Katalog izdelkov
Product catalogue

06/2020

IZOELEKTRO

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 devet 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 izolacijskim zgornjim priključkom in inovativnim načinom pritrditve vodnika. Leta 2019 smo patentirali RAM-1 z digitalnim javljanjem uporovne komponente odvodnika prenapetosti v obratovanju.

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 Ø15 do Ø30. RAM-1 sistem za brezžični nadzor odvodnikov prenapetosti nad 1 kV.

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 pametnih srednjenapetostnih odvodnikov prenapetosti s silikonskim plaščem, kompozitnih podpornih izolatorjev z uporabo priključkov iz izolacijskega materiala in kompozitnih izolatorjev s kapacitivnim kazalnikom z daljinskim prikazovalnikom.

IZOELEKTRO - KORAK PRED ČASOM

Activity

General

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

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

Along with the supply of our own products we supply all the 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 us to perform most of the tests for medium voltage surge arresters according to the standard IEC 60099-4. For the purposes of development and production we can test insulators with operating voltage of up to 60 kV. We also perform tests for customers.

Certificates

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

Innovativeness

Our products incorporate nine patents which were developed by our own Research and Development Institute. Izoelektro was the first to develop, patent and, in 2004, begin sales of post composite insulators with insulated top fitting and an nnovative method for attachment of the wire conductor. In 2019 we patented the RAM-1 with digital reporting of the resistive component of surge arrester in operation.

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 top fitting with spring clamp for conductor wit cross sections Ø15 to Ø30. RAM-1 remote condition monitor for surge arresters above 1 kV.

Goals

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

Vision

Further development is focused on the production of smart 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 with a remote display.

IZOELEKTRO - AHEAD OF IT'S TIME

Kazalo

Index

1. NN odvodniki prenapetosti

1. *LV surge arresters*

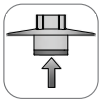
2. SN odvodniki prenapetosti

2. *MV surge arresters*

Kazalo

Index

Seznam ikon — List of icons

Hidrofobnost silikona		*Silicone hydrophobic*
Odporno na UV sevanje		*UV resistance*
Samočistilnost		*Self-cleaning*
IP zaščita		*IP protection*
Odklopna naprava		*Disconnecting Device*
Ozemljitveni vodnik H07V-K		*Earthing conductor H07V-K*
Kabelski čevelj		*Cable lug*
Votlica		*Terminal tube*
Varovalo		*Safety tie*
100% kontrola		*100% control*
Montaža: zgoraj		*Mounting: top*
Montaža: spodaj		*Mounting: bottom*
Izolacijski zgornji priključek		*Insulated top fitting*
Kratek čas dobave		*Short delivery time*
Narejeno v Sloveniji		*Made in Slovenia*
Proizvedeno po EU standardih		*Conformité Européenne*
Možnost reciklaže		*Recyclable*

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 (enota tehničnih risb)
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 po UL 94
W	– energijska absorpcija

List of abbreviations

µs	*– microsecond*
°C	*– degrees celsius*
AD	*– arcing distance*
AgL	*– fuse type*
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}	*– maximum 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 (unit of technical drawings)*
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 by UL 94*
W	*– energy absorption*

1

NN odvodniki prenapetosti
LV surge arresters

IZOELEKTRO

1.1 NNO in MOSIPO splošno

Proizvod

Nizko napetostni kovinsko oksidni odvodniki prenapetosti so namenjeni za vgradnjo v nizko napetostne prosto zračne vode ali razdelilne omarice do 1 kV kot prva stopnja zaščite pred direktnim udarom strele. Varistorji nizko napetostnih odvodnikov tipa NNO in MOSIPO so oplaščeni s silikonsko gumo, zaradi česar dosegajo izredno visoko stopnjo zaščite IP67.

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 po delovanju vidno loči povezavo med odvodnikom prenapetosti in ozemljitvijo.

Vgradnja

Mesto montaže odvodnikov prenapetosti tipa NNO in MOSIPO, določajo pravilniki in tehnični predpisi. Obvezno se vgradijo na:

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

Splošni podatki

- Napetostni nivoji: **275, 280, 360, 440, 690 V**
- Ozemljitveni vodnik: **H07V-K 6 mm² - črn**
- Temperaturno območje okolja: **T = -60 °C ... +85 °C**
- Stopnja zaščite: **IP 67**
- Odzivni čas: **tA < 25 ns**
- Plašč: **silikon LSR**
- Barva silikona: **NCS S 2502 - siva**
- IEC razred: **II**
- Testirani po standardu: **IEC 61643-1 in IEC 61643-11**

1.1 *NNO and MOSIPO generally*

Product

Low voltage metal oxide surge arresters with silicone coating are designed to be installed in low voltage power lines or in junction boxes up to 1 kV as the first level of protection against direct lightning strikes. Varistors of low voltage arresters type NNO and MOSIPO are coated with silicone rubber, so they have a high ingress protection level IP 67.

Characteristics

The disconnecting device reacts:

- *after a certain no. of strokes when in normal operation the current through the arrester increases over 1 mA,*
- *in case of atmospheric discharge (current bigger than 65 kA).*

After the disconnecting device has been actived, the surge arrester and earthing conductor are visibly separated. It is then necessary to replace the surge arrester.

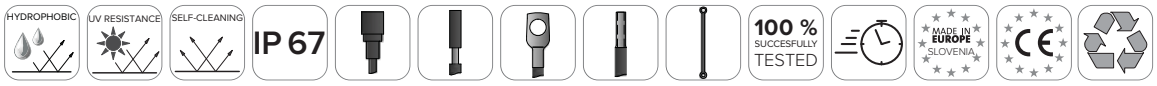
Installation

The position for installing type NNO and MOSIPO surge arresters is determined by directives and technical regulations. They must be installed:

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

General data

- *Voltage levels:* ***275, 280, 360, 440, 690 V***
- *Earthing conductor:* ***H07V-K 6 mm² - black***
- *Ambient temperature range:* ***T = -60 °C ... +85 °C***
- *Ingress protection level:* ***IP 67***
- *Response time:* ***tA < 25 ns***
- *Coat:* ***silicone LSR***
- *Silicone colour:* ***NCS S 2502 - grey***
- *IEC class:* ***II***
- *Tested according to standard:* ***IEC 61643-1 and IEC 61643-11***



Prednosti pred konkurenco

NNO in MOSIPO odvodniki prenapetosti imajo:

- stopnjo zaščite IP 67,
- ohišje iz silikonske gume,
- vedno integriran ozemljitveni vodnik,
- po delovanju odklopne naprave dobro vidno ločen ozemljitveni vodnik,

Na zahtevo kupca izdelamo odvodnike prenapetosti NNO in MOSIPO:

- brez ozemljitvenega vodnika,
- s poljubno dolžino, barvo in zakjučkom ozemljitvenega vodnika,
- kot tovarniški komplet po izbiri kupca.

Competitive advantages

NNO and MOSIPO surge arresters have:

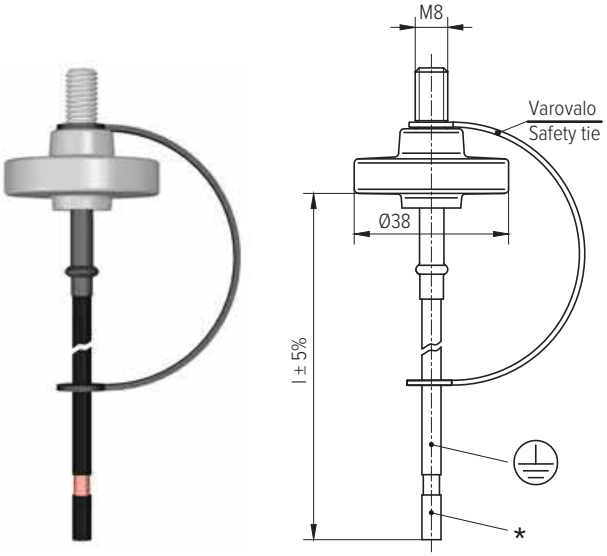
- *an ingress protection level IP 67,*
- *a housing made of silicone rubber,*
- *an always integrated earthing conductor,*
- *a well visible seperated conductor after operation of the disconnecting device,*

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

- *without earthing conductor,*
- *withanyearthingconductor,length,colour and end fitting,*
- *as a factory set by customer's demand.*

1.2 NNO

Na zahtevo kupca izdelamo NNO odvodnik s poljubno dolžino, barvo in zaključkom ozemljitvenega vodnika.



* Zaključki ozemljitvenega vodnika / ** End fittings of earthing conductor*

1.2 NNO

At the customer's request we produce NNO surge arrester with any earthing conductor length, colour and end fitting.

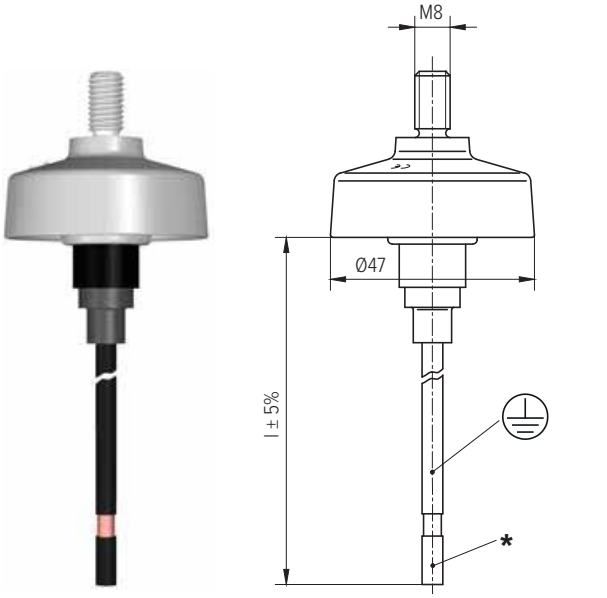
Splošni podatki / *General data*

- Napetostni nivoji / *Voltage levels*: **280, 440, 690 V**
- Ozemljitveni vodnik / *Earthing conductor:* **H07V-K 6 mm² - črn/*black***
- Temperaturno območje okolja / *Ambient temperature range*: **T = -60 °C ... +85 °C**
- Stopnja zaščite / *Ingress protection level*: **IP 67**
- Plašč / *Coat*: **silicone LSR**
- Barva silikona / *Silicone colour*: **NCS S 2502 - siva/grey**
- IEC razred / *IEC class*: **II**
- Testirani po standardu / *Tested according to standard*: **IEC 61643-11**

Naziv/*Name*	I_n [kA]	Uc (AC/DC) [V]	U_p [kV]	W [J]
NNO 5/280	5	280/350	1,00	2450
NNO 5/440	5	440/585	1,50	3200
NNO 10/280	10	280/350	1,20	2450
NNO 10/440	10	440/585	1,80	3200

1.3 MOSIPO

Na zahtevo kupca izdelamo NNO odvodnik s poljubno dolžino, barvo in zaključkom ozemljitvenega vodnika.



* Zaključki ozemljitvenega vodnika / ** End fittings of earthing conductor*

1.3 MOSIPO

At the customer's request we produce NNO surge arrester with any earthing conductor length, colour and end fitting.

Splošni podatki / *General data*

- Napetostni nivoji / *Voltage levels*: **275, 440, 690 V**
- Ozemljitveni vodnik / *Earthing conductor:* **H07V-K 6 mm² - črn/*black***
- Temperaturno območje okolja / *Ambient temperature range*: **T = -60 °C ... +85 °C**
- Stopnja zaščite / *Ingress protection level*: **IP 67**
- Plašč / *Coat*: **silicone LSR**
- Barva silikona / *Silicone colour*: **NCS S 2502 - siva/grey**
- IEC razred / *IEC class*: **II**
- Testirani po standardu / *Tested according to standard*: **IEC 61643-1, IEC 61643-11**

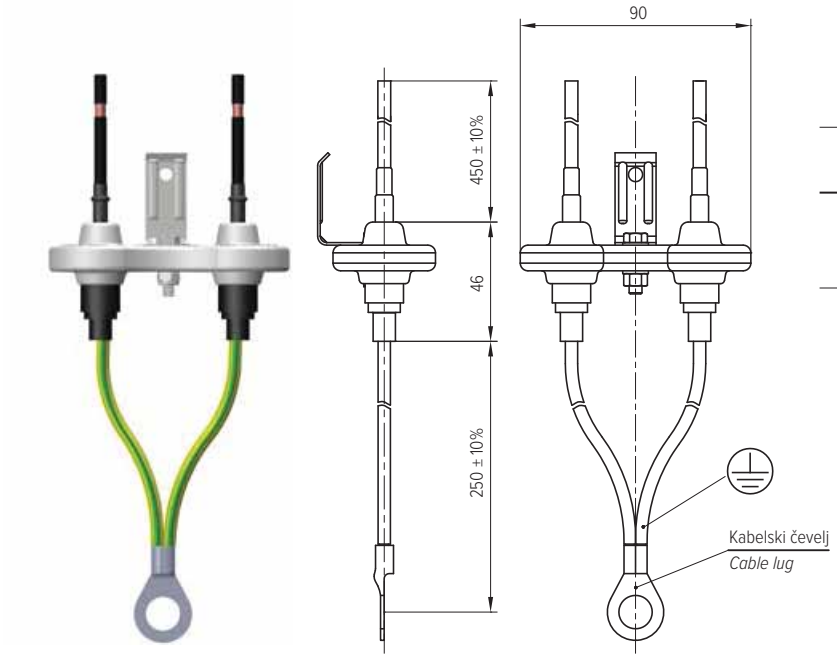
Naziv/*Name*	I_n [kA]	Uc (AC/DC) [V]	U_p [kV]	W [J]
MOSIPO 10/275	10	275/350	1,20	2450
MOSIPO 10/440	10	440/585	1,80	3200
MOSIPO 10/690	10	690/910	2,50	3960
MOSIPO 15/275	15	275/350	1,50	2450
MOSIPO 15/440	15	440/585	2,00	3200
MOSIPO 15/690	15	690/910	3,00	3960

1.4 NNO dvojni

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

1.4 NNO double

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



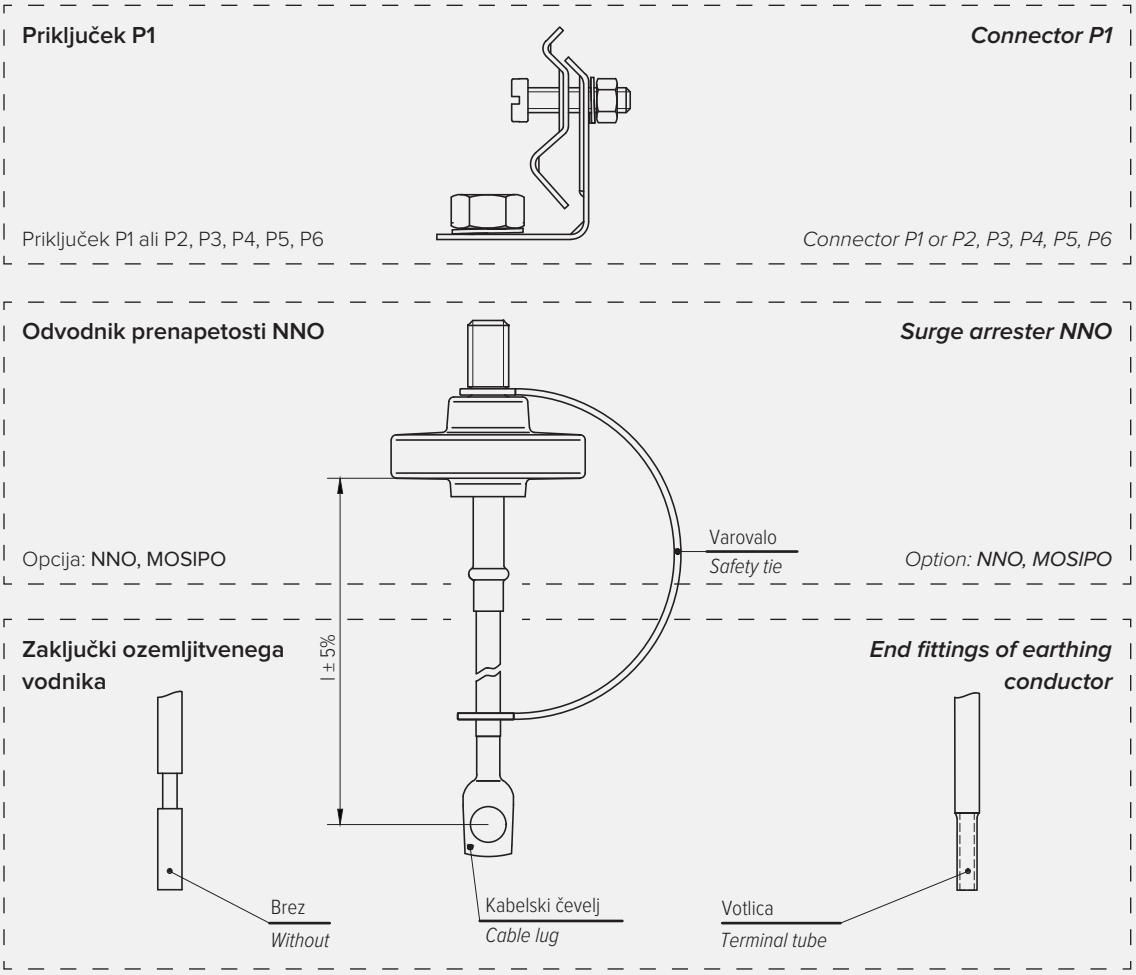
Naziv/*Name*	I_n [kA]	Uc (AC/DC) [V]	U_p [kV]	W [J]
NNO 15/275 x 2	15	275/350	1,50	2450
NNO 15/360 x 2	15	360/465	1,80	2450
NNO 15/440 x 2	15	440/585	2,00	3200

1.5 Najbolj uporabljene kode za naročilo

1.5 Most used codes for order

Koda/*Code*	Naziv/*Name*	I_n [kA]	U_c (AC/DC) [V]	U_p [kV]	W [J]	Masa/*Mass* [kg]	l [m]
20 50 10	NNO 5/280 - 0,5m	5	280/350	1,00	2450	0,0608	0,5
20 50 11	NNO 5/280 - 1,0m	5	280/350	1,00	2450	0,0967	1,0
20 50 20	NNO 5/440 - 0,5m	5	440/585	1,50	3200	0,0971	0,5
20 50 21	NNO 5/440 - 1,0m	5	440/585	1,50	3200	0,1037	1,0
20 60 50	NNO 10/280 - 0,5m	10	280/350	1,20	2450	0,0608	0,5
20 60 51	NNO 10/280 - 1,0m	10	280/350	1,20	2450	0,0967	1,0
20 60 60	NNO 10/440 - 0,5m	10	440/585	1,80	3200	0,097	0,5
20 60 61	NNO 10/440 - 1,0m	10	440/585	1,80	3200	0,1037	1,0
20 60 11	MOSIPO 10/275 - 0,5m	10	275/350	1,20	2450	0,0870	0,5
20 60 12	MOSIPO 10/275 - 1,0m	10	275/350	1,20	2450	0,1170	1,0
20 60 21	MOSIPO 10/440 - 0,5m	10	440/585	1,80	3200	0,0950	0,5
20 60 22	MOSIPO 10/440 - 1,0m	10	440/585	1,80	3200	0,1230	1,0
20 60 27	MOSIPO 10/690 - 0,5m	10	690/910	2,50	3960	0,1000	0,5
20 60 32	MOSIPO 10/690 - 1,0m	10	690/910	2,50	3960	0,3000	1,0
20 66 10	MOSIPO 15/275 - 0,5m	15	275/350	1,50	2450	0,0870	0,5
20 66 11	MOSIPO 15/275 - 1,0m	15	275/350	1,50	2450	0,1170	1,0
20 66 20	MOSIPO 15/440 - 0,5m	15	440/585	2,00	3200	0,0950	0,5
20 66 21	MOSIPO 15/440 - 1,0m	15	440/585	2,00	3200	0,1230	1,0
22 66 27	MOSIPO 15/690 - 0,5m	15	690/910	3,00	3960	0,1000	0,5
22 66 32	MOSIPO 15/690 - 1,0m	15	690/910	3,00	3960	0,3000	1,0

1.6 NNO - primer naročila / *1.6 NNO - 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

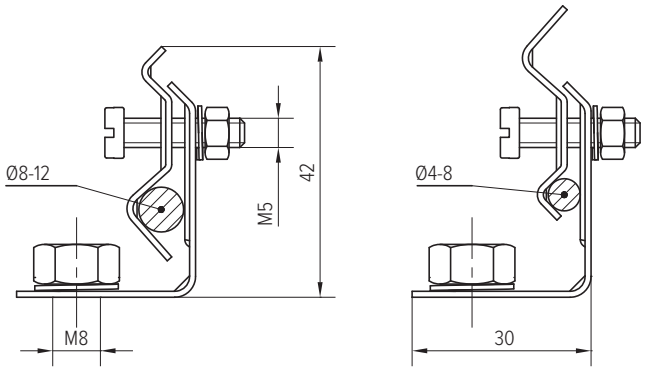
NNO	- Tip NN odvodnika
10	- Nazivni odvodni tok In (kA)
440	- Trajna obratovalna napetost (V)
1,0	- Dolžina ozemljitvenega vodnika l (m)
KČ 6/8	- Oznaka zaključka ozemljitvenega vodnika
P1	- Priključek

Name explanation

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

1.7 Priključek P1

Namen: priključek za goli vodnik ø4-12
Moment M8: 5 Nm
Moment M5: 6 Nm
Koda: **20 66 01**

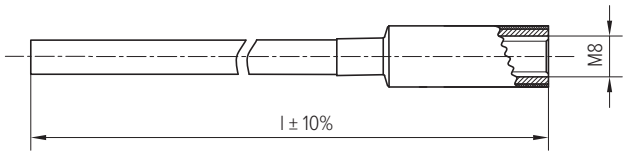


1.7 Connector P1

Purpose: connector for bare conductor ø4-12
Torque M8: 5 Nm
Torque M5: 6 Nm
*Code: **20 66 01***

1.8 Priključek P2

Namen: priključek za izoliran vodnik
Moment M8: 5 Nm - zategniti z roko
- 0,5 m; koda: **20 66 02**
- 1,0 m; koda: **20 66 05**
Opomba: dolžina priključka P2 po izbiri

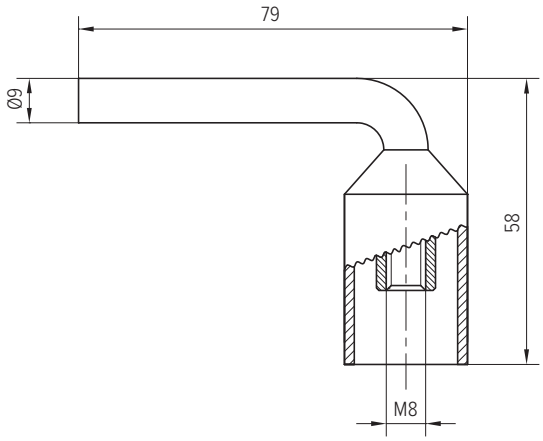


1.8 Connector P2

Purpose: connector for covered conductor
Torque M8: 5 Nm - tighten by hand
*- 0,5 m; code: **20 66 02***
*- 1,0 m; code: **20 66 05***
Note: length of connector P2 by choice

