC 60099-5*	*IEC 60099-4:2004 and IEC 60099-5*
IEC class	*DH*	*1*

Prednosti pred konkurenco

SNO in 2SS15N odvodniki prenapetosti za zunanjo in notranjo montažo imajo:

- certifikat akreditiranega laboratorija,
- varistorje neposredno zalite s silikonom,
- togo konstrukcijo ohišja,
- nizko preostalo napetost,
- visoko energetsko absorpcijo,
- odlične mehanske lastnosti,
- 100% končno kontrolo v lastnem laboratoriju,
- predvidena vgradnja indikatorja stanja..

Na zahtevo kupca izdelamo in dobavimo odvodnike prenapetosti SNO in 2SS15N:

- kot tovarniški komplet po izbiri kupca,
- s trajno obratovalno napetostjo Uc do 1 do 44 kV.

Competitive advantages

SNO and 2SS15N surge arresters for indoor and outdoor installation have:

- *a certificate from an accredited laboratory,*
- *varistors directly encased by silicone,*
- *a rigid housing construction,*
- *low residual voltage,*
- *high energy absorption,*
- *excellent mechanical properties,*
- *100% final inspection in our own laboratory,*
- *planned installation for condition indicators.*

At the customer's request we produce and deliver surge arresters SNO and 2SS15N:

- *as a factory set by buyer's choice,*
- *with continuous operating voltage Uc from 1 to 44kV.*

2.2 Razred 1 - izračun in izbira

2.2 Class 1 - calculation and selection

2.2.1 Izračun

Podatki omrežja distributerja

- U_m – maksimalna napetost
- t – čas trajanja kratkega stika
- k_z – faktor zemeljskega stika
  k_z = 1,40 – neposredno ozemljeno
  k_z = 1,40 – 1,7 z malim uporom
  k_z = 1,73 – 1,8 z izolirano nevtralno točko

Podatki odvodnikov 2SS15N

- k_0 = 0,8
- k_t = faktor trajne obratovalne napetosti za časno prenapetost.

2.2.1 Calculation

Data of electric network

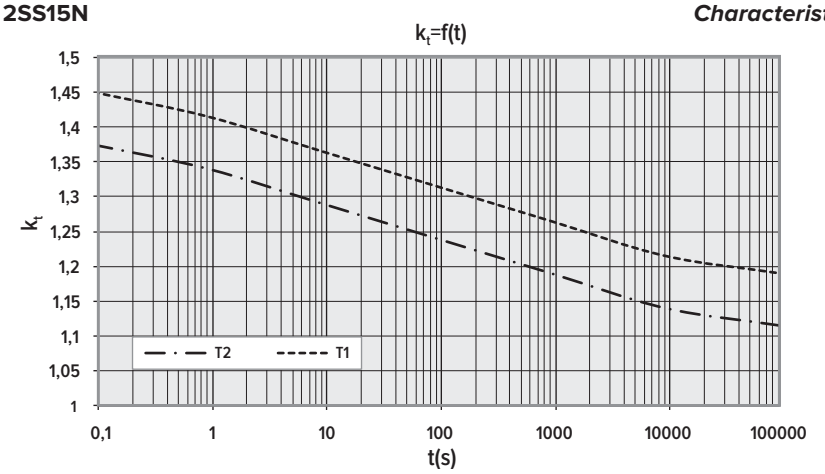
- *U_m – maximum voltage*
- *t – short circuit duration time*
- *k_z – factor of earthing*
  k_z = 1,40 – directly earthed
  k_z = 1,40 – 1,7 with little resistance
  k_z = 1,73 – 1,8 with a neutral insulated spot

Data for surge arresters type 2SS15N

- *k_0 = 0,8*
- *k_t = factor of permanent operating voltage for temporary over voltage duration time.*

Karakteristike za tip 2SS15N

Characteristics for type 2SS15N



Legenda:
Krivulja T1:
brez predhodne energije

Krivulja T2:
100 k_A, 4/10 µs predhodna energija

Legend:
Curve T1:
without prior energy

Curve T2:
100 k_A, 4/10 µs prior energy

Izračun

- Trajna obratovalna napetost sistema:

$$U_{cs} = \frac{U_m}{\sqrt{3}} \text{ [kV]}$$

- Predhodna obratovalna napetost odvodnika:

$$U_{c1} = \frac{U_{cs}}{k_0} \text{ [kV]}$$

- Najvišja pričakovana časna prenapetost odvodnika:

$$U_t = k_z \frac{U_m}{\sqrt{3}} \text{ [kV]}$$

- Trajna obratovalna napetost odvodnika:

$$U_{c2} = \frac{U_t}{k_t} \text{ [kV]}$$

Calculation

- *Continuous operating voltage of system:*

$$U_{cs} = \frac{U_m}{\sqrt{3}} \text{ [kV]}$$

- *Preliminary operating voltage of surge arrester:*

$$U_{c1} = \frac{U_{cs}}{k_0} \text{ [kV]}$$

- *Highest expected transient over voltage of surge arrester:*

$$U_t = k_z \frac{U_m}{\sqrt{3}} \text{ [kV]}$$

- *Continuous operating voltage of surge arrester:*

$$U_{c2} = \frac{U_t}{k_t} \text{ [kV]}$$

2.2.2 Izbira

Ustrezen odvodnik prenapetosti izberemo iz tabel s podatki, na podlagi višje izračunane vrednosti med U_{C1} in U_{C2} tako, da izberemo prvo višjo trajno obratovalno napetost U_C, ki je podana v tabeli.

2.2.2 Selection

We choose a suitable surge arrester from tables with data based on higher calculated value between U_{C1} and U_{C2} so, that we choose the first higher value of permanent operating voltage U_C specified in the table.

2.3 Določitev zaščitne razdalje

Podatki omrežja distributerja

Stopnja zaščite naprav na daljnovodih je odvisna od razdalje med ščiteno napravo in odvodnikom. Prenapetostni odvodnik ščiti v določeni razdalji od mesta, kjer je montiran.

Za izračun so potrebni najmanj naslednji podatki:

- I_z – zaščitna razdalja odvodnika
- U_z – zdržna udarna napetost izolacije opreme.
- U_{res} – maksimalna vrednost preostale napetosti za določen tip odvodnika
- v – hitrost širjenja udarnega vala po električnih vodih
  v = 300 m/µs – nadzemni vod
  v = 150 m/µs – kabel
- S – pričakovana strmina prenapetostnega udara strele
  S = 1550 kV/µs – leseni drogovi
  S = 800 kV/µs – ozemljene konzole

Izračun

Poenostavljena formula za izračun zaščitne razdalje:

$$I_z = \frac{U_z - U_{res}}{2S} v$$

Praviloma naj bo odvodnik prenapetosti priključen čim bliže ščiteni napravi.

2.4 Parametri za tip 2SS15N - razred 1

Razred odvodnika	1
Tip prenapetostnega odvodnika	2SS15N
Komercialne oznake oblike	R, RP, RO, NO
Trajna obratovalna napetost U_c	3 – 44 kV
Nazivna napetost U_r	3,7 – 55 kV
Nazivni odvodni tok I_n (8/20µs)	10 kA
Visok impulzni tok (4/10µs)	100 kA
Zdržni kratkostični tok (I_s)	20 kA
Tok dolgega vala (I_{2ms})	250 A
Sposobnost energijske absorpcije (dolgi val) (W_{2ms})	2,8 kJ/kVU_c
Sposobnost energijske absorpcije (impulzni tok) ($W_{4/10}$)	4,8 kJ/kVU_c
Upogibni moment 24 kV (M_u)	300 Nm
Upogibni moment 36 kV (M_u)	250 Nm
Vertikalna sila (F_v)	625 N
Torzijski moment pri Ur= 45 kV (M_t)	80 Nm

2.3 Determination of the shielding distance

Data of electric network

The level of protection for devices on power lines is dependent from the distance between the protected device and the surge arrester. The surge arrester protects in a certain distance from the spot where it is mounted.

At least next data is necessary for the calculation:

- I_z – *shielding distance of the surge arrester*
- U_z – *allowed trigger voltage of insulating equipment.*
- U_{res} – *maximum value of redidual voltage for the chosen type of surge arresters*
- *v* – *speed of shock wave spreading through electric power lines*
  v = 300 m/µs – overhead line
  v = 150 m/µs – cable
- *S* – *anticipated steepness of over voltage lightning stroke*
  S = 1550 kV/µs – wooden poles
  S = 800 kV/µs – earthed brackets

Calculation

Simplified formula for calculating the shielding distance:

$$I_z = \frac{U_z - U_{res}}{2S} v$$

As a rule, the surge arrester should be mounted as near as possible to the device it protects.

2.4 Parameters for type 2SS15N - class 1

Arrester class	*1*
Arrester type	*2SS15N*
Commercial designation	*R, RP, RO, NO*
Continious operating voltage U_c	*3 – 44 kV*
Rated voltage U_r	*3,7 – 55 kV*
Nominal discharge current I_n (8/20µs)	*10 kA*
High impulse current (4/10µs)	*100 kA*
Short circuit current (I_s)	*20 kA*
Long-duration current (I_{2ms})	*250 A*
Energy absorption capability (long duration) (W_{2ms})	*2,8 kJ/kVU_c*
Energy absorption capability (impulse current) ($W_{4/10}$)	*4,8 kJ/kVU_c*
Cantilever strenght 24 kV (M_u)	*300 Nm*
Cantilever strenght 36 kV (M_u)	*250 Nm*
Vertical load (F_v)	*625 N*
Terminal torque at Ur= 45 kV (M_t)	*80 Nm*

2.5 Razred DH - izračun in izbira

2.5 *Class DH - calculation and selection*

2.5.1 Izračun

Podatki omrežja distributerja

- U_m – maksimalna napetost
- t – čas trajanja kratkega stika
- k_z – faktor zemeljskega stika
  k_z = 1,40 – neposredno ozemljeno
  k_z = 1,40 – 1,7 z malim uporom
  k_z = 1,73 – 1,8 z izolirano nevtralno točko

Podatki odvodnikov SNO

- k_0 = 0,8
- k_t = faktor trajne obratovalne napetosti za časno prenapetost.

2.5.1 Calculation

Data of electric network

- *U_m – maximum voltage*
- *t – short circuit duration time*
- *k_z – factor of earthing*
  k_z = 1,40 – directly earthed
  k_z = 1,40 – 1,7 with little resistance
  k_z = 1,73 – 1,8 with a neutral insulated spot

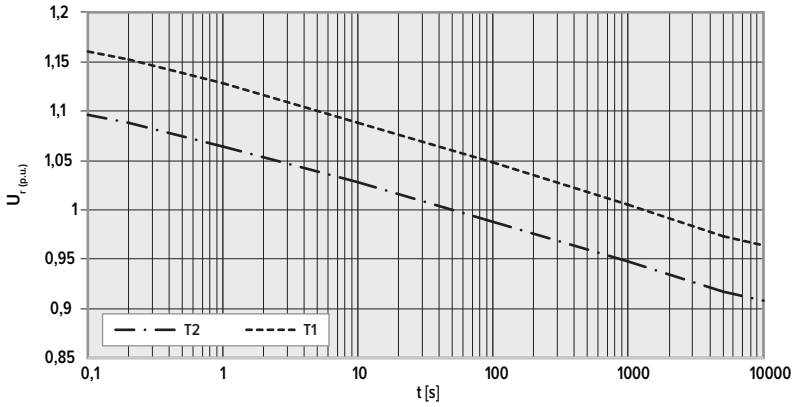
Data for surge arresters types SNO

- *k_0 = 0,8*
- *k_t = factor of permanent operating voltage for temporary over voltage duration time.*

Karakteristike za tip SNO / ***Characteristics for type SNO***

Legenda:
Krivulja T1:
brez predhodne energije

Krivulja T2:
2 x 34 kA, 8/20 µs predhodna energija



Legend:
Curve T1:
without prior energy

Curve T2:
2 x 34 kA, 8/20 prior energy

Izračun

- Nazivna napetost sistema:

$$U_{rs} = \frac{U_m}{\sqrt{3}} \times 1{,}25\ [kV]$$

- Predhodna nazivna napetost odvodnika:

$$U_{r1} = \frac{U_{rs}}{k_0}\ [kV]$$

- Najvišja pričakovana časna prenapetost odvodnika:

$$U_t = k_z \frac{U_m}{\sqrt{3}}\ [kV]$$

- Nazivna obratovalna napetost odvodnika:

$$U_{r2} = \frac{U_t}{k_t}\ [kV]$$

Calculation

- Rated voltage of system:

$$U_{rs} = \frac{U_m}{\sqrt{3}} \times 1{,}25\ [kV]$$

- *Preliminary rated voltage of surge arrester:*

$$U_{r1} = \frac{U_{rs}}{k_0}\ [kV]$$

- *Highest expected transient over voltage of surge arrester:*

$$U_t = k_z \frac{U_m}{\sqrt{3}}\ [kV]$$

- *Rated voltage of surge arrester:*

$$U_{r2} = \frac{U_t}{k_t}\ [kV]$$

2.5.2 Izbira

Ustrezen odvodnik prenapetosti izberemo iz tabel s podatki, na podlagi višje izračunane vrednosti med U_{r1} in U_{r2} tako, da izberemo prvo višjo nazivno napetost U_r, ki je podana v tabeli.

2.5.2 Selection

We choose a suitable surge arrester from tables with data based on higher calculated value between U_{r1} and U_{r2} so, that we choose the first higher value of rated voltage U_r specified in the table.

2.6 Določitev zaščitne razdalje

Podatki omrežja distributerja

Stopnja zaščite naprav na daljnovodih je odvisna od razdalje med ščiteno napravo in odvodnikom. Prenapetostni odvodnik ščiti v določeni razdalji od mesta, kjer je montiran.

Za izračun so potrebni najmanj naslednji podatki:

- I_z – zaščitna razdalja odvodnika
- U_z – zdržna udarna napetost izolacije opreme.
- U_{res} – maksimalna vrednost preostale napetosti za določen tip odvodnika
- v – hitrost širjenja udarnega vala po električnih vodih
  v = 300 m/µs – nadzemni vod
  v = 150 m/µs – kabel
- S – pričakovana strmina prenapetostnega udara strele
  S = 1550 kV/µs – leseni drogovi
  S = 800 kV/µs – ozemljene konzole

Izračun

Poenostavljena formula za izračun zaščitne razdalje:

$$I_z = \frac{U_z - U_{res}}{2S} v$$

Praviloma naj bo odvodnik prenapetosti priključen čim bliže ščiteni napravi.

2.7 Parametri za tip SNO - razred DH

Razred odvodnika	DH
Tip prenapetostnega odvodnika	SNO
Komercialna oznaka oblike	RP
Trajna obratovalna napetost U_c	3,2 – 44 kV
Nazivna napetost U_r	4 – 55 kV
Nazivni odvodni tok In (8/20µs)	10 kA
Visok impulzni tok (4/10µs)	100 kA
Zdržni kratkostični tok (Is)	20 kA
Sposobnost prenosa termičnega naboja (Q_{th})	1,1 C
Sposobnost prenosa ponavljajočega naboja (Q_{rs})	0,4 C
Upogibni moment 24 kV (M_u)	320 Nm
Upogibni moment pri Ur= 55 kV (M_u)	250 Nm
Vertikalna sila (F_v)	800 N
Torzijski moment pri Ur= 55 kV (M_t)	50 Nm

2.6 Determination of the shielding distance

Data of electric network

The level of protection for devices on power lines is dependent from the distance between the protected device and the surge arrester. The surge arrester protects in a certain distance from the spot where it is mounted.

At least next data is necessary for the calculation:

- I_z – *shielding distance of the surge arrester*
- U_z – *allowed trigger voltage of insulating equipment.*
- U_{res} – *maximum value of redidual voltage for the chosen type of surge arresters*
- *v* – *speed of shock wave spreading through electric power lines*
  v = 300 m/µs – overhead line
  v = 150 m/µs – cable
- *S* – *anticipated steepness of over voltage lightning stroke*
  S = 1550 kV/µs – wooden poles
  S = 800 kV/µs – earthed brackets

Calculation

Simplified formula for calculating the shielding distance:

$$I_z = \frac{U_z - U_{res}}{2S} v$$

As a rule, the surge arrester should be mounted as near as possible to the device it protects.

2.7 Parameters for type SNO - class DH

Arrester class	*DH*
Arrester type	*SNO*
Commercial designation	*RP*
Continious operating voltage U_c	*3,2 – 44 kV*
Rated voltage U_r	*4 – 55 kV*
Nominal discharge current In (8/20µs)	*10 kA*
High impulse current (4/10µs)	*100 kA*
Short circuit current (I_s)	*20 kA*
Thermal charge transfer rating (Q_{th})	*1,1 C*
Repetative charge transfer rating (Q_{rs})	*0,4 C*
Cantilever strenght 24 kV (M_u)	*320 Nm*
Cantilever strenhgt at Ur=55 kV (M_u)	*250 Nm*
Vertical load (F_v)	*800 N*
Terminal torque at Ur= 55 kV (M_t)	*50 Nm*

2.8 Primerjava energijskih absorbcij med razredom 1 in razredom DH po IEC60099-4:2014 (Ed.3.0)

2.8 The Comparison of energy absorbtion between class 1 and class DH according to IEC 60099-4:2014 (Ed.3.0)

Primerjalna tabela iz IEC 60099-4:2014 (Ed.3.0)

Comparision table of IEC 60099-4:2014 (Ed.3.0)

Table L.3 – comparision of the classification system according to IEC 60099-4:2009 (Ed.2.2) and to IEC 60099-4:2014 (Ed.3.0)

Old LDC	*Required minimum test energy*[a] *kJ/kV*	*Corresponding new thermal energy rating as per 8.7.3* W_{th} *kJ/kV*	*Estimated current at old LD test*[b] *A*	*Charge calculated with the same current and duration as for old LDC to give the required minimum energy* *C*	*Corresponding new repetitive charge transfer rating as per 8.5.4* Q_{rs} *C*	*Repetitive charge transfer test value* (=1,1 x Q_{rs}) *C*
1	1,0	2	277	0,56	0,5	0,55
2	2,1	4	538	1,10	1	1,10
3	3,3	7	721	1,78	1,6	1,76
4	5,0	10	962	2,75	2,4	2,64
5	6,9	14	1118	3,75	3,6	3,96

[a] *Calculated with* U_{resmin} (I_{min}) = 1,8 x U_r , [b] *Estimated from LD parameters and b) and c) above.*

Table L3: prepis iz IEC 60099-4:2014 (Ed.3.0), str. 165

Table L3: transcript from IEC 60099-4:2014 (Ed.3.0), p. 165

Razlaga primerjalnega diagrama

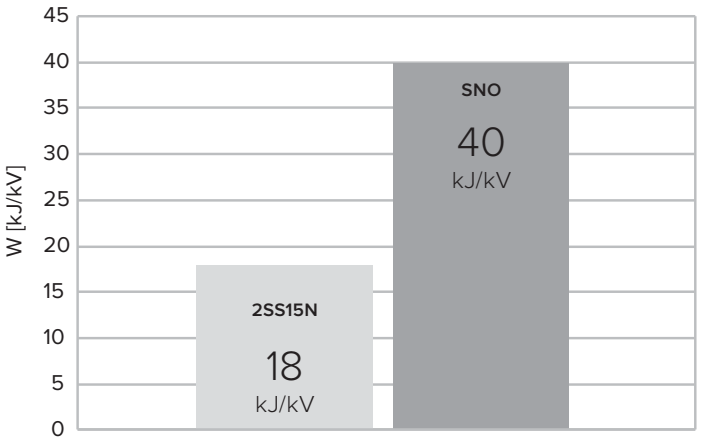
Na podlagi primerjalne tabele L.3 je v primerjalnem diagramu izrisana grafična ponazoritev celotnega testa hipotetične absorbcije energije odvodnika prenapetosti za razred 1 in dejanske testne absorbcije energije za razred DH. Po novem standardu bi odvodnik prenapetosti razreda 1 po izračunu moral na testu prenesti skupno 18 kJ/kV energije, odvodnik razreda DH pa dejansko na testu po novem standardu prenese 40 kJ/kV.

Comparision table of IEC 60099-4:2014 (Ed.3.0)

Based on the comparison table L.3 a comparative diagram was drawn where a graphical visualization between the hypothetical energy absorption of the Class 1 surge arrester and the actual energy absorption of the Class DH surge arrester is presented. Calculating the hypothetical energy absorption of the Class 1 surge arrester on the basis of the new standard edition shows that the Class 1 surge arrester would absorb a total of 18 kJ/kV of energy whereas the Class DH must absorb according to the new standard edition 40 kJ/kV.

Primerjalni diagram / *Comparative diagram*

Energijska absorbcija / *Energy absorbtion*



Legenda:

W: energija [kJ/kV]

Razred 1 ..... **2SS15N**

Razred DH ..... **SNO**

Legend:

***W:** energy [kJ/kV]*

Class 1** **2SS15N

Class DH** ..... **SNO

Povzetek

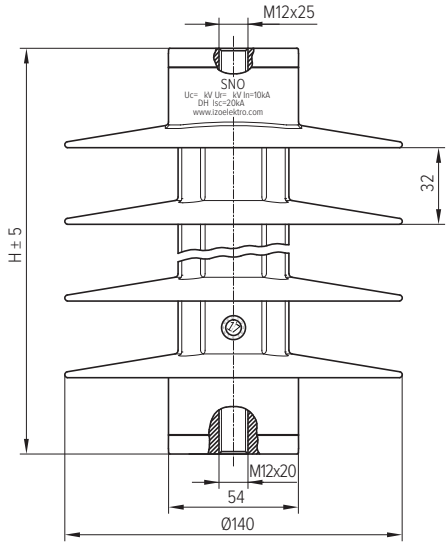
Odvodniki prenapetosti tip SNO razreda DH so sposobni absorbirati in odvesti za 122 % več energije, kot jih odvedejo odvodniki prenapetosti razreda 1.

Abstract

The Class DH surge arresters type SNO are capable to absorb and dissipate 122 % more energy as the Class 1 surge arresters.

2.9 Razred DH
2.9.1 SNO - RP

Tip prenapetostnega odvodnika: SNO
Komercialna oznaka oblike: RP



2.9 *Class DH*
2.9.1 *SNO - RP*

Surge arrester type: SNO
Commercial designation: RP

SNO - RP 24 kV
Koda/*Code*: 12 40 00

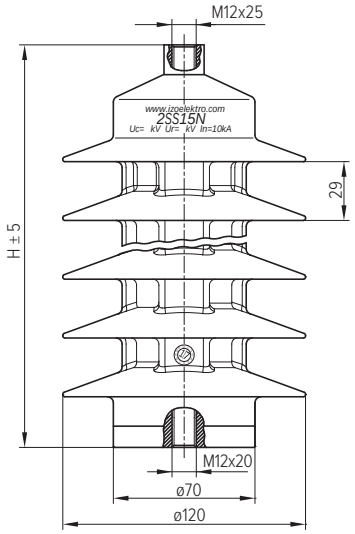
	ELEKTRIČNE KARAKTERISTIKE / *ELECTRICAL CHARACTERISTICS*							MEHANSKE KARAKTERISTIKE / *MEHANICAL CHARACTERISTICS*							
	U_c	U_r	U_{res}			U_{peak}	U_{rms}	SSL	SLL	AD	CD	A	B	H	
Koda			8/20µs 5kA	8/20µs 10kA	8/20µs 20kA	1,2/50µs	50 Hz, 1 min								Rebra
Code	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[N]	[N]	[mm]	[mm]	[mm]	[mm]	[mm]	*Shets*
10 40 00	3,2	4,0	9,12	9,84	10,78							80	100		
10 60 00	6,4	8,0	18,24	19,68	21,56	90	35	1800	1437	154	343	100	120	136	3
10 80 00	7,6	9,5	21,67	23,38	25,60							120	140		
11 00 00	10,8	13,5	30,79	33,22	36,38	105	40	1454	1163	186	453	140	160	168	4
11 20 00	12,0	15,0	34,22	36,93	40,42							160	180		
11 40 00	14,0	17,5	39,91	43,04	47,12	120	45	1220	975	218	563	180	200	200	5
11 60 00	16,0	20,0	43,34	46,76	51,20	130	50	1052	841	250	674	200	220	232	6
12 00 00	20,4	25,5	55,89	60,30	66,02							240	260		
12 20 00	22,0	27,5	62,75	67,70	74,10	140	65	929	742	282	784	240	260	263	7
12 40 00	24,0	30,0	68,44	73,86	80,84							300	320		
12 60 00	26,0	32,5	74,13	79,98	87,57	150	75	828	662	314	894	320	340	295	8
12 80 00	28,0	35,0	79,82	86,12	94,32							340	360		
13 20 00	32,8	41,0	92,45	100,32	109,56	160	80	747	597	345	1004	380	400	327	9
13 40 00	34,0	42,5	96,97	104,62	114,51							400	420		
13 60 00	36,0	45,0	102,68	110,78	121,52	170	85	680	544	377	1114	420	440	359	10
13 80 00	38,0	47,5	108,38	116,93	127,99							440	460		
14 00 00	40,4	50,5	115,23	124,32	136,07	180	90	625	500	409	1234	450	470	391	11
14 40 00	44,0	55,0	125,50	135,40	148,20							470	490		

U_c Trajna obratovalna napetost
U_r Nazivna napetost
U_{res} Preostala napetost pri različnih tokovnih impulzih
U_{peak} Atmosferska udarna napetost 1,2/50µs v suhem
U_{rms} Izmenična vzdržna napetost 50 Hz v mokrem, 1min
SSL Specifična kratkotrajna obremenitev
SLL Specifična dolgotrajna obremenitev
AD Preskočna razdalja
CD Plazilna pot
A Minimalna razdalja do stene
B Minimalna razdalja med fazami
H Višina odvodnika prenapetosti

U_c *Continious operating voltage*
U_r *Rated voltage*
U_{res} *Residual voltages at different impulse currentss*
U_{peak} *Lightning impulse withstand voltage 1,2/50µs in dry*
U_{rms} *Power frequency Withstand voltage 1 min. 50Hz, wet*
SSL *Specific short-term load*
SLL *Specific long-term load*
AD *Arcing distance*
CD *Creepage distance*
A *Minimum distance to wall*
B *Minimum distance between phases*
H *Surge arrester height*

2.10 **Razred 1**
2.10.1 **2SS15N - R**

Tip prenapetostnega odvodnika: 2SS15N
Komercialna oznaka oblike: R



2.10 ***Class 1***
2.10.1 ***2SS15N - R***

Surge arrester type: 2SS15N
Commercial designation: R

2SS15N - R 12 kV
Koda/*Code*: 21 48 06

	ELEKTRIČNE KARAKTERISTIKE / *ELECTRICAL CHARACTERISTICS*											MEHANSKE KARAKTERISTIKE / *MEHANICAL CHARACTERISTICS*					
	U_c	U_r	U_{res}							U_{peak}	U_{rms}	AD	CD	A	B	H	
Koda			1/20µs 5 kA	1/20µs 10kA	8/20µs 5kA	8/20µs 10kA	8/20µs 20kA	30/60µs 125 A	30/60µs 500 A	1,2/50µs	50 Hz, 1 min						Rebra
Code	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[mm]	[mm]	[mm]	[mm	[mm]	*Shets*
21 48 01	3	3,75	8,55	9,65	7,18	8,78	9,60	7,35	7,85	62	25	139	360	60	90	147	3
21 48 02	4	5,00	12,8	14,20	11,25	12,92	14,15	9,63	10,16					80	100		
21 48 03	6	7,50	21,35	23,85	17,95	21,70	23,75	16,98	18,01					100	120		
21 48 04	8	10,00	25,60	28,40	26,12	25,84	28,30	19,26	20,32	98	35	185	520	120	140	193	5
21 48 05	10	12,50	34,15	38,05	29,00	34,62	37,90	26,61	28,17					140	160		
21 48 06	12	15,00	38,40	42,60	33,15	38,96	42,45	28,89	30,48					160	180		
21 48 07	14	17,50	46,95	52,25	39,98	47,54	52,05	36,24	38,33	125	55	235	600	180	200	243	6
21 48 08	16	20,00	51,20	56,80	44,10	51,68	56,60	38,52	40,64					200	220		
21 48 09	18	22,50	59,75	66,45	51,26	60,46	66,20	45,87	48,49					220	240		
21 48 10	20	25,00	64,00	71,00	55,45	64,60	70,75	48,15	50,80	135	60	262	680	240	260	270	7
21 48 11	21	26,25	67,55	77,10	58,93	67,95	76,25	52,15	54,55					260	280		
21 48 12	22	27,50	72,55	80,65	63,00	73,38	80,35	55,50	58,65					270	300		
21 48 22	24	30,00	76,80	85,20	66,15	75,98	84,90	57,78	60,96					320	320		
21 48 13	24	30,00	76,80	85,20	74,39	75,95	84,90	57,78	60,96	150	65	309	760	320	320	317	8
21 48 14	26	32,50	85,35	94,85	77,20	84,76	94,50	65,13	68,81					340	340		
21 48 15	28	35,00	89,60	99,40	84,90	88,21	99,05	67,41	71,12					360	360		
21 48 16	30	37,50	98,15	109,05	88,00	96,99	108,65	74,76	78,97	170	70	362	1000	295	380	370	11
21 48 17	32	40,00	102,40	113,60	96,05	101,15	113,20	77,04	81,28					380	400		
21 48 24	35	43,75	112,30	125,50	97,86	112,81	125,15	85,16	90,12					410	430		
21 48 23	36	45,00	115,20	127,80	99,10	114,10	127,25	86,67	91,44					420	440		
21 48 18	34	42,50	110,95	123,25	96,05	109,93	122,80	84,39	89,13	180	75	396	1080	400	420	404	12
21 48 19	36	45,00	115,20	127,80	99,10	114,10	127,35	86,67	91,44					420	440		
21 48 26	40,5	50,60	125,76	136,35	114,89	129,78	146,25	96,12	101,35					450	470		