1.9 Priključek P3

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

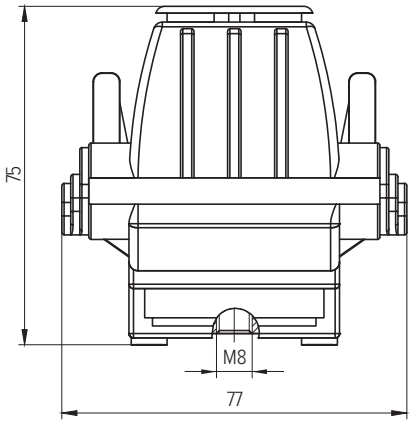


1.9 Connector P3

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

1.10 Priključek P4

Namen: priključek za izoliran vodnik ø16-95
Moment M8: 5 Nm - zategniti z roko
Koda: **20 66 57**

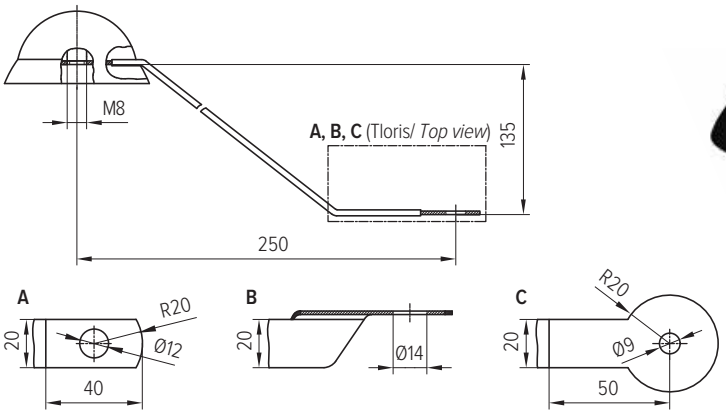


1.10 Connector P4

Purpose: connector for covered conductor ø16-95
Torque M8: 5 Nm - tighten by hand
*Code: **20 66 57***

1.11 Priključek P5

Namen: izolacijski priključek
- raven (A), koda: **20 66 04**
- 90° (B), koda: **20 66 09**
- okrogel (C), koda: **20 66 66**

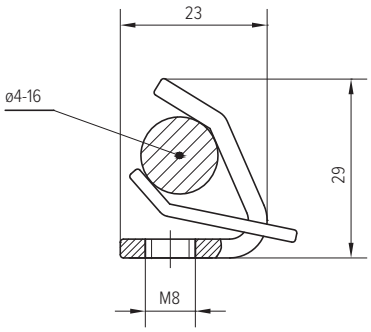


1.11 Connector P5

Purpose: insulated connector
*- flat (A), code: **20 66 04***
*- 90° (B), code: **20 66 09***
*- round (C), code: **20 66 66***

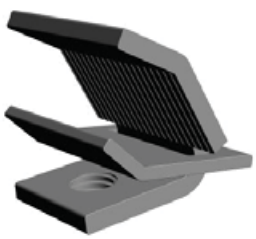
1.12 Priključek P6

Namen: priključek za goli vodnik ø4-16
Moment M8: 5 Nm - zategniti z roko
Koda: **20 66 08**



1.12 Connector P6

Purpose: connector for bare conductor ø4-16
Torque M8: 5 Nm - tighten by hand
*Code: **20 66 08***



1.13 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
- Presek priključnega vodnika:
  - enožilni 35 mm^2
  - večžilni 25 mm^2
- IEC razred: **I, II**
- Testirani po standardu: **IEC 61643-11**

1.13 *TY1 and TY1-F generally*

Product

TY1 are metal oxide surge arresters in a modular housing. TY1-F are compact metal oxide surge arresters with an 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 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 turns red. In this case it is necessary to replace the TY1 module or in case of TY1-F the 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*
- *Cross-section of connection conductor:*
  - *single-strand 35 mm^2*
  - *multi-strand 25 mm^2*
- *IEC class: **I, II***
- *Tested according to standard: **IEC 61643-11***




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:

- ugodno ceno,
- modularno ohišje,
- zanesljivo delovanje.

Competitive advantages

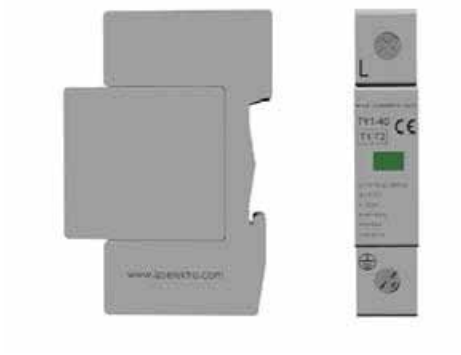
TY1-F surge arresters for indoor installation have an integrated backup fuse. Therefore the installation of a backup fuse (if main > 100 A) 100 AgL is not necessary.

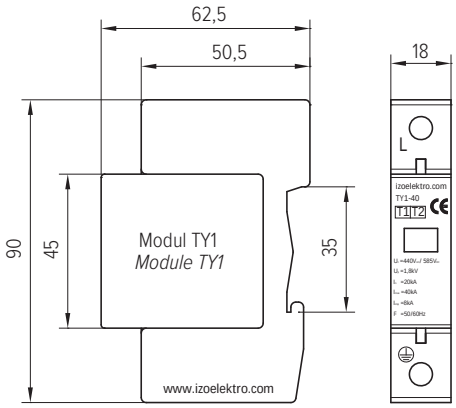
TY1 and TY1-F surge arresters for indoor installation have:

- *a favourable price,*
- *a modular housing,*
- *reliable performance.*

1.14 TY1 enopolni

1.14 TY1 single pole

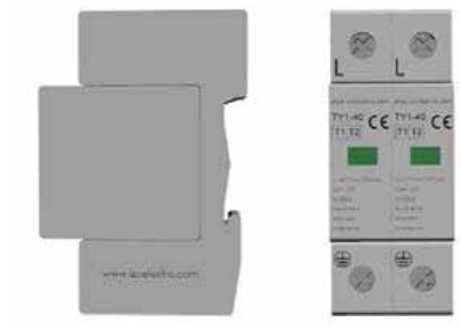


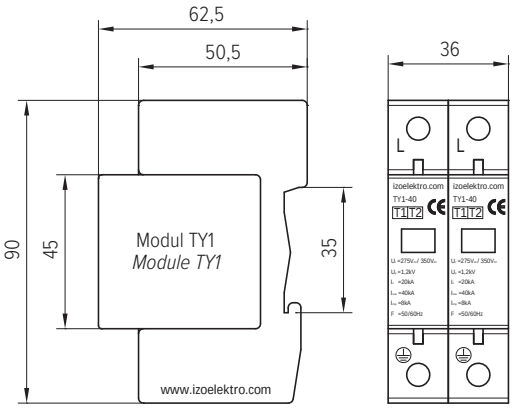


Naziv kompleta Set name	Modul TY1 *TY1 module*	U_c (V)	I_n (kA)	I_{imp} (kA)	I_{max} (kA)	U_p (kV)
TY1-1-275-40	M1-275-40	275	20	8	40	< 1,2
TY1-1-320-40	M1-320-40	320	20	8	40	< 1,5
TY1-1-385-40	M1-385-40	385	20	8	40	< 1,8
TY1-1-440-40	M1-440-40	440	20	8	40	< 1,8
TY1-1-275-60	M1-275-60	275	30	12,5	60	< 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

1.15 TY1 dvopolni

1.15 TY1 double pole

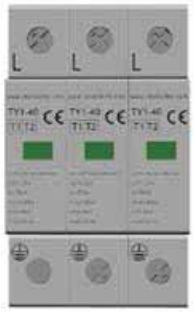


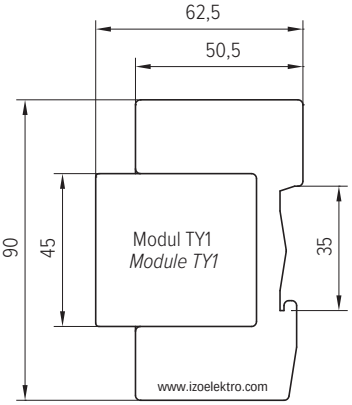


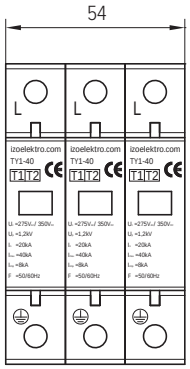
Naziv kompleta Set name	Modul TY1 *TY1 module*	U_c (V)	I_n (kA)	I_{imp} (kA)	I_{max} (kA)	U_p (kV)
TY1-2-275-40	M2-275-40	275	20	8	40	< 1,2
TY1-2-320-40	M2-320-40	320	20	8	40	< 1,5
TY1-2-385-40	M2-385-40	385	20	8	40	< 1,8
TY1-2-440-40	M2-440-40	440	20	8	40	< 1,8
TY1-2-275-60	M2-275-60	275	30	12,5	60	< 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

1.16 TY1 tripolni

1.16 TY1 triple pole



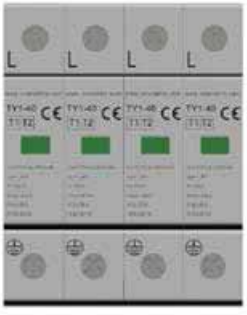


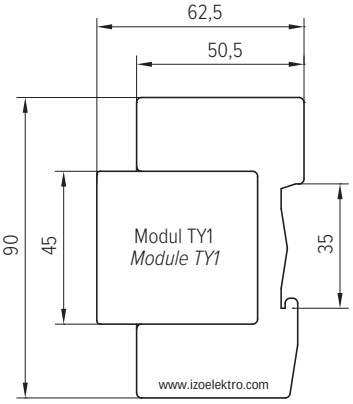


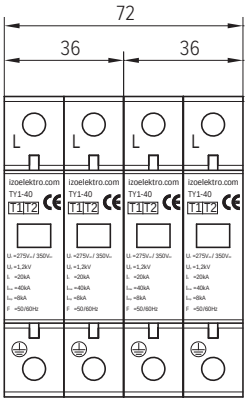
Naziv kompleta Set name	Modul TY1 *TY1 module*	U_c (V)	I_n (kA)	I_{imp} (kA)	I_{max} (kA)	U_p (kV)
TY1-3-275-40	M3-275-40	275	20	8	40	< 1,2
TY1-3-320-40	M3-320-40	320	20	8	40	< 1,5
TY1-3-385-40	M3-385-40	385	20	8	40	< 1,8
TY1-3-440-40	M3-440-40	440	20	8	40	< 1,8
TY1-3-275-60	M3-275-60	275	30	12,5	60	< 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

1.17 TY1 štiripolni

1.17 TY1 quadruple pole



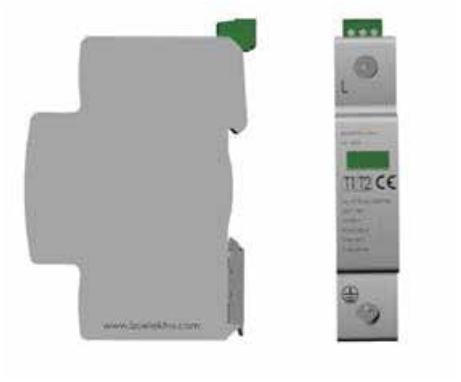


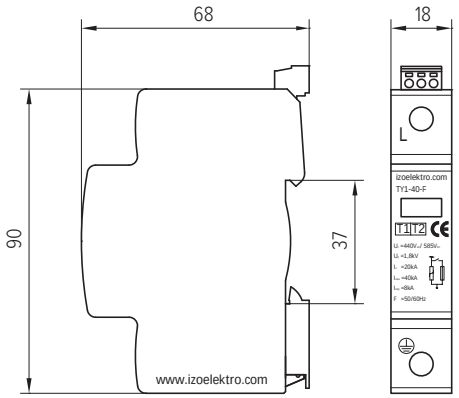


Naziv kompleta Set name	Modul TY1 *TY1 module*	U_c (V)	I_n (kA)	I_{imp} (kA)	I_{max} (kA)	U_p (kV)
TY1-4-275-40	M4-275-40	275	20	8	40	< 1,2
TY1-4-320-40	M4-320-40	320	20	8	40	< 1,5
TY1-4-385-40	M4-385-40	385	20	8	40	< 1,8
TY1-4-440-40	M4-440-40	440	20	8	40	< 1,8
TY1-4-275-60	M4-275-60	275	30	12,5	60	< 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

1.18 TY1-F enopolni

1.18 TY1-F single pole





Naziv kompleta Set name	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

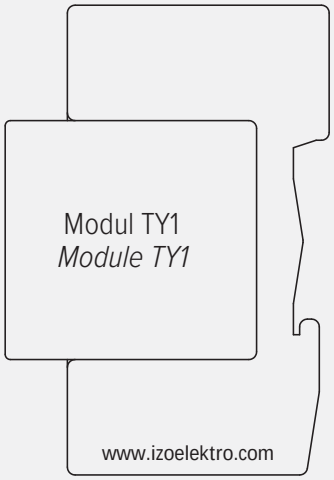
1.19 Najbolj uporabljene kode za naročilo TY1

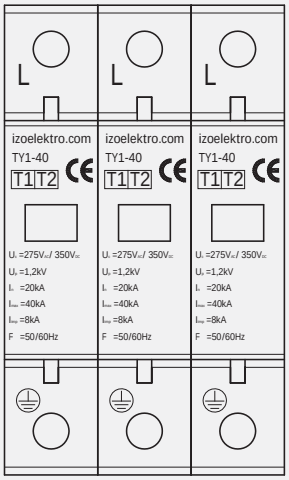
1.19 Most used codes for order TY1

Koda/*Code*	Naziv/*Name*	I_n (kA)	U_c (V)	I_{imp} (kA)	I_{max} (kA)	Masa/*Mass* (kg)	U_p (kV)	Št. polov/ *No. of poles*
20 70 01	TY1-1-275-40	20	275	8	40	0,126	<1,2	1
20 70 04	TY1-1-440-40	20	440	8	40	0,129	<1,8	1
20 70 05	TY1-2-275-40	20	275	8	40	0,260	<1,2	2
20 70 08	TY1-2-440-40	20	440	8	40	0,266	<1,8	2
20 70 09	TY1-3-275-40	20	275	8	40	0,362	<1,2	3
20 70 12	TY1-3-440-40	20	440	8	40	0,390	<1,8	3
20 70 13	TY1-4-275-40	20	275	8	40	0,520	<1,2	4
20 70 05	TY1-4-440-40	20	440	8	40	0,540	<1,8	4

1.20 TY1 in TY1-F - primer naročila

1.20 *TY1 and TY1-F - order example*





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

Razlaga naziva

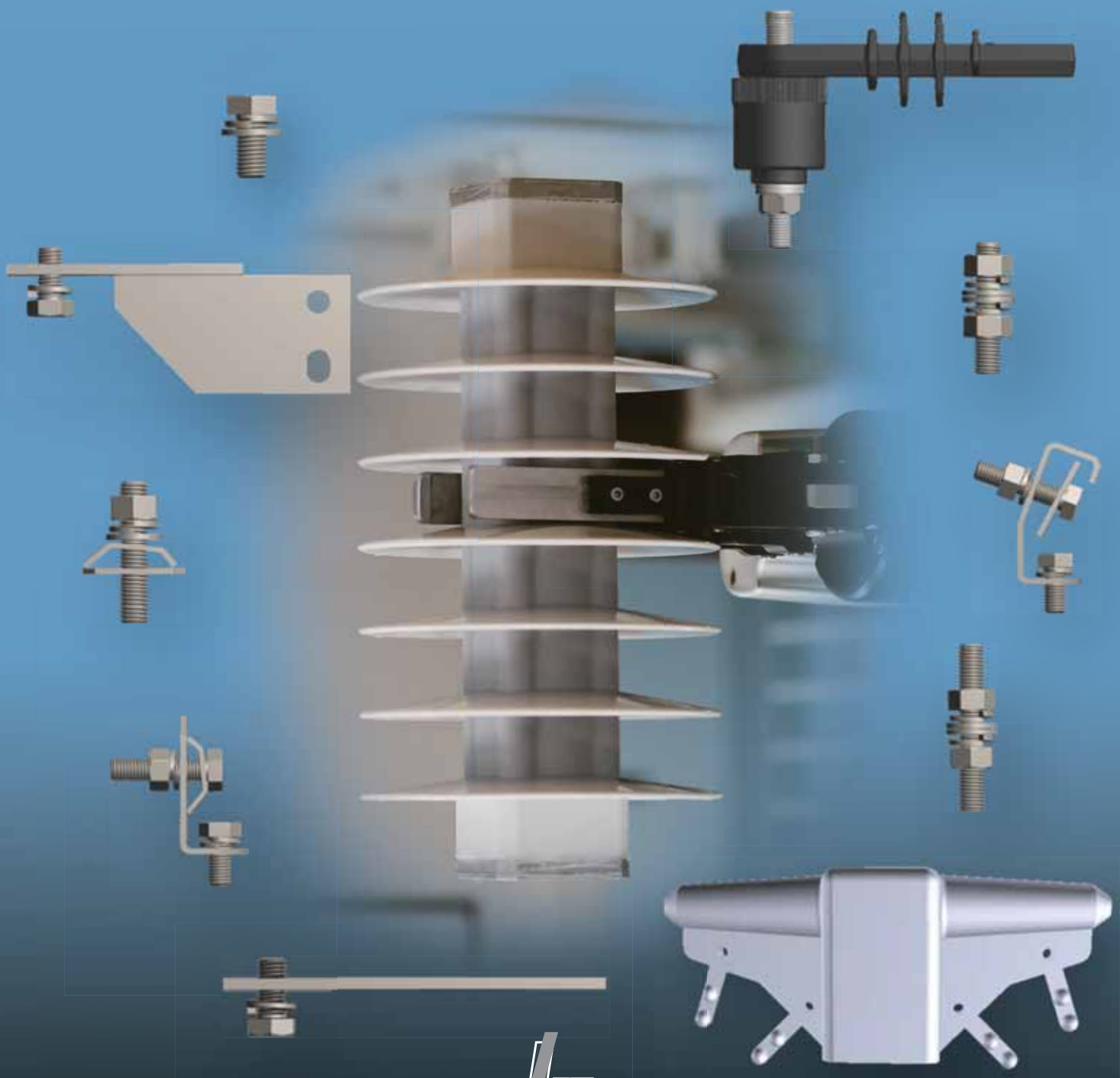
TY1 - Tip NN odvodnika
3 - Število polov
275 - Trajna obratovalna napetost U_c (V)
40 - Maksimalni odvodni tok I_{max} (kA)

Name explanation

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

SN odvodniki prenapetosti
MV surge arresters

2



IZOELEKTRO

2.1 SNO in 2SS15N splošno

Proizvod

SNO in 2SS15N so tipi srednjenapetostnih 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
Standard	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:

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

Installation

The position for installing SNO and 2SS15N surge arresters is determinated 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,*
- *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*
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 U_c od 1 do 44 kV,
- z neizbrisljivo številko meritve na vsakem odvodniku.

Competitive advantages

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

- *a certificate from an accredited laboratory,*
- *varistors directly enclosed 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 monitors.*

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

- *as a factory set per buyer's choice,*
- *with continuous operating voltage U_c from 1 to 44kV,*
- *with an indelible measurement number on each arrester.*

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.

Diagram karakteristik za tip 2SS15N

2.2.1 Calculation

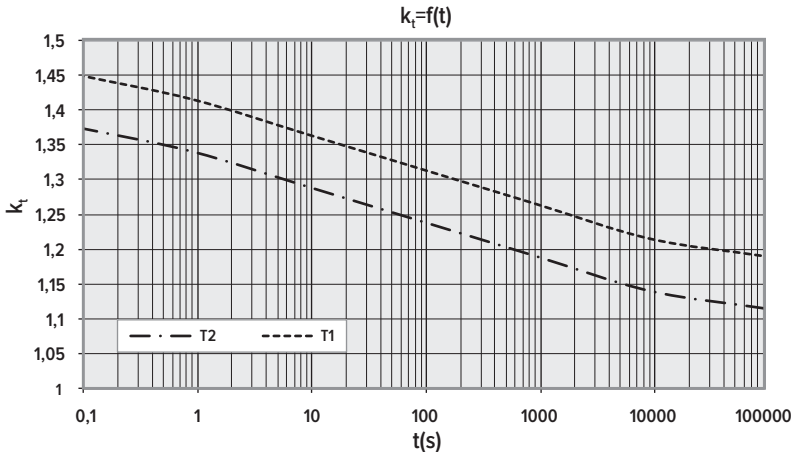
Data of electric network

- *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 continious operating voltage for temporary over voltage duration time.*

Characteristics diagram 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 kA, 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 continuous 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:

- l_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:

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

Praviloma naj bo odvodnik prenapetosti priključen čim bliže ščiteni napravi.

2.3 *Determination of the shielding distance*

Data of electric network

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

The next data is necessary for the calculations:

- l_z – *shielding distance of the surge arrester*
- U_z – *the allowed trigger voltage of insulating equipment.*
- U_{res} – *the maximum value of residual 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 strike*
  S = 1550 kV/µs – wooden poles
  S = 800 kV/µs – earthed brackets

Calculation

Simplified formula for calculating the shielding distance:

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

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

2.4 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_{sc})	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

2.4 *Parameters for type 2SS15N - class 1*

Arrester class	*1*
Arrester type	*2SS15N*
Commercial designation	*R, RP, RO, NO*
Continuous 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_{sc})	*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 / 2.5.1 Calculation

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

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

Podatki odvodnikov SNO

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

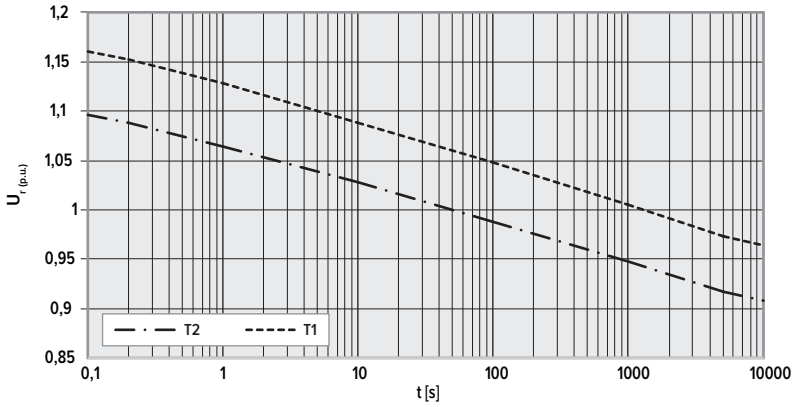
Data for surge arresters types SNO

- *k_0 = 0,8*
- *k_t = factor of rated 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 / 2.5.2 Selection

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.

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:

- l_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:

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

Praviloma naj bo odvodnik prenapetosti priključen čim bliže ščiteni napravi.