U_c	Trajna obratovalna napetost
U_r	Nazivna napetost
U_{res}	Preostala napetost pri različnih tokovnih impulzih
U_{peak}	Atmosferska udarna napetost 1,2/50µs v suhem
U_{rms}	Izmenična vzdržna napetost 50 Hz v mokrem, 1min
AD	Preskočna razdalja
CD	Plazilna pot
A	Minimalna razdalja do stene
B	Minimalna razdalja med fazami
H	Višina odvodnika prenapetosti

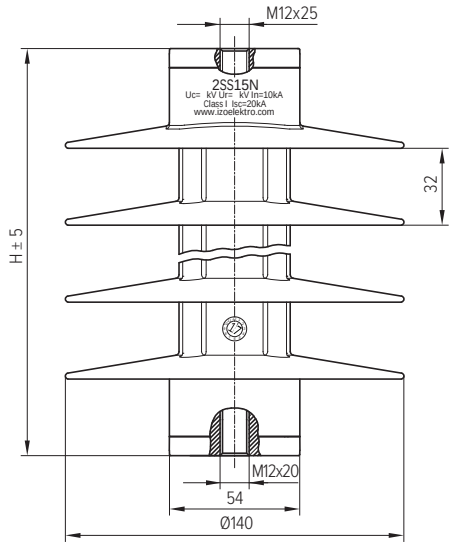
U_c	*Continious operating voltage*
U_r	*Rated voltage*
U_{res}	*Residual voltages at different impulse currentss*
U_{peak}	*Lightning impulse withstand voltage 1,2/50µs in dry*
U_{rms}	*Power frequency Withstand voltage 1 min. 50Hz, wet*
AD	*Arcing distance*
CD	*Creepage distance*
A	*Minimum distance to wall*
B	*Minimum distance between phases*
H	*Surge arrester height*

2.10.2 **2SS15N - RP**

Tip prenapetostnega odvodnika: 2SS15N
Komercialna oznaka oblike: RP

2.10.2 ***2SS15N - RP***

Surge arrester type: 2SS15N
Commercial designation: RP



2SS15N-RP 12 kV
Koda/Code: 221 48 06

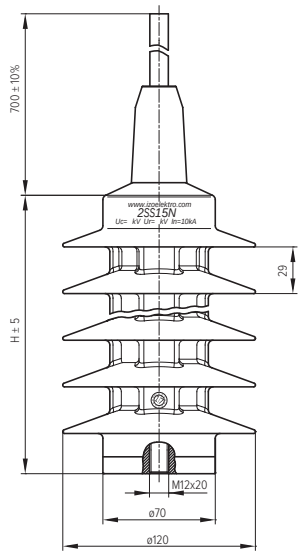
	ELEKTRIČNE KARAKTERISTIKE / *ELECTRICAL CHARACTERISTICS*											MEHANSKE KARAKTERISTIKE / *MEHANICAL CHARACTERISTICS*					
	U_c	U_r	U_{res}							U_{peak}	U_{rms}	AD	CD	A	B	H	
Koda			1/20µs 5 kA	1/20µs 10kA	8/20µs 5kA	8/20µs 10kA	8/20µs 20kA	30/60µs 125 A	30/60µs 500 A	1,2/50µs	50 Hz, 1 min						Rebra
Code	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[mm]	[mm]	[mm]	[mm	[mm]	*Shets*
221 48 01	3	3,75	8,55	9,65	7,18	8,78	9,60	7,35	7,85	90	35	154	343	60	90	136	3
221 48 02	4	5,00	12,80	14,20	11,25	12,92	14,15	9,63	10,16					80	100		
221 48 03	6	7,50	21,35	23,85	17,95	21,70	23,75	16,98	18,01					100	120		
221 48 04	8	10,00	25,60	28,40	26,12	25,84	28,30	19,26	20,32					120	140		
221 48 05	10	12,50	34,15	38,05	29,00	34,62	37,90	26,61	28,17	105	40	186	453	140	160	168	4
221 48 06	12	15,00	38,40	42,60	33,15	38,76	42,45	28,89	30,48					160	180		
221 48 07	14	17,50	46,95	52,25	39,98	47,54	52,05	36,24	38,33	120	45	218	563	180	200	200	5
221 48 08	16	20,00	51,20	56,80	44,10	51,68	56,60	38,52	40,64					200	220		
221 48 09	18	22,50	59,75	66,45	51,26	60,46	66,20	45,87	48,49	130	50	250	674	220	240	232	6
221 48 10	20	25,00	64,00	71,00	55,45	64,60	70,75	48,15	50,80					240	260		
221 48 11	21	26,25	67,55	77,10	58,93	67,95	76,25	52,15	54,55	140	65	282	784	260	280	263	7
221 48 12	22	27,50	72,55	80,65	63,00	73,38	80,35	55,50	58,65					270	300		
221 48 13	24	30,00	76,80	85,20	66,15	75,98	84,90	57,78	60,96					300	320		
221 48 14	26	32,50	85,35	94,85	74,39	84,76	94,50	65,13	68,81	150	75	314	894	320	340	295	8
221 48 15	28	35,00	89,60	99,40	77,20	88,21	99,05	67,41	71,12					340	360		
221 48 16	30	37,50	98,15	109,05	84,90	96,99	108,65	74,46	78,97	160	80	345	1004	360	380	327	9
221 48 17	32	40,00	102,40	113,60	88,00	101,15	113,20	77,04	81,28					380	400		
221 48 18	34	42,50	110,95	123,25	96,05	109,93	122,80	84,39	89,13	170	85	377	1114	400	420	359	10
221 48 19	36	45,00	115,20	127,80	99,10	114,10	127,35	86,67	91,44					420	440		
221 48 20	38	47,50	120,35	130,33	106,25	123,66	136,50	90,85	95,65	180	90	409	1234	440	460	391	11
221 48 21	40	50,00	124,87	135,63	114,33	129,78	145,73	95,50	100,75					450	470		
221 48 22	42	52,50	130,50	138,75	120,63	137,85	154,78	100,43	105,47					460	480		
221 48 23	44	55,00	136,75	143,25	127,55	142,68	162,35	103,58	108,35					470	490		

U_c	Trajna obratovalna napetost
U_r	Nazivna napetost
U_{res}	Preostala napetost pri različnih tokovnih impulzih
U_{peak}	Atmosferska udarna napetost 1,2/50µs v suhem
U_{rms}	Izmenična vzdržna napetost 50 Hz v mokrem, 1min
AD	Preskočna razdalja
CD	Plazilna pot
A	Minimalna razdalja do stene
B	Minimalna razdalja med fazami
H	Višina odvodnika prenapetosti

U_c	*Continious operating voltage*
U_r	*Rated voltage*
U_{res}	*Residual voltages at different impulse currentss*
U_{peak}	*Lightning impulse withstand voltage 1,2/50µs in dry*
U_{rms}	*Power frequency Withstand voltage 1 min. 50Hz, wet*
AD	*Arcing distance*
CD	*Creepage distance*
A	*Minimum distance to wall*
B	*Minimum distance between phases*
H	*Surge arrester height*

2.10.3 **2SS15N - RO**

Tip prenapetostnega odvodnika: 2SS15N
Komercialna oznaka oblike: RO



2.10.3 ***2SS15N - RO***

Surge arrester type: 2SS15N
Commercial designation: RO

2SS15N - RO 12 kV
Koda/Code: 21 49 06

	ELEKTRIČNE KARAKTERISTIKE / *ELECTRICAL CHARACTERISTICS*											MEHANSKE KARAKTERISTIKE / *MEHANICAL CHARACTERISTICS*					
	U_c	U_r	U_{res}							U_{peak}	U_{rms}	AD	CD	A	B	H	
Koda			1/20µs 5 kA	1/20µs 10kA	8/20µs 5kA	8/20µs 10kA	8/20µs 20kA	30/60µs 125 A	30/60µs 500 A	1,2/50µs	50 Hz, 1 min						Rebra
Code	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[mm]	[mm]	[mm]	[mm	[mm]	*Shets*
21 49 01	3	3,75	8,55	9,65	7,18	8,78	9,60	7,35	7,85	62	25	257	491	60	90	129	3
21 49 02	4	5,00	12,8	14,20	11,25	12,92	14,15	9,63	10,16					80	100		
21 49 03	6	7,50	21,35	23,85	17,95	21,70	23,75	16,98	18,01					100	120		
21 49 04	8	10,00	25,60	28,40	26,12	25,84	28,30	19,26	20,32	98	35	303	651	120	140	175	5
21 49 05	10	12,50	34,15	38,05	29,00	34,62	37,90	26,61	28,17					140	160		
21 49 06	12	15,00	38,40	42,60	33,15	38,96	42,45	28,89	30,48					160	180		
21 49 07	14	17,50	46,95	52,25	39,98	47,54	52,05	36,24	38,33	125	55	353	731	180	200	225	6
21 49 08	16	20,00	51,20	56,80	44,10	51,68	56,60	38,52	40,64					200	220		
21 49 09	18	22,50	59,75	66,45	51,26	60,46	66,20	45,87	48,49					220	240		
21 49 10	20	25,00	64,00	71,00	55,45	64,60	70,75	48,15	50,80	135	60	380	811	240	260	252	7
21 49 11	21	26,25	67,55	77,10	58,93	67,95	76,25	52,15	54,55					260	280		
21 49 12	22	27,50	72,55	80,65	63,00	73,38	80,35	55,50	58,65					270	300		
21 49 20	24	30,00	76,80	85,20	66,15	75,98	84,90	57,78	60,96					320	320		
21 49 13	24	30,00	76,80	85,20	74,39	75,95	84,90	57,78	60,96	150	65	427	891	320	320	299	8
21 49 14	26	32,50	85,35	94,85	77,20	84,76	94,50	65,13	68,81					340	340		
21 49 15	28	35,00	89,60	99,40	84,90	88,21	99,05	67,41	71,12					360	360		
21 49 16	30	37,50	98,15	109,05	88,00	96,99	108,65	74,76	78,97	170	70	480	1131	295	380	352	11
21 49 17	32	40,00	102,40	113,60	96,05	101,15	113,20	77,04	81,28					380	400		
21 49 24	35	43,75	112,30	125,50	97,86	112,81	125,15	85,16	90,12					410	430		
21 49 21	36	45,00	115,20	127,80	99,10	114,10	127,25	86,67	91,44					420	440		
21 49 18	34	42,50	110,95	123,25	96,05	109,93	122,80	84,39	89,13	180	75	517	1211	400	420	386	12
21 49 19	36	45,00	115,20	127,80	99,10	114,10	127,35	86,67	91,44					420	440		
21 49 26	40,5	50,60	125,76	136,35	114,89	129,78	146,25	96,12	101,35					450	470		

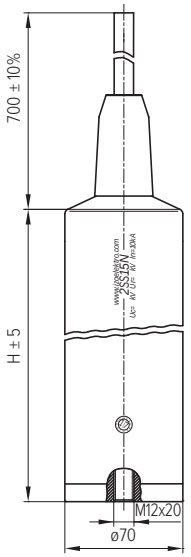
U_c	Trajna obratovalna napetost	***U_c***	*Continious operating voltage*
U_r	Nazivna napetost	***U_r***	*Rated voltage*
U_{res}	Preostala napetost pri različnih tokovnih impulzih	***U_{res}***	*Residual voltages at different impulse currentss*
U_{peak}	Atmosferska udarna napetost 1,2/50µs v suhem	***U_{peak}***	*Lightning impulse withstand voltage 1,2/50µs in dry*
U_{rms}	Izmenična vzdržna napetost 50 Hz v mokrem, 1min	***U_{rms}***	*Power frequency Withstand voltage 1 min. 50Hz, wet*
AD	Preskočna razdalja	***AD***	*Arcing distance*
CD	Plazilna pot	***CD***	*Creepage distance*
A	Minimalna razdalja do stene	***A***	*Minimum distance to wall*
B	Minimalna razdalja med fazami	***B***	*Minimum distance between phases*
H	Višina odvodnika prenapetosti	***H***	*Surge arrester height*

2.10.4 **2SS15N - NO**

Tip prenapetostnega odvodnika: 2SS15N
Komercialna oznaka oblike: NO

*2.10.4 **2SS15N - NO***

Surge arrester type: 2SS15N
Commercial designation: NO



2SS15N-NO 22 kV
Koda/Code: 21 59 12

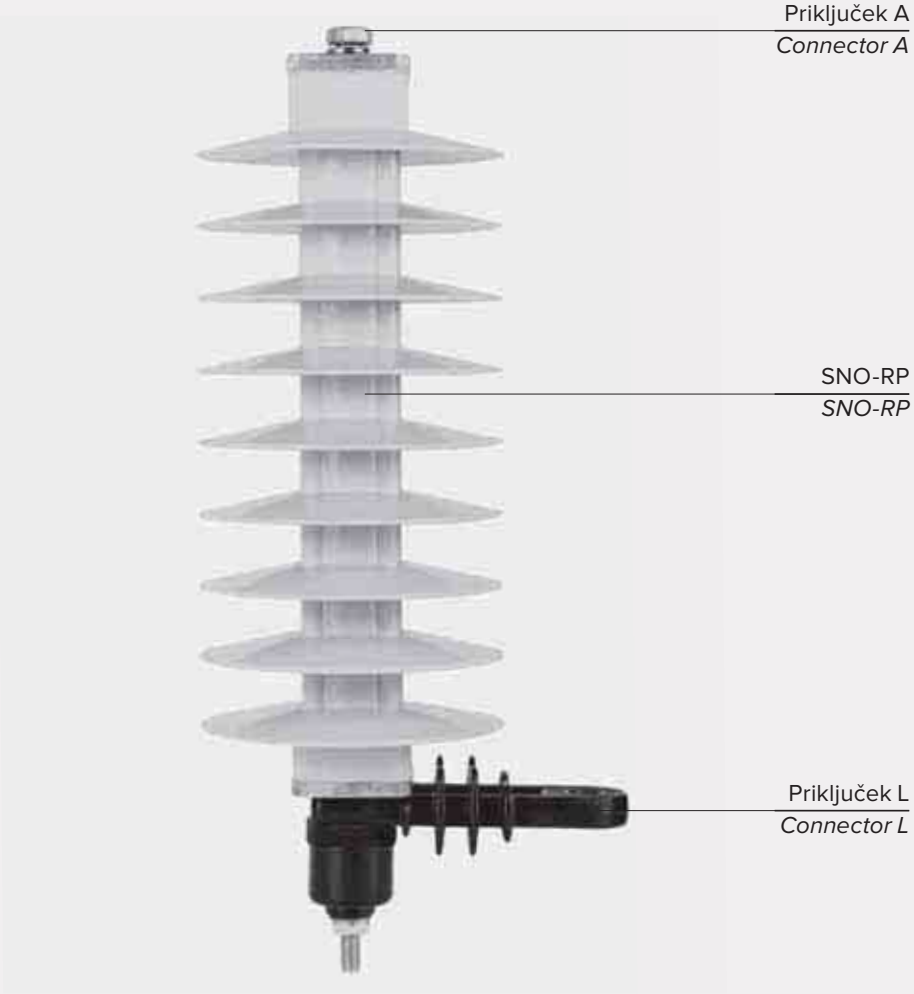
	ELEKTRIČNE KARAKTERISTIKE / *ELECTRICAL CHARACTERISTICS*											MEHANSKE KARAKTERISTIKE / *MEHANICAL CHARACTERISTICS*				
	U_c	U_r	U_{res}							U_{peak}	U_{rms}	AD	CD	A	B	H
			1/20µs	1/20µs	8/20µs	8/20µs	8/20µs	30/60µs	30/60µs	1,2/50µs	50 Hz,					
Koda			5 kA	10kA	5kA	10kA	20kA	125 A	500 A		1 min					
Code	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[mm]	[mm]	[mm]	[mm	[mm]
21 59 01	3	3,75	8,55	9,65	7,18	8,78	9,60	7,35	7,85	62	25	215	243	60	90	129
21 59 02	4	5,00	12,8	14,20	11,25	12,92	14,15	9,63	10,16				243	408	100	
21 59 03	6	7,50	21,35	23,85	17,95	21,70	23,75	16,98	18,01				289	508	120	
21 59 04	8	10,00	25,60	28,40	26,12	25,84	28,30	19,26	20,32	98	35	271	289	120	140	175
21 59 05	10	12,50	34,15	38,05	29,00	34,62	37,90	26,61	28,17				289	683	160	
21 59 06	12	15,00	38,40	42,60	33,15	38,96	42,45	28,89	30,48				339	887	180	
21 59 07	14	17,50	46,95	52,25	39,98	47,54	52,05	36,24	38,33	125	55	321	339	180	200	225
21 59 08	16	20,00	51,20	56,80	44,10	51,68	56,60	38,52	40,64				339	200	220	
21 59 09	18	22,50	59,75	66,45	51,26	60,46	66,20	45,87	48,49				366	220	240	
21 59 10	20	25,00	64,00	71,00	55,45	64,60	70,75	48,15	50,80	135	60	348	366	240	260	252
21 59 11	21	26,25	67,55	77,10	58,93	67,95	76,25	52,15	54,55				366	260	280	
21 59 12	22	27,50	72,55	80,65	63,00	73,38	80,35	55,50	58,65				366	270	300	
21 59 20	24	30,00	76,80	85,20	66,15	75,98	84,90	57,78	60,96				413	320	320	
21 59 13	24	30,00	76,80	85,20	74,39	75,95	84,90	57,78	60,96	150	65	395	413	320	320	299
21 59 14	26	32,50	85,35	94,85	77,20	84,76	94,50	65,13	68,81				413	340	340	
21 59 15	28	35,00	89,60	99,40	84,90	88,21	99,05	67,41	71,12				466	360	360	
21 59 16	30	37,50	98,15	109,05	88,00	96,99	108,65	74,76	78,97	170	70	418	466	295	380	352
21 59 17	32	40,00	102,40	113,60	96,05	101,15	113,20	77,04	81,28				466	380	400	
21 59 24	35	43,75	112,30	125,50	97,86	112,81	125,15	85,16	90,12				500	410	430	
21 59 21	36	45,00	115,20	127,80	99,10	114,10	127,25	86,67	91,44				500	420	440	
21 59 18	34	42,50	110,95	123,25	96,05	109,93	122,80	84,39	89,13	180	75	482	500	400	420	386
21 59 19	36	45,00	115,20	127,80	99,10	114,10	127,35	86,67	91,44				500	420	440	
21 59 26	40,5	50,60	125,76	136,35	114,89	129,78	146,25	96,12	101,35				243	450	470	

U_c	Trajna obratovalna napetost
U_r	Nazivna napetost
U_{res}	Preostala napetost pri različnih tokovnih impulzih
U_{peak}	Atmosferska udarna napetost 1,2/50µs v suhem
U_{rms}	Izmenična vzdržna napetost 50 Hz v mokrem, 1min
AD	Preskočna razdalja
CD	Plazilna pot
A	Minimalna razdalja do stene
B	Minimalna razdalja med fazami
H	Višina odvodnika prenapetosti

U_c	*Continious operating voltage*
U_r	*Rated voltage*
U_{res}	*Residual voltages at different impulse currentss*
U_{peak}	*Lightning impulse withstand voltage 1,2/50µs in dry*
U_{rms}	*Power frequency Withstand voltage 1 min. 50Hz, wet*
AD	*Arcing distance*
CD	*Creepage distance*
A	*Minimum distance to wall*
B	*Minimum distance between phases*
H	*Surge arrester height*

2.11 SNO primer naročila

2.11 SNO order example



Naziv: **SNO - RP 34 kV + Priključka AL**
*Name: **SNO - RP 34 kV + Connectors AL***

Razlaga naziva

SNO	- tip
RP	- komercialna oznaka oblike
34	- trajna obratovalna napetost (Uc)
kV	- merska enota
AL	- oznake priključkov

Name explanation

SNO	*- type*
RP	*- commercial designation*
34	*- continuous operating voltage (Uc)*
kV	*- measuring unit*
AL	*- marks of connectors*

Oznake na odvodniku prenapetosti

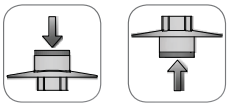
Izoelektro	- proizvajalec
SNO	- tip
2/17	- mesec in leto proizvodnje
U_c ...V	- trajna obratovalna napetost
U_r ...kV	- nazivna napetost
I_n ...kA	- nazivni odvodni tok
I_{sc} ...kA	- kratkostični tok
DH	- IEC razred

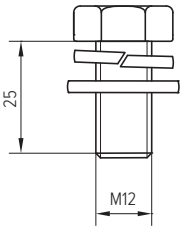
Marks on surge arrester

Izoelektro	*- manufacturer*
SNO	*- type*
2/17	*- month and year of production*
U_c ...V	*- continuous operating voltage*
U_r ...kV	*- rated voltage*
I_n ...kA	*- nominal discharge current*
I_{sc} ...kA	*- short-circuit current*
DH	*- IEC class*

2.12 **Priključek A**

Opis: vijačni priključek za kabelski čevelj
Material: nerjavno jeklo A2
Masa: 0,044 kg
Koda: **21 47 01**



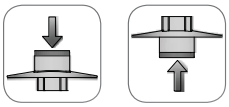


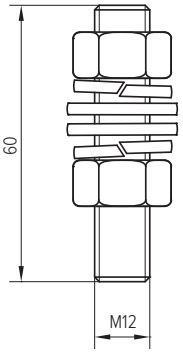
*2.12 **Connector A***

Description: screw connector for cable lug
Material: stainless steel A2
Mass: 0,044 kg
*Code: **21 47 01***

2.13 **Priključek B**

Opis: vijačni priključek za kabelski čevelj
Material: nerjavno jeklo A2
Masa: 0,086 kg
Koda: **21 47 02**



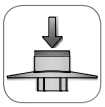


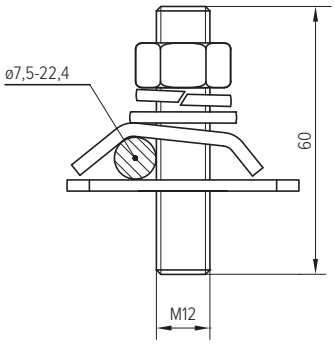
*2.13 **Connector B***

Description: screw connector for cable lug
Material: stainless steel A2
Mass: 0,086 kg
*Code: **21 47 02***

2.14 **Priključek C**

Opis: vijačni priključek za AlFe ø7,5-22,4 mm
Material: nerjavno jeklo A2
Masa: 0,133 kg
Koda: **21 47 03**



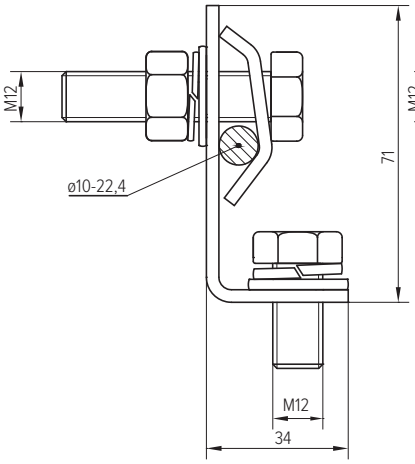


*2.14 **Connector C***

Description: connector for AlFe ø7,5-22,4 mm
Material: stainless steel A2
Mass: 0,133 kg
*Code: **21 47 03***

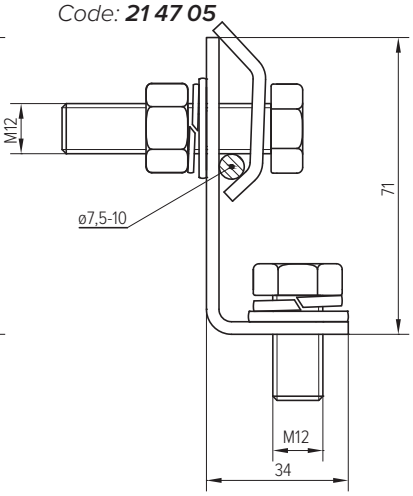
2.15 **Priključek E**

Opis: vijačni priključek za AlFe ø7,5-22,4 mm
Material: nerjavno jeklo A2
Masa: 0,210 kg
Koda: **21 47 05**



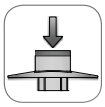
2.15 ***Connector E***

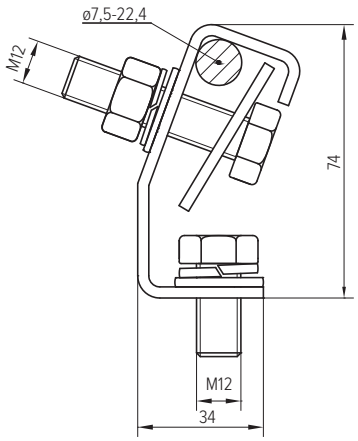
Description: screw connector for AlFe ø7,5-22,4 mm
Material: stainless steel A2
Mass: 0,210 kg
Code: ***21 47 05***



2.16 **Priključek F**

Opis: vijačni priključek za AlFe ø7,5-22,4 mm
Material: nerjavno jeklo A2
Masa: 0,210 kg
Koda: **21 47 06**



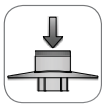


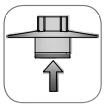
2.16 ***Connector F***

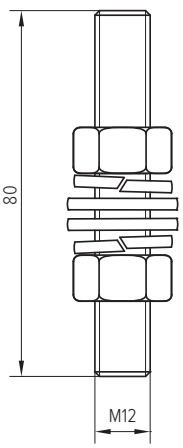
Description: screw screw connector for AlFe ø7,5-22,4 mm
Material: stainless steel A2
Mass: 0,210 kg
Code: ***21 47 06***

2.17 **Priključek G**

Opis: vijačni priključek za kabelski čevelj
Material: nerjavno jeklo A2
Masa: 0,100 kg
Koda: **21 47 07**







2.17 ***Connector G***

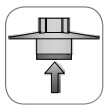
Description: screw connector for cable lug
Material: stainless steel A2
Mass: 0,100 kg
Code: ***21 47 07***

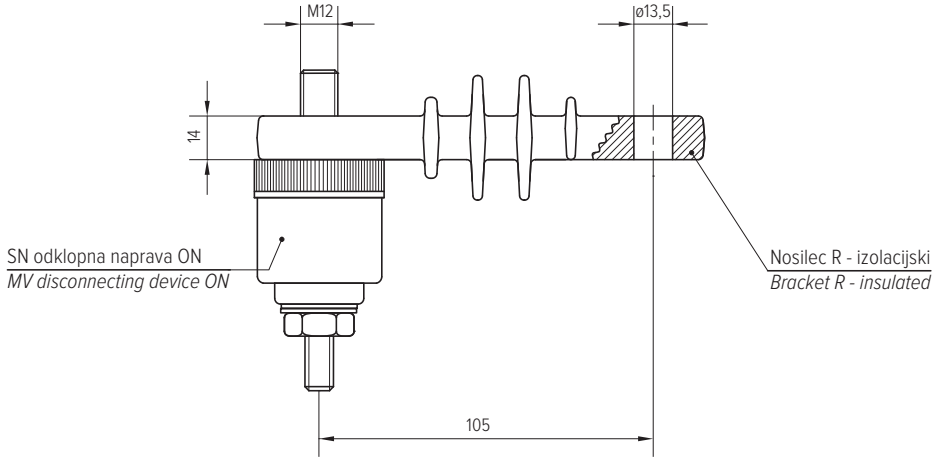
2.18 **Priključek L**

Opis: izolacijski nosilec R z odklopno napravo ON
Masa: 0,200 kg
Koda: **21 47 22**

2.18 ***Connector L***

Description: insulative bracket R with disconnector ON
Mass: 0,200 kg
Code: ***21 47 22***