2.6 *Determination of the shielding distance*

Data of electric network

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

The following data is necessary for the calculations:

- l_z – *shielding distance of the surge arrester*
- U_z – *the allowed trigger voltage of insulating equipment.*
- U_{res} – *the maximum value of residual 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 strike*
  S = 1550 kV/µs – wooden poles
  S = 800 kV/µs – earthed brackets

Calculation

Simplified formula for calculating the shielding distance:

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

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

2.7 Parametri za tip SNO - razred DH

Razred odvodnika	DH
Tip prenapetostnega odvodnika	SNO
Komercialna oznaka oblike	RP
Trajna obratovalna napetost U_c	3 – 44 kV
Nazivna napetost U_r	4 – 55 kV
Nazivni odvodni tok I_n (8/20µs)	10 kA
Visok impulzni tok (4/10µs)	100 kA
Zdržni kratkostični tok (I_{sc})	20 kA
Sposobnost prenosa termičnega naboja (Q_{th})	1,1 C
Sposobnost prenosa ponavljajočega naboja (Q_{rs})	0,4 C
Upogibni moment pri U_r= 55 kV (M_u)	238 Nm
Vertikalna sila (F_v)	800 N
Torzijski moment pri Ur= 55 kV (M_t)	50 Nm

2.7 *Parameters for type SNO - class DH*

Arrester class	*DH*
Arrester type	*SNO*
Commercial designation	*RP*
Continuous operating voltage U_c	*3 – 44 kV*
Rated voltage U_r	*4 – 55 kV*
Nominal discharge current I_n (8/20µs)	*10 kA*
High impulse current (4/10µs)	*100 kA*
Short circuit current (I_{sc})	*20 kA*
Thermal charge transfer rating (Q_{th})	*1,1 C*
Repetitive charge transfer rating (Q_{rs})	*0,4 C*
Cantilever strenght at Ur=55 kV (M_u)	*238 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 IEC 60099-4:2014 (Ed.3.0)

2.8 *The Comparison of energy absorption 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 from 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.*

Tabela 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 1

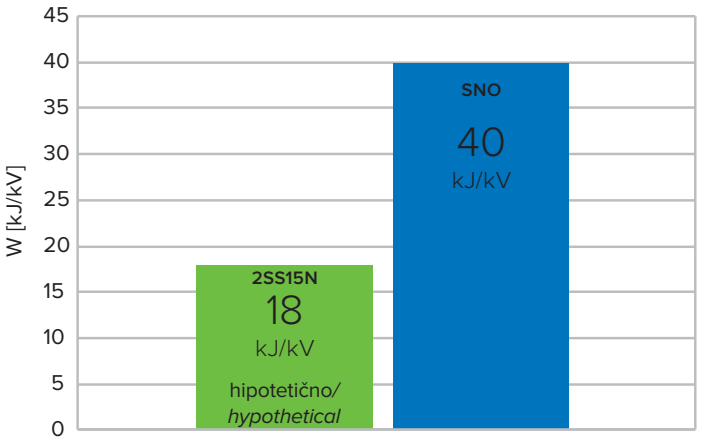
Na podlagi primerjalne tabele L.3 je v primerjalnem diagramu 1 izrisana grafična ponazoritev celotnega testa hipotetične absorbcije energije odvodnika prenapetosti za razred 1 in dejanske testne absorbcije energije za razred DH. Po novem standardu bi odvodnik prenapetosti razreda 1 po izračunu moral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

Interpretation of the comparative diagram 1

Based on the comparison table L.3 a comparative diagram 1 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 1
Energijska absorbcija

Comparative diagram 1
Energy absorption



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.

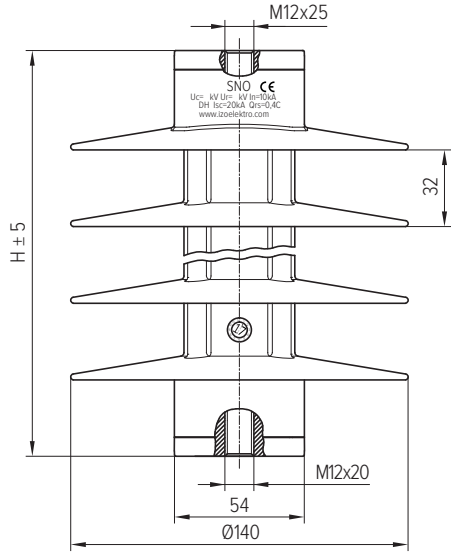
Abstract

The Class DH surge arresters type SNO are capable to absorb and dissipate 122 % more energy than 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 12 kV
Koda/*Code*: 12 20 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	N
			1/2,5µs	8/20µs	8/20µs	8/20µs	1,2/50µs	50 Hz,								
Koda			10 kA	5 kA	10 kA	100 A		1 min								
Code	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[N]	[N]	[mm]	[mm]	[mm]	[mm]	[mm]	
10 40 00	3,2	4,0	10,31	9,12	9,84	7,35	90	35	1800	1437	154	343	80	100	136	3
10 60 00	6,4	8,0	20,62	18,24	19,68	14,70							100	120		
10 80 00	7,6	9,5	24,49	21,67	23,38	17,64							120	140		
11 00 00	10,8	13,5	34,80	30,79	33,22	24,99	105	40	1454	1163	186	453	140	160	168	4
11 20 00	12,0	15,0	38,67	34,22	36,93	27,93							160	180		
11 40 00	14,0	17,5	45,11	39,91	43,04	32,34	120	45	1220	975	218	563	180	200	200	5
11 60 00	16,0	20,0	51,55	43,34	46,76	36,75	130	50	1052	841	250	674	200	220	232	6
12 00 00	20,4	25,5	65,73	55,89	60,30	47,04	140	65	929	742	282	784	240	260	263	7
12 20 00	22,0	27,5	70,90	62,75	67,70	51,45							240	260		
12 40 00	24,0	30,0	77,34	68,44	73,86	55,86							300	320		
12 60 00	26,0	32,5	83,78	74,13	79,98	63,21	150	75	828	662	314	894	320	340	295	8
12 80 00	28,0	35,0	90,22	79,82	86,12	64,68	160	80	747	597	345	1004	340	360	327	9
13 20 00	32,8	41,0	105,70	92,45	100,32	76,44							380	400		
13 40 00	34,0	42,5	109,57	96,97	104,62	79,38							400	420		
13 60 00	36,0	45,0	116,01	102,68	110,78	83,79	170	85	680	544	377	1114	420	440	359	10
13 80 00	38,0	47,5	122,45	108,38	116,93	88,20	180	90	625	500	409	1234	440	460	391	11
14 00 00	40,4	50,5	130,19	115,23	124,32	94,08							450	470		
14 40 00	44,0	55,0	141,80	125,50	135,40	102,90							470	490		

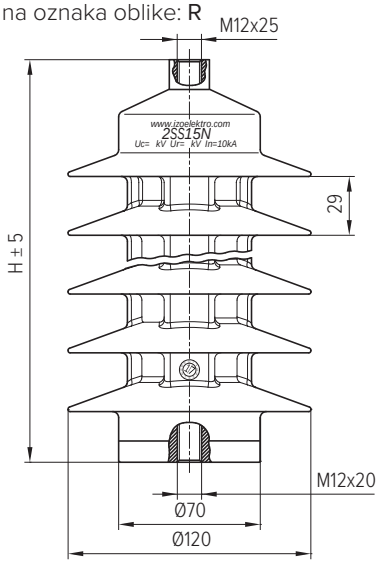
U_c	Trajna obratovalna napetost
U_r	Nazivna napetost
U_{res}	Preostala napetost pri različnih tokovnih impulzih
U_{peak}	Atmosferska udarna napetost 1,2/50µs v suhem
U_{rms}	Izmenična vzdržna napetost 50 Hz v mokrem, 1min
SSL	Specifična kratkotrajna obremenitev
SLL	Specifična dolgotrajna obremenitev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

U_c	*Continuous operating voltage*
U_r	*Rated voltage*
U_{res}	*Residual voltages at different impulse currents*
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*
N	*Number of sheds*

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	N
Koda			1/20µs 5 kA	1/20µs 10 kA	8/20µs 5 kA	8/20µs 10 kA	8/20µs 20 kA	30/60µs 125 A	30/60µs 500 A	1,2/50µs	50 Hz, 1 min						
Code	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[mm]	[mm]	[mm]	[mm	[mm]	
21 48 01	3	3,75	8,55	9,65	7,18	8,78	9,60	7,35	7,85					60	90		
21 48 02	4	5,00	12,8	14,20	11,25	12,92	14,15	9,63	10,16	62	25	139	360	80	100	147	3
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					120	140		
21 48 05	10	12,50	34,15	38,05	29,00	34,62	37,90	26,61	28,17	98	35	185	520	140	160	193	5
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					180	200		
21 48 08	16	20,00	51,20	56,80	44,10	51,68	56,60	38,52	40,64	125	55	235	600	200	220	243	6
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					240	260		
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	135	60	262	680	270	300	270	7
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	66,15	75,95	84,90	57,78	60,96					320	320		
21 48 14	26	32,50	85,35	94,85	77,20	84,76	94,50	65,13	68,81	150	65	309	760	340	340	317	8
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					295	380		
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	170	70	362	1000	410	430	370	11
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					400	420		
21 48 19	36	45,00	115,20	127,80	99,10	114,10	127,35	86,67	91,44	180	75	396	1080	420	440	404	12
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
N	Število reber

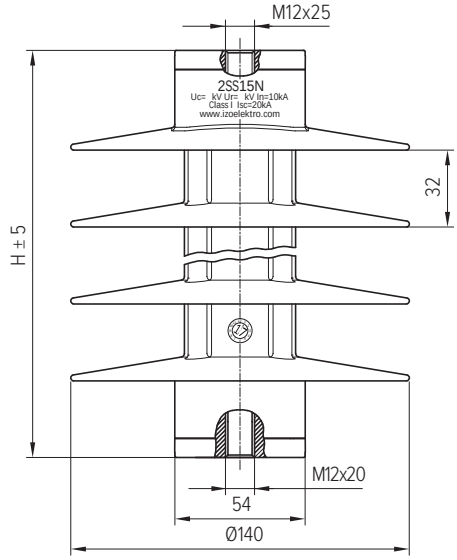
U_c	*Continuous operating voltage*
U_r	*Rated voltage*
U_{res}	*Residual voltages at different impulse currents*
U_{peak}	*Lightning impulse withstand voltage 1,2/50µs in dry*
U_{rms}	*Power frequency withstand voltage 1 min. 50Hz, wet*
AD	*Arcing distance*
CD	*Creepage distance*
A	*Minimum distance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

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

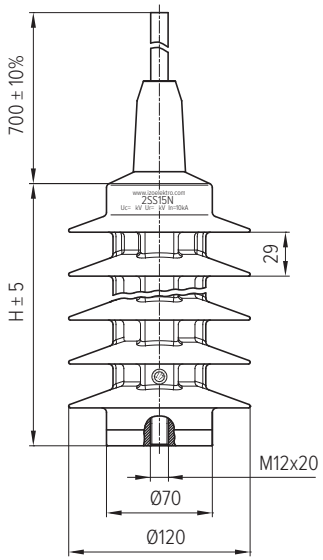
	ELEKTRIČNE KARAKTERISTIKE / *ELECTRICAL CHARACTERISTICS*											MEHANSKE KARAKTERISTIKE / *MEHANICAL CHARACTERISTICS*					
	U_c	U_r	U_{res}							U_{peak}	U_{rms}	AD	CD	A	B	H	N
			1/20µs	1/20µs	8/20µs	8/20µs	8/20µs	30/60µs	30/60µs	1,2/50µs	50 Hz,						
Koda			5 kA	10 kA	5 kA	10 kA	100 A	125 A	500 A		1 min						
Code	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[mm]	[mm]	[mm]	[mm]	[mm]	
221 48 01	3	3,75	8,55	9,65	7,18	8,78	6,20	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	8,93	9,63	10,16					80	100		
221 48 03	6	7,50	21,35	23,85	17,95	21,70	15,12	16,98	18,01					100	120		
221 48 04	8	10,00	25,60	28,40	26,12	25,84	17,85	19,26	20,32					120	140		
221 48 05	10	12,50	34,15	38,05	29,00	34,62	24,05	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	26,78	28,89	30,48					160	180		
221 48 07	14	17,50	46,95	52,25	39,98	47,54	32,97	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	35,70	38,52	40,64					200	220		
221 48 09	18	22,50	59,75	66,45	51,26	60,46	41,90	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	44,63	48,15	50,80					240	260		
221 48 11	21	26,25	67,55	77,10	58,93	67,95	48,09	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	50,82	55,50	58,65					270	300		
221 48 13	24	30,00	76,80	85,20	66,15	75,98	53,55	57,78	60,96					300	320		
221 48 14	26	32,50	85,35	94,85	74,39	84,76	59,75	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	62,48	67,41	71,12					340	360		
221 48 16	30	37,50	98,15	109,05	84,90	96,99	68,67	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	71,40	77,04	81,28					380	400		
221 48 18	34	42,50	110,95	123,25	96,05	109,93	77,60	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	80,33	86,67	91,44					420	440		
221 48 20	38	47,50	120,35	130,33	106,25	123,66	86,52	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	89,25	95,50	100,75					450	470		
221 48 22	42	52,50	130,50	138,75	120,63	137,85	95,45	100,43	105,47					460	480		
221 48 23	44	55,00	136,75	143,25	127,55	142,68	98,18	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
N	Število reber

U_c	*Continuous operating voltage*
U_r	*Rated voltage*
U_{res}	*Residual voltages at different impulse currents*
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*
N	*Number of sheds*

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

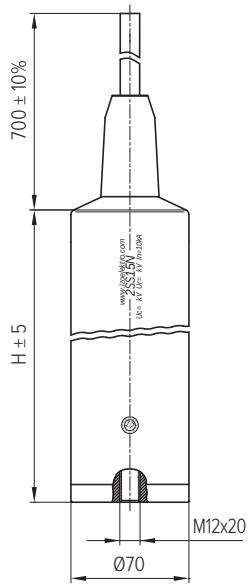
	ELEKTRIČNE KARAKTERISTIKE / *ELECTRICAL CHARACTERISTICS*											MEHANSKE KARAKTERISTIKE / *MEHANICAL CHARACTERISTICS*					
	U_c	U_r	U_{res}							U_{peak}	U_{rms}	AD	CD	A	B	H	N
			1/20µs	1/20µs	8/20µs	8/20µs	8/20µs	30/60µs	30/60µs	1,2/50µs	50 Hz,						
Koda			5 kA	10 kA	5 kA	10 kA	20 kA	125 A	500 A		1 min						
Code	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[kV]	[mm]	[mm]	[mm]	[mm	[mm]	
21 49 01	3	3,75	8,55	9,65	7,18	8,78	9,60	7,35	7,85					60	90		
21 49 02	4	5,00	12,8	14,20	11,25	12,92	14,15	9,63	10,16	62	25	257	491	80	100	129	3
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					120	140		
21 49 05	10	12,50	34,15	38,05	29,00	34,62	37,90	26,61	28,17	98	35	303	651	140	160	175	5
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					180	200		
21 49 08	16	20,00	51,20	56,80	44,10	51,68	56,60	38,52	40,64	125	55	353	731	200	220	225	6
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					240	260		
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	135	60	380	811	270	300	252	7
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					320	320		
21 49 14	26	32,50	85,35	94,85	77,20	84,76	94,50	65,13	68,81	150	65	427	891	340	340	299	8
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					295	380		
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	170	70	480	1131	410	430	352	11
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					400	420		
21 49 19	36	45,00	115,20	127,80	99,10	114,10	127,35	86,67	91,44	180	75	517	1211	420	440	386	12
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_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
N	Število reber

U_c	*Continuous operating voltage*
U_r	*Rated voltage*
U_{res}	*Residual voltages at different impulse currents*
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*
N	*Number of sheds*

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

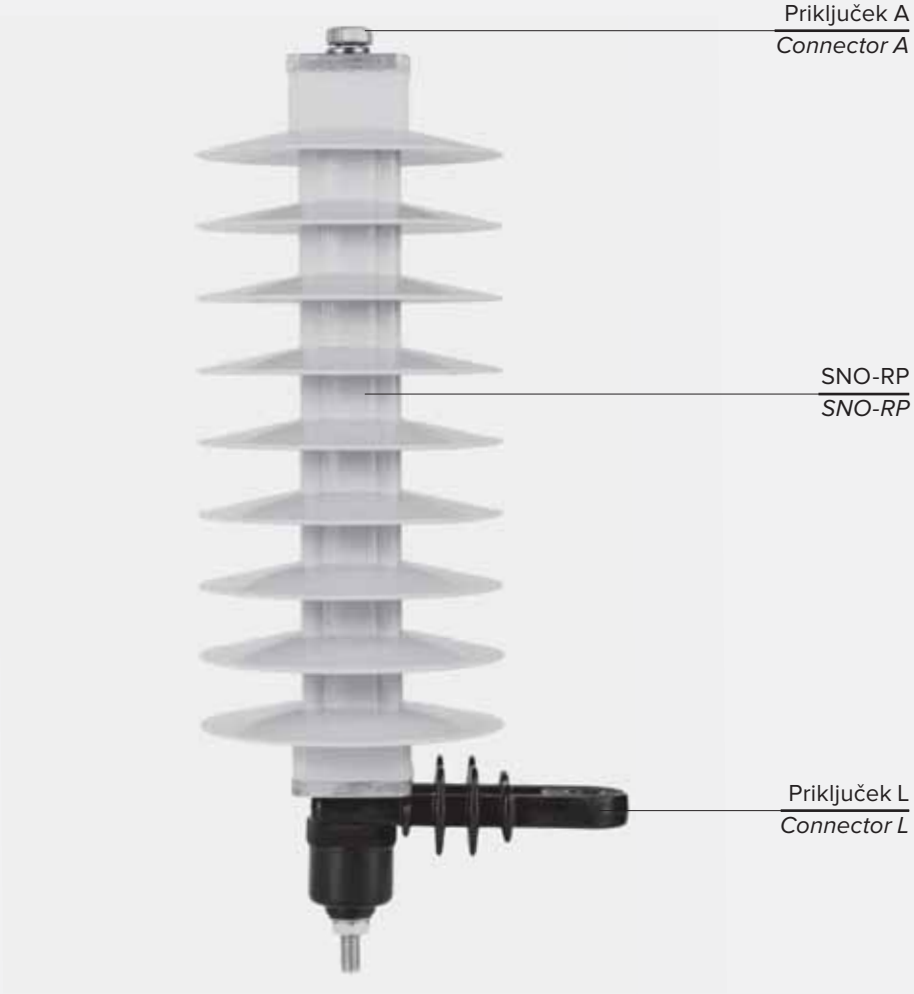
2SS15N-NO 22 kV
Koda/Code: 21 59 12

	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	10 kA	5 kA	10 kA	20 kA	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					60	90	
21 59 02	4	5,00	12,8	14,20	11,25	12,92	14,15	9,63	10,16	62	25	215	243	408	100	129
21 59 03	6	7,50	21,35	23,85	17,95	21,70	23,75	16,98	18,01					508	120	
21 59 04	8	10,00	25,60	28,40	26,12	25,84	28,30	19,26	20,32					120	140	
21 59 05	10	12,50	34,15	38,05	29,00	34,62	37,90	26,61	28,17	98	35	271	289	683	160	175
21 59 06	12	15,00	38,40	42,60	33,15	38,96	42,45	28,89	30,48					887	180	
21 59 07	14	17,50	46,95	52,25	39,98	47,54	52,05	36,24	38,33					180	200	
21 59 08	16	20,00	51,20	56,80	44,10	51,68	56,60	38,52	40,64	125	55	321	339	200	220	225
21 59 09	18	22,50	59,75	66,45	51,26	60,46	66,20	45,87	48,49					220	240	
21 59 10	20	25,00	64,00	71,00	55,45	64,60	70,75	48,15	50,80					240	260	
21 59 11	21	26,25	67,55	77,10	58,93	67,95	76,25	52,15	54,55					260	280	
21 59 12	22	27,50	72,55	80,65	63,00	73,38	80,35	55,50	58,65	135	60	348	366	270	300	252
21 59 20	24	30,00	76,80	85,20	66,15	75,98	84,90	57,78	60,96					320	320	
21 59 13	24	30,00	76,80	85,20	74,39	75,95	84,90	57,78	60,96					320	320	
21 59 14	26	32,50	85,35	94,85	77,20	84,76	94,50	65,13	68,81	150	65	395	413	340	340	299
21 59 15	28	35,00	89,60	99,40	84,90	88,21	99,05	67,41	71,12					360	360	
21 59 16	30	37,50	98,15	109,05	88,00	96,99	108,65	74,76	78,97					295	380	
21 59 17	32	40,00	102,40	113,60	96,05	101,15	113,20	77,04	81,28					380	400	
21 59 24	35	43,75	112,30	125,50	97,86	112,81	125,15	85,16	90,12	170	70	418	466	410	430	352
21 59 21	36	45,00	115,20	127,80	99,10	114,10	127,25	86,67	91,44					420	440	
21 59 18	34	42,50	110,95	123,25	96,05	109,93	122,80	84,39	89,13					400	420	
21 59 19	36	45,00	115,20	127,80	99,10	114,10	127,35	86,67	91,44	180	75	482	500	420	440	386
21 59 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	*Continuous operating voltage*
U_r	*Rated voltage*
U_{res}	*Residual voltages at different impulse currents*
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 (U_c)
kV	- merska enota
AL	- oznake priključkov

Name explanation

SNO	*- type*
RP	*- commercial designation*
34	*- continuous operating voltage (U_c)*
kV	*- measuring unit*
AL	*- connector markings*

Oznake na odvodniku prenapetosti

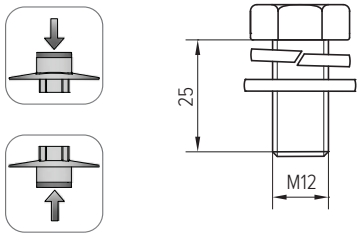
Izoelektro	- proizvajalec
SNO	- tip
12/19	- mesec in leto proizvodnje
U_c ... (kV)	- trajna obratovalna napetost
U_r ... (kV)	- nazivna napetost
I_n ... (kA)	- nazivni odvodni tok
I_{sc} ... (kA)	- kratkostični tok
DH	- IEC razred

Marks on surge arrester

Izoelektro	*- manufacturer*
SNO	*- type*
12/19	*- month and year of production*
U_c ... (kV)	*- 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 ali A4
Moment M12: 60 Nm
Masa: 0,044 kg
Koda: **21 47 01**

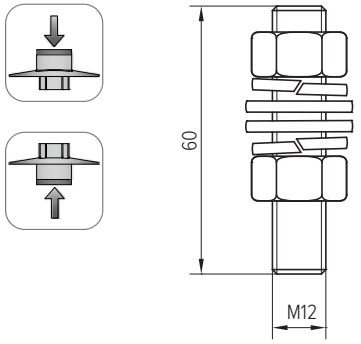


2.12 *Connector A*

Description: screw connector for cable lug
Material: stainless steel A2 or A4
Torque M12: 60 Nm
Mass: 0,044 kg
*Code: **21 47 01***

2.13 Priključek B

Opis: vijačni priključek za kabelski čevelj
Material: nerjavno jeklo A2 ali A4
Moment M12: 60 Nm
Masa: 0,086 kg
Koda: **21 47 02**

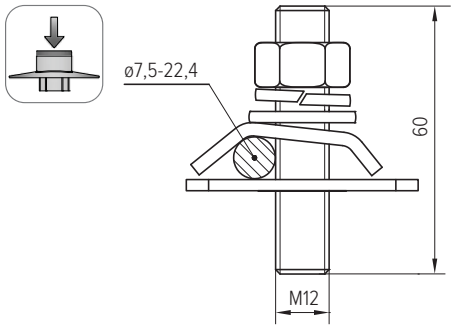


2.13 *Connector B*

Description: screw connector for cable lug
Material: stainless steel A2 or A4
Torque M12: 60 Nm
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**

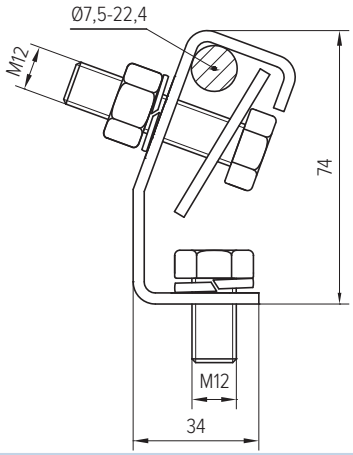


2.14 *Connector C*

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

2.15 Priključek F

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

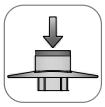


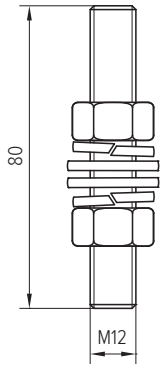
2.15 *Connector F*

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

2.16 Priključek G

Opis: vijačni priključek za kabelski čevelj
Material: nerjavno jeklo A2 ali A4
Masa: 0,100 kg
Koda: **21 47 07**



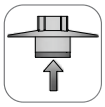


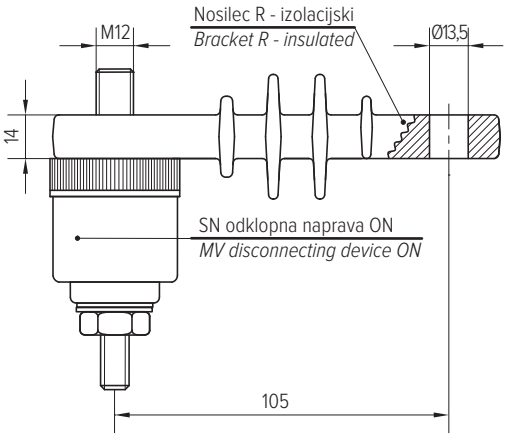
2.16 *Connector G*

Description: screw connector for cable lug
Material: stainless steel A2 or A4
Mass: 0,100 kg
Code: ***21 47 07***

2.17 Priključek L

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



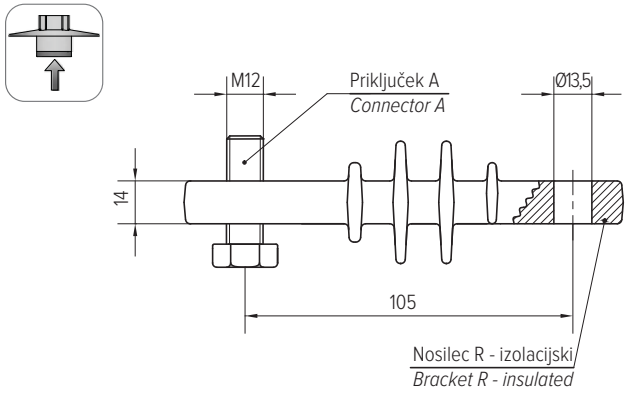


2.17 *Connector L*

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

2.18 Priključek M

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

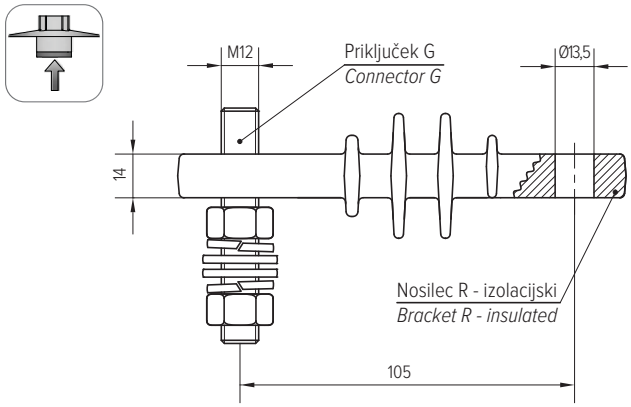


2.18 *Connector M*

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

2.19 Priključek N

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

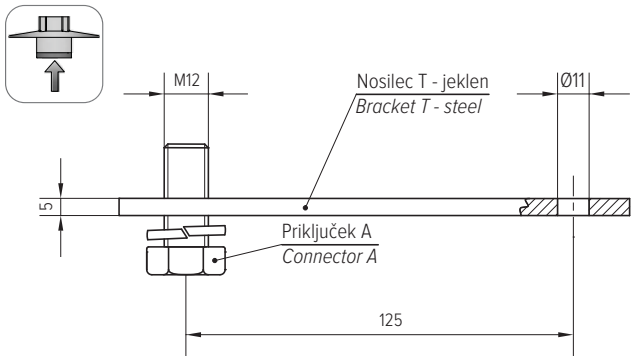


2.19 *Connector N*

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

2.20 Priključek O

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

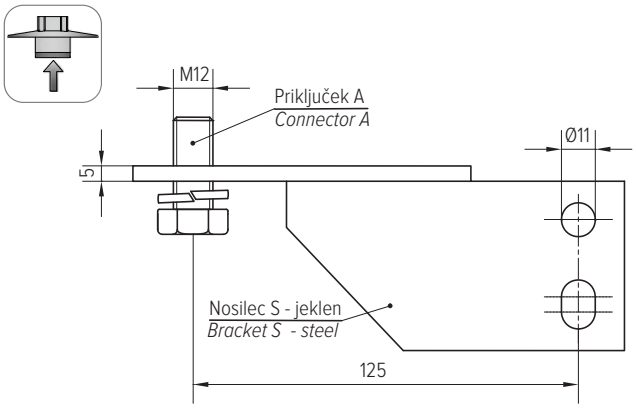


2.20 *Connector O*

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

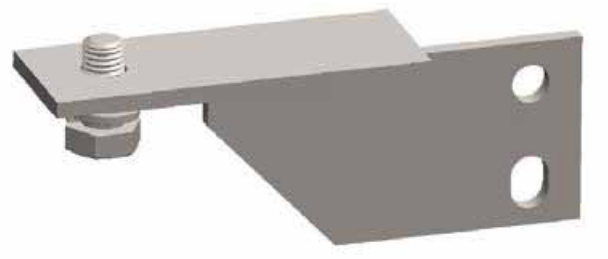
2.21 Priključek P

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



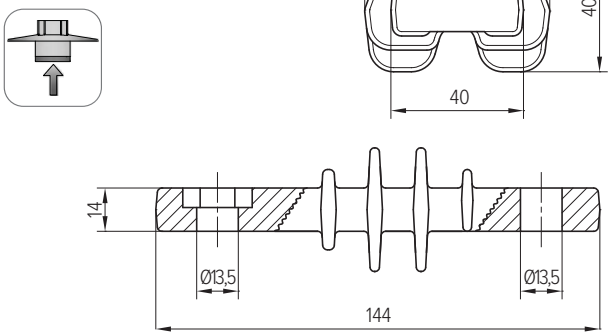
2.21 *Connector P*

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



2.22 Nosilec R - izolacijski

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

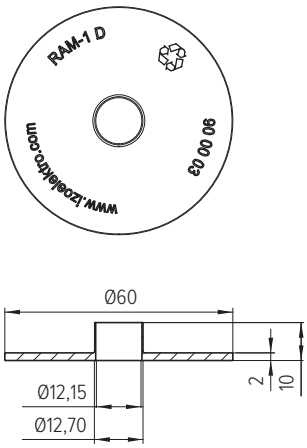


2.22 *Bracket R - insulated*

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

2.23 RAM-1 izolacijski distančnik

Opis: izolacijski distan.nik Ø60 za kovinski nosilec
Material: PA6 GV UV
Masa: 0,006 kg
Koda: **90 00 03**

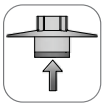


2.23 *RAM-1 insulative spacer*

Description: insulative spacer Ø60 for metal bracket
Material: PA6 GV UV
Mass: 0,006 kg
*Code: **90 00 03***

2.24 Nosilec T - jeklen

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

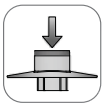


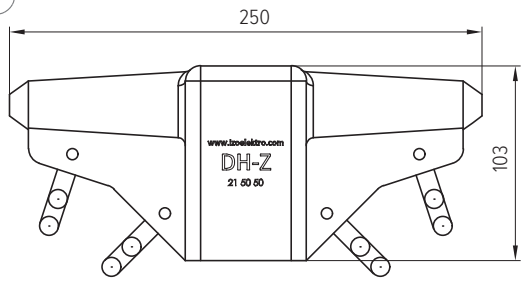
2.24 *Bracket T - steel*

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

2.25 Silikonska zaščita DH-Z

Opis: Zaščita za divje živali
Material: silikon LSR
Masa: 0,183 kg
Koda: **21 50 50**



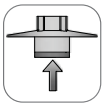


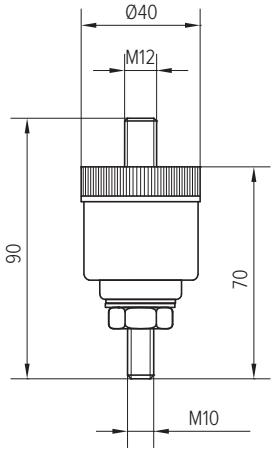
2.25 *Silicone cover DH-Z*

Description: Wildlife protection
Material: silicone LSR
Mass: 0,183 kg
*Code: **21 50 50***

2.26 SN odklopna naprava ON

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





2.26 *MV disconnecting device ON*

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

2.27 RAM-1 - Daljinski nadzor elektroenergetskega omrežja

Namen

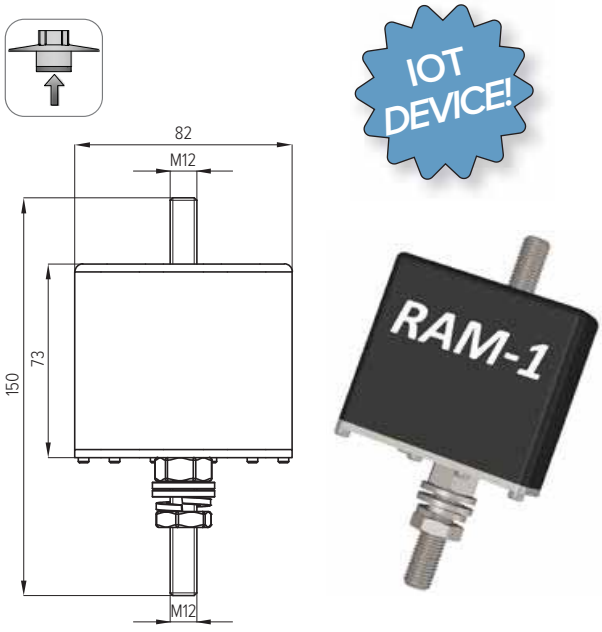
Prvi v svetu smo izdelali in s patentom zaščitili pametno napravo RAM-1, ki omogoča daljinski nadzor elektroenergetskega omrežja.

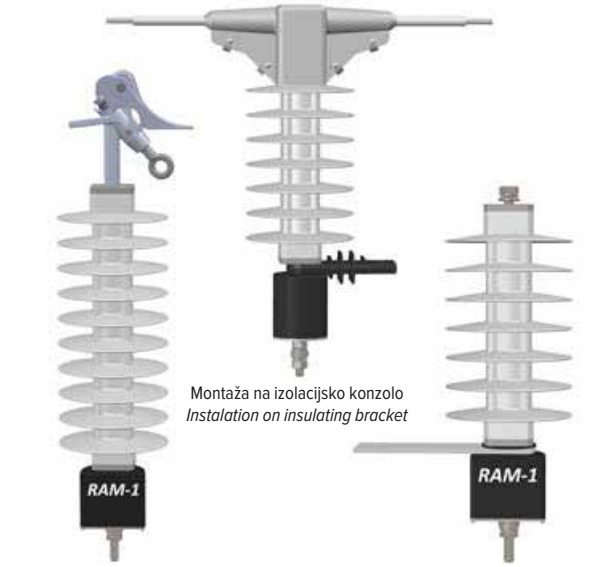
2.27 *RAM-1 - Remote power grid monitoring*

Usage

We are the first on the world to design and patent a smart device RAM-1 which is intended for remote monitoring of power grids.

Tehnični podatki		*Technical data*	
Uporaba	daljinski nadzor vgrajenih odvodnikov prenapetosti nad 1 kV	*Application*	*remote monitoring of installed surge arresters above 1 kV*
Osnovna meritev	ohmska komponenta uhajavega toka od 0 ... 0 ...3 mA (± 10%)	*Main measurement*	*resistive component of leakage current from 0 ... 3 mA (± 10%)*
Ostale meritve	okvara, števec strel, temperatura, nagib, lokacija	*Other measurements*	*instant fault, surge counter, temperature, position, location*
Standard	IEC 60099-5	*Standard*	*IEC 60099-5*
Temperaturno območje	- 20 °C (- 40 °C) ... + 85 °C	*Temperature range*	*- 20 °C (- 40 °C) ... + 85 °C*
Stopnja zaščite ohišja	IP 67	*Housing IP protection level*	*IP 67*
Frekvenca	48 Hz ... 62 Hz	*Frequency*	*48 Hz ... 62 Hz*
Uporabniški vmesnik	web, app, email	*User interface*	*web, app, email*
Merilni cikel	1 ura	*Measuring cycle*	*1 hour*
Komunikacijski cikel	okvara - takoj, normalno delovanje - 60 dni (nastavljivo)	*Communication cycle*	*instant fault - instantly, normal conditions - 60 days (customizable)*
Komunikacija	Bluetooth, 4G, 5G ali LoRaWAN	*Communication*	*Bluetooth, 4G, 5G or LoRaWAN*
Avtonomija	do 20 let brez vzdrževanja	*Autonomy*	*up to 20 years with out maintenance*
Material ohišja	termoplast V-0 (UL 94), nerjavno jeklo A2 ali A4	*Housing material*	*termoplast V-0 (UL 94), stainless steel A2 ali A4*
Priključek / material	M12 / nerjavno jeklo A2 ali A4	*Connector / material*	*M12 / stainless steel A2 ali A4*
Montaža	na ozemljitveni strani odvodnika	*Installation*	*on the earthing side of the arrester*
Masa	0,580 kg	*Mass*	*0,580 kg*





Montaža na izolacijsko konzolo
Instalation on insulating bracket

Prostozračna montaža
Instalation on overhead power line

Montaža na kovinsko konzolo
Instalation on steel bracket

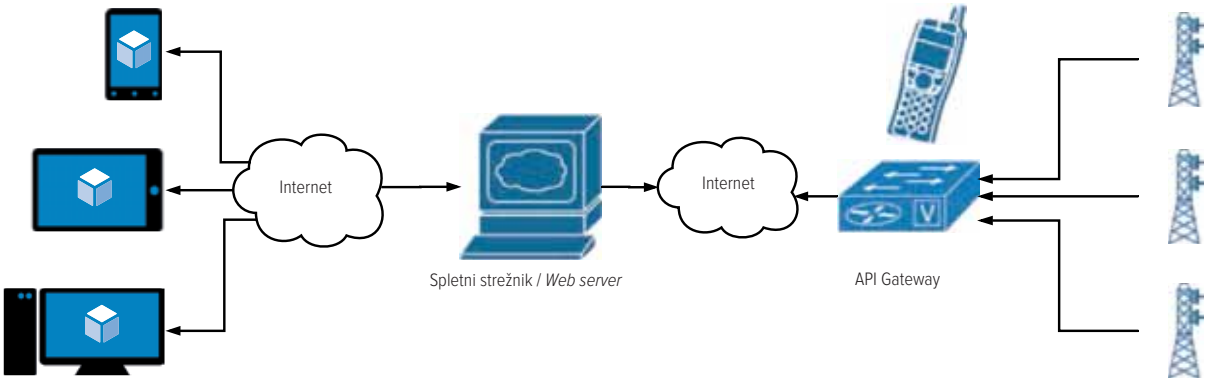
Prednosti

- Trenutno javljanje okvare, avtonomno delovanje, prikaz mesta vgradnje
- Enostavna vgradnja, ugodna cena, do 20 let brez vzdrževanja, brez stroškov povezave
- Dograditev na vse tipe vgrajenenih ali na nove odvodnike prenapetosti od 1 kV dalje
- **Pripravljeno za strojno učenje**

Advantages

- *Alarm in case of instant fault, autonomous working, showing the installation location*
- *Simple instalation, low price, up to 20 years with out maintenance, no conection fees*
- *Instalation possible on all already instaled or new surge arresters above 1 kV*
- ***Machine learning ready device***

Shema delovanja (RAM-1) ***Operation scheme (RAM-1)***



Paketi / *Package*	1 **Nelicenčni** *Without licence*	2 **Osnovni** *Basic*	3 **Razširjen** *Extended*	4 **Upravljanje** *Full*
Meritve / *Measurements*				
Ohmska komponenta uhajavega toka IEC 60099:5 *Resistive component of leakage current IEC 60099:5*	✓	✓	✓	✓
Okvara / *Instant fault*	✓	✓	✓	✓
Lokacija / *Location*		✓	✓	✓
Števec strel / *Surge counter*			✓	✓
Temperatura / *Temperature*			✓	✓
Nagib / *Position*			✓	✓
Izračun izgub (v pripravi) / *Calculation of power loss (in preparation)*			✓	✓
Povezljivost / *Connectivity*				
4G / *4G*	✓	✓	✓	✓
5G / *5G*			✓	✓
Bluetooth / *Bluetooth*	✓	✓	✓	✓
LoRaWan / *LoRaWan*			✓	✓
Obveščanje / *Messaging*				
Prikaz sporočila na 2 meseca (email) / *Status report every 2 months (email)*	✓	✓	✓	✓
Prikaz zadnjih 5 meritev (web, app) / *Display of last 5 status reports (web, app)*		✓	✓	✓
Prikaz celotne zgodovine meritev, grafični prikaz (web, app) *Display of entire history of status reports (web, app)*			✓	✓
Avtomatsko obveščanje ob prekoračitvi dovoljene vrednosti (email) *Automatic status report when set values are exceeded (email)*	✓	✓	✓	✓
Avtomatsko obveščanje ob prekoračitvi dovoljene vrednosti (web, app, email) *Automatic status report when set values are exceeded (web, app, email)*		✓	✓	✓
Nastavljiv interval poročanja / *Adjustable status report interval*			✓	✓
GPS lokacija (koordinate) / *GPS location (coordinates)*		✓	✓	✓
GPS lokacija (koordinate, zemljevid, vodenje do naprave) *GPS location (coordinates, map, guidance to surge arrester)*			✓	✓
Alarm za okvaro (email) / *Alarm in case of instant fault (email)*	✓	✓	✓	✓
Alarm za okvaro (web, app, email) *Alarm in case of instant fault (web, app, email)*		✓	✓	✓
Opcije / *Additional options*				
Odčitavanje meritev iz naprave RAM-1 na terenu (Bluetooth) *Status report from RAM-1 in the field (Bluetooth)*		✓	✓	✓
Jezik uporabniškega vmesnika - angleški / *User Interface - English language*	✓	✓	✓	✓
Jezik uporabniškega vmesnika - na željo kupca / *User Interface - language by request*			✓	✓
Beleženje aktivnosti naprave (pregledi, popravki, morebitne poškodbe, ...) *Activity log (inspections, repairs, maintenance, ...)*			✓	✓
Upravljanje z uporabniki (omejeno) / *User management (limited)*		✓		
Upravljanje z uporabniki (neomejeno) / *User management (unlimited)*			✓	✓
Upravljanje s sistemom RAM-1 v domeni podjetja Izoelektro *Outsourcing services - management of RAM-1 system by Izoelektro*				✓
Možnost integracije v obstoječ nadzorni sistem (SCADA) *Possibility of integration into the existing control system (SCADA)*		✓	✓	
Pripravljeno za strojno učenje / *Machine learning ready device*	✓	✓	✓	✓

SN natezni/nosilni izolatorji
MV tension/suspension insulators

3

IZOELEKTRO

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, 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 jeklenih priključkov: **ST 52-3**
- Debelina nanosa cinka: **≥ 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, 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 during 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 steel end fittings: **ST 52-3***
- *Zinc coat: **≥ 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:

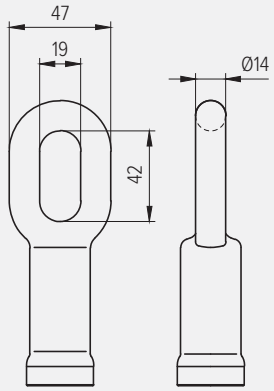
- oblika plašča in priključki izdelani po standardu IEC 61466,
- certifikat akreditiranega laboratorija,
- silikonski plašč je izdelan iz dvokomponentnega silikona brez dodatkov,
- primerni za agresivna okolja,
- verige izdelane iz NKI izolatorjev in našega spojnega materiala so kratke in lahke,
- nazivna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

Competitive advantages

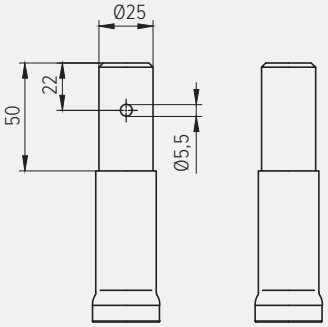
NKI tension composite insulators for indoor and outdoor installation feature:

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

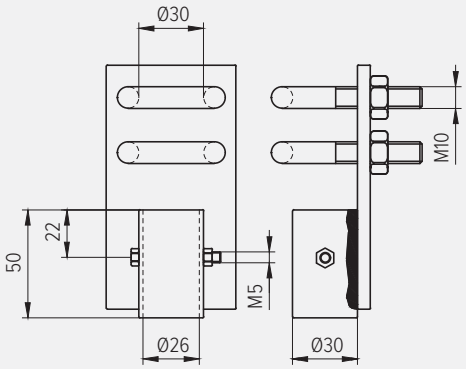
3.2 Oblike priključkov *3.2 Shape of end fittings*