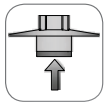


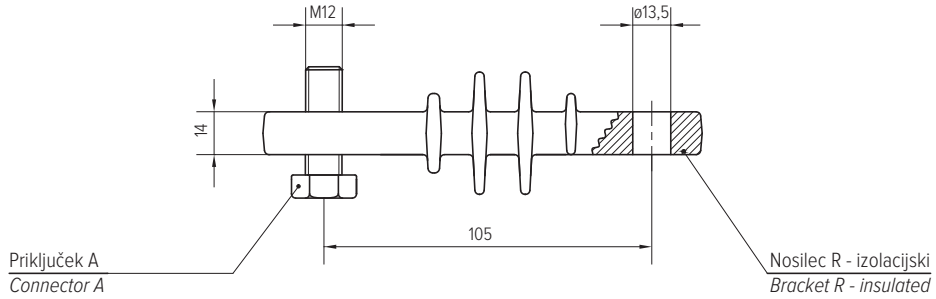
2.19 **Priključek M**

Opis: izolacijski nosilec R z vijakom M12x25
Masa: 0,120 kg
Koda: **21 47 23**

2.19 ***Connector M***

Description: insulative bracket R with screw M12x25
Mass: 0,120 kg
Code: ***21 47 23***



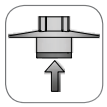


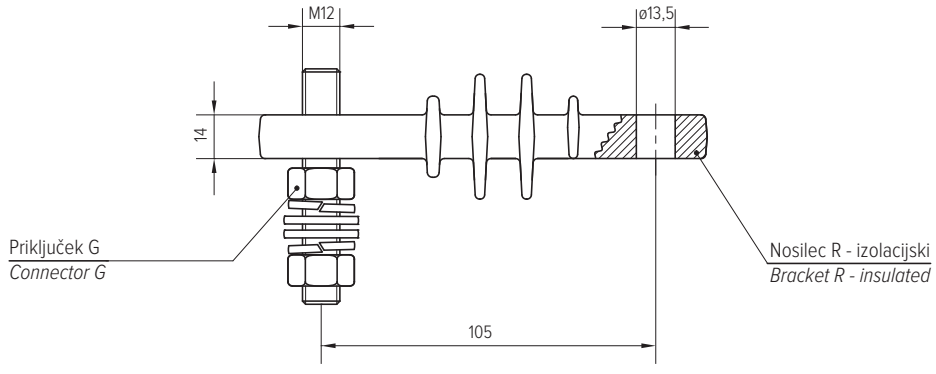
2.20 **Priključek N**

Opis: izolacijski nosilec R s SN priključkom G
Masa: 0,160 kg
Koda: **21 47 24**

2.20 ***Connector N***

Description: insulative bracket R with MV connector G
Mass: 0,160 kg
Code: ***21 47 24***



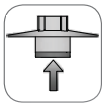


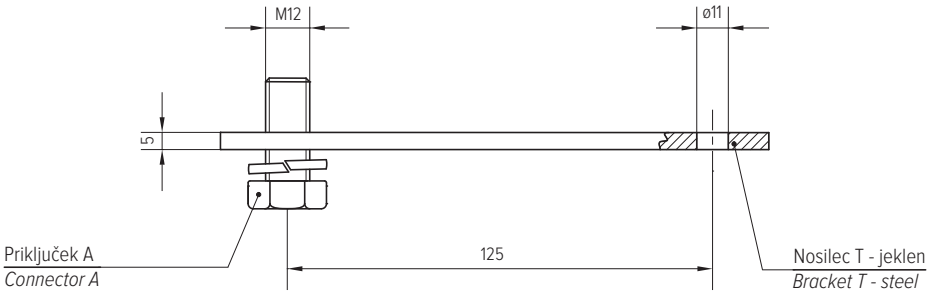
2.21 **Priključek O**

Opis: jeklen nosilec T z vijakom M12x25
Material: nerjavno jeklo A2
Masa: 0,120 kg
Koda: **21 47 25**

*2.21 **Connector O***

Description: steel bracket T with screw M12x25
Material: stainless steel A2
Mass: 0,120 kg
*Code: **21 47 25***



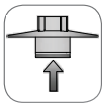


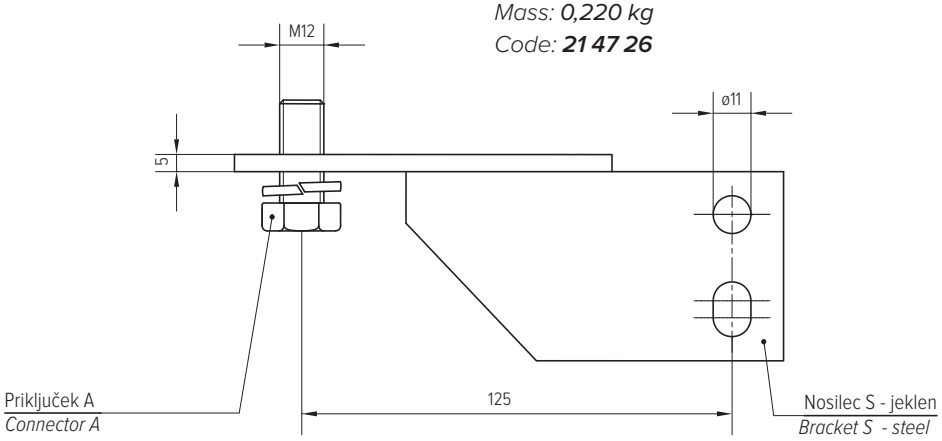
2.22 **Priključek P**

Opis: jeklen nosilec S (90°) z vijakom M12x25
Material: nerjavno jeklo A2
Masa: 0,220 kg
Koda: **21 47 26**

*2.22 **Connector P***

Description: steel bracket S (90°) with screw M12x25
Material: stainless steel A2
Mass: 0,220 kg
*Code: **21 47 26***



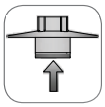


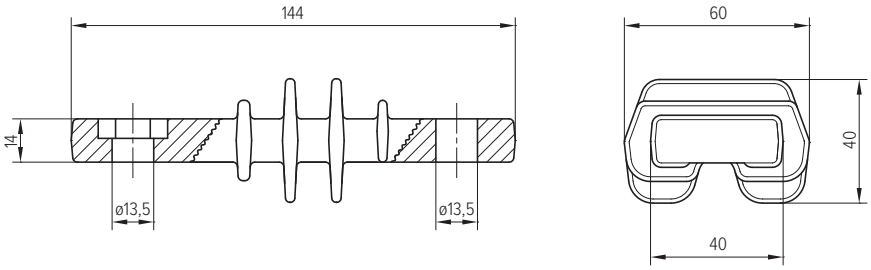
2.23 **Nosilec R - izolacijski**

Opis: izolacijski nosilec
Material: poliamid PA6
Masa: 0,100 kg
Koda: **21 48 30**

*2.23 **Bracket R - insulated***

Description: insulative bracket
Material: polyamide PA6
Mass: 0,100 kg
*Code: **21 48 30***



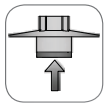


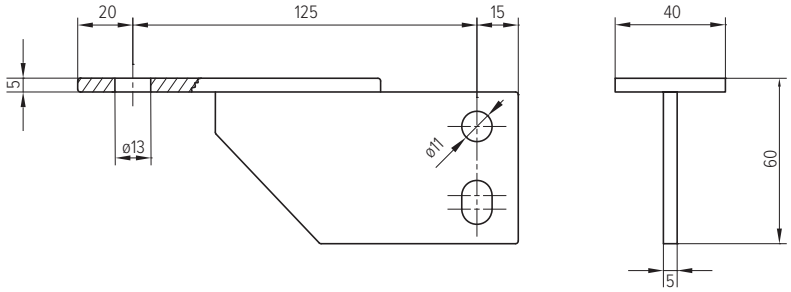
2.24 **Nosilec S - jeklen**

Opis: nosilec jeklen 90°
Material: nerjavno jeklo A2
Masa: 0,176 kg
Koda: **21 48 31**

2.24 ***Bracket S - steel***

Description: steel bracket 90°
Material: stainless steel A2
Mass: 0,176 kg
*Code: **21 48 31***



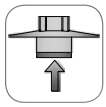


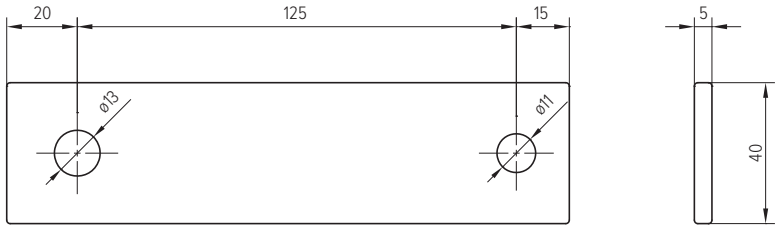
2.25 **Nosilec T - jeklen**

Opis: nosilec jeklen
Material: nerjavno jeklo A2
Masa: 0,100 kg
Koda: **21 48 32**

2.25 ***Bracket T - steel***

Description: steel bracket
Material: stainless steel A2
Mass: 0,100 kg
*Code: **21 48 32***





2.26 SN indikatorja stanja - splošno

Proizvodi
Odklopna naprava **ON**, indikator stanja **ISOP** in daljinska kontrola stanja **RAM** so indikatorji stanja SN odvodnikov prenapetosti. Določajo uporabnost vgrajenih odvodnikov med obratovanjem.

Lastnosti
ON - odklopna naprava
Reagira pri tokovni preobremenitvi. Ozemljitveni vodnik odvodnika prenapetosti, pritrjen na odklopno napravo, se po reagiranju oddvoji od odklopne naprave. V tem primeru je potrebno zamenjati odvodnik prenapetosti in odklopno napravo.

ISOP - indikator stanja odvodnika prenapetosti
Indikator ISOP M brez daljinske komande ne potrebuje zunanjega napajanja. ISOP reagira pri:
- trajno previsokem uhajavem toku,
- atmosferskih praznjenjih nad 100 kA.

Po delovanju ISOP brez daljinske komande je potrebno indikator stanja zamenjati. Okvara odvodnika je vidna tako, da se zelena površina indikatorja obarva rdeče.

RAM – daljinska kontrola stanja odvodnika prenapetosti
Uporablja se za nadzor funkcionalnosti odvodnikov prenapetosti, ki so vgrajeni v elektro-distribucijsko omrežje. Daljinska kontrola stanja odvodnika prenapetosti RAM s svojim delovanjem informacijo o ustreznosti delovanja vgrajenega odvodnika prenapetosti posreduje instantno in daljinsko v elektrodistribucijske centre. RAM je možno uporabiti za nadzor enega samega odvodnika prenapetosti, ali treh skupaj, saj je to najpogostejša aplikacija v trofaznih električnih sistemih. Prav digitalna informacija prinaša prednost pred konkurenčnimi izdelki. Dodano vrednost našemu izdelku zagotavlja tudi avtonomno delovanje brez potrebe po zunanjem napajalnem viru, enostavna montaža na raznolike podlage in brez vzdrževanja.

Splošni podatki
- Uporaba: **odvodniki prenapetosti nad 1 KV**
- Stopnja zaščite: **IP 65**
- Material ohišja: **termoplast V-0 (UL 94)**
- Temperaturno območje: **T = -40 °C ... +85 °C**
- Indikacija: **vizualna (ISOP M) ali daljinska (RAM)**

2.26 MV condition indicators - generally

Product
*Disconnecting device **ON**, condition indicator **ISOP** and remote arrester monitoring **RAM** are indicators of MV surge arresters condition. During operation they monitor functionality and determine usability of installed surge arresters.*

Characteristics
***ON** - disconnecting device*
It reacts at current overload. Surge arrester's earthing conductor, which is attached to ON, sunders from the device after functioning. In this case both surge arrester and the disconnecting device need to be replaced.

***ISOP** -* condition indicator for surge arresters.
Indicator ISOP M without remote command does not need an external power source. ISOP reacts at:
- to high leakage current,
- atmospheric discharges over 100 kA.

After ISOP without remote command functions the device needs to be replaced. Defect on surge arrester is shown when green surface on device colours red.

***RAM** - remote arrester monitoring*
Is used to monitor the functionality of surge arresters integrated into the distribution systems. Remote surge arrester monitor RAM provides information about the suitability of the integrated surge arrester and transmits it instantaneously and remotely to the control center. RAM can be used to monitor a single surge arrester or three together since this is the most common application in three-phase electrical systems. The digital information brings advantage over the competition. The added value to our product is also ensured by autonomous operation without the need for an external power supply, simple installation on different surfaces and maintenance free operation.

General data
- *Usage: **surge arrester up to 1 kV***
- *Ingress protection level: **IP 65***
- *Housing material: **thermoplastic V-0 (UL 94)***
- *Temperature range: **T = -40 °C ... +85 °C***
- *Indication: **visual (ISOP M) or remote (RAM)***

Prednosti pred konkurenco

ISOP M in RAM se odlikujeta zaradi:
- enostavne montaže in zanesljivosti delovanja,
- obratovanja brez vzdrževanja in napajanja,
- uporabe za zunanjo in notranjo montažo,
- ISOP M - vizualne indikacije stanja,
- RAM - digitalne indikacije stanja.

Competitive advantages

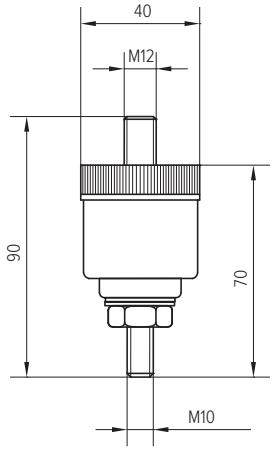
ISOP M and RAM have:
- *simple installation and reliable functioning,*
- *maintenance free, without power supply*
- *applicability for outdoor and indoor mounting,*
- *ISOP M - visual indication,*
- *RAM - remote indication.*

2.27 SN odklopna naprava ON

Namen: odklopi uničen odvodnik prenapetosti
Koda: **21 47 21**

2.27 MV disconnecting device ON

Purpose: disconnects a destroyed surge arrester
*Code: **21 47 21***

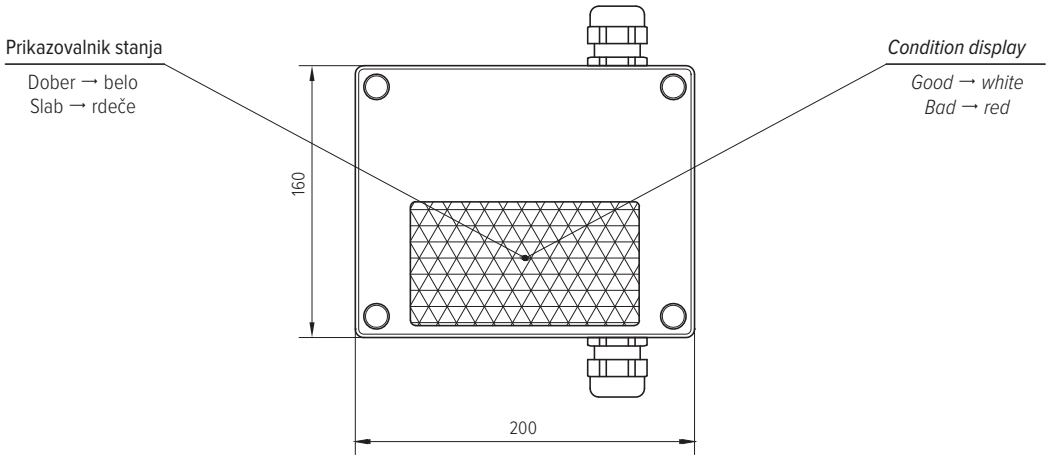


2.28 SN indikator stanja ISOP

Namen: nadzor funkcionalnosti odvodnikov prenapetosti
Premer ozemljitvenega vodnika: 2,5 do 15 mm
Koda: **90 00 01**

2.28 MV condition indicator ISOP

Purpose: to control the functionality of surge arresters
Earthing conductor diameter: 2,5 to 15 mm
*Code: **90 00 01***

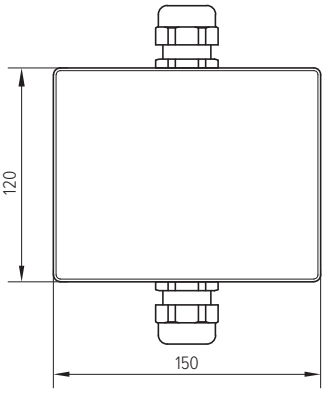


2.29 SN daljinska kontrola stanja RAM

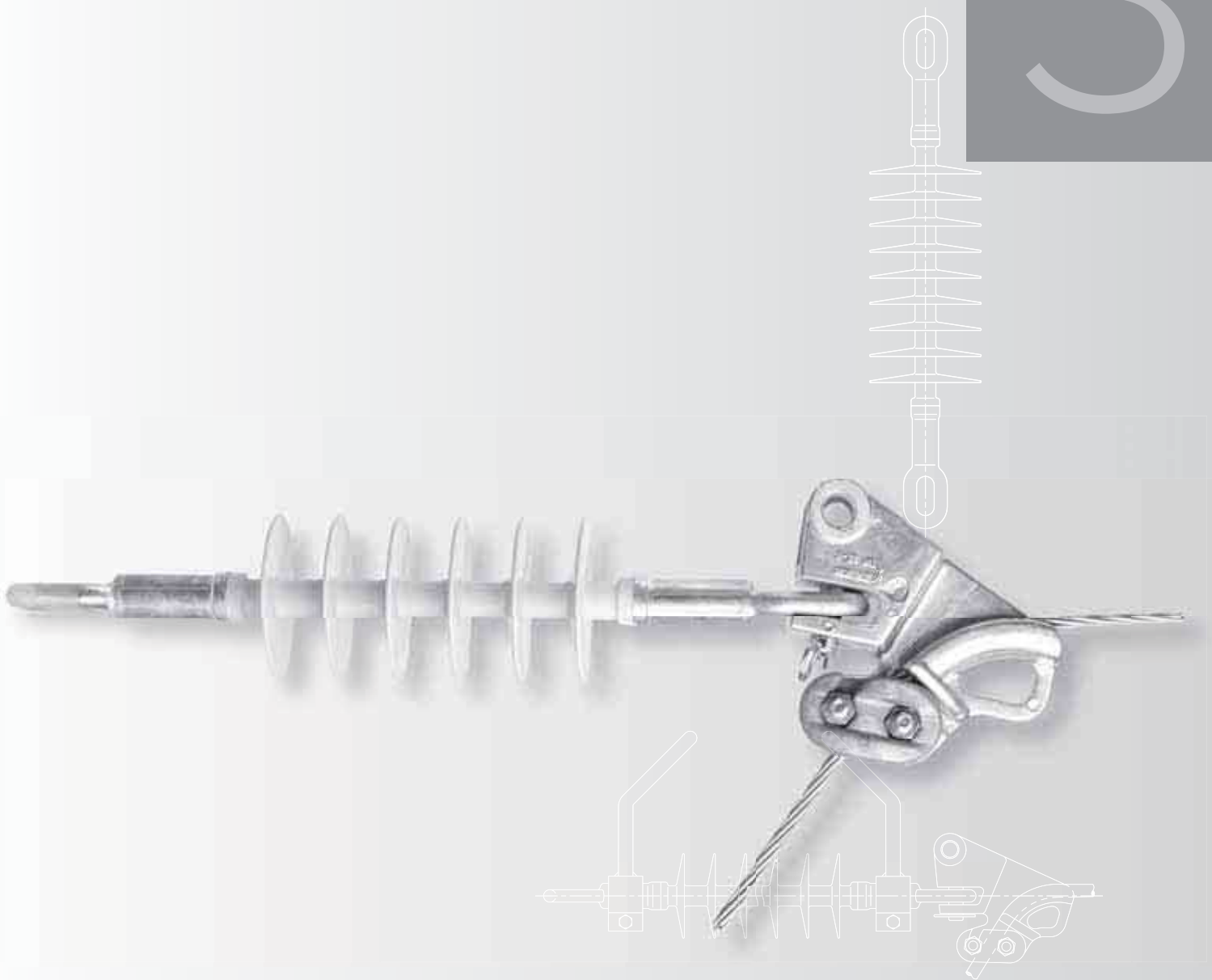
Namen: nadzor funkcionalnosti odvodnikov prenapetosti
Premer ozemljitvenega vodnika: 2,5 do 15 mm
Koda: **90 00 02**

2.29 MV remote arrester control RAM

Purpose: to control the functionality of surge arresters
Earthing conductor diameter: 2,5 to 15 mm
*Code: **90 00 02***



3



SN
natezni/nosilni izolatorji

MV
tension/suspension insulators

SN natezni izolatorji

MV tension insulators

3.1 NKI splošno

Proizvod

NKI so natezni/nosilni kompozitni izolatorji s silikonskim plaščem. Namenjeni so za vgradnjo v nadzemne električne vode do nazivne napetosti 52 kV.

Lastnosti

Natezni/nosilni kompozitni izolatorji NKI so:

- odporni na UV sevanje in kemične vplive,
- obstojni na vremenske vplive in staranje,
- oplaščeni s silikonom brez dodatkov,
- primerni za agresivna okolja (industrija, morska obala in puščavsko podnebje,...),
- neobčutljivi na udarce.

Vgradnja

Mesto montaže nateznih/nosilnih kompozitnih izolatorjev NKI določajo pravilniki in tehnični predpisi. Vgrajujejo se v novogradnje, rekonstrukcije in pri vzdrževanju. Ne glede na druge že vgrajene izolatorje v daljnovodih, novo vgrajeni NKI izolatorji ne vplivajo na spremembo koordinacije izolacije.

Splošni podatki

- Nazivna mehanska sila (SML): **90 kN**
- Maksimalna torzijska sila: **50 Nm**
- Temperaturno območje okolja: **T = -60 °C ... +85 °C**
- Plašč: **silikon LSR**
- Barva silikona: **siva**
- Material priključkov: **jeklo**
- Površinska zaščita priključkov: **vroči cink ≥ 70 µm**
- Možno odstopanje po dolžini: **±10 mm**
- Testirani po standardu:
  IEC 61109, IEC/TS 60815, IEC 62217, IEC 61466
  IEC 61284

3.1 *NKI generally*

Product

NKI are tension/suspension composite insulators coated with silicone rubber. They are designed to be installed in overhead power lines with voltage up to 52 kV.

Characteristics

Tension/suspension composite insulators NKI are:

- *resistant to UV radiation and chemical influences,*
- *resistant to weathering and aging,*
- *coated with silicone without additives,*
- *suitable for aggressive environments (industry, seaside and desert climate,...),*
- *insensitive to impacts.*

Installation

The position for installing tension composite insulators NKI is decided by directives and technical regulations. They are being installed in new constructions, reconstructions and at maintenance. Newly installed NKI insulators have no impact on any change of insulation coordination regardless to previous installed insulators in overhead power lines.

General data

- *Specified mechanical load (SML): **90 kN***
- *Maximum torsion load: **50 Nm***
- *Ambient temperature range: **T = -60 °C ... +85 °C***
- *Coat: **silicone LSR***
- *Silicone colour: **grey***
- *Material of end fittings: **steel***
- *Surface protection of fittings: **hot zinc ≥ 70 µm***
- *Tolerance in length: **±10 mm***
- *Tested according to standard:*
  IEC 61109, IEC/TS 60815, IEC 62217, IEC 61466
  IEC 61284

Prednosti pred konkurenco

NKI natezne kompozitne izolatorje za zunanjo in notranjo montažo odlikujejo:

- oblika plašča in priključki izdelani po standardu IEC 61466,
- certifikat akreditiranega laboratorija,
- silikonski plašč je izdelan iz dvokomponentnega silikona brez dodatkov,
- primerni za agresivna okolja,
- verige izdelane iz NKI izolatorjev in našega spojnega materiala so kratke in lahke,
- nazivna natezna sila SML 90 kN,
- 100% rutinski test RTL,
- izdelava s priključki na zahtevo kupca.

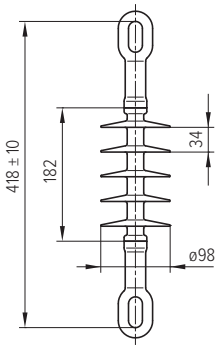
Competitive advantages

NKI tension composite insulators for indoor and outdoor installation feature:

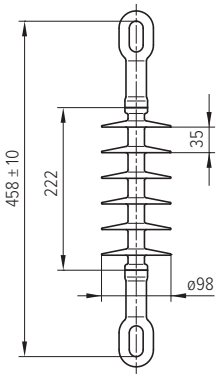
- *Shape of the coat and fittings manufactured according to standard IEC 61466,*
- *certificate from accredited laboratory,*
- *silicone coating is made of a two component silicone without additives,*
- *suitable also for aggressive environments ,*
- *chains made from NKI insulators and our connecting material are short and lightweight,*
- *specified tension load SML 90 kN,*
- *100% routine test RTL,*
- *production with end fittings on customer's request.*

3.2 NKI uho-uho

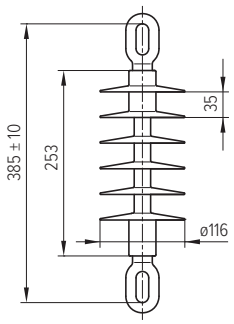
3.2 NKI eye-eye



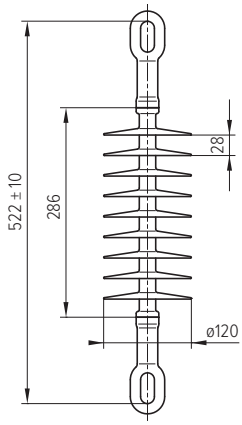
NKI N/UU



NKI L/UU



NKI M/UU

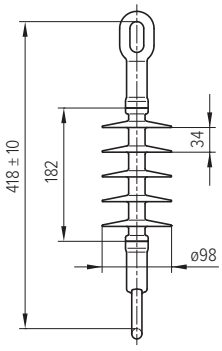


NKI X/UU

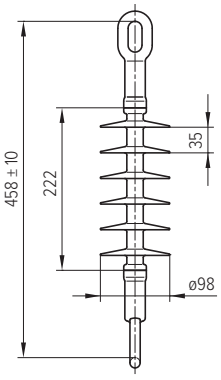
Naziv	NKI N/UU	NKI L/UU	NKI M/UU	NKI X/UU	*Name*
Koda	**80 70 55**	**80 70 57**	**80 71 00**	**80 70 59**	*Code*
Nazivna obratovalna napetost	24 kV	36 kV	36 kV	52 kV	*Nominal operating voltage*
Plazilna pot	520 mm	650 mm	793 mm	1120 mm	*Creepage distance*
Preskočna razdalja	230 mm	270 mm	290 mm	335 mm	*Arcing distance*
Vzdržna atm. udarna nap. v suhem	155 kV	175 kV	176 kV	223 kV	*Dry lighting impulse withstand voltage*
Vzdržna izmenična nap. v mokrem	60 kV	75 kV	91 kV	106 kV	*Wet power frequency withstand voltage*
Masa	1,0 kg	1,1 kg	1,1 kg	1,3 kg	*Mass*

3.3 NKI uho-uho 90°

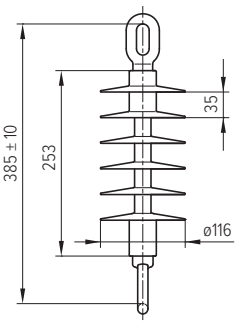
3.3 NKI eye-eye 90°



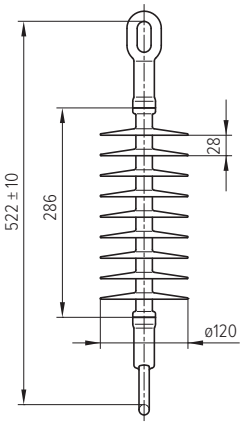
NKI N/UU 90°



NKI L/UU 90°



NKI M/UU 90°

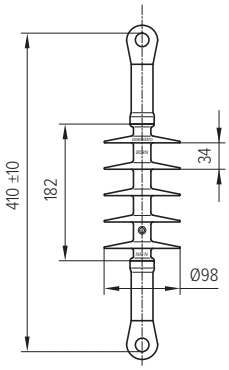


NKI X/UU 90°

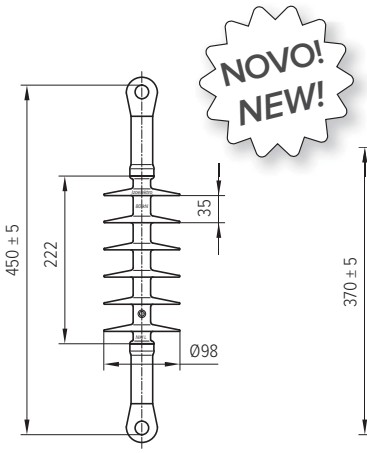
Naziv	NKI N/UU 90°	NKI L/UU 90°	NKI M/UU 90°	NKI X/UU 90°	*Name*
Koda	**80 70 56**	**80 70 58**	**80 71 11**	**80 70 84**	*Code*
Nazivna obratovalna napetost	24 kV	36 kV	36 kV	52 kV	*Nominal operating voltage*
Plazilna pot	520 mm	650 mm	793 mm	1120 mm	*Creepage distance*
Preskočna razdalja	230 mm	270 mm	290 mm	335 mm	*Arcing distance*
Vzdržna atm. udarna nap. v suhem	155 kV	175 kV	176 kV	223 kV	*Dry lighting impulse withstand voltage*
Vzdržna izmenična nap. v mokrem	60 kV	75 kV	91 kV	106 kV	*Wet power frequency withstand voltage*
Masa	1,0 kg	1,1 kg	1,1 kg	1,3 kg	*Mass*