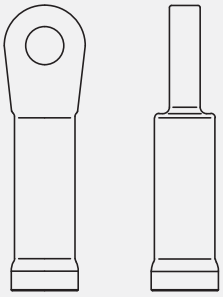
UHO / *EYE*
»U«



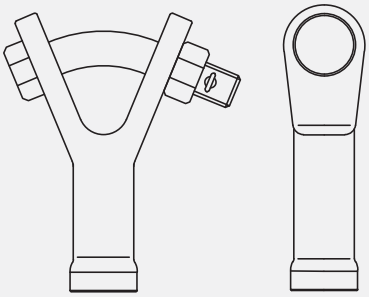
POGON / *ROD*
»I«



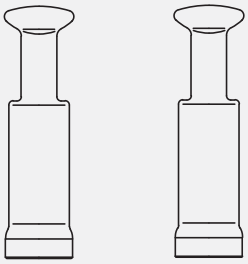
POGON 3/4 / *ROD 3/4*
»I 3/4«



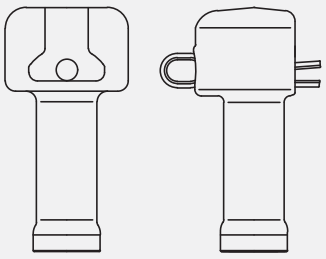
IEC 61466
OKO / *TONGUE*
»O«



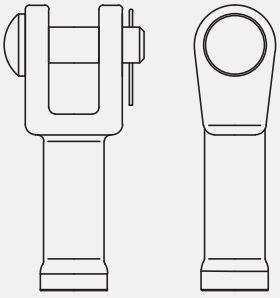
IEC 61466
Y VILICA / *Y CLEVIS*
»Y«



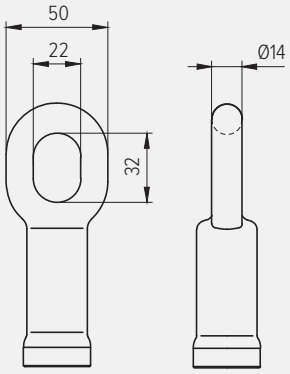
IEC 61466
BATIČ / *BALL*
»B«



IEC 61466
PONVICA / *SOCKET*
»P«



IEC 61466
VILICA / *CLEVIS*
»V«



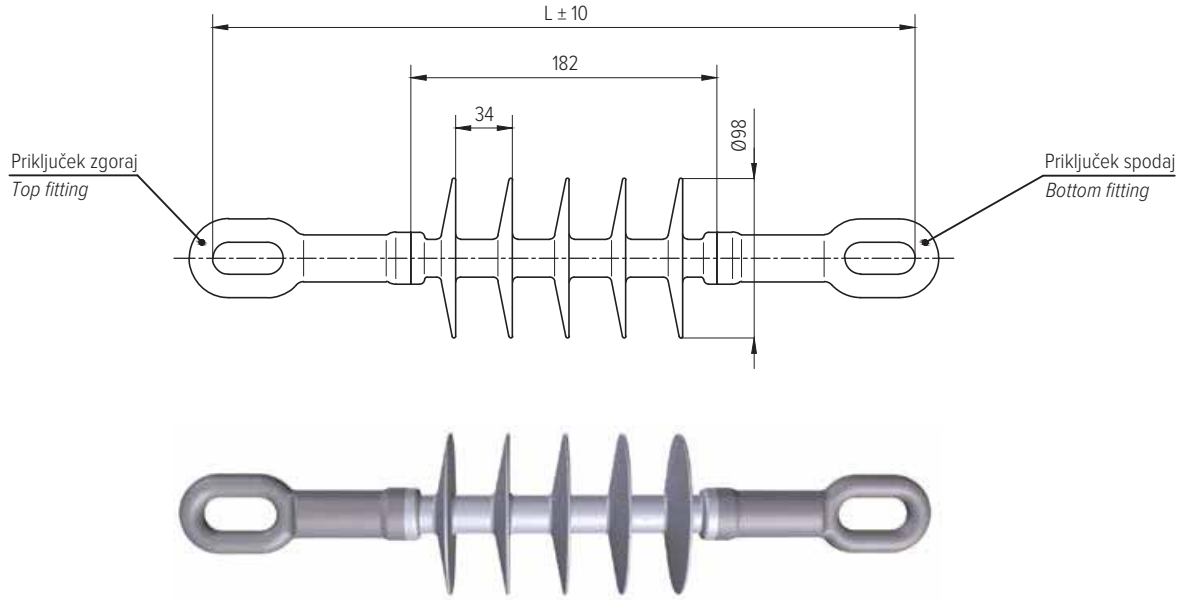
IEC 61466
UHO / *EYE*
»E«

3.3 Silikonski plašč N - plazilna razdalja 520 mm

3.3 *Silicone coat N - creepage distance 520 mm*

Opomba: Izbira izolatorja NKI N

Note: selection of insulator NKI N



NKI N/UU

Tip	Komercialna oznaka	Nazivna obratovalna napetost	Število reber	Plazilna pot	Preskočna razdalja	Vzdržna atm. udarna nap. v suhem	Vzdržna izmenična nap. v mokrem
Type	*Commercial designation*	*Nominal operating voltage*	*Number of Sheds*	*Creepage distance*	*Arcing distance*	*Dry lighting impulse withstand voltage*	*Wet power frequency withstand voltage*
NKI N	* *	24 kV	5	520 mm	215 mm	159 kV	66 kV

Najbolj uporabljene kode za naročilo NKI izolatorjev / *Most used NKI insulator order codes*

Zgornji priključek *	Spodnji priključek *	Komercialna oznaka	Koda	Dolžina (mm)	Masa (kg)
*Top end fitting *	*Bottom end fitting *	*Commercial designation*	*Code*	*Length* (mm)	*Mass* (kg)
uho/*eye*	uho/*eye*	UU	80 70 55	418	1,0
uho/*eye*	uho/*eye*	UU 90°	80 70 56	418	1,0
oko/*tongue*	oko/*tongue*	OO	80 71 04	410	1,3
oko/*tongue*	oko/*tongue*	OO 90°	80 71 41	410	1,3
batič/*ball*	batič/*ball*	BB	80 70 60	389	0,9
ponvica/*socket*	ponvica/*socket*	PP	80 70 62	378	1,7
vilica/*clevis*	vilica/*clevis*	VV	80 70 64	395	1,2
uho/*eye*	batič/*ball*	UB	80 70 66	404	1,0
ponvica/*socket*	uho/*eye*	PU	80 70 68	398	1,4
uho/*eye*	vilica/*clevis*	UV	80 70 70	407	1,1
ponvica/*socket*	batič/*ball*	PB	80 70 72	384	1,4
vilica/*clevis*	batič/*ball*	N/VB	80 70 74	392	1,1
ponvica/*socket*	vilica/*clevis*	PV	80 70 76	387	1,7
vilica/*clevis*	vilica/*clevis*	VV 90°	80 70 78	395	1,2
pogon/*rod*	pogon/*rod*	II	80 70 80	424	1,1
pogon/*rod*	pogon/*rod*	II ¾"	80 70 83	424	2,3

Oznake na izolatorju / *Marks on insulator*

Izoelektro Proizvajalec *Manufacturer*

NKI N Tip SN kompozitnega izolatorja *Type of MV composite insulator*

3/19 Mesec in leto proizvodnje *Month and year of production*

≤90 kN Nazivna mehanska sila (SML) *Specified mechanical load (SML)*

* Oblike priključkov v poglavju 3.2

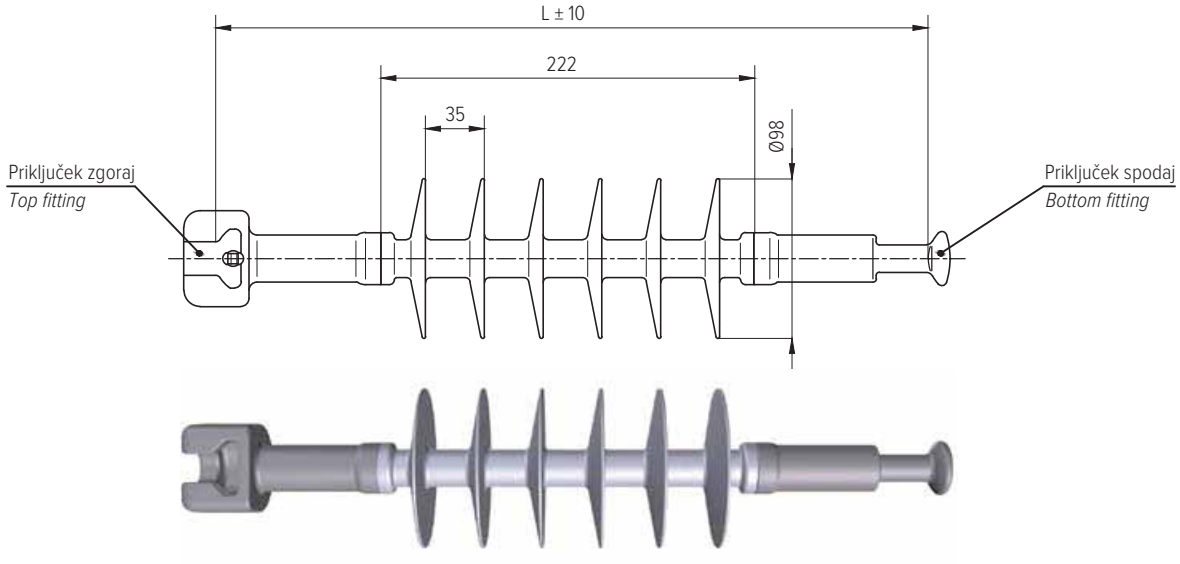
** Shape of end fittings in chapter 3.2*

3.4 Silikonski plašč L - plazilna razdalja 630 mm

Opomba: Izbira izolatorja NKI L

3.4 *Silicone coat L - creepage distance 630 mm*

Note: selection of insulator NKI L



NKI L/PB

Tip	Komercialna oznaka	Nazivna obratovalna napetost	Število reber	Plazilna pot	Preskočna razdalja	Vzdržna atm. udarna nap. v suhem	Vzdržna izmenična nap. v mokrem
Type	*Commercial designation*	*Nominal operating voltage*	*Number of Sheds*	*Creepage distance*	*Arcing distance*	*Dry lighting impulse withstand voltage*	*Wet power frequency withstand voltage*
NKI L	* *	36 kV	6	630 mm	250 mm	186 kV	76 kV

Najbolj uporabljene kode za naročilo NKI izolatorjev / *Most used NKI insulator order codes*

Zgornji priključek *	Spodnji priključek *	Komercialna oznaka	Koda	Dolžina (mm)	Masa (kg)
Top end fitting *	*Bottom end fitting* *	*Commercial designation*	*Code*	*Length* (mm)	*Mass* (kg)
uho/*eye*	uho/*eye*	UU	80 70 57	458	1,1
uho/*eye*	uho/*eye*	UU 90°	80 70 58	458	1,1
oko/*tongue*	oko/*tongue*	OO	80 71 07	450	1,4
oko/*tongue*	oko/*tongue*	OO 90°	80 71 42	450	1,4
batič/*ball*	batič/*ball*	BB	80 70 61	429	1,0
ponvica/*socket*	ponvica/*socket*	PP	80 70 63	418	1,8
vilica/*clevis*	vilica/*clevis*	VV	80 70 65	435	1,3
uho/*eye*	batič/*ball*	UB	80 70 67	444	1,1
ponvica/*socket*	uho/*eye*	PU	80 70 69	438	1,5
uho/*eye*	vilica/*clevis*	UV	80 70 71	447	1,2
ponvica/*socket*	batič/*ball*	PB	80 70 73	424	1,5
vilica/*clevis*	batič/*ball*	N/VB	80 70 75	432	1,2
ponvica/*socket*	vilica/*clevis*	PV	80 70 77	427	1,8
vilica/*clevis*	vilica/*clevis*	VV 90°	80 70 79	435	1,3
pogon/*rod*	pogon/*rod*	II	80 70 81	464	1,2
pogon/*rod*	pogon/*rod*	II ¾"	80 70 96	464	2,4

Oznake na izolatorju / *Marks on insulator*

Izoelektro — Proizvajalec / *Manufacturer*

NKI L — Tip SN kompozitnega izolatorja / *Type of MV composite insulator*

3/19 — Mesec in leto proizvodnje / *Month and year of production*

≤90 kN — Nazivna mehanska sila (SML) / *Specified mechanical load (SML)*

* Oblike priključkov v poglavju 3.2

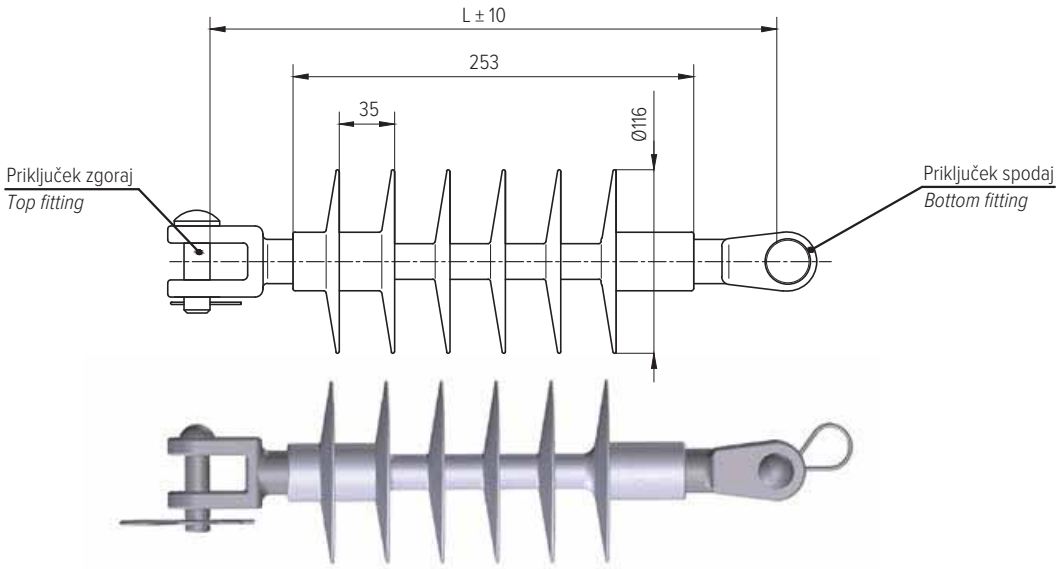
** Shape of end fittings in chapter 3.2*

3.5 Silikonski plašč M - plazilna razdalja 783 mm

3.5 *Silicone coat M - creepage distance 783 mm*

Opomba: Izbira izolatorja NKI M

Note: selection of insulator NKI M



NKI M/VV 90°

Tip	Komercialna oznaka	Nazivna obratovalna napetost	Število reber	Plazilna pot	Preskočna razdalja	Vzdržna atm. udarna nap. v suhem	Vzdržna izmenična nap. v mokrem
Type	*Commercial designation*	*Nominal operating voltage*	*Number of Sheds*	*Creepage distance*	*Arcing distance*	*Dry lighting impulse withstand voltage*	*Wet power frequency withstand voltage*
NKI M	* *	36 kV	6	783 mm	290 mm	169 kV	91 kV

Najbolj uporabljene kode za naročilo NKI izolatorjev / *Most used NKI insulator order codes*

Zgornji priključek *	Spodnji priključek *	Komercialna oznaka	Koda	Dolžina (mm)	Masa (kg)
*Top end fitting *	*Bottom end fitting *	*Commercial designation*	*Code*	*Length* (mm)	*Mass* (kg)
uho/*eye*	uho/*eye*	UU	80 70 00	385	1,1
uho/*eye*	uho/*eye*	UU 90°	80 70 11	385	1,1
oko/*tongue*	oko/*tongue*	OO	80 71 05	370	1,4
oko/*tongue*	oko/*tongue*	OO 90°	80 71 43	370	1,4
batič/*ball*	batič/*ball*	BB	80 71 12	352	1,0
ponvica/*socket*	ponvica/*socket*	PP	80 71 13	342	1,8
vilica/*clevis*	vilica/*clevis*	VV	80 71 14	358	1,3
uho/*eye*	batič/*ball*	UB	80 71 15	366	1,1
ponvica/*socket*	uho/*eye*	PU	80 71 16	362	1,5
uho/*eye*	vilica/*clevis*	UV	80 71 17	369	1,2
ponvica/*socket*	batič/*ball*	PB	80 71 18	346	1,5
vilica/*clevis*	batič/*ball*	N/VB	80 71 19	355	1,2
ponvica/*socket*	vilica/*clevis*	PV	80 71 20	350	1,8
vilica/*clevis*	vilica/*clevis*	VV 90°	80 71 21	358	1,3
pogon/*rod*	pogon/*rod*	II	80 71 22	387	1,2
pogon/*rod*	pogon/*rod*	II ¾"	80 71 23	387	2,4

Oznake na izolatorju / *Marks on insulator*

Izoelektro Proizvajalec *Manufacturer*

NKI M Tip SN kompozitnega izolatorja *Type of MV composite insulator*

3/19 Mesec in leto proizvodnje *Month and year of production*

≤90 kN Nazivna mehanska sila (SML) *Specified mechanical load (SML)*

* Oblike priključkov v poglavju 3.2

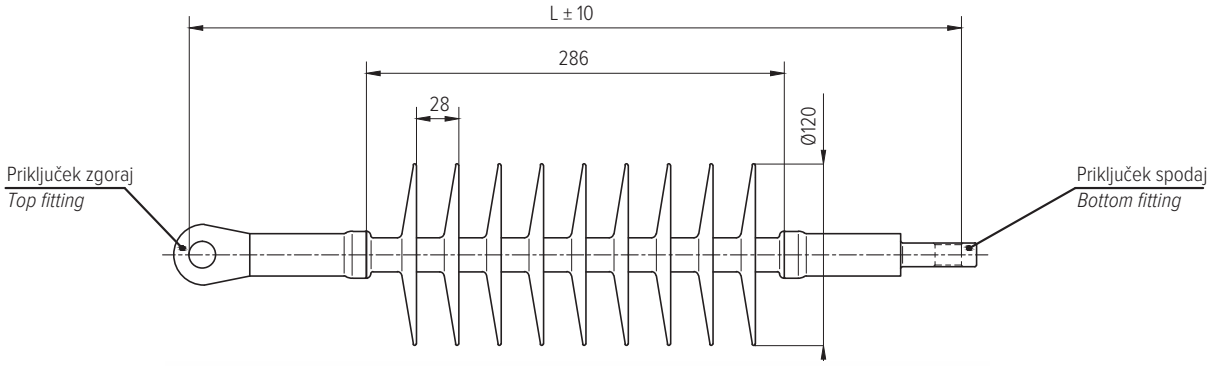
** Shape of end fittings in chapter 3.2*

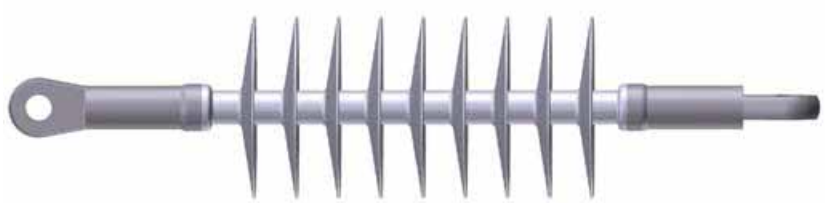
3.6 Silikonski plašč X - plazilna razdalja 1120 mm

Opomba: Izbira izolatorja NKI X

3.6 *Silicone coat X - creepage distance 1120 mm*

Note: selection of insulator NKI X





NKI X/OO 90°

Tip	Komercialna oznaka	Nazivna obratovalna napetost	Število reber	Plazilna pot	Preskočna razdalja	Vzdržna atm. udarna nap. v suhem	Vzdržna izmenična nap. v mokrem
Type	*Commercial designation*	*Nominal operating voltage*	*Number of Sheds*	*Creepage distance*	*Arcing distance*	*Dry lighting impulse withstand voltage*	*Wet power frequency withstand voltage*
NKI X	* *	52 kV	9	1120 mm	335 mm	214 kV	106 kV

Najbolj uporabljene kode za naročilo NKI izolatorjev / *Most used NKI insulator order codes*

Zgornji priključek *	Spodnji priključek *	Komercialna oznaka	Koda	Dolžina (mm)	Masa (kg)
Top end fitting *	*Bottom end fitting* *	*Commercial designation*	*Code*	*Length* (mm)	*Mass* (kg)
uho/*eye*	uho/*eye*	UU	80 70 59	522	1,3
uho/*eye*	uho/*eye*	UU 90°	80 70 84	522	1,3
oko/*tongue*	oko/*tongue*	OO	80 71 24	510	1,6
oko/*tongue*	oko/*tongue*	OO 90°	80 71 44	510	1,6
batič/*ball*	batič/*ball*	BB	80 70 87	493	1,2
ponvica/*socket*	ponvica/*socket*	PP	80 70 88	482	2,0
vilica/*clevis*	vilica/*clevis*	VV	80 70 85	499	1,5
uho/*eye*	batič/*ball*	UB	80 70 90	508	1,3
ponvica/*socket*	uho/*eye*	PU	80 70 89	502	1,7
uho/*eye*	vilica/*clevis*	UV	80 70 91	511	1,4
ponvica/*socket*	batič/*ball*	PB	80 70 92	488	1,7
vilica/*clevis*	batič/*ball*	VB	80 70 93	496	1,4
ponvica/*socket*	vilica/*clevis*	PV	80 70 94	491	2,0
vilica/*clevis*	vilica/*clevis*	VV 90°	80 70 86	499	1,5
pogon/*rod*	pogon/*rod*	II	80 70 95	528	1,4
pogon/*rod*	pogon/*rod*	II ¾"	80 70 97	528	2,6

Oznake na izolatorju / *Marks on insulator*

Izoelektro Proizvajalec *Manufacturer*

NKI X Tip SN kompozitnega izolatorja *Type of MV composite insulator*

3/19 Mesec in leto proizvodnje *Month and year of production*

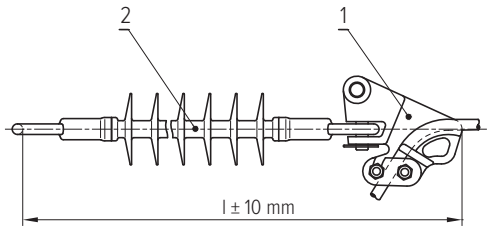
≤90 kN Nazivna mehanska sila (SML) *Specified mechanical load (SML)*

* Oblike priključkov v poglavju 3.2

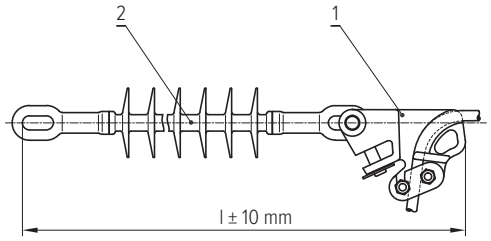
** Shape of end fittings in chapter 3.2*

3.7 NKI enojna zatezna veriga

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



ali / *or*



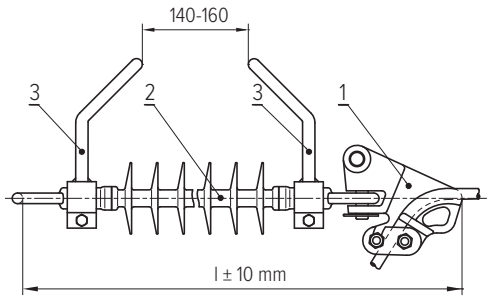
3.7 *NKI single tension string*

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

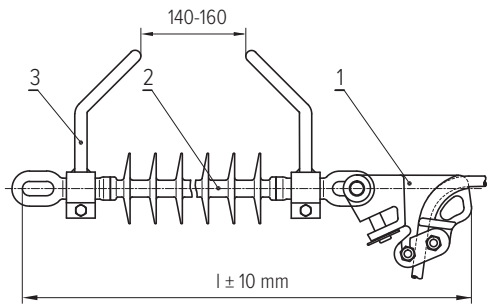
Naziv *Name*	Koda *Code*	l (mm)	Poz. *Pos.*	Kos *Pcs*	Koda *Code*	Masa *Mass* (kg)
EZ-01 N/UU	**90 70 55**	590	1	1	**80 60 03**	1,1
			2	1	**80 70 55**	1,0
EZ-01 L/UU	**90 70 57**	630	1	1	**80 60 03**	1,1
			2	1	**80 70 57**	1,1
EZ-01 M/UU	**90 71 00**	557	1	1	**80 60 03**	1,1
			2	1	**80 71 00**	1,1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

3.8 NKI enojna zatezna veriga z iskriščem

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



ali / *or*



3.8 *NKI single tension string with arcing horn*

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

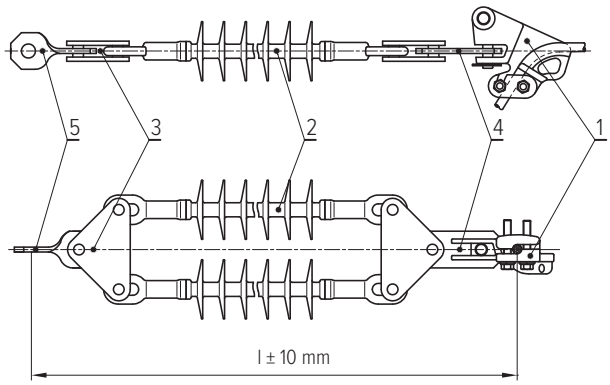
Naziv *Name*	Koda *Code*	l (mm)	Poz. *Pos.*	Kos *Pcs*	Koda *Code*	Masa *Mass* (kg)
EZI-01 N/UU	**91 70 55**	590	1	1	**80 60 03**	1,1
			2	1	**80 70 55**	1,0
			3	2	**80 70 54**	0,3
EZI-01 L/UU	**91 70 57**	630	1	1	**80 60 03**	1,1
			2	1	**80 70 57**	1,1
			3	2	**80 70 54**	0,3
EZI-01 X/UU	**91 70 59**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

3.9 NKI dvojna zatezna veriga

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

3.9 *NKI double tension string*

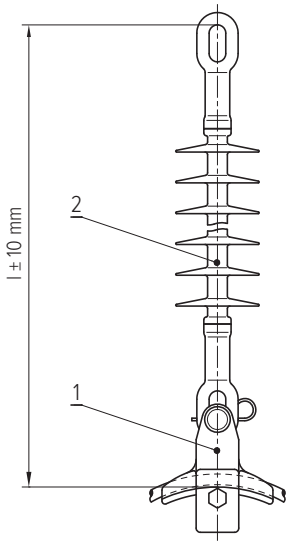
Note: SZ-U clamp (pos. 1) allows fastening into two planes



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

3.10 NKI enojna nosilna veriga

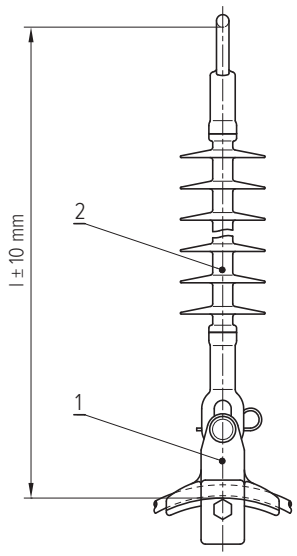
3.10 *NKI single suspension string*



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

3.11 NKI enojna nosilna veriga 90°

3.11 *NKI single suspension string 90°*



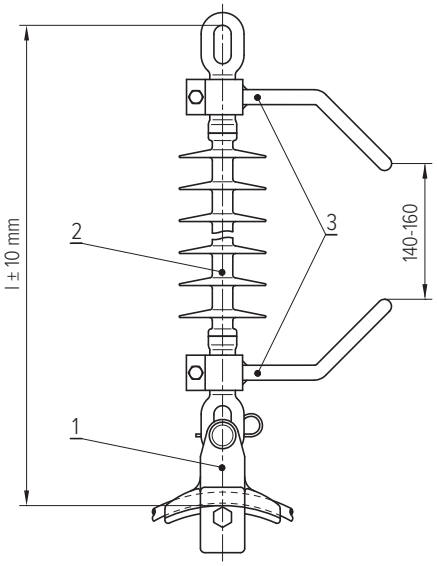
Naziv *Name*	Koda *Code*	l (mm)	Poz. *Pos.*	Kos *Pcs*	Koda *Code*	Masa *Mass* (kg)
EN-02 N/UU	**92 70 56**	511	1	1	**80 60 04**	0,7
			2	1	**80 70 56**	1,0
EN-02 L/UU	**92 70 58**	551	1	1	**80 60 04**	0,7
			2	1	**80 70 58**	1,1
EN-02 M/UU	**92 71 11**	478	1	1	**80 60 04**	0,7
			2	1	**80 71 11**	1,1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

3.12 NKI enojna nosilna veriga z iskriščem

Opomba: uporaba za polizolirane vodnike (PIV)

3.12 *NKI single suspension string with arcing horn*

Note: use with covered conductors (CC)



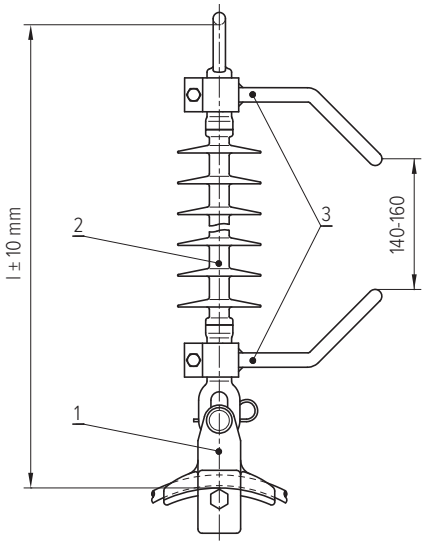
Naziv *Name*	Koda *Code*	l (mm)	Poz. *Pos.*	Kos *Pcs*	Koda *Code*	Masa *Mass* (kg)
ENI-01 N/UU	**93 70 55**	511	1	1	**80 60 04**	0,7
			2	1	**80 70 55**	1,0
			3	2	**80 70 54**	0,3
ENI-01 L/UU	**93 70 57**	551	1	1	**80 60 04**	0,7
			2	1	**80 70 57**	1,1
			3	2	**80 70 54**	0,3
ENI-01 X/UU	**93 70 59**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

3.13 NKI enojna nosilna veriga 90° z iskriščem

Opomba: uporaba za polizolirane vodnike (PIV)

3.13 *NKI single suspension string 90° with arcing horn*

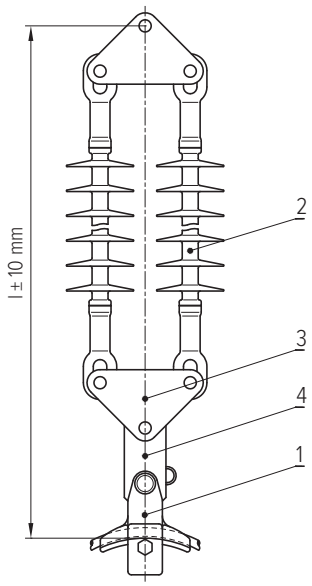
Note: use with covered conductors (CC)



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 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

3.14 NKI dvojna nosilna veriga

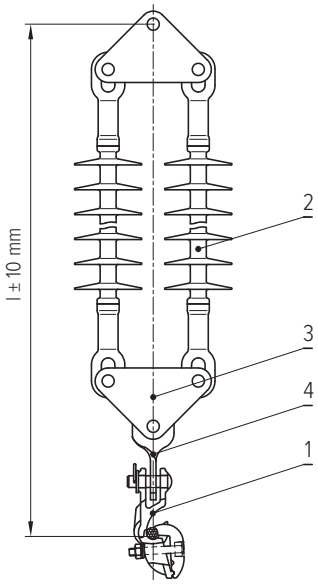
3.14 *NKI double suspension string*



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

3.15 NKI dvojna nosilna veriga 90°

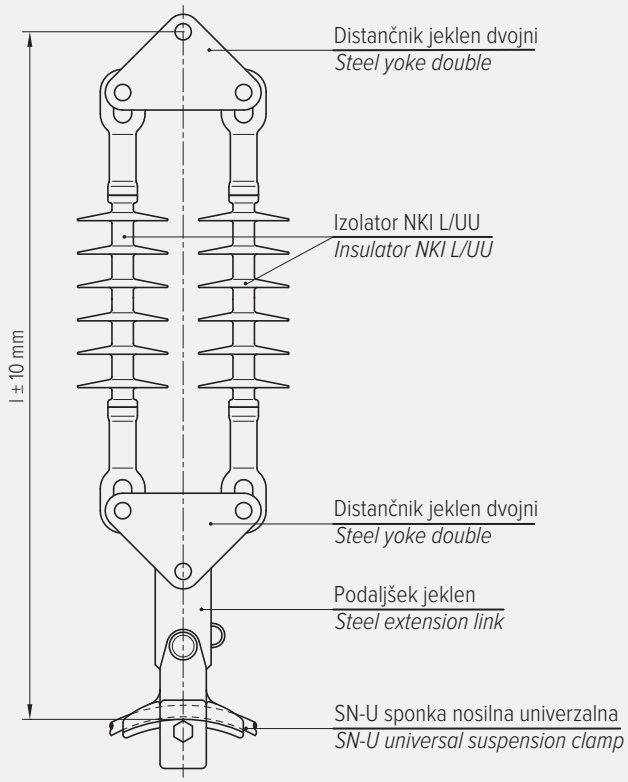
3.15 *NKI double suspension string 90°*



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

3.16 NKI izolatorska veriga - primer naročila 1

3.16 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

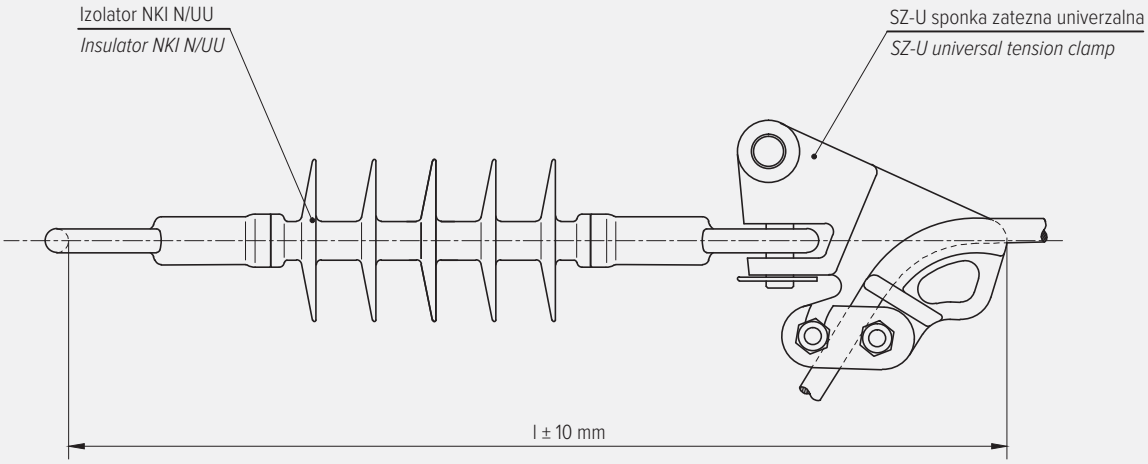
L/UU	- uporabljen je naziv nateznega kompozitnega izolatorja brez oznake NKI

Type of NKI insulator in string

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

3.17 NKI izolatorska veriga - primer naročila 2

3.17 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	*- the name of the tension composite insulator is used without the mark NKI.*

SN podporni izolatorji
MV postinsulators

4

IZOELEKTRO

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 silikonsko gumo brez dodatkov,
- primerni za agresivna in onesnažena okolja (industrija, morska obala, 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): **12,5 in 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**
- Izvedba standardiziranih tipov po standardu **IEC 61952-1/2019**

4.1 *PKI generally*

Product

The 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 and polluted environments (industry, seaside, desert climate, ...),*
- *usable for overhead power lines and devices,*
- *insensitive to impacts.*

Installation

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

General data

- *Specified cantilever load (SCL): **12,5 and 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***
- *Zinc coat: ≥ **70 µm***
- *Tolerance in length: **±5 mm***
- *Tested according to standards: **IEC 62217, IEC 61952, IEC 60437***
- *Production of standardized types according to **IEC 61952-1 / 2019***

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. 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:

- *a certificate from accredited laboratory,*
- *Innovativeness - the PKI insulator type with a top fitting made of insulating material is the result of expert studies carried out by our researchers (published in the world-renowned journal IEEE Transactions on Power Delivery, 2009), our patent and practical experiences of users. It eliminates deficiencies of insulators with metal top fittings and metal cable ties.*
- *a method of fixing 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 footage of power lines provide us with proof 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 fitting of composite post insulators confirms high probability of too high electric field strength (at prolonged usage of insulators with top metal fitting). This may lead to damage and cut conductors due to burns where the conductor comes in to contact with metal top fittings or metal bond.
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

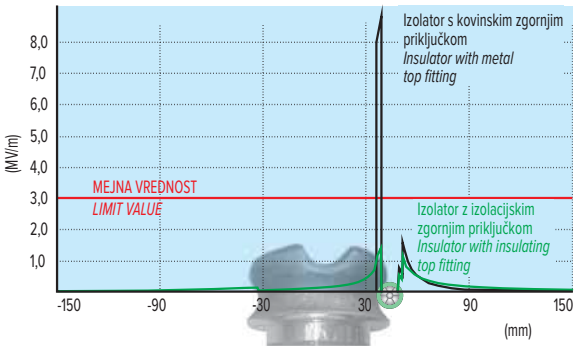
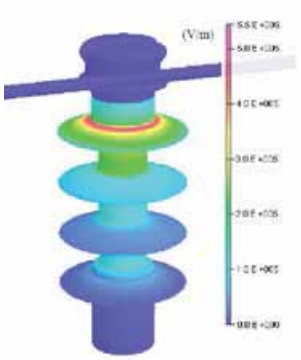


Diagram of electric field strength

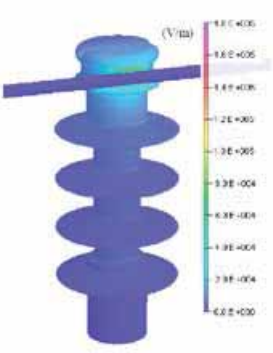
Izolacijski zgornji priključek
Izolator tip PKI z zgornjim priključkom iz izolacijskega materiala je rezultat strokovnih raziskav in praktičnih izkušenj uporabnikov naših izdelkov. Odpravlja pomanjkljivosti izolatorjev s kovinskim zgornjim priključkom. Zgornji priključek je izdelan iz poliamida PA6 z 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 insulators type PKI with top fitting made of insulating material is the result of professional research and of practical experiences of our product users. It eliminates deficiencies of insulators with metal top fittings. The top 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



Kovinski zgornji priključek
Metal top fitting



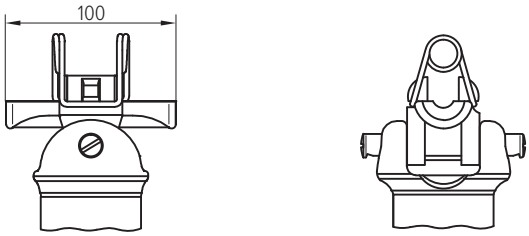
Izolacijski zgornji priključek
PA insulation top fitting

Allocation of electric field strength

4.3 A PKI - oblike zgornjih priključkov

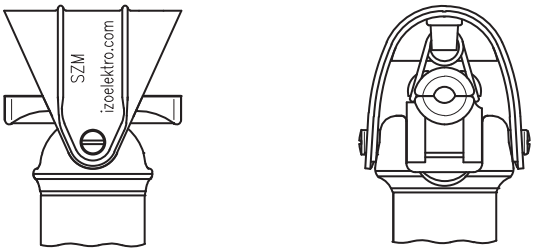
4.3 A PKI - shape of top fittings

A PKI "S" - VZMETNA SPONKA



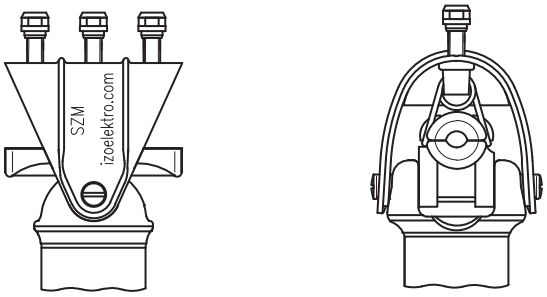
A PKI "S" - SPRING CLAMP

A PKI "Z" - VZMETNA SPONKA S KAPO SZM/0



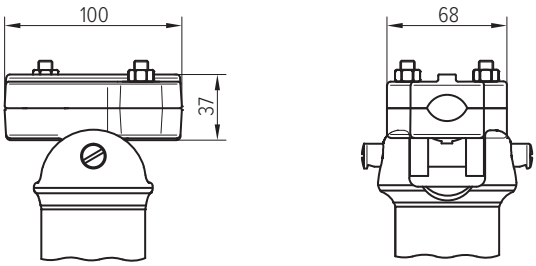
A PKI "Z" - SPRING CLAM WITH CAP SMZ/0

A PKI "M" - VZMETNA SPONKA S KAPO SZM/3



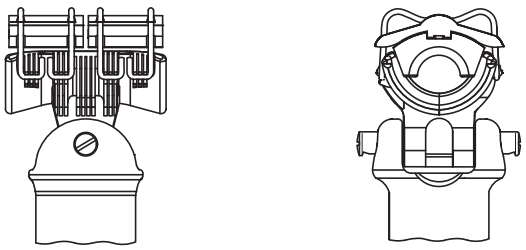
A PKI "M" - SPRING CLAMP WITH CAP SZM/3

A PKI "G" - VIJAČNA SPONKA



A PKI "G" - SCREW CLAMP

A PKI "E" – ZA VODNIKE OD Ø15 DO Ø30

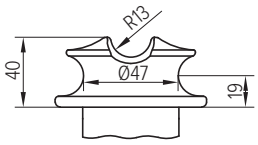


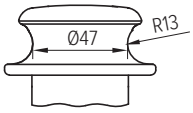
A PKI "E" – FOR CONDUCTORS FROM Ø15 TO Ø30

4.4 PKI - oblike zgornjih priključkov

4.4 PKI - shape of top fittings

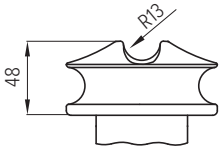
PKI "O" - BREZ SPONKE

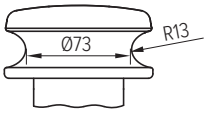




PKI "O" - WITHOUT CLAMP

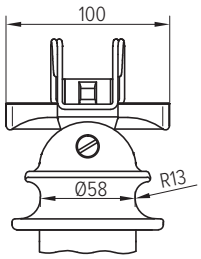
PKI "H" - BREZ SPONKE

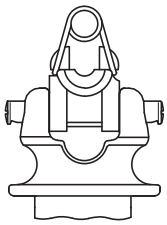




PKI "H" - WITHOUT CLAMP

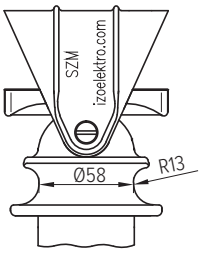
PKI "S" - VZMETNA SPONKA

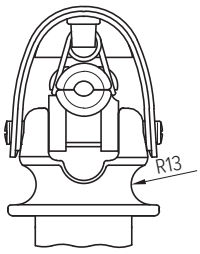




PKI "S" - SPRING CLAMP

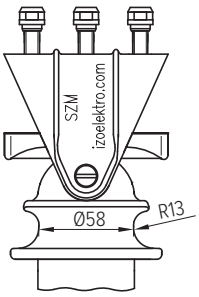
PKI "Z" - VZMETNA SPONKA S KAPO SZM/0

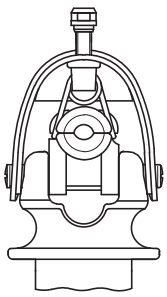




PKI "Z" - SPRING CLAM WITH CAP SZM/0

PKI "M" - VZMETNA SPONKA S KAPO SZM/3





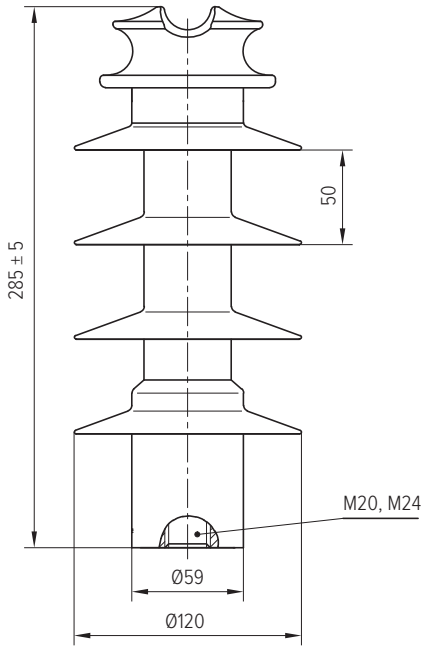
PKI "M" - SPRING CLAMP WITH CAP SZM/3

4.5 Silikonski plašč N

Opomba: izbira izolatorja

4.5 Silicone coat N

Note: selection of the insulator



PKI NO

Tip	Komercialna oznaka	Nazivna obratovalna napetost	Število reber	Plazilna pot	Preskočna razdalja	Vzdržna atm. udarna nap. v suhem	Vzdržna izmenična nap. v mokrem
Type	*Commercial designation*	*Nominal operating voltage*	*Number of Sheds*	*Creepage distance*	*Arcing distance*	*Dry lighting impulse withstand voltage*	*Wet power frequency withstand voltage*
PKI N	O, H	24 kV	4	543 mm	250 mm	155 kV	77 kV
A PKI N	S, V, Z, M, M 120/99, G, E	24 kV	4	643 mm	308 mm	177 kV	82 kV

Možnost izbire izolatorjev PKI N in A PKI N / ***The choice of insulators PKI N and A PKI N***

Tip	Komercialna *oznaka*	Zgornji priključek	Spodnji priključek	IEC 61952-1 *oznaka*	Dolžina	Masa
Type	*Commercial designation*	*Top fitting*	*Bottom end fitting*	*IEC 61952-1 designation*	*Length* L ± 5% [mm]	*Mass* m [kg]
PKI N	O	brez sponke / *without clamp*	M20, M24	CLP7.5-170NRN-543	285	1,70
PKI N	H	brez sponke / *without clamp*	M20, M24	CLP7.5-170NRN-543	310	1,65
A PKI / PKI N	S	z vzmetno sponko / *with spring clamp*	M20, M24	CLP7.5-170JRN-670	305	2,00
A PKI N	V	z oslabljeno vzmetno sponko / *with a weakened spring clamp*	M20, M24	CLP7.5-170JRN-670	305	2,05
A PKI / PKI N	Z	s kapo SZM/0 / *with cap SZM/0*	M20, M24	CLP7.5-170JRN-670*	305	2,10
A PKI / PKI N	M	s kapo SZM/3 / *with cap SZM/3*	M20, M24	CLP7.5-170JRN-670**	305	2,10
A PKI N	M 120/99	za vodnike AlFe 120/PIV99 / *for cunductors AlFe 120/CC99*	M20, M24	CLP7.5-170JRN-670	305	2,10
A PKI N	G	z vijačno sponko / *with screw clamp*	M20, M24	/	308	2,10
A PKI N	E	za vodnike od 15Ø do 30Ø / *for cunductor from 15Ø to 30Ø*	M20, M24	/	320	2,25