3.4 NKI oko-oko

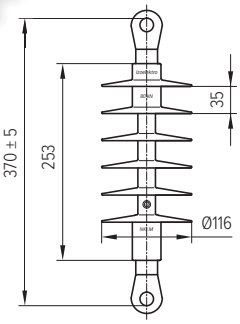
3.4 NKI tongue-tongue



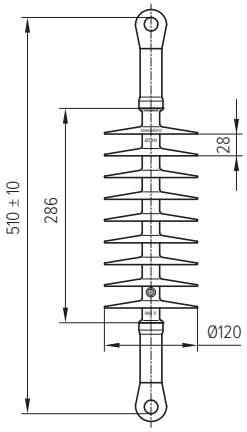
NKI N/OO



NKI L/OO



NKI M/OO

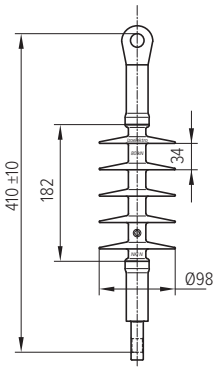


NKI X/OO

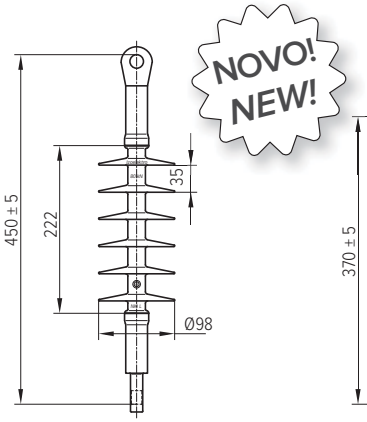
Naziv	NKI N/OO	NKI L/OO	NKI M/OO	NKI X/OO	*Name*
Koda	**80 71 04**	**80 71 07**	**80 71 05**	**80 71 24**	*Code*
Nazivna obratovalna napetost	24 kV	36 kV	36 kV	52 kV	*Nominal operating voltage*
Plazilna pot	520 mm	650 mm	793 mm	1120 mm	*Creepage distance*
Preskočna razdalja	230 mm	270 mm	290 mm	335 mm	*Arcing distance*
Vzdržna atm. udarna nap. v suhem	155 kV	175 kV	176 kV	223 kV	*Dry lighting impulse withstand voltage*
Vzdržna izmenična nap. v mokrem	60 kV	75 kV	91 kV	106 kV	*Wet power frequency withstand voltage*
Masa	1,3 kg	1,4 kg	1,4 kg	1,6 kg	*Mass*

3.5 NKI oko-oko 90°

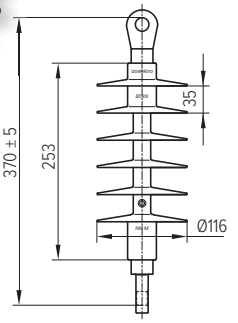
3.5 NKI tongue-tongue 90°



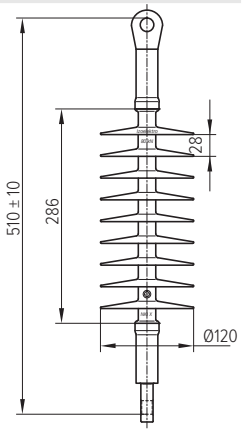
NKI N/OO 90°



NKI L/OO 90°



NKI M/OO 90°

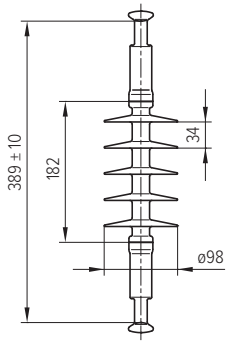


NKI X/OO 90°

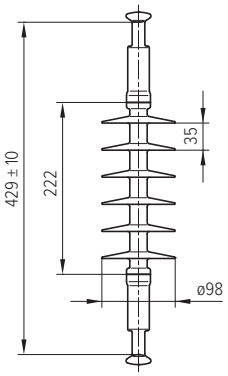
Naziv	NKI N/OO 90°	NKI L/OO 90°	NKI M/OO 90°	NKI X/OO 90°	*Name*
Koda	**80 71 32**	**80 71 32**	**80 71 33**	**80 71 34**	*Code*
Nazivna obratovalna napetost	24 kV	36 kV	36 kV	52 kV	*Nominal operating voltage*
Plazilna pot	520 mm	650 mm	793 mm	1120 mm	*Creepage distance*
Preskočna razdalja	230 mm	270 mm	290 mm	335 mm	*Arcing distance*
Vzdržna atm. udarna nap. v suhem	155 kV	175 kV	176 kV	223 kV	*Dry lighting impulse withstand voltage*
Vzdržna izmenična nap. v mokrem	60 kV	75 kV	91 kV	106 kV	*Wet power frequency withstand voltage*
Masa	1,3 kg	1,4 kg	1,4 kg	1,6 kg	*Mass*

3.6 NKI batič-batič

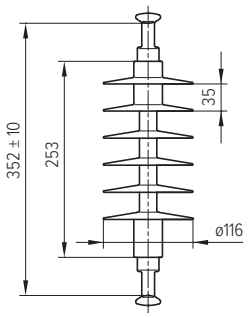
3.6 *NKI ball-ball*



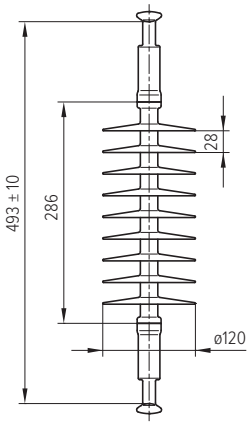
NKI N/BB



NKI L/BB



NKI M/BB

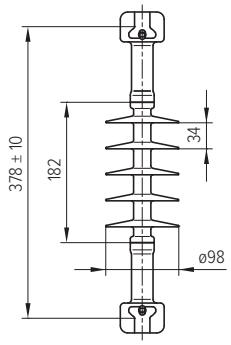


NKI X/BB

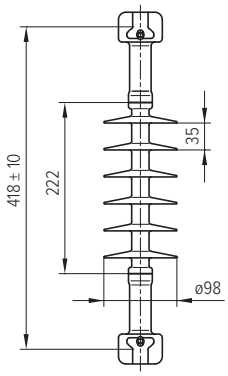
Naziv	NKI N/BB	NKI L/BB	NKI M/BB	NKI X/BB	*Name*
Koda	**80 70 60**	**80 70 61**	**80 71 12**	**80 70 87**	*Code*
Nazivna obratovalna napetost	24 kV	36 kV	36 kV	52 kV	*Nominal operating voltage*
Plazilna pot	520 mm	650 mm	793 mm	1120 mm	*Creepage distance*
Preskočna razdalja	230 mm	270 mm	290 mm	335 mm	*Arcing distance*
Vzdržna atm. udarna nap. v suhem	155 kV	175 kV	176 kV	223 kV	*Dry lighting impulse withstand voltage*
Vzdržna izmenična nap. v mokrem	60 kV	75 kV	91 kV	106 kV	*Wet power frequency withstand voltage*
Masa	0,9 kg	1,0 kg	1,0 kg	1,2 kg	*Mass*

3.7 NKI ponvica-ponvica

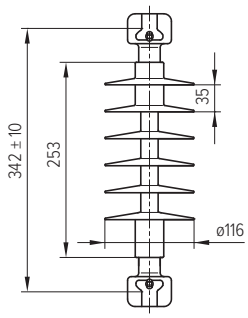
3.7 *NKI socket-socket*



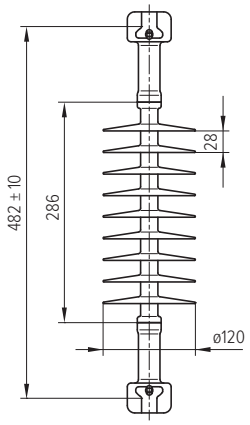
NKI N/PP



NKI L/PP



NKI M/PP

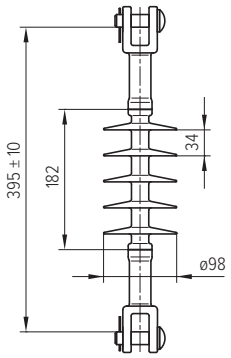


NKI X/PP

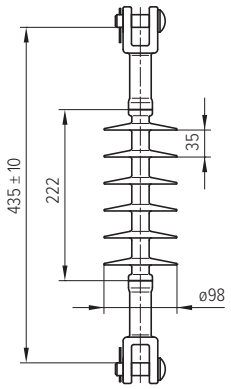
Naziv	NKI N/PP	NKI L/PP	NKI M/PP	NKI X/PP	*Name*
Koda	**80 70 62**	**80 70 63**	**80 71 13**	**80 70 88**	*Code*
Nazivna obratovalna napetost	24 kV	36 kV	36 kV	52 kV	*Nominal operating voltage*
Plazilna pot	520 mm	650 mm	793 mm	1120 mm	*Creepage distance*
Preskočna razdalja	230 mm	270 mm	290 mm	335 mm	*Arcing distance*
Vzdržna atm. udarna nap. v suhem	155 kV	175 kV	176 kV	223 kV	*Dry lighting impulse withstand voltage*
Vzdržna izmenična nap. v mokrem	60 kV	75 kV	91 kV	106 kV	*Wet power frequency withstand voltage*
Masa	1,7 kg	1,8 kg	1,8 kg	2,0 kg	*Mass*

3.8 NKI vilica-vilica

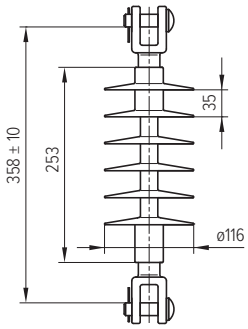
3.8 NKI clevis-clevis



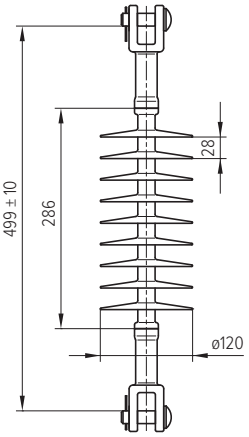
NKI N/VV



NKI L/VV



NKI M/VV

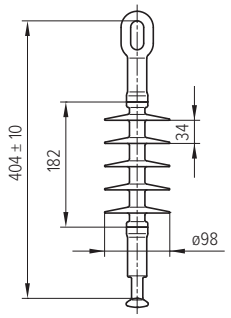


NKI X/VV

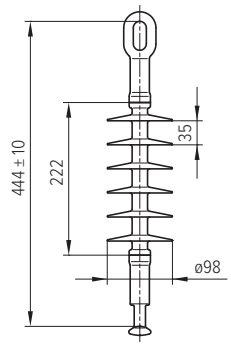
Naziv	NKI N/VV	NKI L/VV	NKI M/VV	NKI X/VV	*Name*
Koda	**80 70 64**	**80 70 65**	**80 71 14**	**80 70 85**	*Code*
Nazivna obratovalna napetost	24 kV	36 kV	36 kV	52 kV	*Nominal operating voltage*
Plazilna pot	520 mm	650 mm	793 mm	1120 mm	*Creepage distance*
Preskočna razdalja	230 mm	270 mm	290 mm	335 mm	*Arcing distance*
Vzdržna atm. udarna nap. v suhem	155 kV	175 kV	176 kV	223 kV	*Dry lighting impulse withstand voltage*
Vzdržna izmenična nap. v mokrem	60 kV	75 kV	91 kV	106 kV	*Wet power frequency withstand voltage*
Masa	1,2 kg	1,3 kg	1,3 kg	1,5 kg	*Mass*

3.9 NKI uho-batič

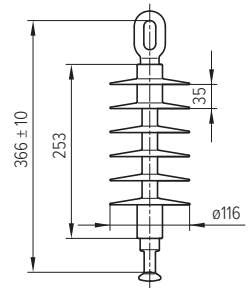
3.9 NKI eye-ball



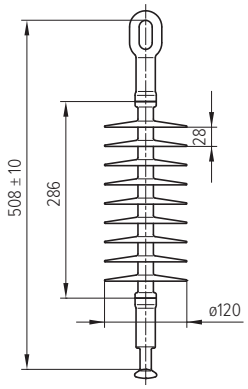
NKI N/UB



NKI L/UB



NKI M/UB

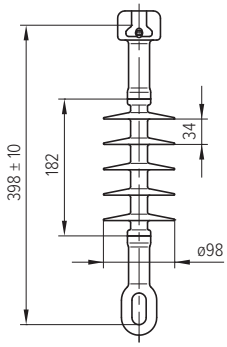


NKI X/UB

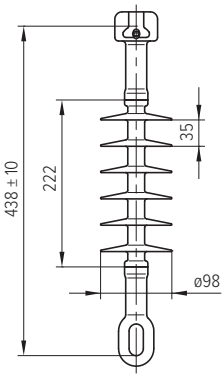
Naziv	NKI N/UB	NKI L/UB	NKI M/UB	NKI X/UB	*Name*
Koda	**80 70 66**	**80 70 67**	**80 71 15**	**80 70 90**	*Code*
Nazivna obratovalna napetost	24 kV	36 kV	36 kV	52 kV	*Nominal operating voltage*
Plazilna pot	520 mm	650 mm	793 mm	1120 mm	*Creepage distance*
Preskočna razdalja	230 mm	270 mm	290 mm	335 mm	*Arcing distance*
Vzdržna atm. udarna nap. v suhem	155 kV	175 kV	176 kV	223 kV	*Dry lighting impulse withstand voltage*
Vzdržna izmenična nap. v mokrem	60 kV	75 kV	91 kV	106 kV	*Wet power frequency withstand voltage*
Masa	1,0 kg	1,1 kg	1,1 kg	1,3 kg	*Mass*

3.10 NKI ponvica-uho

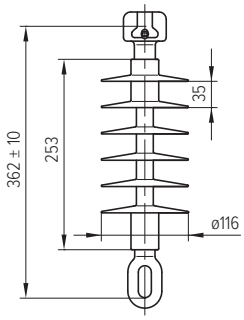
3.10 NKI socket-eye



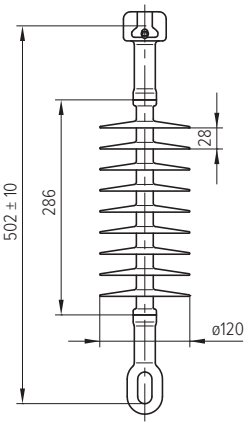
NKI N/PU



NKI L/PU



NKI M/PU

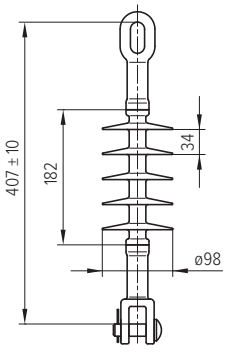


NKI X/PU

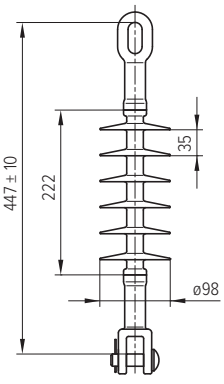
Naziv	NKI N/PU	NKI L/PU	NKI M/PU	NKI X/PU	*Name*
Koda	**80 70 68**	**80 70 69**	**80 71 16**	**80 70 89**	*Code*
Nazivna obratovalna napetost	24 kV	36 kV	36 kV	52 kV	*Nominal operating voltage*
Plazilna pot	520 mm	650 mm	793 mm	1120 mm	*Creepage distance*
Preskočna razdalja	230 mm	270 mm	290 mm	335 mm	*Arcing distance*
Vzdržna atm. udarna nap. v suhem	155 kV	175 kV	176 kV	223 kV	*Dry lighting impulse withstand voltage*
Vzdržna izmenična nap. v mokrem	60 kV	75 kV	91kV	106 kV	*Wet power frequency withstand voltage*
Masa	1,4 kg	1,5 kg	1,5 kg	1,7 kg	*Mass*

3.11 NKI uho-vilica

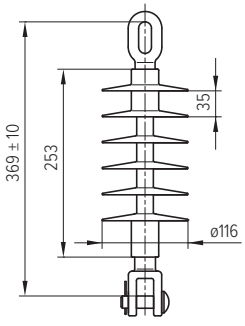
3.11 NKI eye-clevis



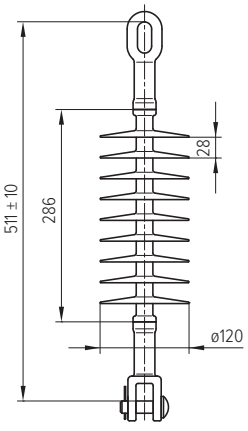
NKI N/UV



NKI L/UV



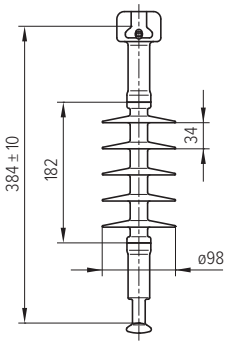
NKI M/UV



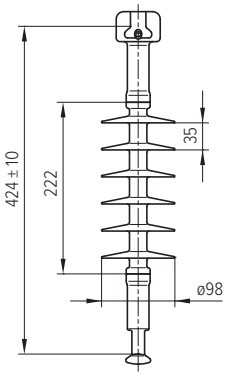
NKI X/UV

Naziv	NKI N/UV	NKI L/UV	NKI M/UV	NKI X/UV	*Name*
Koda	**80 70 70**	**80 70 71**	**80 71 17**	**80 70 91**	*Code*
Nazivna obratovalna napetost	24 kV	36 kV	36 kV	52 kV	*Nominal operating voltage*
Plazilna pot	520 mm	650 mm	793 mm	1120 mm	*Creepage distance*
Preskočna razdalja	230 mm	270 mm	290 mm	335 mm	*Arcing distance*
Vzdržna atm. udarna nap. v suhem	155 kV	175 kV	176 kV	223 kV	*Dry lighting impulse withstand voltage*
Vzdržna izmenična nap. v mokrem	60 kV	75 kV	91 kV	106 kV	*Wet power frequency withstand voltage*
Masa	1,1 kg	1,2 kg	1,2 kg	1,4 kg	*Mass*

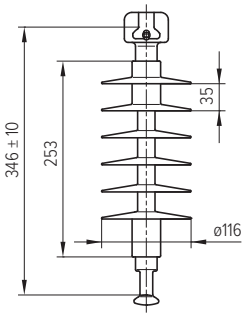
3.12 NKI ponvica-batič *3.12 NKI socket-ball*



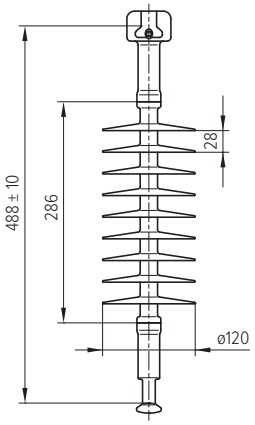
NKI N/PB



NKI L/PB



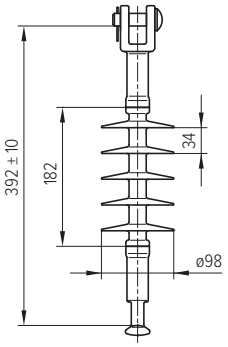
NKI M/PB



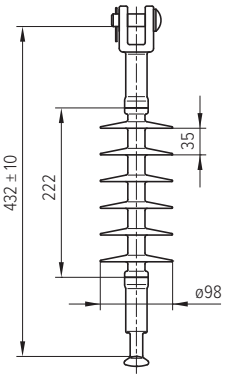
NKI X/PB

Naziv	NKI N/PB	NKI L/PB	NKI M/PB	NKI X/PB	*Name*
Koda	**80 70 72**	**80 70 73**	**80 71 18**	**80 70 92**	*Code*
Nazivna obratovalna napetost	24 kV	36 kV	36 kV	52 kV	*Nominal operating voltage*
Plazilna pot	520 mm	650 mm	793 mm	1120 mm	*Creepage distance*
Preskočna razdalja	230 mm	270 mm	290 mm	335 mm	*Arcing distance*
Vzdržna atm. udarna nap. v suhem	155 kV	175 kV	176 kV	223 kV	*Dry lighting impulse withstand voltage*
Vzdržna izmenična nap. v mokrem	60 kV	75 kV	91 kV	106 kV	*Wet power frequency withstand voltage*
Masa	1,4 kg	1,5 kg	1,5 kg	1,7 kg	*Mass*

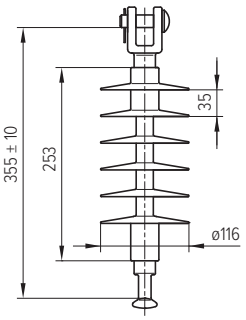
3.13 NKI vilica-batič *3.13 NKI clevis-ball*



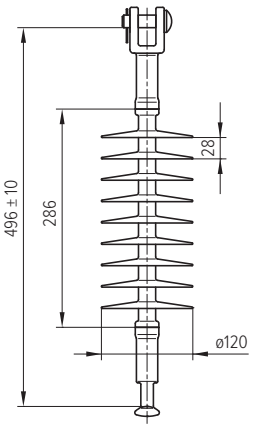
NKI N/VB



NKI L/VB



NKI M/VB

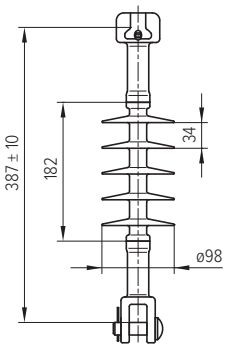


NKI X/VB

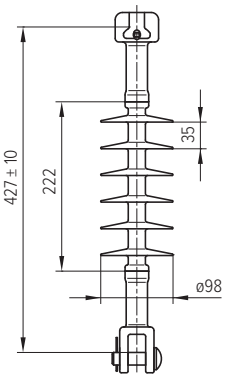
Naziv	NKI N/VB	NKI L/VB	NKI M/VB	NKI X/VB	*Name*
Koda	**80 70 74**	**80 70 75**	**80 71 19**	**80 70 93**	*Code*
Nazivna obratovalna napetost	24 kV	36 kV	36 kV	52 kV	*Nominal operating voltage*
Plazilna pot	520 mm	650 mm	793 mm	1120 mm	*Creepage distance*
Preskočna razdalja	230 mm	270 mm	290 mm	335 mm	*Arcing distance*
Vzdržna atm. udarna nap. v suhem	155 kV	175 kV	176 kV	223 kV	*Dry lighting impulse withstand voltage*
Vzdržna izmenična nap. v mokrem	60 kV	75 kV	91 kV	106 kV	*Wet power frequency withstand voltage*
Masa	1,1 kg	1,2 kg	1,2 kg	1,4 kg	*Mass*

3.14 NKI ponvica-vilica

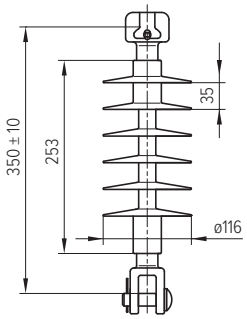
3.14 NKI socket-clevis



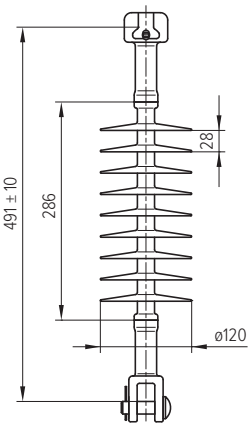
NKI N/PV



NKI L/PV



NKI M/PV

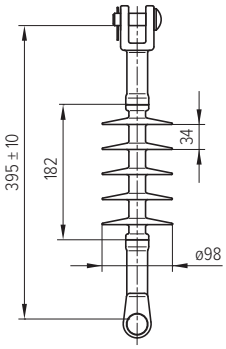


NKI X/PV

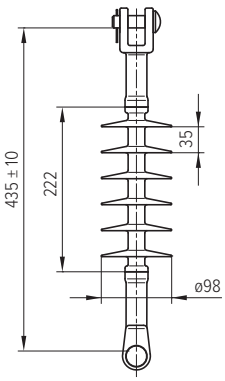
Naziv	NKI N/PV	NKI L/PV	NKI M/PV	NKI X/PV	*Name*
Koda	**80 70 76**	**80 70 77**	**80 71 20**	**80 70 94**	*Code*
Nazivna obratovalna napetost	24 kV	36 kV	36 kV	52 kV	*Nominal operating voltage*
Plazilna pot	520 mm	650 mm	793 mm	1120 mm	*Creepage distance*
Preskočna razdalja	230 mm	270 mm	290 mm	335 mm	*Arcing distance*
Vzdržna atm. udarna nap. v suhem	155 kV	175 kV	176 kV	223 kV	*Dry lighting impulse withstand voltage*
Vzdržna izmenična nap. v mokrem	60 kV	75 kV	91 kV	106 kV	*Wet power frequency withstand voltage*
Masa	1,7 kg	1,8 kg	1,8 kg	2,0 kg	*Mass*

3.15 NKI vilica-vilica 90°

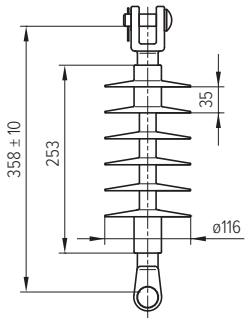
3.15 NKI clevis-clevis 90°



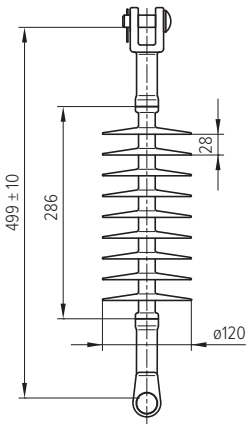
NKI N/VV 90°



NKI L/VV 90°



NKI M/VV 90°

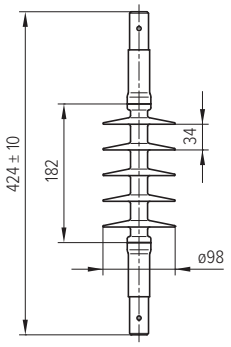


NKI X/VV 90°

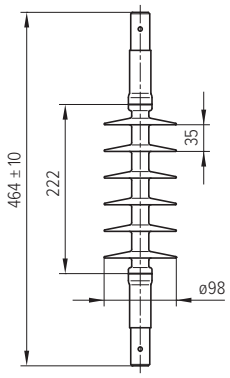
Naziv	NKI N/VV 90°	NKI L/VV 90°	NKI M/VV 90°	NKI X/VV 90°	*Name*
Koda	**80 70 78**	**80 70 79**	**80 71 21**	**80 70 86**	*Code*
Nazivna obratovalna napetost	24 kV	36 kV	36 kV	52 kV	*Nominal operating voltage*
Plazilna pot	520 mm	650 mm	793 mm	1120 mm	*Creepage distance*
Preskočna razdalja	230 mm	270 mm	290 mm	335 mm	*Arcing distance*
Vzdržna atm. udarna nap. v suhem	155 kV	175 kV	176 kV	223 kV	*Dry lighting impulse withstand voltage*
Vzdržna izmenična nap. v mokrem	60 kV	75 kV	91 kV	106 kV	*Wet power frequency withstand voltage*
Masa	1,2 kg	1,3 kg	1,3 kg	1,5 kg	*Mass*

3.16 NKI pogon-pogon

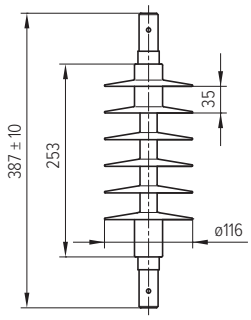
3.16 NKI rod-rod



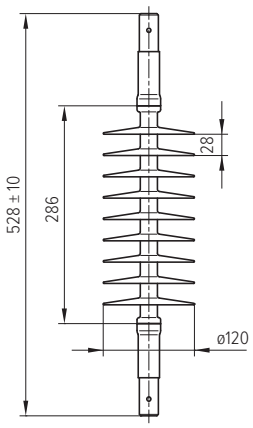
NKI N/II



NKI L/II



NKI M/II

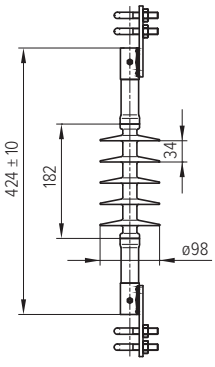


NKI X/II

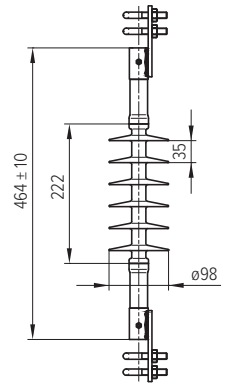
Naziv	NKI N/II	NKI L/II	NKI M/II	NKI X/II	*Name*
Koda	**80 70 80**	**80 70 81**	**80 71 22**	**80 70 95**	*Code*
Nazivna obratovalna napetost	24 kV	36 kV	36 kV	52 kV	*Nominal operating voltage*
Plazilna pot	520 mm	650 mm	793 mm	1120 mm	*Creepage distance*
Preskočna razdalja	230 mm	270 mm	290 mm	335 mm	*Arcing distance*
Vzdržna atm. udarna nap. v suhem	155 kV	175 kV	176 kV	223 kV	*Dry lighting impulse withstand voltage*
Vzdržna izmenična nap. v mokrem	60 kV	75 kV	91 kV	106 kV	*Wet power frequency withstand voltage*
Masa	1,1 kg	1,2 kg	1,2 kg	1,4 kg	*Mass*

3.17 NKI pogon ¾″-pogon ¾″

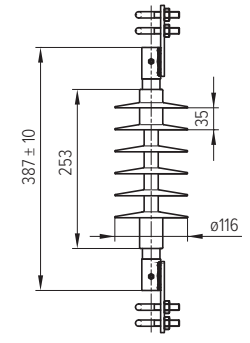
3.17 NKI rod ¾″-rod ¾″



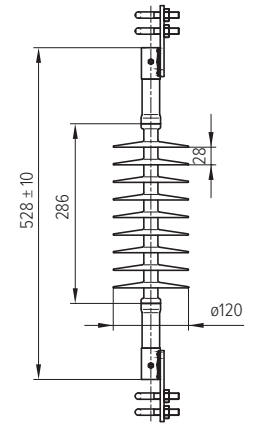
NKI N/II ¾“



NKI L/II ¾“



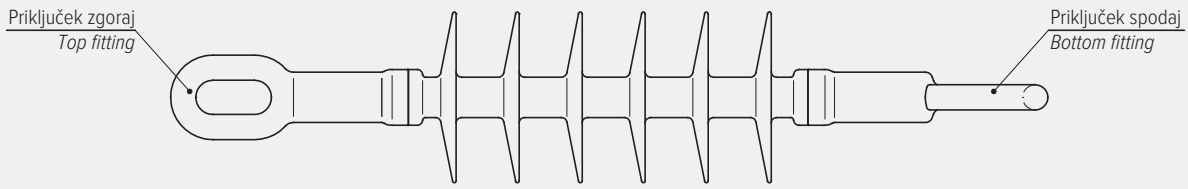
NKI M/II ¾“



NKI X/II ¾“

Naziv	NKI N/II ¾“	NKI L/II ¾“	NKI M/II ¾“	NKI X/II ¾“	*Name*
Koda	**80 70 83**	**80 70 96**	**80 71 23**	**80 70 97**	*Code*
Nazivna obratovalna napetost	24 kV	36 kV	36 kV	52 kV	*Nominal operating voltage*
Plazilna pot	520 mm	650 mm	793 mm	1120 mm	*Creepage distance*
Preskočna razdalja	230 mm	270 mm	290 mm	335 mm	*Arcing distance*
Vzdržna atm. udarna nap. v suhem	155 kV	175 kV	176 kV	223 kV	*Dry lighting impulse withstand voltage*
Vzdržna izmenična nap. v mokrem	60 kV	75 kV	91 kV	106 kV	*Wet power frequency withstand voltage*
Masa	2,3 kg	2,4 kg	2,4 kg	2,6 kg	*Mass*

3.18 NKI izolatorji - primer naročila / *3.18 NKI insulators - order example*



Naziv/ *Name*: **NKI L/UU 90°**

Razlaga naziva

NKI	- Tip
L, N, M, X	- Oblika plašča
U, U90°, V, B, P, Y, O, I, I¾″	- Oblika priključka zgoraj
U 90°, U, V, B, P, Y, O, I, I¾″	- Oblika priključka spodaj

Name explanation

NKI	*- Type*
L, N, M, X	*- Shape of coating*
U, U90°, V, B, P, Y, O, I, I¾″	*- Shape of top end fitting*
U 90°, U, V, B, P, Y, O, I, I¾″	*- Shape of bottom end fitting*

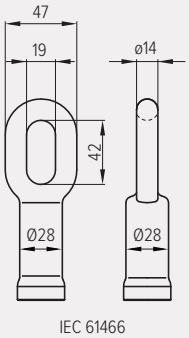
Oznake na izolatorju

Izoelektro	- proizvajalec
NKI	- Tip SN kompozitnega izolatorja
2/14	- Mesec in leto proizvodnje
90 kN	- Nazivna mehanska sila (SML)

Marks on insulator

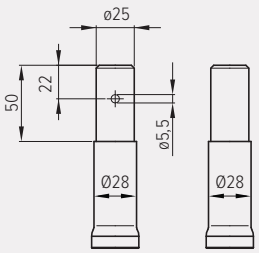
Izoelektro	*- manufacturer*
NKI	*- Type of MV composite insulator*
2/14	*- Month and year of production*
90 kN	*- Specified mechanical load (SML)*

Oblike priključkov / *Shapes of end fittings*

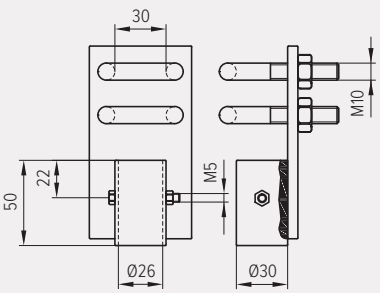


IEC 61466

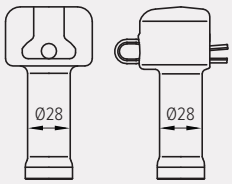
U



I

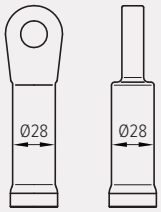


I 3/4"



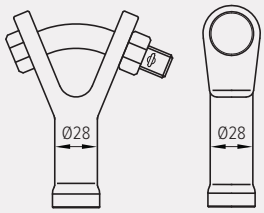
IEC 61466

P



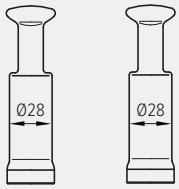
IEC 61466

O



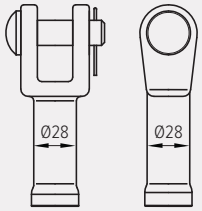
IEC 61466

Y



IEC 61466

B

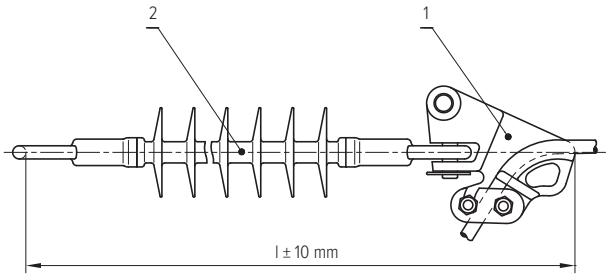


IEC 61466

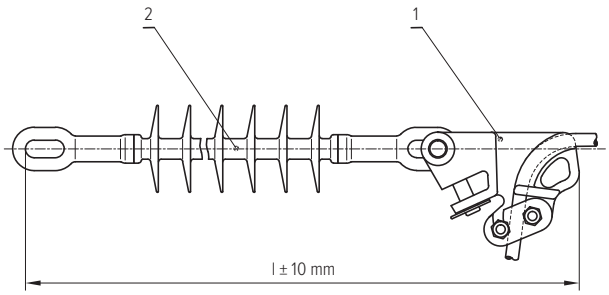
V

3.19 NKI enojna zatezna veriga

Opomba: SZ-U sponka (poz. 1) omogoča vpetje v dveh ravninah



ali / *or*



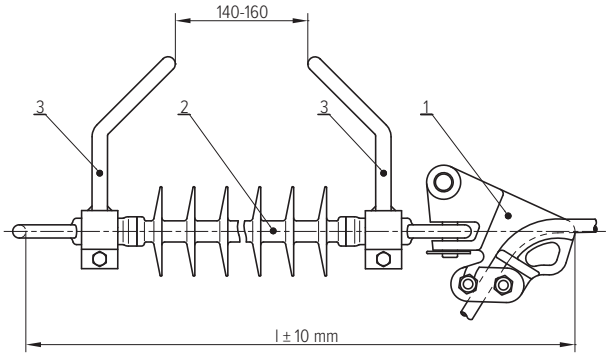
3.19 NKI single tension string

Note: SZ-U clamp (pos. 1) allows fastening into two planes

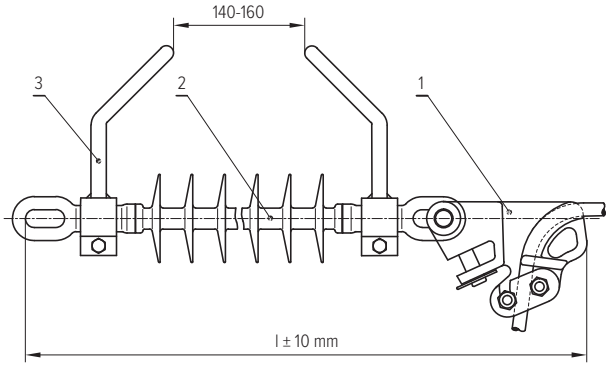
Naziv *Name*	Koda *Code*	l (mm)	Poz. *Pos.*	Kos *Pcs*	Koda *Code*	Masa *Mass* (kg)
EZ-01 N/UU	**90 70 55**	590	1	1	**80 60 03**	1,1
			2	1	**80 70 55**	1,0
EZ-01 L/UU	**90 70 57**	630	1	1	**80 60 03**	1,1
			2	1	**80 70 57**	1,1
EZ-01 M/UU	**90 71 00**	557	1	1	**80 60 03**	1,1
			2	1	**80 71 00**	1,1
EZ-01 X/UU	**90 70 59**	686	1	1	**80 60 03**	1,1
			2	1	**80 70 59**	1,3

3.20 NKI enojna zatezna veriga z iskriščem

Opomba: SZ-U sponka (poz. 1) omogoča vpetje v dveh ravninah



ali / *or*



3.20 NKI single tension string with arcing horn

Note: SZ-U clamp (pos. 1) allows fastening into two planes

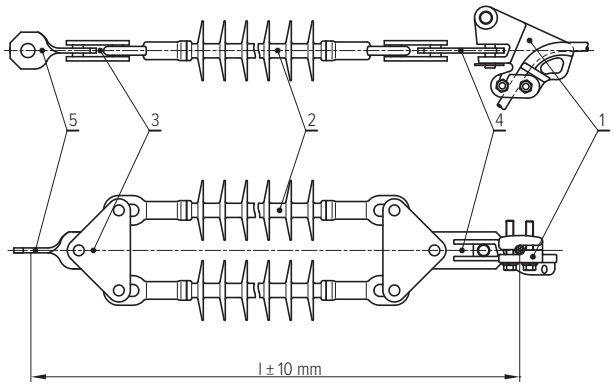
Naziv *Name*	Koda *Code*	l (mm)	Poz. *Pos.*	Kos *Pcs*	Koda *Code*	Masa *Mass* (kg)
EZI-01 N/UU	**91 70 55**	590	1	1	**80 60 03**	1,1
			2	1	**80 70 55**	1,0
			3	2	**80 70 54**	0,3
EZI-01 L/UU	**91 70 57**	630	1	1	**80 60 03**	1,1
			2	1	**80 70 57**	1,1
			3	2	**80 70 54**	0,3
EZI-01 M/UU	**91 71 00**	557	1	1	**80 60 03**	1,1
			2	1	**80 71 00**	1,1
			3	2	**80 70 54**	0,3
EZI-01 X/UU	**91 70 59**	686	1	1	**80 60 03**	1,1
			2	1	**80 70 59**	1,3
			3	2	**80 70 54**	0,3

3.21 NKI dvojna zatezna veriga

Opomba: SZ-U sponka (poz. 1) omogoča vpetje v dveh ravninah

3.21 NKI double tension string

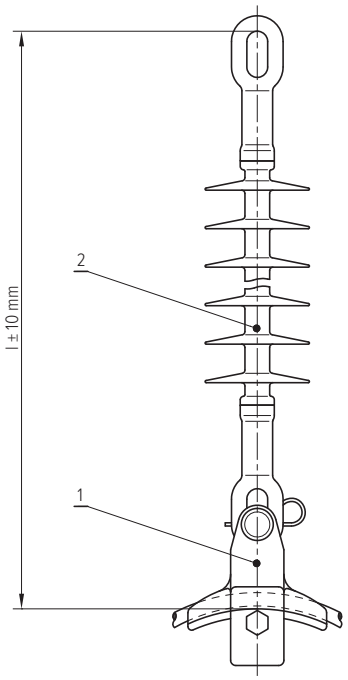
Note: SZ-U clamp (pos. 1) allows fastening into two planes



Naziv *Name*	Koda *Code*	l (mm)	Poz. *Pos.*	Kos *Pcs*	Koda *Code*	Masa *Mass* (kg)
DZ-01 N/UU	**95 70 55**	872	1	1	**80 60 03**	1,1
			2	2	**80 70 55**	1,0
			3	2	**43 29 408**	1,6
			4	1	**80 60 30**	0,5
			5	1	**80 60 31**	0,5
DZ-01 L/UU	**95 70 57**	912	1	1	**80 60 03**	1,1
			2	2	**80 70 57**	1,1
			3	2	**43 29 408**	1,6
			4	1	**80 60 30**	0,5
			5	1	**80 60 31**	0,5
DZ-01 M/UU	**95 71 00**	839	1	1	**80 60 03**	1,1
			2	2	**80 71 00**	1,1
			3	2	**43 29 408**	1,6
			4	1	**80 60 30**	0,5
			5	1	**80 60 31**	0,5
DZ-01 X/UU	**95 70 59**	968	1	1	**80 60 03**	1,1
			2	2	**80 70 59**	1,3
			3	2	**43 29 408**	1,6
			4	1	**80 60 30**	0,5
			5	1	**80 60 31**	0,5

3.22 NKI enojna nosilna veriga

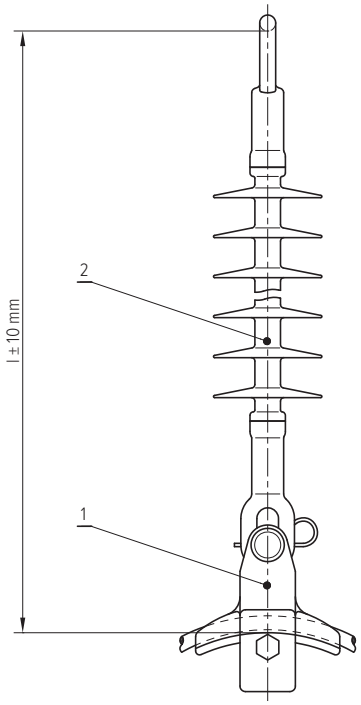
3.22 NKI single suspension string



Naziv *Name*	Koda *Code*	l (mm)	Poz. *Pos.*	Kos *Pcs*	Koda *Code*	Masa *Mass* (kg)
EN-01 N/UU	**92 70 55**	511	1	1	**80 60 04**	0,7
			2	1	**80 70 55**	1,0
EN-01 L/UU	**92 70 57**	551	1	1	**80 60 04**	0,7
			2	1	**80 70 57**	1,1
EN-01 M/UU	**92 71 00**	478	1	1	**80 60 04**	0,7
			2	1	**80 71 00**	1,1
EN-01 X/UU	**92 70 59**	607	1	1	**80 60 04**	0,7
			2	1	**80 70 59**	1,3

3.23 NKI enojna nosilna veriga 90°

3.23 NKI single suspension string 90°



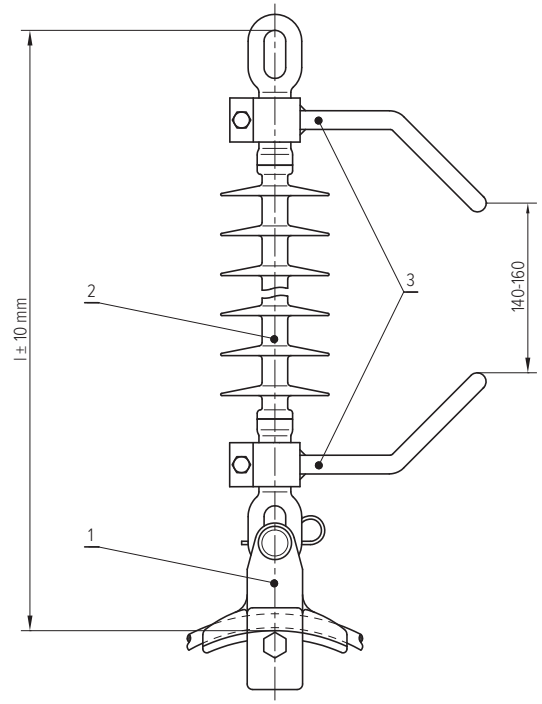
Naziv *Name*	Koda *Code*	l (mm)	Poz. *Pos.*	Kos *Pcs*	Koda *Code*	Masa *Mass* (kg)
EN-02 N/UU	**92 70 56**	511	1	1	**80 60 04**	0,7
			2	1	**80 70 56**	1,0
EN-02 L/UU	**92 70 58**	551	1	1	**80 60 04**	0,7
			2	1	**80 70 58**	1,1
EN-02 M/UU	**92 71 11**	478	1	1	**80 60 04**	0,7
			2	1	**80 71 11**	1,1
EN-02 X/UU	**92 70 84**	607	1	1	**80 60 04**	0,7
			2	1	**80 70 84**	1,3

3.24 NKI enojna nosilna veriga z iskriščem

3.24 NKI single suspension string with arcing horn

Opomba: uporaba za polizolirane vodnike (PIV)

Note: use with covered conductors (CC)



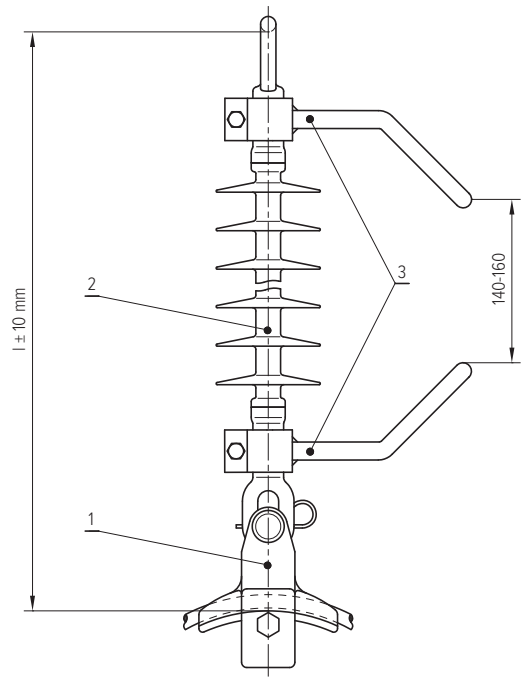
Naziv *Name*	Koda *Code*	l (mm)	Poz. *Pos.*	Kos *Pcs*	Koda *Code*	Masa *Mass* (kg)
ENI-01 N/UU	**93 70 55**	511	1	1	**80 60 04**	0,7
			2	1	**80 70 55**	1,0
			3	2	**80 70 54**	0,3
ENI-01 L/UU	**93 70 57**	551	1	1	**80 60 04**	0,7
			2	1	**80 70 57**	1,1
			3	2	**80 70 54**	0,3
ENI-01 M/UU	**93 71 00**	478	1	1	**80 60 04**	0,7
			2	1	**80 71 00**	1,1
			3	2	**80 70 54**	0,3
ENI-01 X/UU	**93 70 59**	607	1	1	**80 60 04**	0,7
			2	1	**80 70 59**	1,2
			3	2	**80 70 54**	0,3

3.25 NKI enojna nosilna veriga 90° z iskriščem

3.25 NKI single suspension string 90° with arcing horn

Opomba: uporaba za polizolirane vodnike (PIV)

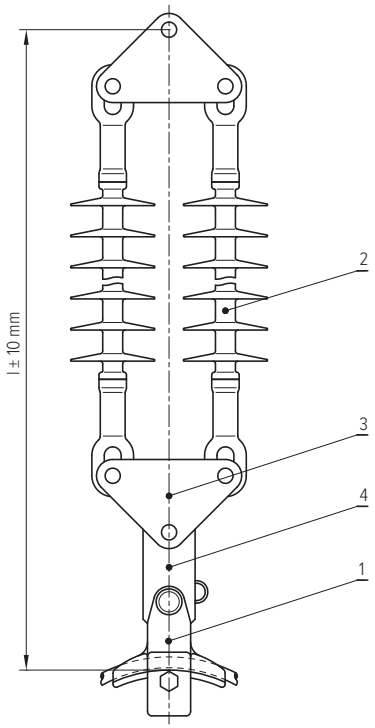
Note: use with covered conductors (CC)



Naziv *Name*	Koda *Code*	l (mm)	Poz. *Pos.*	Kos *Pcs*	Koda *Code*	Masa *Mass* (kg)
ENI-02 N/UU	**93 70 56**	511	1	1	**80 60 04**	0,7
			2	1	**80 70 56**	1,0
			3	2	**80 70 54**	0,3
ENI-02 L/UU	**93 70 58**	551	1	1	**80 60 04**	0,7
			2	1	**80 70 58**	1,1
			3	2	**80 70 54**	0,3
ENI-02 M/UU	**93 71 11**	478	1	1	**80 60 04**	0,7
			2	1	**80 71 11**	1,1
			3	2	**80 70 54**	0,3
ENI-02 X/UU	**93 70 84**	607	1	1	**80 60 04**	0,7
			2	1	**80 70 84**	1,3
			3	2	**80 70 54**	0,3

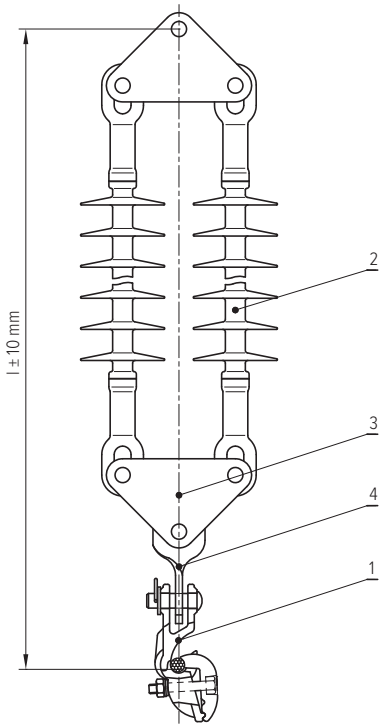
3.26 NKI dvojna nosilna veriga

3.26 NKI double suspension string



Naziv *Name*	Koda *Code*	l (mm)	Poz. *Pos.*	Kos *Pcs*	Koda *Code*	Masa *Mass* (kg)
DN-01 N/UU	**94 70 55**	710	1	1	**80 60 04**	0,7
			2	2	**80 70 55**	1,0
			3	2	**43 29 408**	1,6
			4	1	**80 60 30**	0,5
DN-01 L/UU	**94 70 58**	750	1	1	**80 60 04**	0,7
			2	2	**80 70 57**	1,1
			3	2	**43 29 408**	1,6
			4	1	**80 60 30**	0,5
DN-01 M/UU	**94 71 00**	677	1	1	**80 60 04**	0,7
			2	2	**80 71 00**	1,1
			3	2	**43 29 408**	1,6
			4	1	**80 60 30**	0,5
DN-01 X/UU	**94 70 57**	806	1	1	**80 60 04**	0,7
			2	2	**80 70 59**	1,3
			3	2	**43 29 408**	1,6
			4	1	**80 60 30**	0,5

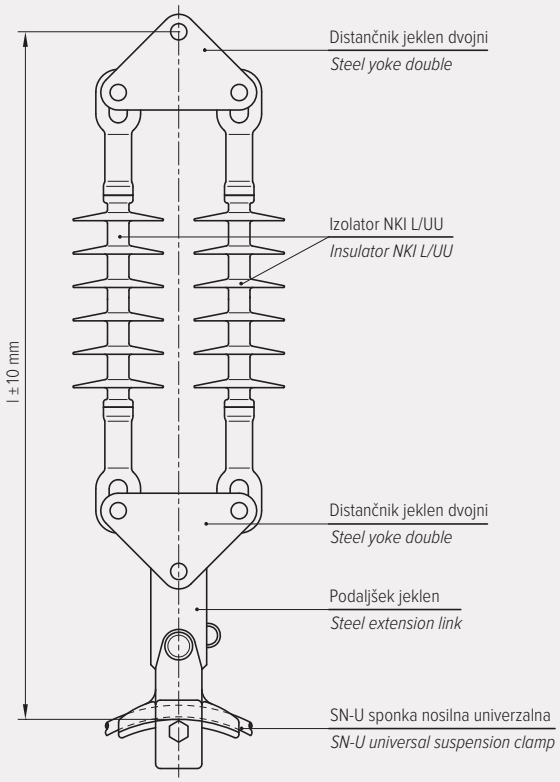
3.27 **NKI dvojna nosilna veriga 90°** *3.27 **NKI double suspension string 90°***



Naziv *Name*	**Koda** *Code*	**l** (mm)	**Poz.** *Pos.*	**Kos** *Pcs*	**Koda** *Code*	**Masa** *Mass* (kg)
DN-02 N/UU	**94 70 56**	710	1	1	**80 60 04**	0,7
			2	2	**80 70 55**	1,0
			3	2	**43 29 408**	1,6
			4	1	**80 60 31**	0,5
DN-02 L/UU	**94 70 59**	750	1	1	**80 60 04**	0,7
			2	2	**80 70 57**	1,1
			3	2	**43 29 408**	1,6
			4	1	**80 60 31**	0,5
DN-02 M/UU	**94 71 11**	677	1	1	**80 60 04**	0,7
			2	2	**80 71 00**	1,1
			3	2	**43 29 408**	1,6
			4	1	**80 60 31**	0,5
DN-02 X/UU	**94 70 60**	806	1	1	**80 60 04**	0,7
			2	2	**80 70 59**	1,3
			3	2	**43 29 408**	1,6
			4	1	**80 60 31**	0,5

3.28 NKI izolatorska veriga - primer naročila 1

3.28 NKI insulator string - order example 1



Naziv/ *Name*: **DN-02 L/UU**

Razlaga naziva

DN	- tip izolatorske verige
02	- zaključek verige
L/UU	- tip NKI izolatorja

Name explanation

DN	*- type of insulator string*
02	*- string ending*
L/UU	*- type of NKI insulator*

Tipi izolatorskih verig

EZ	- enojna zatezna
EZI	- enojna zatezna z iskriščem
DZ	- dvojna zatezna
EN	- enojna nosilna
ENI	- enojna nosilna z iskriščem
DN	- dvojna nosilna

Types of insulator strings

EZ	*- single tension*
EZI	*- single tension with arcing horn*
DZ	*- double tension*
EN	*- single suspension*
ENI	*- single suspension with arcing horn*
DN	*- double suspension*

Zaključek verige

01	- ravni zaključek
02	- 90° zaključek

String ending

01	*- straight ending*
02	*- 90° ending*

Tip NKI izolatorja v verigi

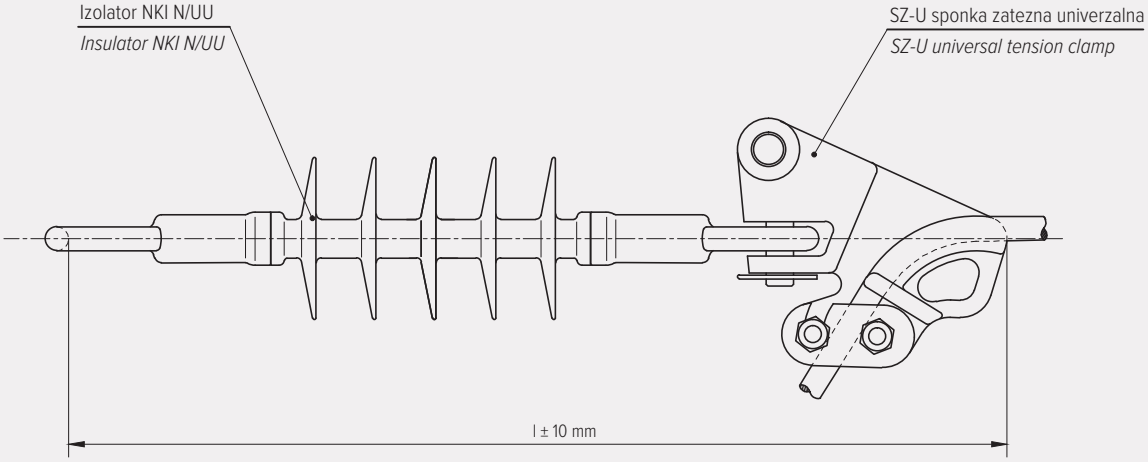
L/UU	- uporabljen je naziv nateznega kompozitnega izolatorja brez oznake NKI