* z vzmetno sponko s kapo SZM/0
with a spring clamp and a SZM/0 cap

** z vzmetno sponko s kapo SZM/3
with a spring clamp and a SZM/3 cap

Oznake na izolatorju / *Marks on insulator*

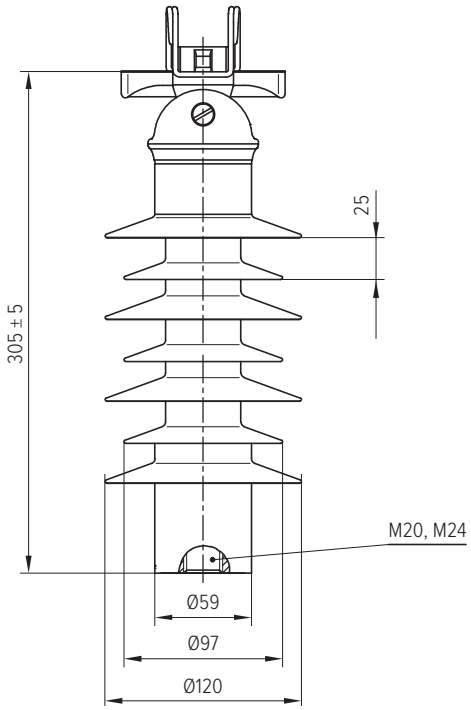
Proizvajalec *Manufacturer*	Tip SN kompozitnega izolatorja *Type of MV composite insulator*	Mesec in leto proizvodnje *Month and year of production*	Nazivna upogibna sila (SCL) *Specified cantilever load (SCL)*
Izoelektro	A PKI, PKI	3/19	12,5 ali / *or* 15 kN

4.6 Silikonski plašč L

Opomba: izbira izolatorja

4.6 *Silicone coat L*

Note: selection of the insulator



A PKI LS

Tip	Komercialna oznaka	Nazivna obratovalna napetost	Število reber	Plazilna pot	Preskočna razdalja	Vzdržna atm. udarna nap. v suhem	Vzdržna izmenična nap. v mokrem
Type	*Commercial designation*	*Nominal operating voltage*	*Number of Sheds*	*Creepage distance*	*Arcing distance*	*Dry lighting impulse withstand voltage*	*Wet power frequency withstand voltage*
PKI L	O, H	36 kV	7	680 mm	250 mm	158 kV	89 kV
A PKI L	S, V, Z, M, M 120/99, G, E	36 kV	7	741 mm	308 mm	182 kV	82 kV

Možnost izbire izolatorjev PKI L in A PKI L / *The choice of insulators PKI L and A PKI L*

Tip	Komercialna oznaka	Zgornji priključek	Spodnji priključek	IEC 61952-1 oznaka	Dolžina	Masa
Type	*Commercial designation*	*Top fitting*	*Bottom end fitting*	*IEC 61952-1 designation*	*Length* L ± 5% [mm]	*Mass* m [kg]
PKI L	O	brez sponke / *without clamp*	M20, M24	CLP7.5-170NRN-670	285	1,80
PKI L	H	brez sponke / *without clamp*	M20, M24	CLP7.5-170NRN-670	310	1,75
A PKI / PKI L	S	z vzmetno sponko / *with spring clamp*	M20, M24	CLP7.5-170JRN-782	305	2,10
A PKI L	V	z oslabljeno vzmetno sponko / *with a weakened spring clamp*	M20, M24	CLP7.5-170JRN-782	305	2,10
A PKI / PKI L	Z	s kapo SZM/0 / *with cap SZM/0*	M20, M24	CLP7.5-170JRN-782*	305	2,15
A PKI / PKI L	M	s kapo SZM/3 / *with cap SZM/3*	M20, M24	CLP7.5-170JRN-782**	305	2,20
A PKI L	M 120/99	za vodnike AlFe 120/PIV99 / *for cunductors AlFe 120/CC99*	M20, M24	CLP7.5-170JRN-782	305	2,20
A PKI L	G	z vijačno sponko / *with screw clamp*	M20, M24	/	308	2,20
A PKI L	E	za vodnike od 15Ø do 30Ø / *for cunductor from 15Ø to 30Ø*	M20, M24	/	320	2,35

* z vzmetno sponko s kapo SZM/0
with a spring clamp and a SZM/0 cap

** z vzmetno sponko s kapo SZM/3
with a spring clamp and a SZM/3 cap

Oznake na izolatorju / *Marks on insulator*

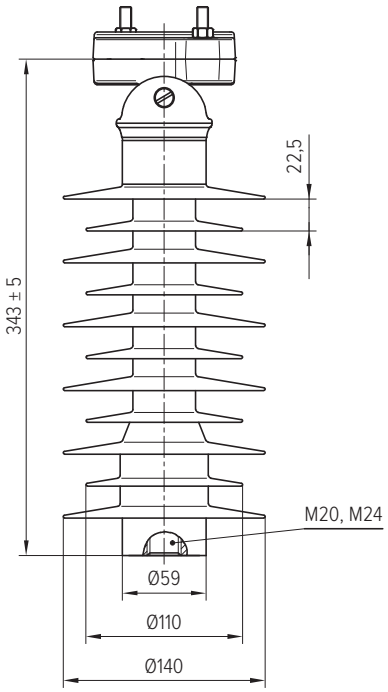
Proizvajalec *Manufacturer*	Tip SN kompozitnega izolatorja *Type of MV composite insulator*	Mesec in leto proizvodnje *Month and year of production*	Nazivna upogibna sila (SCL) *Specified cantilever load (SCL)*
Izoelektro	A PKI, PKI	3/19	12,5 ali / *or* 15 kN

4.7 Silikonski plašč X

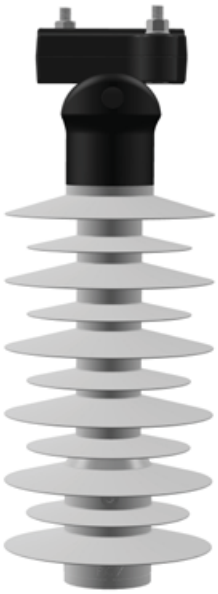
Opomba: izbira izolatorja

4.7 *Silicone coat X*

Note: selection of the insulator



A PKI XG



Tip	Komercialna oznaka	Nazivna obratovalna napetost	Število reber	Plazilna pot	Preskočna razdalja	Vzdržna atm. udarna nap. v suhem	Vzdržna izmenična nap. v mokrem
Type	*Commercial designation*	*Nominal operating voltage*	*Number of Sheds*	*Creepage distance*	*Arcing distance*	*Dry lighting impulse withstand voltage*	*Wet power frequency withstand voltage*
PKI X	O, H	52 kV	11	1170 mm	296 mm	190 kV	104 kV
A PKI X	S, V, Z, M, M 120/99, G, E	52 kV	11	1230 mm	380mm	230 kV	106 kV

Možnost izbire izolatorjev PKI X in A PKI X / *The choice of insulators PKI X and A PKI X*

Tip	Komercialna *oznaka*	Zgornji priključek	Spodnji priključek	IEC 61952-1 *oznaka*	Dolžina	Masa
Type	*Commercial designation*	*Top fitting*	*Bottom end fitting*	*IEC 61952-1 designation*	*Length* L ± 5% [mm]	*Mass* m [kg]
PKI X	O	brez sponke / *without clamp*	M20, M24	CLP7.5-200NRN-1150	330	2,10
PKI X	H	brez sponke / *without clamp*	M20, M24	CLP7.5-200NRN-1150	350	2,05
A PKI / PKI X	S	z vzmetno sponko / *with spring clamp*	M20, M24	CLP7.5-200JRN-1230	340	2,40
A PKI X	V	z oslabljeno vzmetno sponko / *with a weakened spring clamp*	M20, M24	CLP7.5-200JRN-1230	340	2,40
A PKI / PKI X	Z	s kapo SZM/0 / *with cap SZM/0*	M20, M24	CLP7.5-200JRN-1230*	340	2,45
A PKI / PKI X	M	s kapo SZM/3 / *with cap SZM/3*	M20, M24	CLP7.5-200JRN-1230**	340	2,40
A PKI X	M 120/99	za vodnike AlFe 120/PIV99 / *for cunductors AlFe 120/CC99*	M20, M24	CLP7.5-200JRN-1230	340	2,40
A PKI X	G	z vijačno sponko / *with screw clamp*	M20, M24	/	343	2,40
A PKI X	E	za vodnike od 15Ø do 30Ø / *for cunductor from 15Ø to 30Ø*	M20, M24	/	365	2,65

* z vzmetno sponko s kapo SZM/0
with a spring clamp and a SZM/0 cap

** z vzmetno sponko s kapo SZM/3
with a spring clamp and a SZM/3 cap

Oznake na izolatorju / *Marks on insulator*

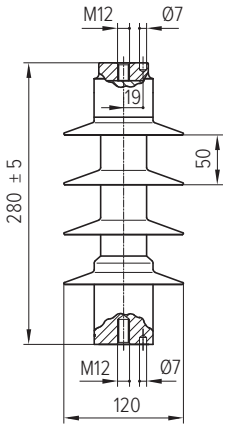
Proizvajalec *Manufacturer*	Tip SN kompozitnega izolatorja *Type of MV composite insulator*	Mesec in leto proizvodnje *Month and year of production*	Nazivna upogibna sila (SCL) *Specified cantilever load (SCL)*
Izoelektro	A PKI, PKI	3/19	12,5 ali / *or* 15 kN

4.8 PKIL za ločilnik

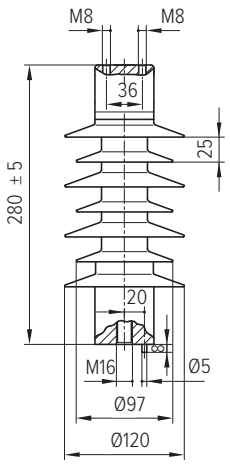
Opomba: obliko in material priključkov izdelamo po zahtevi kupca

4.8 *PKIL for switch disconnector*

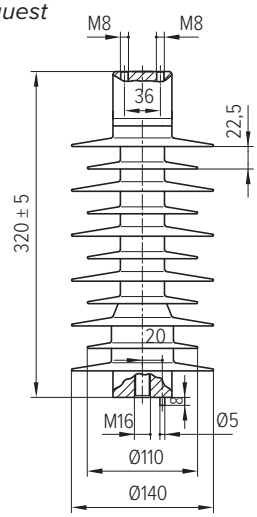
Note: we make the holes for attaching connectors on customer's request



PKIL N ES



PKIL L TSN



PKIL X ME

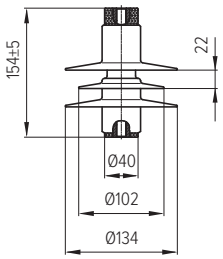
Tip	PKIL N	PKIL L	PKIL X	*Type*
Komercialna oznaka	**ES**	**TSN**	**ME**	***Commercial designation***
Nazivna obratovalna napetost	24 kV	36 kV	52 kV	*Nominal operating voltage*
Plazilna pot	493 mm	620 mm	1125 mm	*Creepage distance*
Preskočna razdalja	275 mm	275 mm	330 mm	*Arcing distance*
Vzdržna atm. 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*

4.9 PKIL IZO za ločilnik

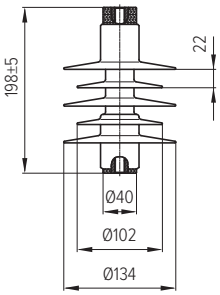
Opomba: obliko in material priključkov izdelamo po zahtevi kupca

4.9 *PKIL IZO for switch disconnector*

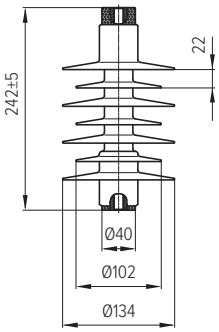
Note: we make the holes for attaching connectors on customer's request



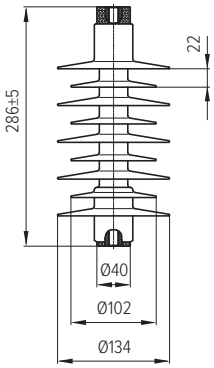
PKIL 12



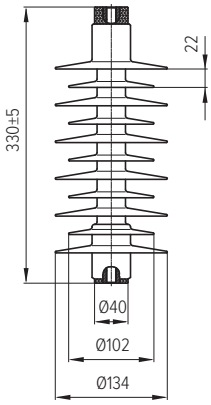
PKIL 24



PKIL 36



PKIL 44



PKIL 52

Naziv	PKIL	PKIL	PKIL	PKIL	PKIL	*Name*
Komercialna oznaka	**12**	**24**	**36**	**44**	**52**	***Commercial designation***
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*

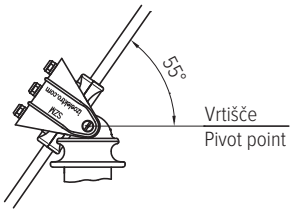
4.10 A PKI in PKI nagib in odkloni vodnika

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

4.10 *A PKI and PKI inclination and conductor declination*

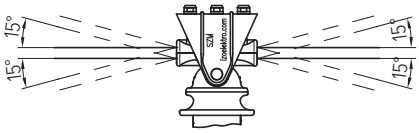
Note: the data in the images below represents the maximum conductor inclinations and declinations in the A PKI and PKI insulators' heads regarding their mounting.

Nagib zgornjega priključka izolatorja



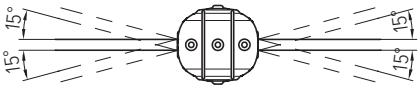
Insulator top inclination

Vertikalni odklon vodnika



Vertical conducto declination

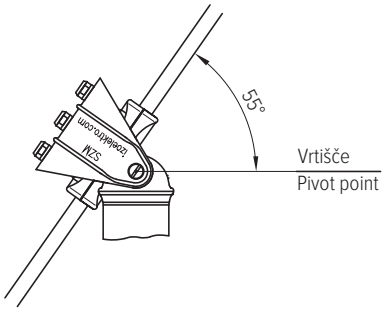
Horizontalni odklon vodnika



Horizontal conductor declination

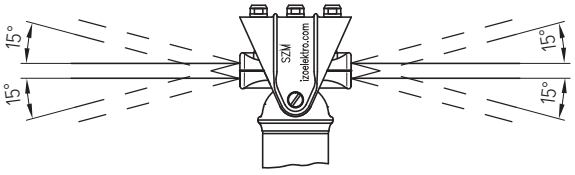
A PKI, PKI (G, S, V, Z, M, M120/99) **PKI (O, H)**

Nagib zgornjega priključka izolatorja



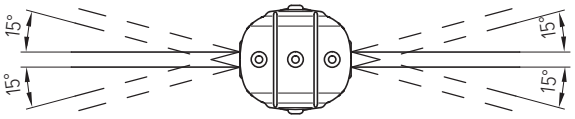
Insulator top inclination

Vertikalni odklon vodnika



Vertical conductor declination

Horizontalni odklon vodnika



Horizontal conductor declination

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

4.11 Zaščita za divje živali 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 divje živali. 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 zgornjega priključka 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
Področja zaščitena zaradi divjih živali vsaka država samostojno določa. Mi vgradnjo zaščite priporočamo na daljnovodih, kjer pogosto prihaja do zemeljskih stikov zaradi:

- večjih ptic,
- na mestih priletov in odletov jate ptic,
- preskakovanja glodalcev na oporiščih.

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

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

Naročanje
Izberete kateri koli velikost podpornega kompozitnega izolatorj A PKI z oznako »G«, kapo SZM/0 in priporočeno število metrov silikonskega plašča SILP. Primer garniture za en izolator je podan v točki 4.12 A PKI zaščita za divje živali.

4.11 *Wildlife protection generally*

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

Characteristic
The A PKI composite post insulators with mark »B« have a fitted cap for the protection of metal composite insulator head parts. The SILP silicone coat mounted on the conductor insulates the bare conductor attached to the insulator on each side of the insulator. A screw clamp tightened with the specifi d torque ensures that the conductor can move through the SILP silicone coat, while at the same time preventing the movement of the silicon coat in relation to the attachment point.

Installation
Protected areas for wildlife conservation are determined by the government of a specifi country. We recommend the installation of wildlife protection onto overhead power lines wherever earth faults often occur due to:

- *larger birds,*
- *birds landing and taking off*
- *rodents jumping onto poles.*

Together with our users we have created a system for installing standard protective elements. For the implementiation of a wildlife protection system, it is necessary to use:

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

Ordering
Choose any A PKI composite post insulator with the mark »G«, cap SZM/0 and the recommended number of meters of the SILP silicone coat. An example for a single set insulator is given in section 4.12 A PKI for wildlife protection.

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 divje živali deluje tudi pri ekstremnih vremenskih pogojih.

Competitive advantages

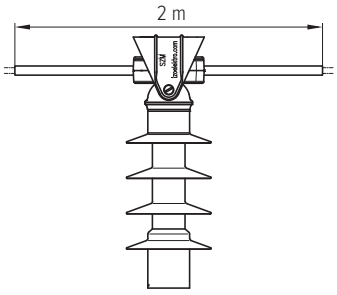
- *All poles with installed insulators A PKI and PKI with mark »G« have an option of a simple system upgrade.*
- *Provides 100% protection on poles.*
- *Wildlife protection works even in extreme weather conditions.*

4.12 Zaščita za divje živali - garnitura

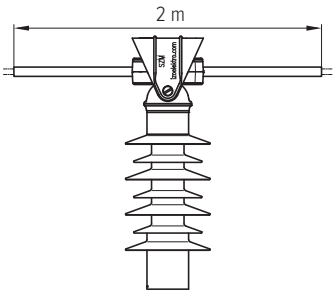
Horizontalna izvlečna sila vodnika (Fh): **2,8 kN**
Vertikalna dopustna obremenitev sponke (Fv): **4,0 kN**

4.12 Wildlife protection - set

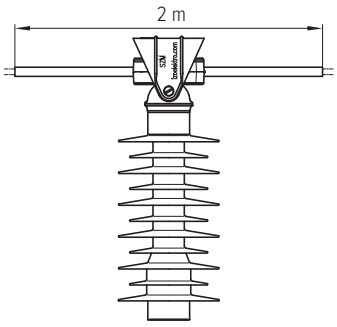
*Horizontal pull-out force of the conductor (Fh): **2,8 kN***
*Vertical maximum load of clamp (Fv): **4,0 kN***



A PKI NB



A PKI LB



A PKI XB

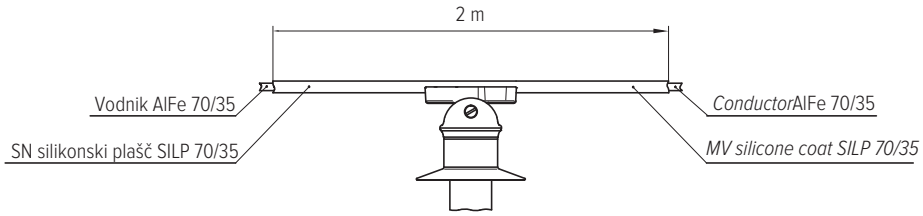
Garnitura	Količina *Quantity*	*Set*
A PKI NG ali A PKI LG ali A PKI XG	1 kos/pcs	*A PKI NG or A PKI LG or A PKI XG*
+ SN silikonski plašč SILP 70/35	2 m	*+ MV SILP 70/35 silicone coat*
+ Kapa SZM/0	1 kos/pcs	*+ SZM/0 cap*

Navodila za namestitev zaščite za divje živali z vijačno sponko

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

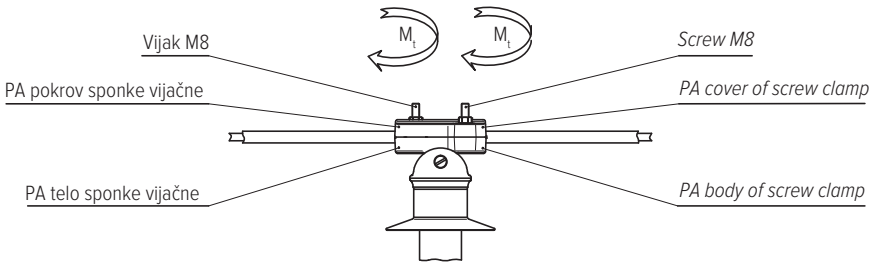
Installation instructions for wildlife protection with a screw clamp

1. The SILP 70/35 silicone coat is installed onto the conductur symmetrically to the screw clamp.



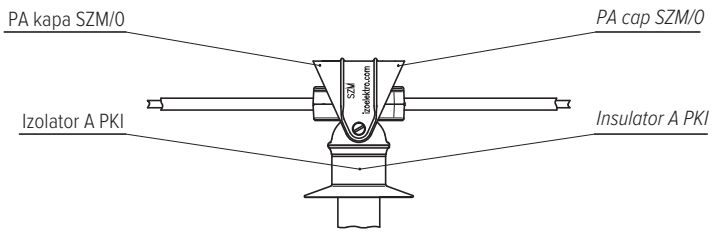
2. Vijaka privijemo z navorom M_t=6 Nm.

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



3. Namestimo kapo SZM/0.

3. Install the cap SZM/0.



4.13 A PKI varna montaža skozi gozd splošno

Proizvod

A 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 A 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 A 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 EIMV, Ljubljana.

4.13 A PKI safe installation through the woods generally

Product

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

Characteristic

Composite post insulators have a weakened spring clamp shuttle for easier collapsing in extreme weather conditions.