Type of NKI insulator in string

L/UU	*- use the name of the tension composite insulator without the mark NKI.*

3.29 NKI izolatorska veriga - primer naročila 2

3.29 NKI insulator string - order example 2



Naziv/ *Name*: **EZI-01 N/UU**

Razlaga naziva

EZI	- tip izolatorske verige
01	- zaključek verige
N/UU	- tip NKI izolatorja v verigi

Name explanation

EZI	*- type of insulator string*
01	*- string ending*
N/UU	*- type of NKI insulator in string*

Tipi izolatorskih verig

EZ	- enojna zatezna
EZI	- enojna zatezna z iskriščem
DZ	- dvojna zatezna
EN	- enojna nosilna
ENI	- enojna nosilna z iskriščem
DN	- dvojna nosilna

Types of insulator strings

EZ	*- single tension*
EZI	*- single tension with arcing horn*
DZ	*- double tension*
EN	*- single suspension*
ENI	*- single suspension with arcing horn*
DN	*- double suspension*

Zaključek verige

01	- ravni zaključek
02	- 90° zaključek

String ending

01	*- straight ending*
02	*- 90° ending*

Tip NKI izolatorja v verigi

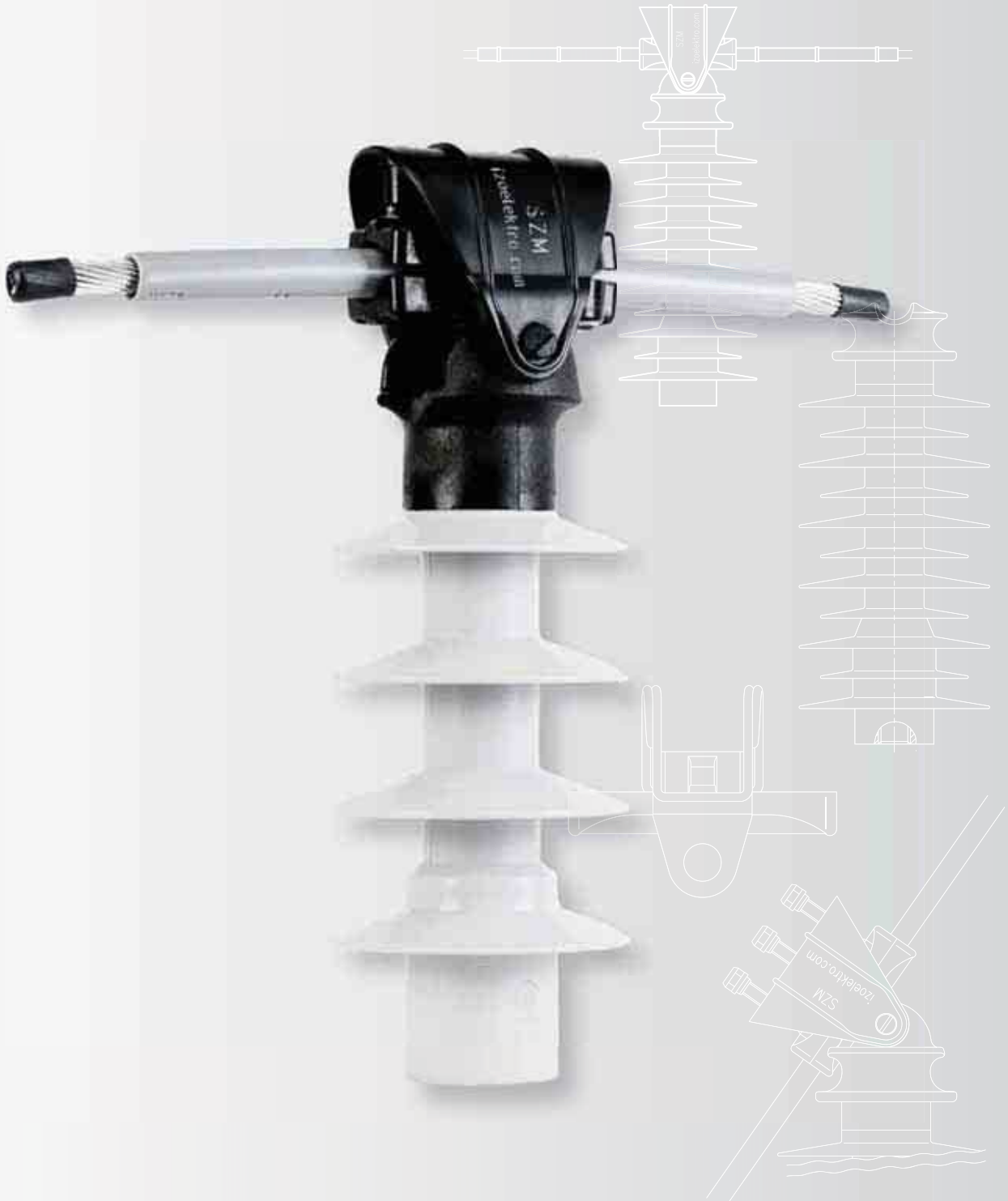
N/UU	- uporabljen je naziv nateznega kompozitnega izolatorja brez oznake NKI

Type of NKI insulator in string

N/UU	*- use the name of the tension composite insulator without the mark NKI.*

IZOELEKTRO

4



SN podporni *izolatorji*

MV post insulators

4.1 PKI splošno

Proizvod

PKI so podporni kompozitni izolatorji s silikonskim plaščem. Namenjeni so za vgradnjo v nadzemne električne vode do nazivne napetosti 52 kV.

Lastnosti

Podporni kompozitni izolatorji PKI so:

- odporni na UV sevanje in kemične vplive,
- obstojni na vremenske vplive in staranje,
- oplaščeni s silikonom brez dodatkov,
- primerni za agresivna okolja (industrija, morska obala in puščavsko podnebje),
- uporabni za daljnovode in naprave,
- neobčutljivi na udarce.

Vgradnja

Mesto montaže podpornih kompozitnih izolatorjev PKI določajo pravilniki in tehnični predpisi. Vgrajujejo se v novogradnje, rekonstrukcije in pri vzdrževanju. Prigrajena vzmetna sponka z ustreznim jahačem zagotavlja tovarniško nastavljeno vertikalno in horizontalno izvlečno silo. Ne glede na druge že vgrajene izolatorje v daljnovodih, novo vgrajeni PKI izolatorji ne vplivajo na spremembo koordinacije izolacije.

Splošni podatki

- Nazivna upogibna sila (SCL): **15 kN**
- Temperaturno območje okolja: **T = -60 °C ... +85 °C**
- Plašč: **silikon LSR**
- Barva silikona: **siva**
- Material zgornjega priključka: **PA6, UV stabiliziran**
- Material jeklenih priključkov: **ST 52-3**
- Navoj priključka spodaj: **M20 ali M24**
- Debelina nanosa cinka: **≥ 70 µm**
- Odstopanje po dolžini: **±5 mm**
- Testirani po standardih: **IEC 62217, IEC 61952, IEC 60437**

4.1 *PKI generally*

Product

PKI are post composite insulators with silicone coating. They are designed to be installed on overhead power lines with rated voltages up to 52 kV.

Characteristic

Post composite insulators PKI are:

- *resistant to UV radiation and chemical influences,*
- *resistant to weathering and aging,*
- *coated with silicone without additives,*
- *suitable for aggressive environments (industry, seaside and desert climate),*
- *usable for overhead power lines and devices,*
- *insensitive to impacts.*

Installation

The position for installing post composite insulators PKI is decided by directives and technical regulations. They are being installed in new constructions, reconstructions and at maintenance. The fitted spring clamp provides factory-set vertical and horizontal pull-out force by using the appropriate cover. Newly installed PKI insulators have no impact on any change of insulation coordination regardless to previous installed insulators in overhead power lines.

General data

- *Specified cantilever load (SCL): **15 kN***
- *Ambient temperature range: **T = -60 °C ... +85 °C***
- *Coat: **silicone LSR***
- *Silicone colour: **grey***
- *Material of top fitting: **PA6, UV stabilized***
- *Material of steel end fitting: **ST 52-3***
- *Connector thread on bottom: **M20 or M24***
- *Layer of zinc: **≥ 70 µm***
- *Tolerance in length: **±5 mm***
- *Tested according to standards: **IEC 62217, IEC 61952, IEC 60437***

Prednosti pred konkurenco

PKI podporne kompozitne izolatorje za zunanjo in notranjo montažo odlikujejo:

- certifikat akreditiranega laboratorija,
- inovativnost. Izolator tip PKI z zgornjim priključkom iz izolacijskega materiala je rezultat strokovnih raziskav naših raziskovalcev (objavljeno v svetovno priznani reviji IEEE Transactions on Power Delivery, 2009), našega patenta in praktičnih izkušenj uporabnikov naših izdelkov. Odpravlja pomanjkljivosti izolatorjev s kovinskim zgornjim priključkom in kovinskimi vezicami.
- način pritrjevanja vodnika na izolator,
- majhna teža,
- enostavna montaža,
- izdelava s priključki na zahtevo kupca.

Competitive advantages

PKI post composite insulators for indoor and outdoor installation feature:

- *certificate from accredited laboratory,*
- *innovativeness. Insulator type PKI with the upper fitting made of insulating material is the result of expert studies of our researchers (published in the world-renowned journal IEEE Transactions on Power Delivery, 2009), our patent and practical experiences by users of our products. It eliminates deficiencies of insulators with metal top and metal cable ties.*
- *method of affixing a conductor onto an insulator,*
- *lightweight,*
- *easy installation,*
- *production with fittings on customer's request.*

4.2 PKI inovacija

Izkušnje uporabnikov in termovizijski posnetki daljnovodov dokazujejo, da v času življenjske dobe prihaja do parcialnih praznitev, kadar je goli ali pol izoliran vodnik:

- vpet v kovinsko pritrdišče,
- pritrjen s kovinsko vezjo na keramični izolator.

Študija porazdelitve električne poljske jakosti na zgornjem kovinskem priključku kompozitnega podpornega izolatorja potrjuje, da obstaja velika verjetnost, da bo zaradi previsoke električne poljske jakosti ob dolgotrajni uporabi izolatorjev z zgornjim kovinskim priključkom prišlo do prežiga na mestu spodnjega roba zgornjega priključka izolatorja ali do odžiga vodnika na mestu pritrditve.
Teoretične raziskave so pokazale, da se v obratovanju vzdolž izolatorja vzpostavi električno polje, ki ni homogeno, temveč je odvisno od lastnosti materialov in geometrije. To vpliva na dielektrične obremenitve izolatorja, ki so odvisne od oblike prevodnih delov in rastejo z velikostjo napetosti U oziroma električnega polja E.

4.2 *PKI innovation*

Experiences of users and thermo-vision snaps of power lines are proving that in the lifespan partial discharges occur when a bare conductor or a covered conductor is:

- *fastened to a metal anchorage,*
- *astened with the metal bond to the ceramic insulator.*

The study of distribution of electric field strength on metal top end fitting of composite post insulators confirms high probability of too high electric field strength (at prolonged usage of insulators with top end metal fitting). It will come to burns at the lower end point of the top end fitting or the conductor will burn off from the fixation place.
Some theoretical research showed that while in operation a non-homogenous electric field that depends on material characteristics and insulator geometry is established along the insulator. This affects the dielectric loads of the insulator that depend upon the shape of conducting parts and increase with the heights of voltage U or electric field E.

Diagram električne poljske jakosti

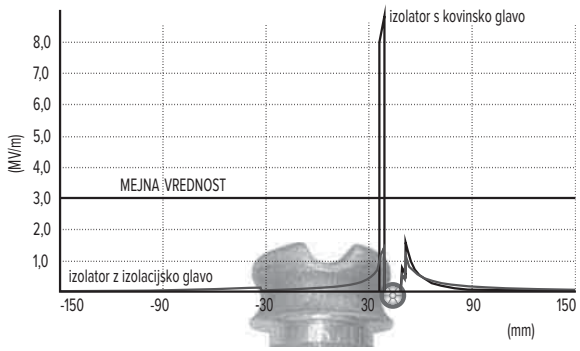
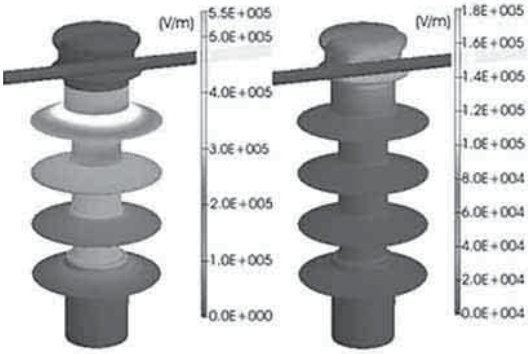


Diagram of electric field strength

Izolacijski zgornji priključek
Izolator tip PKI PA in A PKI PA z zgornjim priključkom iz izolacijskega materiala je rezultat strokovnih raziskav in praktičnih izkušenj uporabnikov naših izdelkov. Odpravlja pomanjkljivosti izolatorjev s kovinskim zgornjim priključkom. Zgornji priključek je izdelan iz poliamida PA6 z dodatkom steklenih vlaken, kar mu zagotavlja ustrezne mehanske lastnosti, časovno stabilnost, odpornost na atmosferske vplive in UV svetlobo. Je značilne črne barve. Ta material že več kot petnajst let uspešno uporabljamo v naši nihajni sponki.

Insulative top
The insulator type PKI PA in A PKI PA with top end fitting made of insulating material is a result of professional research and of practical experiences of our products users. It eliminates deficiencies of insulators with metal top end fittings. The top end fitting is made of polyamide PA6 with the addition of glass fibres which assure suitable mechanical characteristics, lifetime stability, resistance to atmospheric influences and UV light. It is characteristically black coloured. We have already been successfully using this material in our spring clamp for more than fifteen years.

Porazdelitev električne poljske jakosti

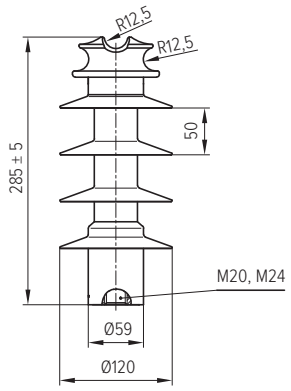


Allocation of electric field strength

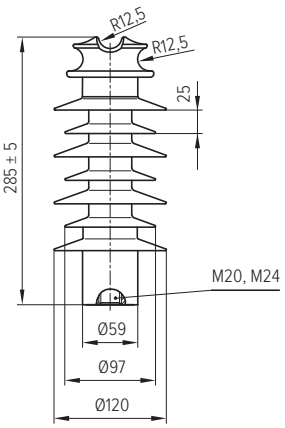
Kovinska glava
Metal head

PA izolacijska glava
PA insulation head

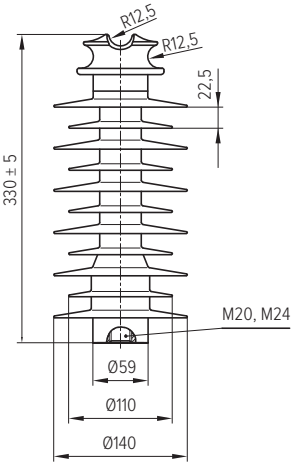
4.3 PKI brez sponke *4.3 PKI without a clamp*



PKI NO



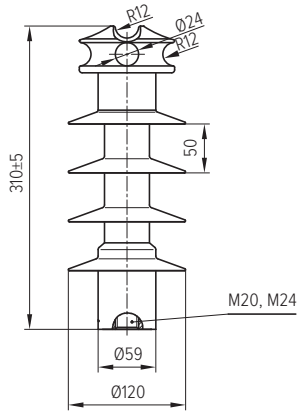
PKI LO



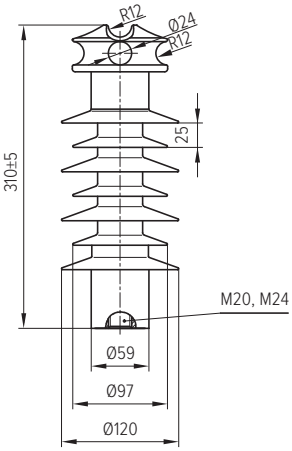
PKI XO

Naziv	PKI NO	PKI LO	PKI XO	*Name*
Nazivna obratovalna napetost	24 kV	36 kV	52 kV	*Nominal operating voltage*
Plazilna pot	543 mm	670 mm	1150 mm	*Creepage distance*
Preskočna razdalja	275 mm	275 mm	330 mm	*Arcing distance*
Vzdržna atm. udarna nap. v suhem	190 kV	192 kV	210 kV	*Dry lighting impulse withstand voltage*
Vzdržna izmenična nap. v mokrem	90 kV	93 kV	106 kV	*Wet power frequency withstand voltage*
Masa	1,7 kg	1,8 kg	2,1 kg	*Mass*

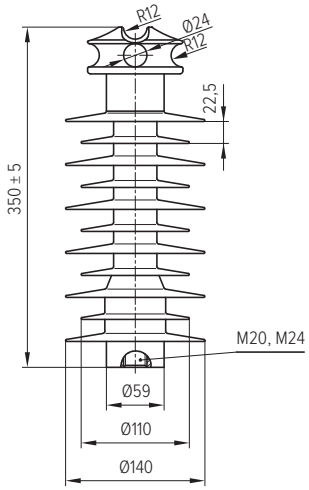
4.4 PKI z luknjo *4.4 PKI with a hole*



PKI NH



PKI LH



PKI XH

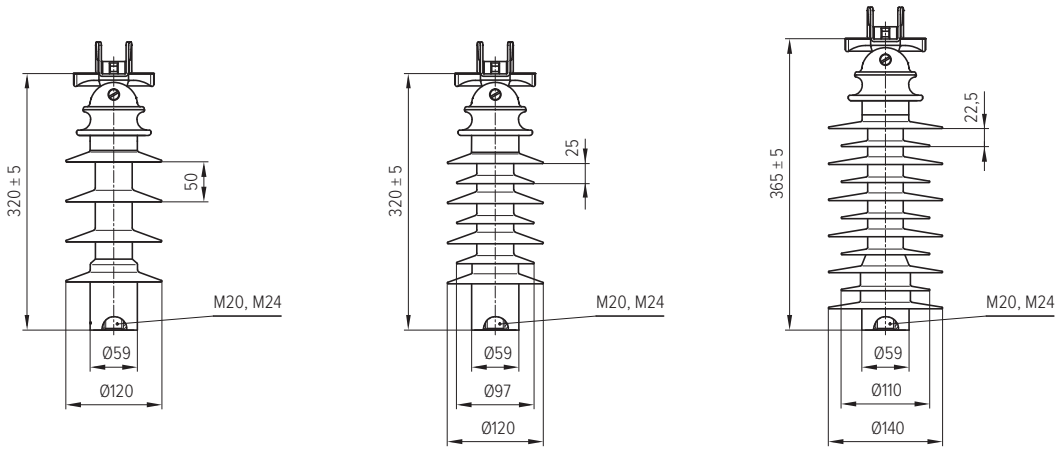
Naziv	PKI NH	PKI LH	PKI XH	*Name*
Nazivna obratovalna napetost	24 kV	36 kV	52 kV	*Nominal operating voltage*
Plazilna pot	543 mm	670 mm	1150 mm	*Creepage distance*
Preskočna razdalja	275 mm	275 mm	330 mm	*Arcing distance*
Vzdržna atm. udarna nap. v suhem	190 kV	192 kV	210 kV	*Dry lighting impulse withstand voltage*
Vzdržna izmenična nap. v mokrem	90 kV	93 kV	106 kV	*Wet power frequency withstand voltage*
Masa	1,65 kg	1,75 kg	2,05 kg	*Mass*

4.5 PKI z vzmetno sponko

Horizontalna izvlečna sila vodnika (F_h): 1,2 kN
Vertikalna dopustna obremenitev sponke (F_v): 2,8 kN

4.5 *PKI with spring clamp*

Horizontal pull-out force of conductor (F_h): 1,2 kN
Vertical maximum load of clamp (F_v): 2,8 kN



PKI NS **PKI LS** **PKI XS**

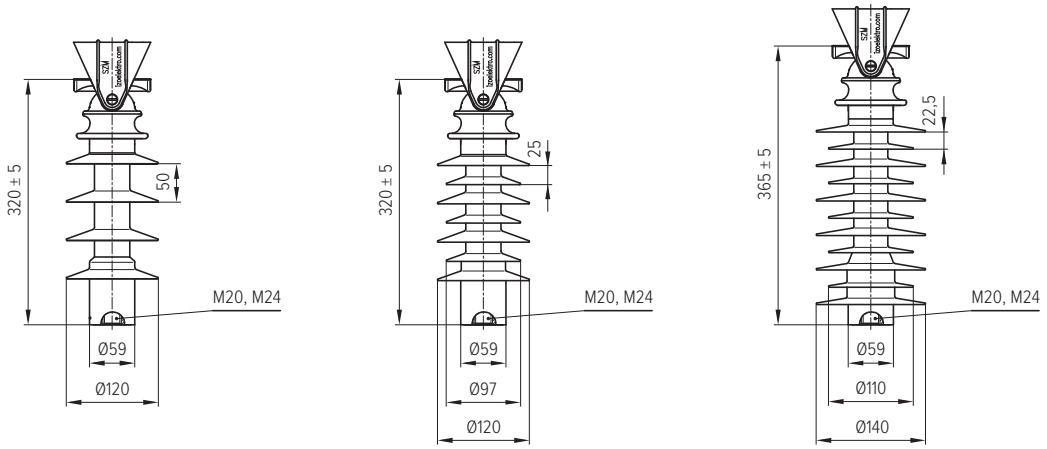
Naziv	PKI NS	PKI LS	PKI XS	*Name*
Nazivna obratovalna napetost	24 kV	36 kV	52 kV	*Nominal operating voltage*
Plazilna pot	691 mm	803 mm	1260 mm	*Creepage distance*
Preskočna razdalja	319 mm	319 mm	375 mm	*Arcing distance*
Vzdržna atm. udarna nap. v suhem	190 kV	192 kV	221 kV	*Dry lighting impulse withstand voltage*
Vzdržna izmenična nap. v mokrem	90 kV	93 kV	106 kV	*Wet power frequency withstand voltage*
Masa	2,0 kg	2,1 kg	2,4 kg	*Mass*

4.6 PKI s kapo SZM/0

Horizontalna izvlečna sila vodnika (F_h): 1,2 kN
Vertikalna dopustna obremenitev sponke (F_v): 4,8 kN

4.6 *PKI with a cap SZM/0*

Horizontal pull-out force of conductor (F_h): 1,2 kN
Vertical maximum load of clamp (F_v): 4,8 kN



PKI NZ **PKI LZ** **PKI XZ**

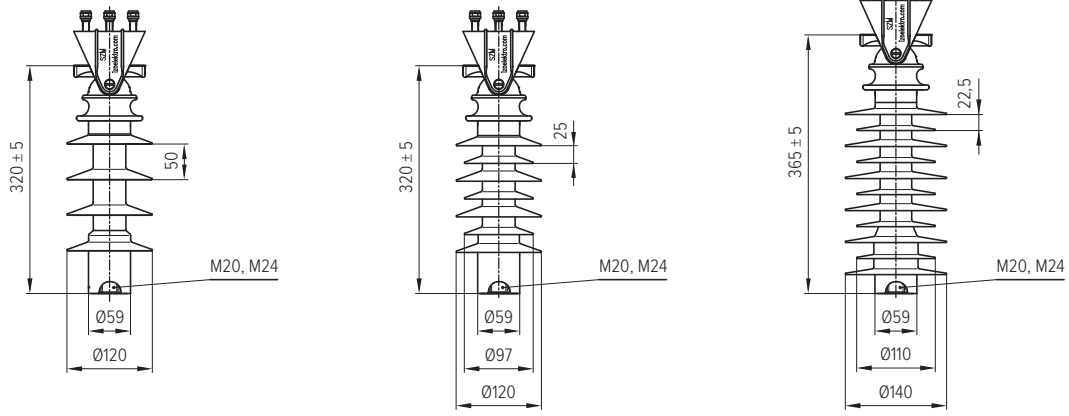
Naziv	PKI NZ	PKI LZ	PKI XZ	*Name*
Nazivna obratovalna napetost	24 kV	36 kV	52 kV	*Nominal operating voltage*
Plazilna pot	691 mm	803 mm	1260 mm	*Creepage distance*
Preskočna razdalja	319 mm	319 mm	375 mm	*Arcing distance*
Vzdržna atm. udarna nap. v suhem	190 kV	192 kV	221 kV	*Dry lighting impulse withstand voltage*
Vzdržna izmenična nap. v mokrem	90 kV	93 kV	106 kV	*Wet power frequency withstand voltage*
Masa	2,05 kg	2,15 kg	2,45 kg	*Mass*

4.7 PKI s kapo SZM/3

Horizontalna izvlečna sila vodnika (F_h): 5,6 kN
Vertikalna dopustna obremenitev sponke (F_v): 5,8 kN

4.7 PKI with a cap SZM/3

Horizontal pull-out force of conductor (F_h): 5,6 kN
Vertical maximum load of clamp (F_v): 5,8 kN



PKI NM **PKI LM** **PKI XM**

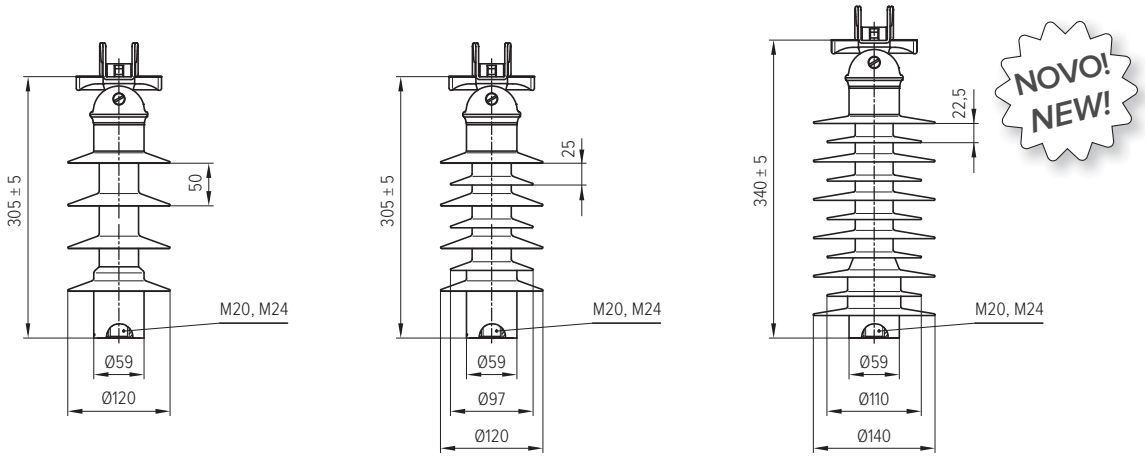
Naziv	**PKI NM**	**PKI LM**	**PKI XM**	***Name***
Nazivna obratovalna napetost	24 kV	36 kV	52 kV	*Nominal operating voltage*
Plazilna pot	691 mm	803 mm	1260 mm	*Creepage distance*
Preskočna razdalja	319 mm	319 mm	375 mm	*Arcing distance*
Vzdržna atm. udarna nap. v suhem	190 kV	192 kV	221 kV	*Dry lighting impulse withstand voltage*
Vzdržna izmenična nap. v mokrem	90 kV	93 kV	106 kV	*Wet power frequency withstand voltage*
Masa	2,1 kg	2,2 kg	2,5 kg	*Mass*

4.8 A PKI z vzmetno sponko

Horizontalna izvlečna sila vodnika (F_h): 1,2 kN
Vertikalna dopustna obremenitev sponke (F_v): 2,8 kN

4.8 A PKI with spring clamp

Horizontal pull-out force of conductor (F_h): 1,2 kN
Vertical maximum load of clamp (F_v): 2,8 kN



A PKI NS **A PKI LS** **A PKI XS**

Naziv	**A PKI NS**	**A PKI LS**	**A PKI XS**	***Name***
Nazivna obratovalna napetost	24 kV	36 kV	52 kV	*Nominal operating voltage*
Plazilna pot	670 mm	782 mm	1230 mm	*Creepage distance*
Preskočna razdalja	308 mm	308 mm	380 mm	*Arcing distance*
Vzdržna atm. udarna nap. v suhem	177 kV	182 kV	230 kV	*Dry lighting impulse withstand voltage*
Vzdržna izmenična nap. v mokrem	82 kV	82 kV	106 kV	*Wet power frequency withstand voltage*
Masa	2,0 kg	2,1 kg	2,4 kg	*Mass*

4.9 A PKI z oslabljeno vzmetno sponko

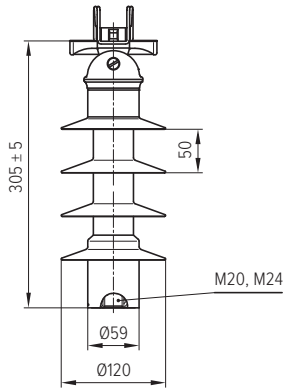
Horizontalna izvlečna sila vodnika (F_h): 1,2 kN
Vertikalna dopustna obremenitev sponke (F_v): 2,8 kN

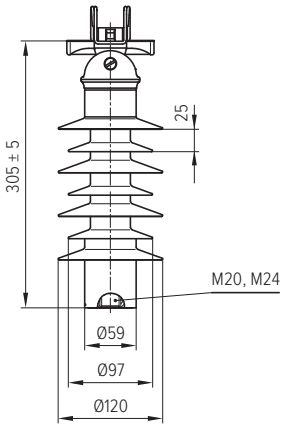
4.9 *A PKI with weakened spring clamp*

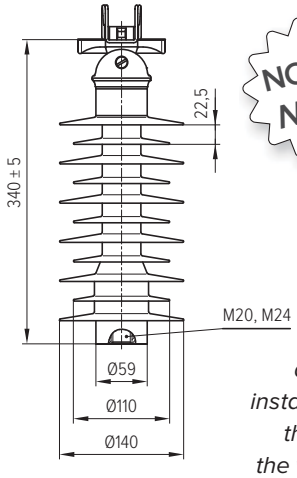
Horizontal pull-out force of conductor (F_h): 1,2 kN
Vertical maximum load of clamp (F_v): 2,8 kN

Uporaba pri varni montaži skozi gozd

Use at safe installation through the woods







NOVO! NEW!

A PKI NV **A PKI LV** **A PKI XV**

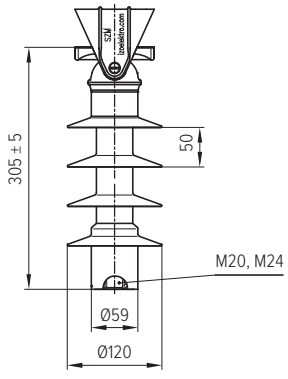
Naziv	A PKI NSV	A PKI LSV	A PKI XSV	*Name*
Nazivna obratovalna napetost	24 kV	36 kV	52 kV	*Nominal operating voltage*
Plazilna pot	670 mm	782 mm	1230 mm	*Creepage distance*
Preskočna razdalja	308 mm	308 mm	380 mm	*Arcing distance*
Vzdržna atm. udarna nap. v suhem	177 kV	182 kV	230 kV	*Dry lighting impulse withstand voltage*
Vzdržna izmenična nap. v mokrem	82 kV	82 kV	106 kV	*Wet power frequency withstand voltage*
Masa	2,0 kg	2,1 kg	2,4 kg	*Mass*

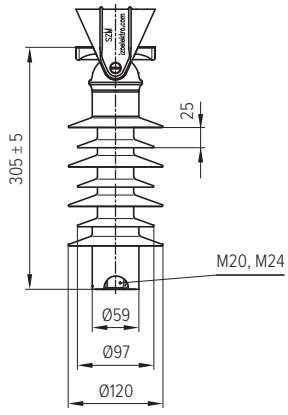
4.10 A PKI s kapo SZM/0

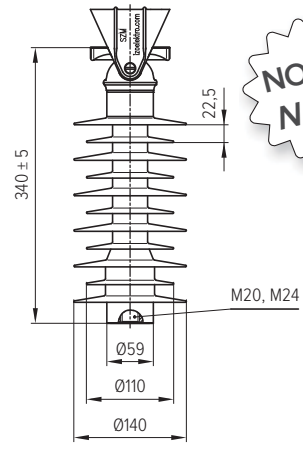
Horizontalna izvlečna sila vodnika (F_h): 1,2 kN
Vertikalna dopustna obremenitev sponke (F_v): 4,8 kN

4.10 *A PKI with a cap SZM/0*

Horizontal pull-out force of conductor (F_h): 1,2 kN
Vertical maximum load of clamp (F_v): 4,8 kN







NOVO! NEW!

A PKI NZ **A PKI LZ** **A PKI XZ**

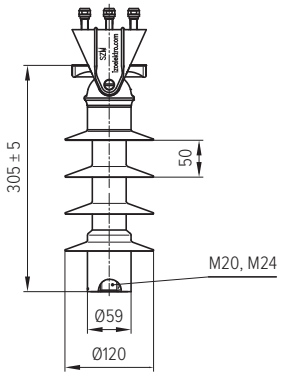
Naziv	A PKI NZ	A PKI LZ	A PKI XZ	*Name*
Nazivna obratovalna napetost	24 kV	36 kV	52 kV	*Nominal operating voltage*
Plazilna pot	670 mm	782 mm	1230 mm	*Creepage distance*
Preskočna razdalja	308 mm	308 mm	380 mm	*Arcing distance*
Vzdržna atm. udarna nap. v suhem	177 kV	182 kV	230 kV	*Dry lighting impulse withstand voltage*
Vzdržna izmenična nap. v mokrem	82 kV	82 kV	106 kV	*Wet power frequency withstand voltage*
Masa	2,05 kg	2,15 kg	2,45 kg	*Mass*

4.11 A PKI s kapo SZM/3

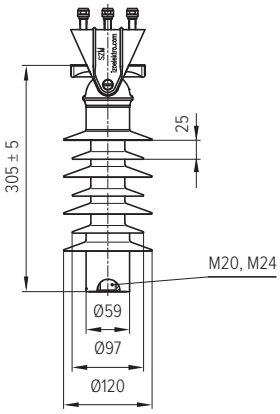
Horizontalna izvlečna sila vodnika (F_h): 5,6 kN
Vertikalna dopustna obremenitev sponke (F_v): 5,8 kN

4.11 A PKI with a cap SZM/3

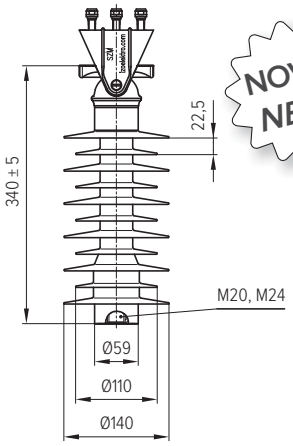
Horizontal pull-out force of conductor (F_h): 5,6 kN
Vertical maximum load of clamp (F_v): 5,8 kN



A PKI NM



A PKI LM



NOVO! NEW!

A PKI XM

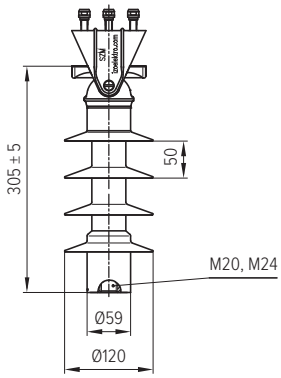
Naziv	A PKI NM	A PKI LM	A PKI XM	*Name*
Nazivna obratovalna napetost	24 kV	36 kV	52 kV	*Nominal operating voltage*
Plazilna pot	670 mm	782 mm	1230 mm	*Creepage distance*
Preskočna razdalja	308 mm	308 mm	380 mm	*Arcing distance*
Vzdržna atm. udarna nap. v suhem	177 kV	182 kV	230 kV	*Dry lighting impulse withstand voltage*
Vzdržna izmenična nap. v mokrem	82 kV	82 kV	106 kV	*Wet power frequency withstand voltage*
Masa	2,1 kg	2,2 kg	2,5 kg	*Mass*

4.12 A PKI za vodnik AlFe 120/PIV 99

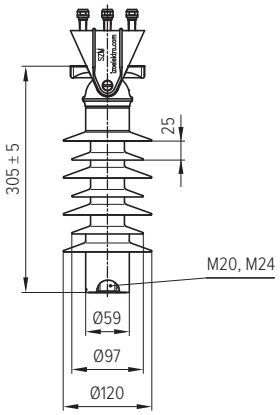
Horizontalna izvlečna sila vodnika (F_h): 5,6 kN
Vertikalna dopustna obremenitev sponke (F_v): 5,8 kN

4.12 A PKI for conductor AlFe 120/PIV 99

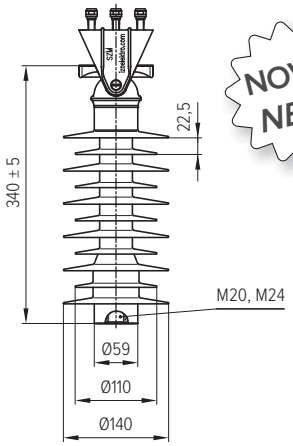
Horizontal pull-out force of conductor (F_h): 5,6 kN
Vertical maximum load of clamp (F_v): 5,8 kN



A PKI NM 120/99



A PKI LM 120/99



NOVO! NEW!

A PKI XM 120/99

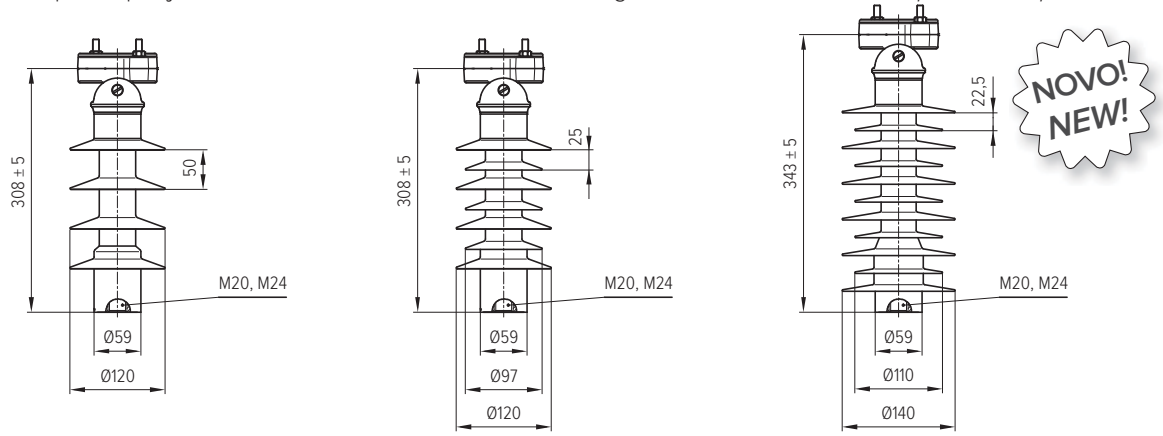
Naziv	A PKI NM 120/99	A PKI LM 120/99	A PKI XM 120/99	*Name*
Nazivna obratovalna napetost	24 kV	36 kV	52 kV	*Nominal operating voltage*
Plazilna pot	691 mm	803 mm	1190 mm	*Creepage distance*
Preskočna razdalja	319 mm	319 mm	330 mm	*Arcing distance*
Vzdržna atm. udarna nap. v suhem	177 kV	182 kV	230 kV	*Dry lighting impulse withstand voltage*
Vzdržna izmenična nap. v mokrem	82 kV	82 kV	106 kV	*Wet power frequency withstand voltage*
Masa	2,1 kg	2,2 kg	2,5 kg	*Mass*

4.13 A PKI z vijačno sponko

Horizontalna izvlečna sila vodnika (F_h): 2,8 kN
Vertikalna dopustna obremenitev sponke (F_v): 4,0 kN
Opomba: Vijaka sponke privijemo z navorom 8 Nm

4.13 A PKI with screw clamp

Horizontal pull-out force of conductor (F_h): 2,8 kN
Vertical maximum load of clamp (F_v): 4,0 kN
Note: Tighten the screws on the clamp with a torque 8 Nm

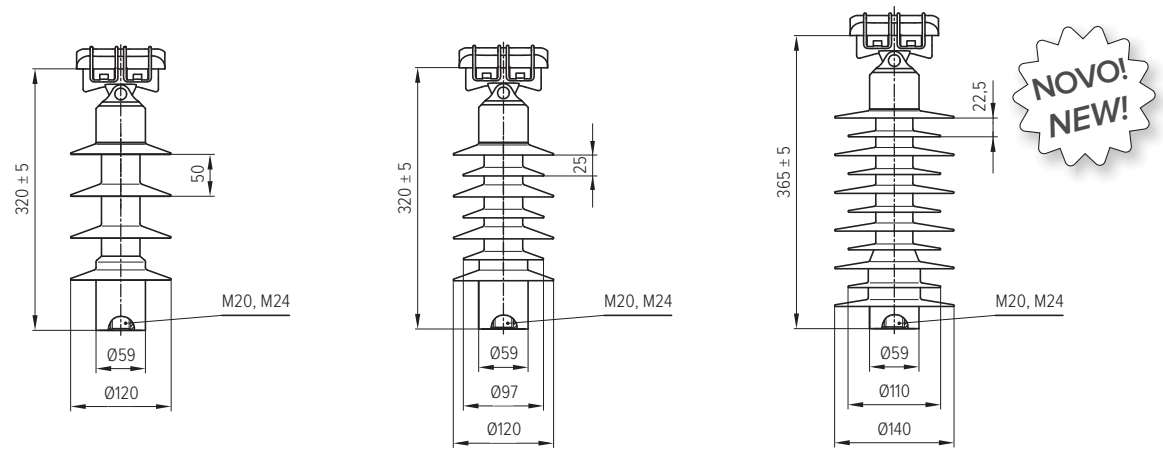


A PKI NG **A PKI LG** **A PKI XG**

Naziv	A PKI NG	A PKI LG	A PKI XG	*Name*
Nazivna obratovalna napetost	24 kV	36 kV	52 kV	*Nominal operating voltage*
Plazilna pot	670 mm	782 mm	1230 mm	*Creepage distance*
Preskočna razdalja	308 mm	308 mm	380 mm	*Arcing distance*
Vzdržna atm. udarna nap. v suhem	177 kV	182 kV	230 kV	*Dry lighting impulse withstand voltage*
Vzdržna izmenična nap. v mokrem	82 kV	82 kV	106 kV	*Wet power frequency withstand voltage*
Masa	2,1 kg	2,2 kg	2,5 kg	*Mass*

4.14 PKI E za vodnike od ø15 do ø30

4.14 PKI E for conductor from ø15 to ø30



PKI NE **PKI LE** **PKI XE**

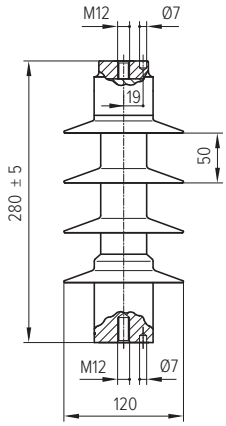
Naziv	PKI NE	PKI LE	PKI XE	*Name*
Nazivna obratovalna napetost	24 kV	36 kV	52 kV	*Nominal operating voltage*
Plazilna pot	670 mm	782 mm	1230 mm	*Creepage distance*
Preskočna razdalja	308 mm	308 mm	380 mm	*Arcing distance*
Vzdržna atm. udarna nap. v suhem	177 kV	182 kV	230 kV	*Dry lighting impulse withstand voltage*
Vzdržna izmenična nap. v mokrem	82 kV	82 kV	106 kV	*Wet power frequency withstand voltage*

4.15 PKIL za ločilnik

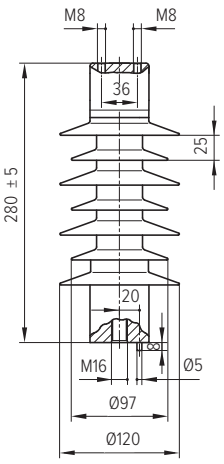
Opomba: obliko in material priključkov izdelamo po zahtevi kupca

4.15 PKIL for switch disconnector

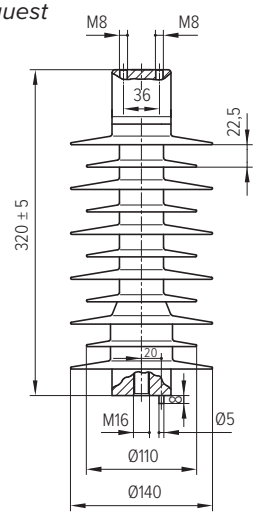
Note: we make the holes for attaching connectors on customer's request



PKIL N ES



PKIL L TSN



PKIL X ME

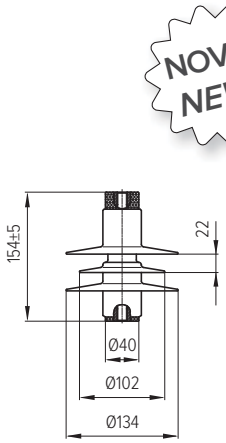
Naziv	PKIL N	PKIL L	PKIL X	*Name*
Nazivna obratovalna napetost	24 kV	36 kV	52 kV	*Nominal operating voltage*
Plazilna pot	493 mm	620 mm	1125 mm	*Creepage distance*
Preskočna razdalja	275 mm	275 mm	330 mm	*Arcing distance*
Vzdržna atm. udarna nap. v suhem	155 kV	180 kV	210 kV	*Dry lighting impulse withstand voltage*
Vzdržna izmenična nap. v mokrem	70 kV	80 kV	100 kV	*Wet power frequency withstand voltage*
Masa	2,0 kg	2,1 kg	2,4 kg	*Mass*

4.16 PKIL IZO za ločilnik

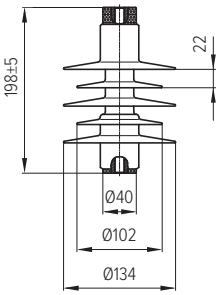
Opomba: obliko in material priključkov izdelamo po zahtevi kupca

4.16 PKIL IZO for switch disconnector

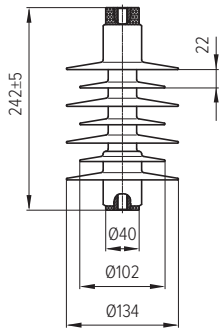
Note: we make the holes for attaching connectors on customer's request



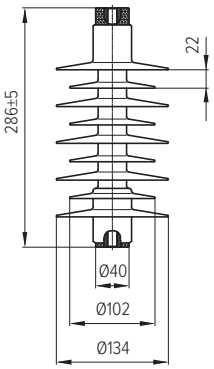
PKIL 12



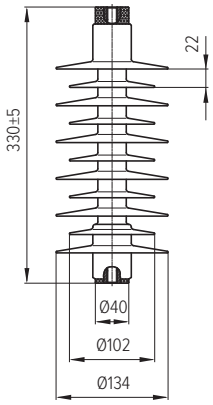
PKIL 24



PKIL 36



PKIL 44



PKIL 52

Naziv	PKIL 12	PKIL 24	PKIL 36	PKIL 44	PKIL 52	*Name*
Nazivna obratovalna napetost	12 kV	24 kV	36 kV	44 kV	52 kV	*Nominal operating voltage*
Plazilna pot	357 mm	557 mm	757 mm	957 mm	1157 mm	*Creepage distance*
Preskočna razdalja	170 mm	214 mm	258 mm	302 mm	346 mm	*Arcing distance*
Masa	1,2 kg	1,4 kg	1,6 kg	1,8 kg	2,0 kg	*Mass*

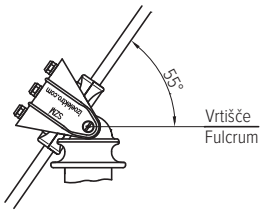
4.17 A PKI in PKI nagib in odkloni vodnika

Opomba: podani so maksimalni nagibi in odkloni vodnika v glavi izolatorjev A PKI in PKI glede na način vpetja vodnika.

4.17 *A PKI and PKI inclination and declination of conductor*

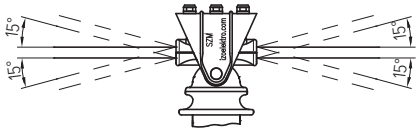
Note: the data in the table is for the maximum inclinations and declinations of conductors in the insulator's head A PKI and PKI in the way of mounting.

Nagib glave izolatorja



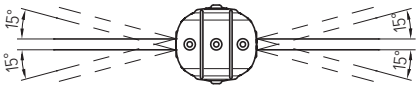
Inclination of insulator top

Odklon vodnika vertikalno



Declination of conductor vertical

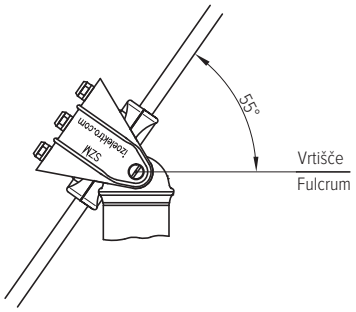
Odklon vodnika horizontalno



Declination of conductor horizontal

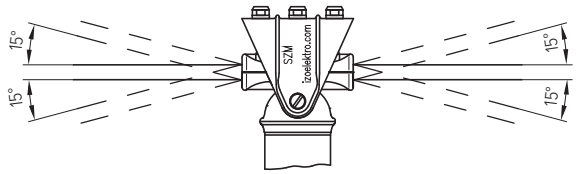
A PKI, PKI (G, S, V, Z, M, M120/99) **PKI (O, H)**

Nagib glave izolatorja



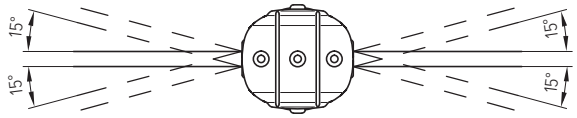
Inclination of insulator top

Odklon vodnika vertikalno



Declination of conductor vertical

Odklon vodnika horizontalno



Declination of conductor horizontal

A PKI, PKI (G, S, V, Z, M, M120/99)

4.18 Zaščita za ptice splošno

Proizvod
A PKI z oznako »B« so podporni kompozitni izolatorji, ki skupaj s silikonskim plaščem SILP in zaščitno kapo SZM/0 predstavljajo zaščito za ptice. Vgrajujemo jih v nadzemne električne vode do nazivne napetosti 52 kV.

Lastnosti
Podporni kompozitni izolatorji A PKI z oznako »B« imajo prigrajeno kapo za zaščito kovinskih delov glave kompozitnega izolatorja. Silikonski plašč SILP, montiran na vodniku na vsaki strani izolatorja, izolira goli vodnik pritrjen na izolator. Vijačna sponka privita z predpisanim navorom zagotavlja zdrs vodnika skozi silikonski plašč SILP istočasno pa onemogoča premik silikonskega plašča glede na mesto pritrditve.

Vgradnja
Mesto montaže sistema zaščite za ptice določajo pravilniki in tehnični predpisi elektrodistribucij. Priporočamo vgradnjo na daljnovodih, kjer pogosto prihaja do zemeljskih stikov zaradi:

- večjih ptic,
- preskakovanja glodalcev na oporiščih.

V našem podjetju smo skupaj z uporabniki razvili sistem za vgradnjo tipskih zaščitnih elementov. Za izvedbo sistema zaščite za ptice je potrebno uporabiti:

- izolatorje A PKI z oznako »G«,
- SN silikonski plašč SILP,
- kapa SZM/0.

Naročanje
Izberete kateri koli podporni kompozitni izolator A PKI z oznako »G«, kapo SZM/0 in priporočeno število metrov silikonskega plašča SILP. Primer garniture za en izolator je podan v točki 4.19 A PKI zaščita za ptice.

4.18 *Protection for birds generally*

Product
A PKI with mark »B« are post composite insulators with silicone coating SILP and protection cap SZM/0 represent the protection for birds. They are designed to be installed on overhead power lines with rated voltages up to 52 kV.

Characteristic
Post composite insulators A PKI with mark »B« have a fitted hat for protecting metal parts of head of a composite insulator. The silicone coat SILP mounted on the conductor insulates the bare conductor attached to the insulator on each side of the insulator. Screw clamp screwed with the specified torque ensures slippage of the conductor through the silicone coat SILP at the same time prevents the movement of a silicon coat according to the site of attachment.

Installation
The position for installing the system of birds' protection is decided by directives and technical regulations of electrical distributors. We recommend installation on overhead power lines wherever earth faults often occur because of:

- *larger birds,*
- *rodents jumping on poles.*

Together with users we created a system for installing standard protective elements. For implementing the system "protection for birds" it is necessary to use:

- *insulators A PKI with mark »G«,*
- *MV silicone coat SILP,*
- *Cap SZM/0.*

Ordering
Choose any post composite insulator A PKI with mark »G«, cap SZM/0 and the recommended number of meters of silicone coat SILP. Example for a single set insulator is given in section 4.19 A PKI protection for birds

Prednosti pred konkurenco

- Vsa stojna mesta z že vgrajenimi izolatorji A PKI in PKI z oznako »G« imajo možnost enostavne predelave sistema.
- Zagotavlja 100% zaščito na oporiščih.
- Zaščita za ptice je obstojna pri ekstremnih vremenskih pogojih.

Competitive advantages

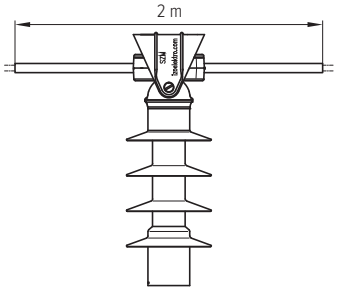
- *All poles with installed insulators A PKI and PKI with mark »G« have the simple system upgrading option.*
- *Provides 100% protection on bases.*
- *Protection for birds is persistent in extreme weather conditions.*

4.19 Zaščita za ptice - garnitura

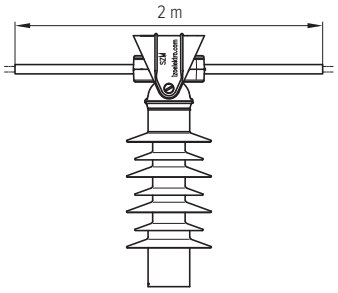
Horizontalna izvlečna sila vodnika (Fh): **2,8 kN**
Vertikalna dopustna obremenitev sponke (Fv): **4,0 kN**

4.19 Protection for birds - set

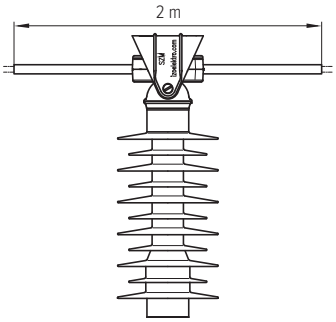
*Horizontal pull-out force of conductor (Fh): **2,8 kN***
*Vertical maximum load of clamp (Fv): **4,0 kN***



A PKI NB



A PKI LB



A PKI XB

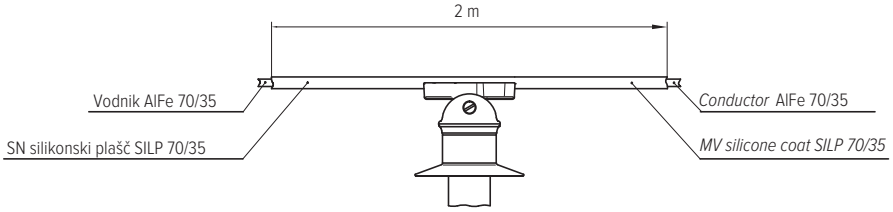
Garnitura	Količina *Quantity*	*Set*
A PKI NG ali A PKI LG ali A PKI XG	1 kos/pcs	*A PKI NG or A PKI LG or A PKI XG*
+ SN silikonski plašč SILP 70/35	2 m	*+ MV silicone coat SILP 70/35*
+ Kapa SZM/0	1 kos/pcs	*+ Cap SZM/0*

Navodila za namestitev zaščite za ptice z vijačno sponko

Installation instructions for the protection for birds with screw clamp

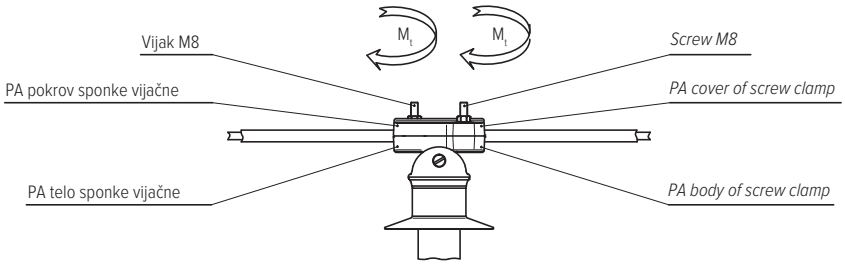
1. Silikonski plašč SILP 70/35 namestimo na vodnik simetrično na vijačno sponko.

1. Silicone coat SILP 70/35 is installed on the conductur symmetrically to the screw clamp.



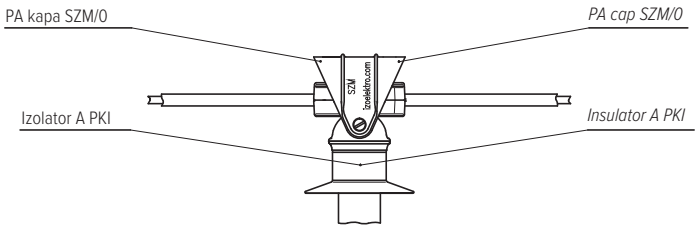
2. Vijaka privijemo z navorom M_t=6 Nm.

2. Tighten the screws with a torque M_t=6 Nm.



3. Namestimo kapo SZM/0.

3. Install cap SZM/0.



4.20 PKI varna montaža skozi gozd splošno

Proizvod

PKI izolatorji z oznako »V« so namenski podporni kompozitni izolatorji s silikonskim plaščem in z oslabljeno vzmetno sponko. Namenjeni so za varno montažo skozi gozd. Vgrajujemo jih v nadzemne električne vode do nazivne napetosti 52 kV.

Lastnosti

Podporni kompozitni izolatorji imajo oslabljeno telo sponke zaradi lažje porušitve pri izrednih vremenskih razmerah.

Vgradnja

Mesto montaže namenskih podpornih kompozitnih izolatorjev PKI določajo pravilniki in tehnični predpisi elektrodistribucij. Na daljnovodih, kjer trasa poteka skozi gozd, pogosto prihaja do prekinitev napajanja zaradi:

- izrednih vremenskih razmer,
- podiranja dreves,
- lomljenja vej,
- otresanja snega in žleda.

V najhujših primerih prihaja do porušitve DV. Dejstvo je, da pri teh porušitvah v večini primerov ostane vodnik nepretrgan.

Zaradi tega smo v našem podjetju skupaj z uporabniki in strokovnimi sodelavci izvedli študijo o varni izgradnji DV skozi gozd ter raziskave podkrepili s preskusom v naravi (video na www.izoelektro.com). Za izvedbo varne montaže skozi gozd so uporabljeni:

- izolatorji PKI z oslabljenim telesom sponke,
- kavelj in
- varnostni lok vodnika.

Izračun in naročanje

Premer loka in dimenzije kavlja je potrebno določiti z izračunom. Za izvedbo »varne montaže skozi gozd« zahtevajte ponudbo na osnovi trasnega načrta in preseka vodnika.

Splošni podatki

- Nazivna upogibna sila (SCL): **15 kN**
- Temperaturno območje okolja **T = -60 °C ... +85 °C**
- Plašč: **silikon LSR**
- Barva silikona: **siva**
- Material zgornjega priključka: **PA6, UV stabiliziran**
- Material jeklenih priključkov: **ST 52-3**
- Debelina nanosa cinka: ≥ **70 µm**

Prednosti pred konkurenco

- Sistem varne montaže z izolatorji PKI z oznako »V« odlikuje varnost zgrajenega DV.
- Varuje stojna mesta DV pred porušitvijo pri padcu dreves na vodnike.
- Sistem je rezultat strokovnih raziskav naših raziskovalcev skupaj z uporabniki in strokovnimi sodelavci instituta ElMV, Ljubljana.

4.20 PKI safe installation through the woods generally

Product

PKI insulators with mark »V« are purposed post composite insulators with silicone coating and a weakened spring clamp shuttle. Their purpose is for a safe installation through the forest. They are designed to be installed on overhead power lines with rated voltages up to 52 kV.

Characteristic

Post composite insulators have a weakened spring clamp shuttle for easier collapsing in extreme weather conditions.

Installation

The position for installing purposed post composite insulators PKI is decided by directives and technical regulations of electrical distributors. On power lines passing through the woods often comes to interruptions of power supply due to:

- *extreme weather conditions,*
- *falling trees,*
- *breaking branches,*
- *shaking off snow and ice.*

In the worst-cases the collapse of the power line occurs. The fact is that at these collapses in most cases the conductor remains unbroken.

For this reason our company conducted a study together with users and technical staff on safe installation of PL through the woods. The research was reinforced by a test in nature (video on www.izoelektro.com). To implement safe installation through the woods use:

- *insulators PKI with weakened spring clamp shuttle,*
- *hook and*
- *conductor safety arc.*

Calculation and ordering

Conductor safety arc diameter and hook size should be determined by a calculation. To implement »safe installation through the woods« request a quotation based on power line route plan and the conductor cross-section.

General data

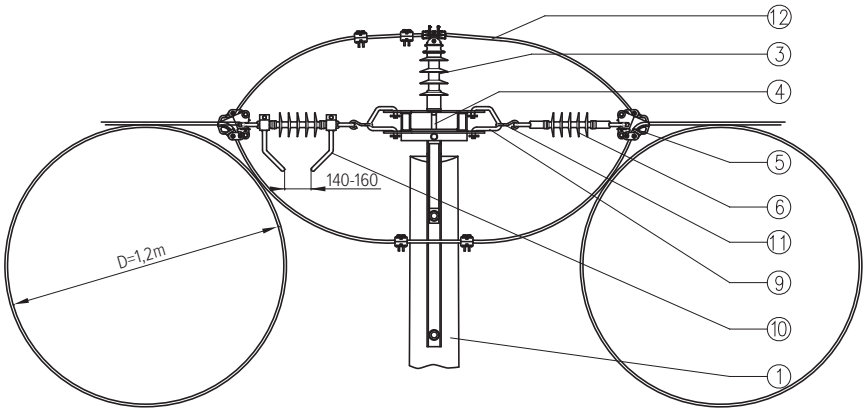
- *Specified cantilever load (SCL): **15 kN***
- *Ambient temperature range **T = -60 °C ... +85 °C***
- *Coating: **silicone LSR***
- *Silicone colour: **grey***
- *Material of top fitting: **PA6, UV stabilized***
- *Material of steel end fitting: **ST 52-3***
- *Layer of zinc: ≥ **70 µm***

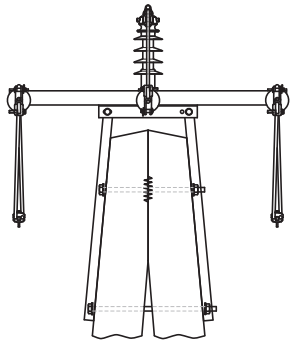
Competitive advantages

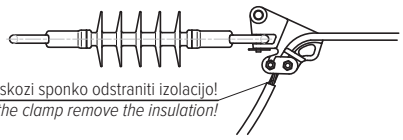
- *The safety of a built PL is distinguished by the system for safe installation using insulators with the mark »V«.*
- *It protects the poles from breaking when trees fall on conductors.*
- *The system is a result of professional research made by our researchers together with users and technical staff from Institute ElMV, Ljubljana.*

4.21 PKI varna montaža skozi gozd - primer

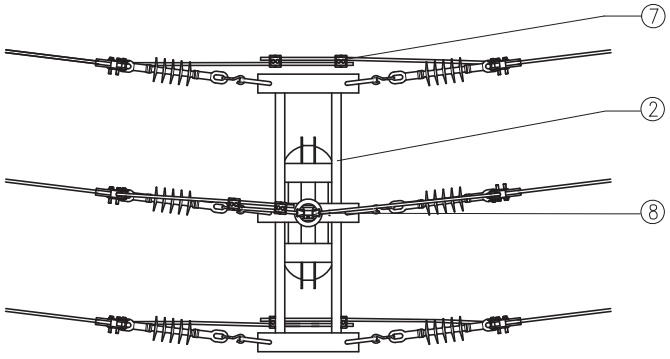
4.21 *PKI safe assembly through the woods - example*







Pri prehodu skozi sponko odstraniti izolacijo!
When cossing trough the clamp remove the insulation!



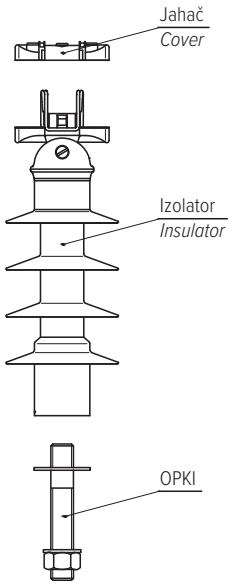
Poz	Naziv	Kos/*Pcs*	*Pos*	*Name*
1	Drog	1	*1*	*Pole*
2	Nosilna konzola - komplet	1	*2*	*Suspension crossarm brace - set*
3	Izolator PKI	1	*3*	*Insulator PKI*
4	Opornica OPKI	1	*4*	*Pin OPKI*
5	Sponka zatezna SZ-U	6	*5*	*Tension clamp SZ-U*
6	Natezni kompozitni izolator NKI	6	*6*	*Tension composite insulator NKI*
7	Sponka tokovna	3	*7*	*Current clamp*
8	Jahač	1	*8*	*Cover*
9	Streme OS 80	6	*9*	*Sshackle OS 80*
10	Rogljič NKI / Arcing horn NKI	6	*10*	*Arcing horn NKI*
11	Kljuka zasukana / Hook turned 90°	6	*11*	*Hook turned 90°*

4.22 A PKI izolatorji garniture

Opomba: na željo kupca izdelamo garniture po zahtevi.

4.22 A PKI insulator sets

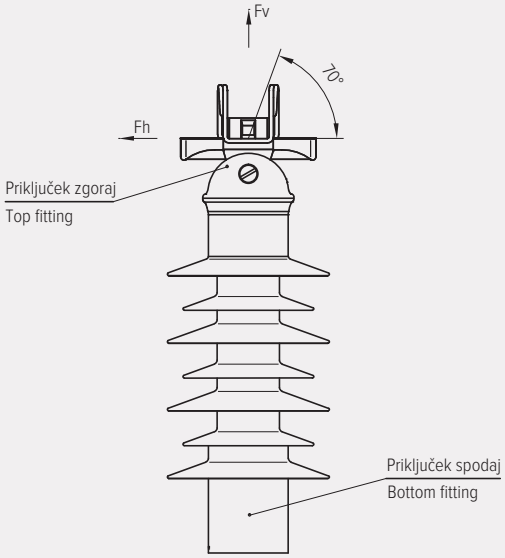
Note: we produce sets on customer's request.



Garnitura	Količina *Quatity*	Set
Izolator A PKI NS M24	1 kos/pcs	*Insulator A PKI NS M24*
+ Jahač 35-AlFe	1 kos/pcs	*+ Cover 35-AlFe*
+ OPKI M24/M24x120	1 kos/pcs	*+ OPKI M24/M24x120*
Izolator A PKI NS M24	1 kos/pcs	*Insulator A PKI NS M24*
+ Jahač 50-AlFe	1 kos/pcs	*+ Cover 50-AlFe*
+ OPKI M24/M24x120	1 kos/pcs	*+ OPKI M24/M24x120*
Izolator A PKI NS M24	1 kos/pcs	*Insulator A PKI NS M24*
+ Jahač 70-AlFe	1 kos/pcs	*+ Cover 70-AlFe*
+OPKI M24/M24X120	1 kos/pcs	*+ OPKI M24/M24x120*

4.23 A PKI izolatorji - primer naročila

4.23 A PKI insulators - order example



Naziv/*Name*: **PKI LS M24**

Razlaga naziva

A PKI, PKI	- Tip SN kompozitnega izolatorja
N, L, X	- Plazilna pot
S, O, H, D, Z, M, G, B	- Oblika priključka zgoraj
M24, M20	- Navoj priključka spodaj

Name explanation

A PKI, PKI	*- Type of MV composite insulator*
N, L, X	*- Creepage distance*
S, O, H, D, Z, M, G, B	*- Shape of top end fitting*
M24, M20	*- Connector thread on bottom end fitting*

Oznake na kompozitnem izolatorju

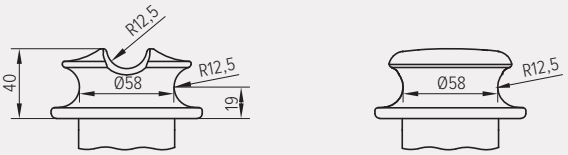
Izoelektro	- Proizvajalec
A PKI	- Tip SN kompozitnega izolatorja
4/17	- Mesec in leto proizvodnje
15 kN	- Nazivna upogibna sila (STL)

Marks on composite insulator

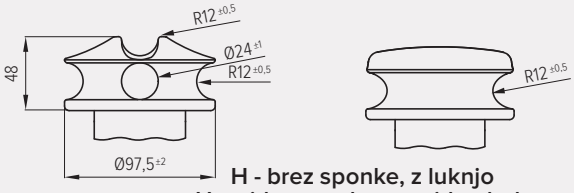
Izoelektro	*- Manufacturer*
A PKI	*- Type of MV composite insulator*
4/17	*- Month and year of production*
15 kN	*- Specified tensile load (STL)*

Priključki zgoraj

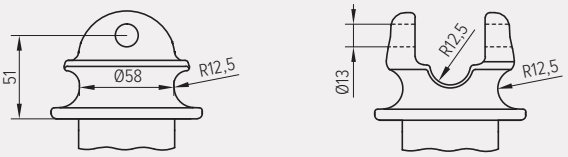
Top fittings



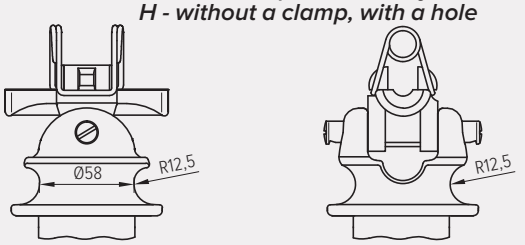
O - brez sponke
O - without a clamp



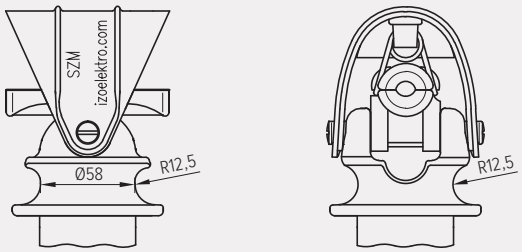
H - brez sponke, z luknjo
H - without a clamp, with a hole



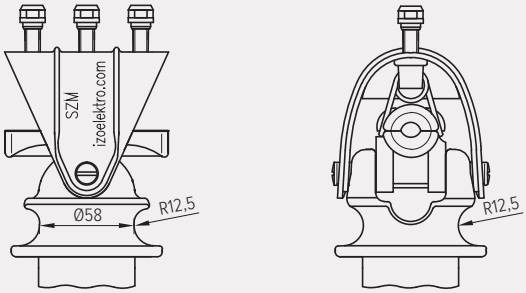
D - nastavek (PKI)
D - adapter (PKI)



S - sponka vzmetna (PKI)
S - spring clamp (PKI)

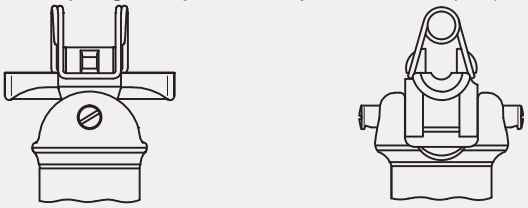


Z - sponka vzmetna s kapo (PKI)
Z - spring clamp with a cap (PKI)

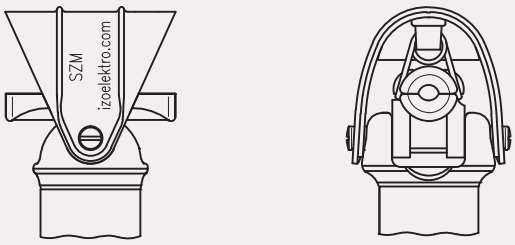


M - sponka vzmetna s kapo z vijaki (PKI)
M - spring clamp with a cap with screws (PKI)

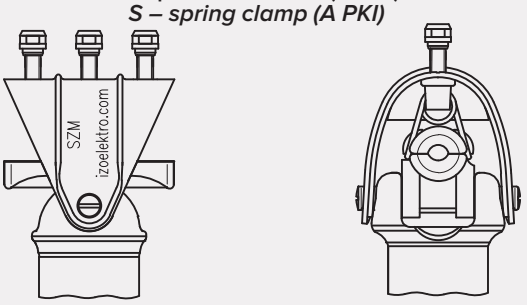
D - nastavek (A PKI)
D - adapter (A PKI)



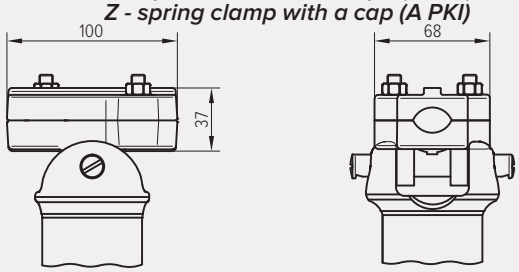
S - sponka vzmetna (A PKI)
S – spring clamp (A PKI)



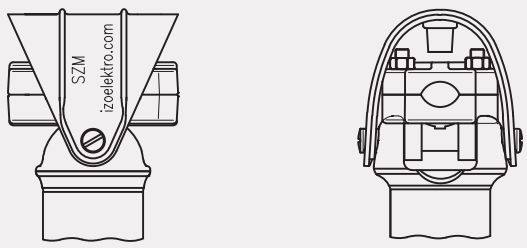
Z - sponka vzmetna s kapo (A PKI)
Z - spring clamp with a cap (A PKI)



M - sponka vzmetna s kapo z vijaki (A PKI)
M - spring clamp with a cap with screws (A PKI)



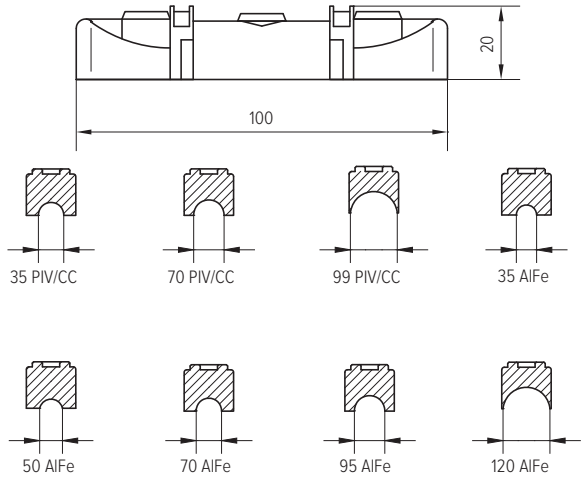
G - sponka vijačna (A PKI)
G - screw clamp (A PKI)



B - sponka vijačna s kapo (A PKI)
B - screw clamp with a cap (A PKI)

4.24 **PA jahači**

Uporaba: obvezno vgraditi pri A PKI in PKI izolatorjih "S", "Z" in "M"



*4.24 **PA covers***

Usage: required to install A PKI and PKI insulators "S", "Z" and "M"

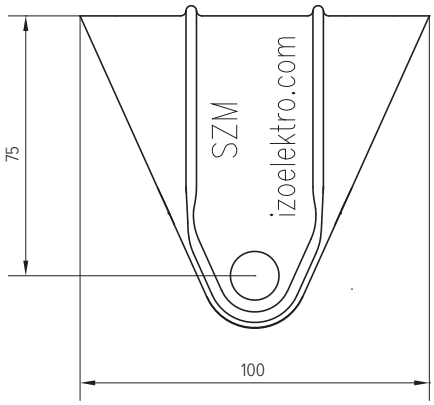
Naziv	*Name*	Koda *Code*	Premer vodnika *Conductor diameter*
Jahač 35 PIV	*Cover 35 CC*	**11 12 08**	9,5 – 11,5
Jahač 70 PIV	*Cover 70 CC*	**11 12 07**	11,5 – 14,5
Jahač 99 PIV	*Cover 99 CC*	**11 12 12**	17,5 – 19,0
Jahač 35 AlFe	*Cover 35 AlFe*	**11 12 09**	7,5 – 8,2
Jahač 50 AlFe	*Cover 50 AlFe*	**11 12 10**	8,2 – 9,5
Jahač 70 AlFe	*Cover 70 AlFe*	**11 12 08**	9,5 – 11,5
Jahač 95 AlFe	*Cover 95 AlFe*	**11 12 11**	11,5 – 14,5
Jahač 120 AlFe	*Cover 120 AlFe*	**11 12 12**	17,5 – 19,0

4.25 **PA kapa SZM/0**

Uporaba: nadgradnja za A PKI in PKI izolatorje "S"
Koda: **40 10 29**

*4.25 **PA cap SZM/0***

Usage: an upgrade for A PKI and PKI insulators "S"
*Code: **40 10 29***

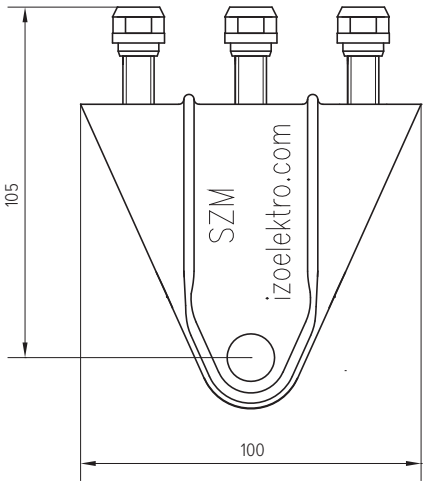


4.26 **PA kapa SZM/3**

Uporaba: pri montaži A PKI in PKI izolatorjev na strmini
*Koda: **40 10 31***

*4.26 **PA cap SZM/3***

Usage: at installation of A PKI and PKI insulators on a slope
*Code: **40 10 31***

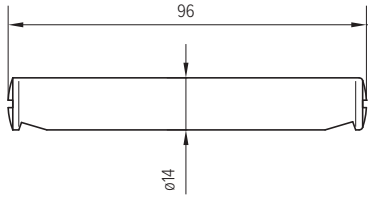


4.27 **PA sornik**

Uporaba: pri zamenjavi PA telesa sponke v glavi A PKI in PKI izolatorjev
Koda: **40 10 32**

*4.27 **PA bolt***

Usage: at the replacement of PA clamp in top fitting of A PKI and PKI insulators
*Code: **40 10 32***

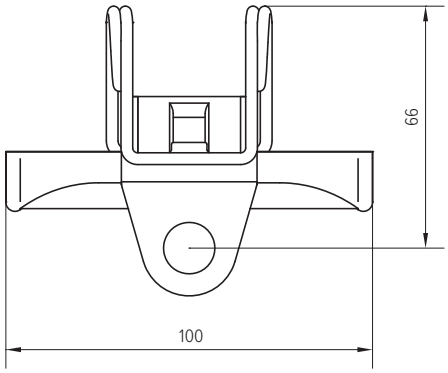


4.28 **PA telo sponke z vzmetjo**

Uporaba: v glavi A PKI in PKI izolatorjev “S“, “Z“ in “M“
Koda: **11 10 01**

*4.28 **PA body of spring clamp***

Usage: in top fitting of A PKI and PKI insulators “S“, “Z“ and “M“
*Code: **11 10 01***

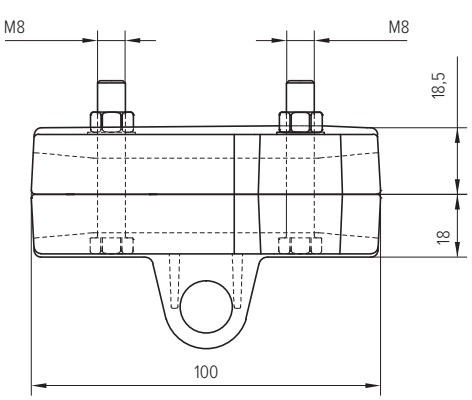


4.29 **PA sponka vijačna**

Uporaba: v glavi A PKI in PKI izolatorja »G«
Koda: **11 11 02**

*4.29 **PA screw clamp***

Usage: in top fitting of A PKI and PKI insulator »G«
*Code: **11 11 02***

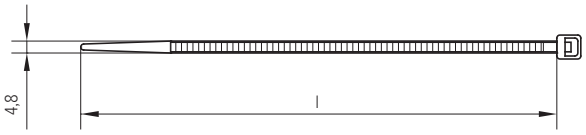


4.30 **PA vezica**

Uporaba: za pritrditev SN silikonskega plašča SILP 70/35
Koda: **40 10 36; l = 140 mm**
Koda: **40 10 39; l = 250 mm**

4.30 ***PA cable tie***

Usage: for affixing SN silicone coat SILP 70/35
Code: ***40 10 36; l = 140 mm***
Code: ***40 10 39; l = 250 mm***

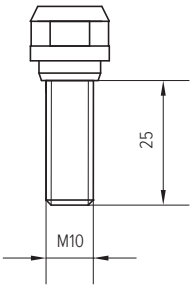


4.31 **PA vijak**

Uporaba: pri kapi SZM/
Koda: **40 10 38**

4.31 ***PA screw***

Usage: at cap SZM/3
Code: ***40 10 38***

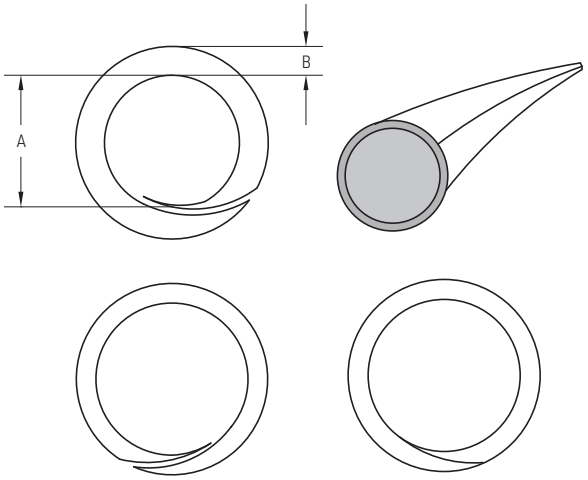


4.32 **SN silikonski plašč SILP**

Uporaba: pri zaščiti za ptice
Koda: **40 10 34**

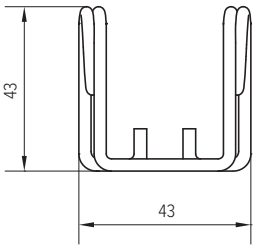
4.32 ***MV silicone coat SILP***

Usage: for birds' protection set
Code: ***40 10 34***



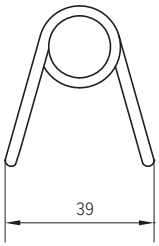
4.33 SN vzmet

Uporaba: pri PA telo sponke
Koda: **12 10 01**



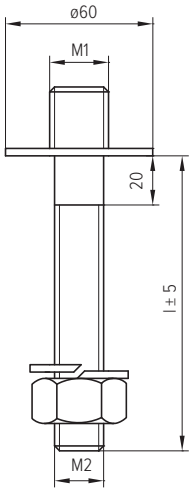
4.33 MV spring

Usage: for PA body of spring clamp
*Code: **12 10 01***



4.34 OPKI oporniki

Uporaba: za pritrditev A PKI in PKI izolatorja na konzolo
Opomba: obliko in dimenzije izdelamo na zahtevo kupca



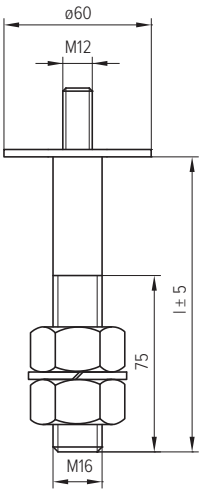
4.34 OPKI pins

Usage: for installing A PKI and PKI insulator on the bracket
Note: the shape and dimensions can be produced by customer request

Naziv *Name*	Koda *Code*	M1	M2	l (mm)
OPKI M20/M20x120	**10 00 461**	20	20	120
OPKI M20/M20x170	**10 00 462**	20	20	170
OPKI M24/M20x170	**10 00 467**	24	20	170
OPKI M24/M24x80	**10 00 459**	24	24	80
OPKI M24/M24x120	**10 00 463**	24	24	120
OPKI M24/M24x170	**10 00 464**	24	24	170

4.35 OPKIL opornik za ločilnik

Uporaba: za zamenjavo keramičnih izolatorjev s PKIL izolatorji na ločilnih stikalih
Koda: **10 00 469**



4.35 OPKIL pin for switch disconnector

Usage: for the replacement of ceramic insulators with PKIL insulators on disconnecting switches
*Code: **10 00 469***

Beležke

Notes

IZOELEKTRO

Naziv podjetja	**Izoelektro d.o.o., proizvodnja in trgovina**	*Name of company*
Skrajšan naziv	**Izoelektro d.o.o.**	*Shortened name*
Datum registracije	**25. 01. 1999**	*Date of registration*
Pravnoorganizacijska oblika	**Družba z omejeno odgovornostjo / *Limited liability company***	*Legal form*
Matična številka	**1366009**	*Registration number*
Davčna številka	**SI 56506635**	*VAT number*
TRR	**SI56 0451 5000 0204 790 Nova KBM d.d., Maribor**	*IBAN*
SWIFT koda	**KBMASI2X**	*SWIFT code*
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ISO 9001
Q-262

ISO 14001
E-238

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Legal disclaimer statement: Dimensions and weight of products that are listed in the catalogue may differ from actual due to the use of different materials. Drawings in catalogue are symbolic. In the case of printing errors the correct data is available by the manufacturer.

www.izoelektro.com