Installation

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

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

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 cooperation with end-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). Safe installation through the woods requires the following equipment:

- *insulators A 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

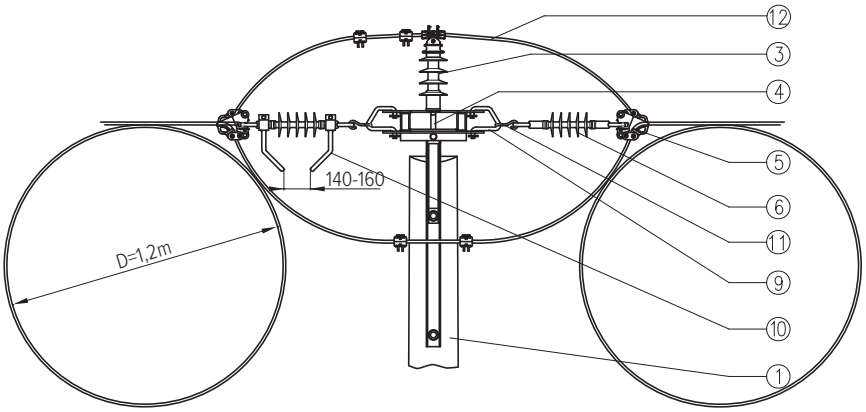
- *Specified cantilever load (SCL): **15 kN***
- *Ambient temperature range **T = -60 °C ... +85 °C***
- *Coating: **silicone LSR***
- *Silicone colour: **grey***
- *Material of top fitting: **PA6, UV stabilized***
- *Material of steel end fitting: **ST 52-3***
- *Zinc coat: ≥ **70 µm***

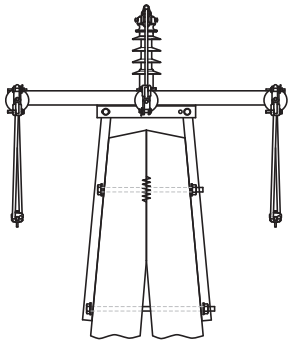
Competitive advantages

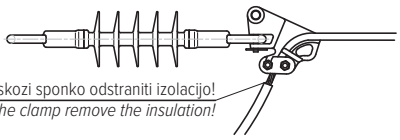
- *The system for safe installation with the PKI insulators with the mark »V« ensures the safety of a power line.*
- *It protects poles from breaking when trees fall on conductors.*
- *The system is the result of professional research conducted by our researchers together with users and the technical staff from the EIMV Institute in Ljubljana.*

4.14 A PKI varna montaža skozi gozd - primer

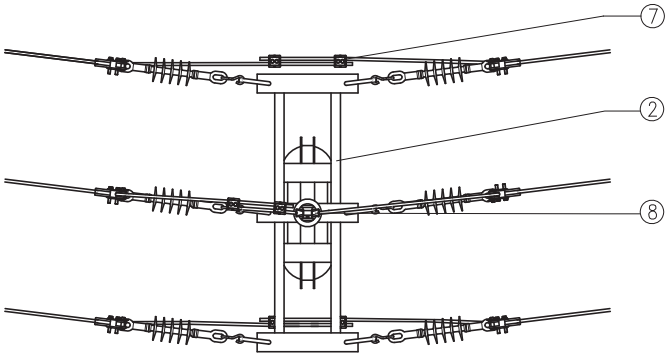
4.14 *A PKI safe installation through the woods - example*







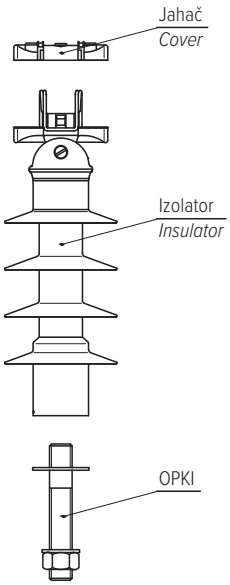
Pri prehodu skozi sponko odstraniti izolacijo!
When cossing trough the clamp remove the insulation!



Poz	Naziv	*Pos*	*Name*	Kos/*Pcs*
1	Drog	*1*	*Pole*	1
2	Nosilna konzola - komplet	*2*	*Suspension crossarm brace - set*	1
3	Podporni kompozitni izolator A PKI	*3*	*A PKI post composite insulato*	1
4	Opornica OPKI	*4*	*Pin OPKI*	1
5	Sponka zatezna SZ-U	*5*	*SZ-U tension clamp*	6
6	Natezni kompozitni izolator NKI	*6*	*NKI tension composite insulator*	6
7	Sponka tokovna	*7*	*Current clamp*	3
8	Jahač	*8*	*Cover*	1
9	Streme OS 80	*9*	*OS 80 shackle*	6
10	Rogljič NKI	*10*	*NKI arcing horn*	6
11	Kljuka zasukana	*11*	*90° hook*	6

4.15 A PKI izolatorji garniture

Opomba: na željo kupca izdelamo garniture po zahtevi.



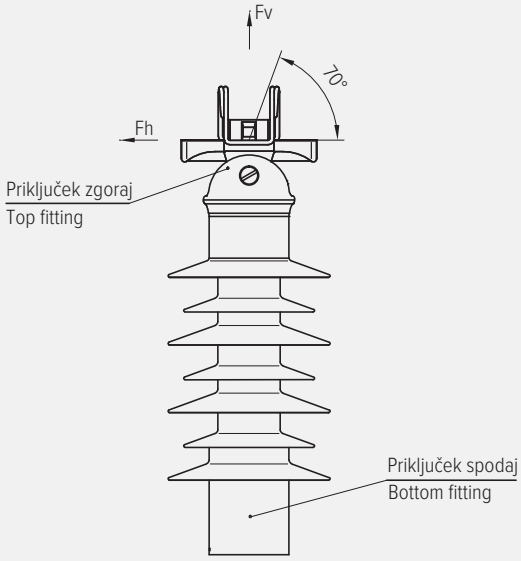
4.15 *A PKI insulator sets*

Note: we produce sets per 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*

4.16 A PKI izolatorji - primer naročila

4.16 *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 fitting*
M24, M20	*- Connector thread on the bottom end fitting*

Oznake na kompozitnem izolatorju

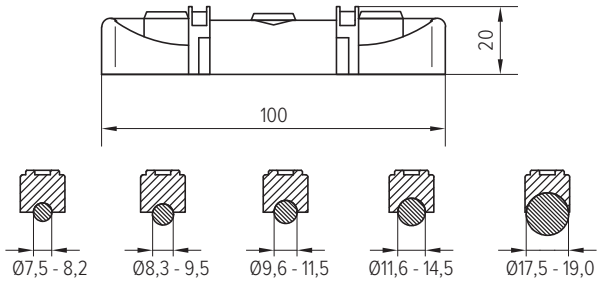
Izoelektro	- Proizvajalec
A PKI	- Tip SN kompozitnega izolatorja
4/17	- Mesec / leto proizvodnje
15 kN	- Nazivna upogibna sila (STL)

Marks on composite insulator

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

4.17 PA jahači

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



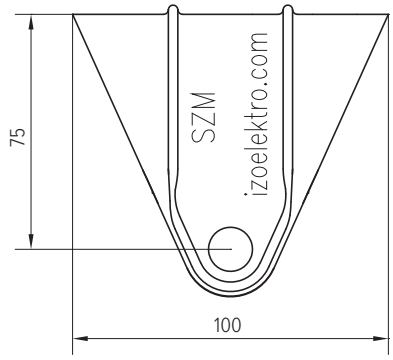
4.17 PA covers

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

Ø vodnika *Ø of Conductor*	Koda *Code*	Naziv *PA jahač*	Name *PA cover*
7,5 - 8,2	**11 12 09**	35 AlFe	35 AlFe
8,3 - 9,5	**11 12 10**	50 AlFe	50 AlFe
9,6 - 11,5	**11 12 08**	70 AlFe in 35 PIV	70 AlFe and 35 CC
11,6 - 14,5	**11 12 11**	95 AlFe in 70 PIV	95 AlFe and 70 CC
17,5 – 19,0	**11 12 12**	120 AlFe in 99 PIV	120 AlFe and 99 CC

4.18 PA kapa SZM/0

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

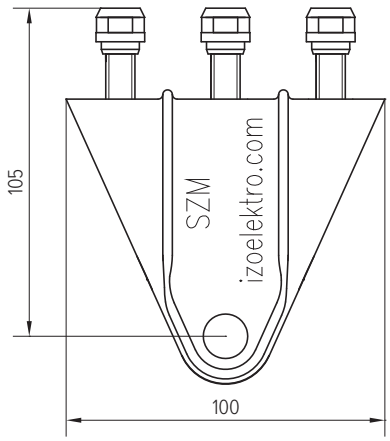


4.18 PA cap SZM/0

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

4.19 PA kapa SZM/3

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

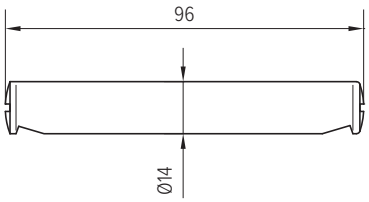


4.19 PA cap SZM/3

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

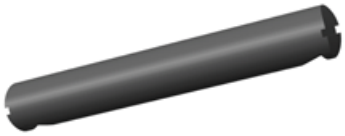
4.20 PA sornik

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



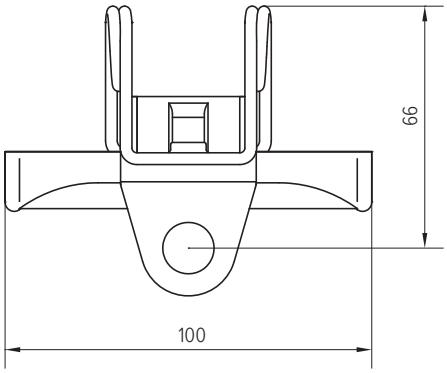
4.20 *PA bolt*

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



4.21 PA telo sponke z vzmetjo

Uporaba: v zgornjem priključku A PKI in PKI izolatorjev "S", "Z" in "M"
Koda: **11 10 01**

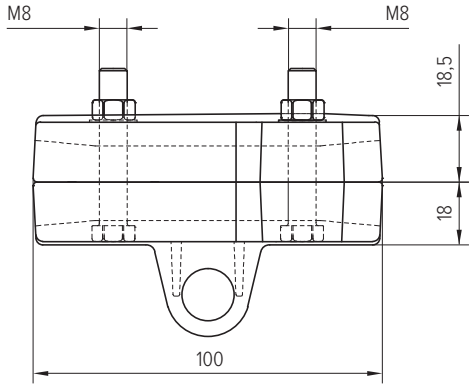


4.21 *PA body with spring clamp*

Usage: n top fittings of "S", "Z" and "M" A PKI and PKI insulators
*Code: **11 10 01***

4.22 PA sponka vijačna

Uporaba: v zgornjem priključku A PKI izolatorja »G«
Premer vodnika: Ø 14 - 22
Koda: **11 11 02**

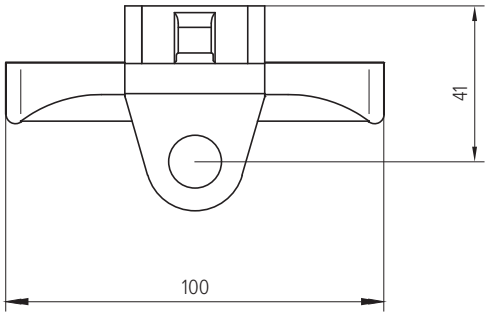


4.22 *PA screw clamp*

Usage: in top fitting of A PKI insulator »G«
Conductor diameter: Ø 14 - 22
*Code: **11 11 02***

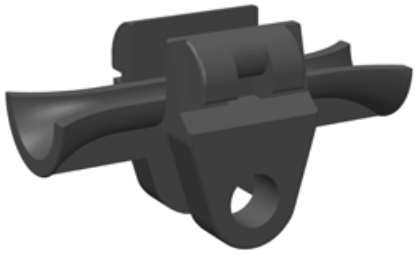
4.23 PA telo sponke vzmetne

Uporaba: v zgornjem priključku A PKI in PKI izolatorjev "S", "Z" in "M"
Koda: **11 10 01**



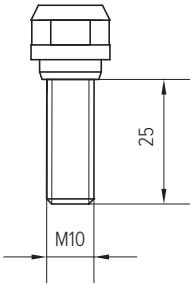
4.23 PA body of spring clamp

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



4.24 PA vijak

Uporaba: pri kapi SZM/3
Koda: **40 10 38**

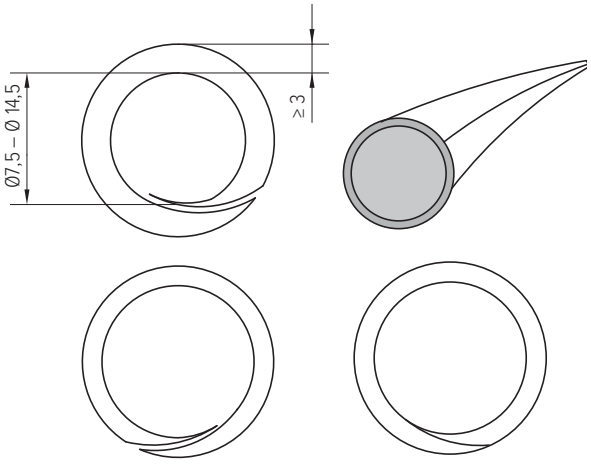


4.24 PA screw

Usage: with the SZM/3 cap
Code: ***40 10 38***

4.25 SN silikonski plašč SILP

Uporaba: pri zaščiti za divje živali
Koda: **40 10 34**



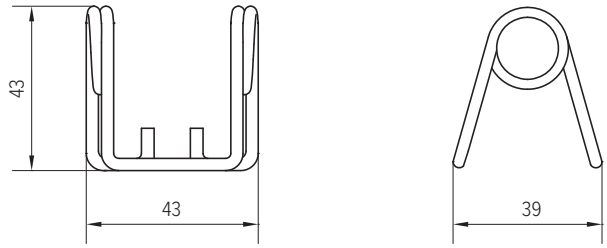
Pred montažo / *before installation* Po montaži / *after installation*

4.25 MV silicone coat SILP

Usage: for wildlife protection set
Code: ***40 10 34***

4.26 SN vzmet

Uporaba: pri PA telesa sponke vzmetne
Koda: **12 10 01**

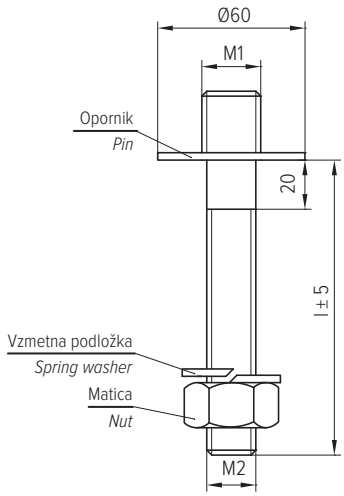


4.26 *MV spring*

Usage: with the PA spring clamp body
Code: ***12 10 01***

4.27 OPKI oporniki

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



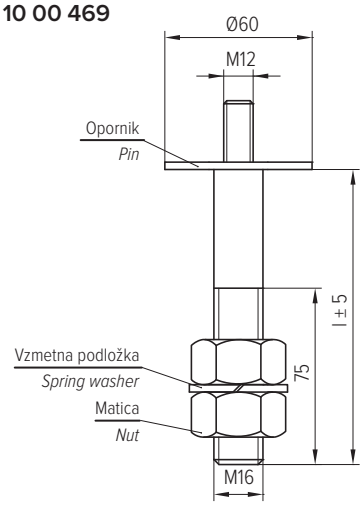
4.27 *OPKI pins*

Usage: for installing A PKI and PKI insulators onto the bracket
Note: the shape and dimensions can be produced per customer's request

Naziv *Name*	Koda *Code*	M1	M2	l (mm)
OPKI M20/M20x140	**10 00 461**	20	20	140
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/M24x140	**10 00 479**	24	24	140
OPKI M24/M24x170	**10 00 464**	24	24	170

4.28 OPKIL opornik za ločilnik

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



4.28 *OPKIL pin for switch disconnector*

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

Beležke

Notes

DV pribor
PL accessories

5

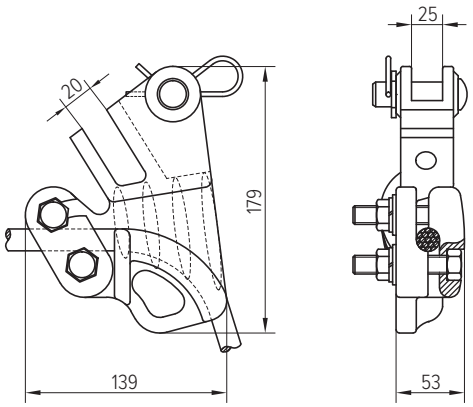
IZOELEKTRO

5.1 SZ-U sponka zatezna univerzalna

Minimalna prelomna sila: 60 kN
Moment zategnitve vijaka: 45 Nm
Premer vodnika AlFe: 6,8-14,0 mm
Material: Al legura, vroče cinkano jeklo
Koda: **80 60 03**

5.1 *SZ-U universal tension clamp*

Minimum breaking load: 60 kN
Tightening torque for screw: 45 Nm
Conductor diameter AlFe: 6,8-14,0 mm
Material: Al alloy, hot dip galvanized steel
*Code: **80 60 03***

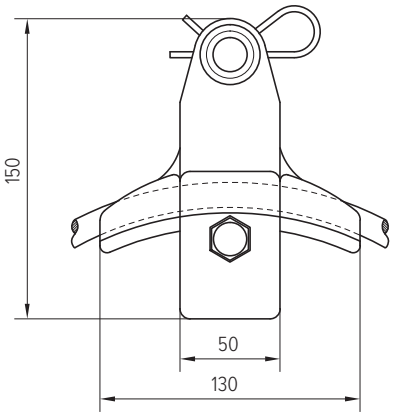


5.2 SN-U sponka nosilna univerzalna

Minimalna prelomna sila: 60 kN
Moment zategnitve vijaka: 45 Nm
Premer vodnika AlFe: 6,8-14,0 mm
Material: Al legura, vroče cinkano jeklo
Koda: **80 60 04**

5.2 *SN-U universal suspension clamp*

Minimum breaking load: 60 kN
Tightening torque for screw: 45 Nm
Conductor diameter AlFe: 6,8-14,0 mm
Material: Al alloy, hot dip galvanized steel
*Code: **80 60 04***

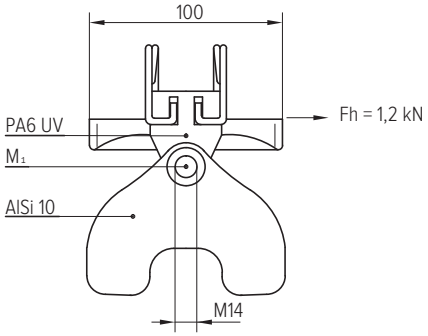


5.3 VS sponka vzmetna

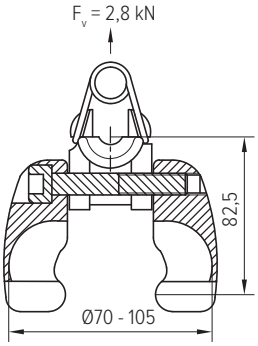
Uporaba: za pritrjevanje vodnikov premera 6,8-18,8 mm za karamične izolatorje.
Sponka VS 20: VHD 20, LPI N, SER-b 20
Sponka VS 25: VHD 25, LPI L, SER-b 25
Orodje: imbus 14 mm
Moment M_1: 25 Nm
Koda VS 20: **10 10 01**
Koda VS 25: **10 10 02**

5.3 *VS spring clamp*

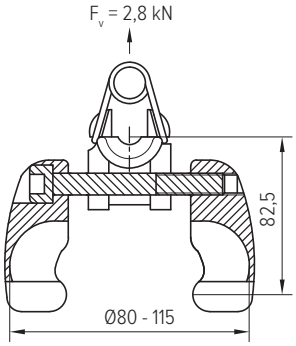
Usage: for installing conductors with diameter 6,8-18,8 mm for ceramic insulators.
Clamp VS 20: VHD 20, LPI N, SER-b 20
Clamp VS 25: VHD 25, LPI L, SER-b 25
Tool: allen key 14 mm
Torque M_1: 25 Nm
*Code VS 20: **10 10 01***
*Code VS 25: **10 10 02***



VS 20 / VS 25



VS 20



VS 25

Opomba: obvezen nastavek PA jahač (poglavje 4.17)

Note: required accessory PA cover (chapter 4.17)

5.4 VSV sponka vijačna

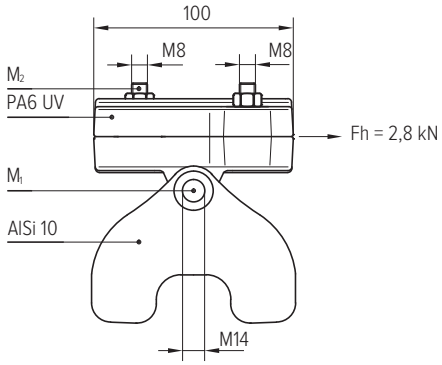
VSV 20 sponka vzmetna, Koda: **10 10 08**
VSV 25 sponka vzmetna, Koda: **10 10 09**
Premer vodnika: **14-22 mm**
M_1 = 25 Nm za vijak M14
M_2 = 8 Nm za vijak M8
M_2 = 6 Nm za vijak M8 pri montaži SILP (zaščita za živali)

Uporaba za karamične izolatorje:
VHD 20, VHD 25, LPI N, LPI L

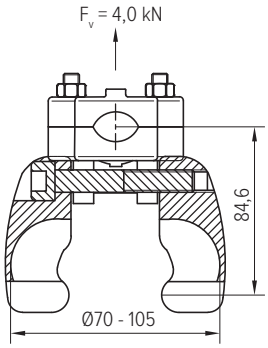
5.4 *VSV screw clamp*

VSV 20 spring clamp, Code: ***10 10 08***
VSV 25 spring clamp, Code: ***10 10 09***
Conductor diameter: ***14-22 mm***
M_1 = 25 Nm for screw M14
M_2 = 8 Nm for screw M8
M_2 = 6 Nm for screw M8 when mounting SILP (wildlife)

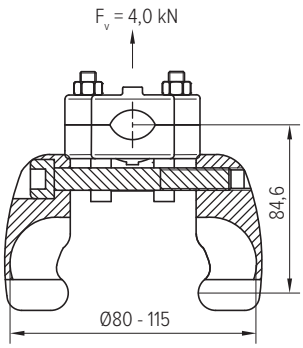
Usage for ceramic insulators:
VHD 20, VHD 25, LPI N, LPI L



VSV 20 / VSV 25



VSV 20



VSV 25

5.5 DSI S distančnik izolacijski z vzmetno sponko

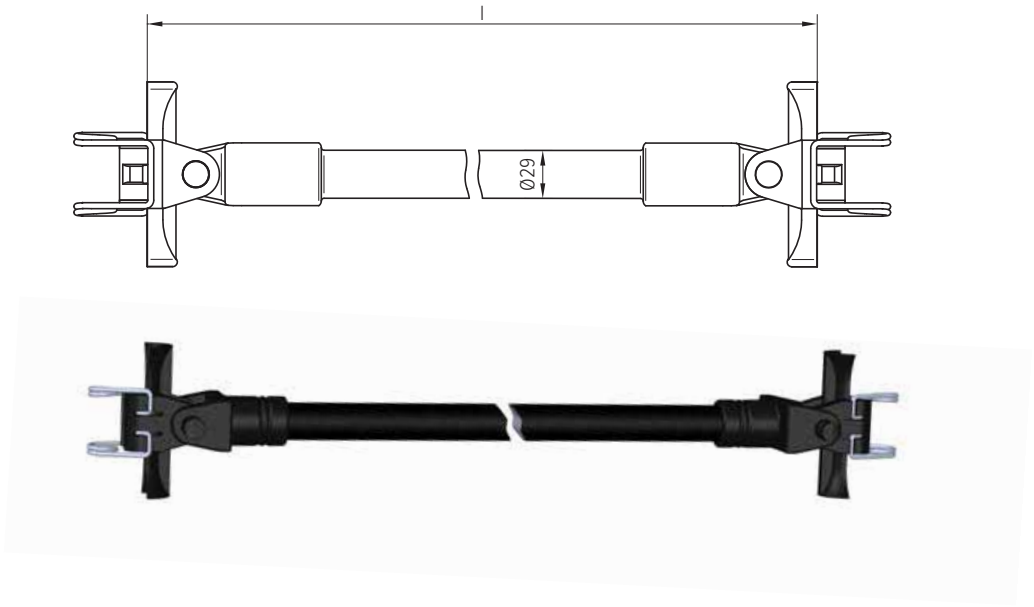
Izvedba: z vzmetno sponko
l (mm): 0400 - 4100
Koda: **24 xxxx ***

* xxxx = dolžina (l) v mm

5.5 *DSI S insulating spacer with a spring clamp*

Version: with spring clamp
l (mm): 0400 - 4100
*Code: **24 xxxx ****

** xxxx = length (l) in mm*



5.6 DSI M distančnik izolacijski z vijačno sponko

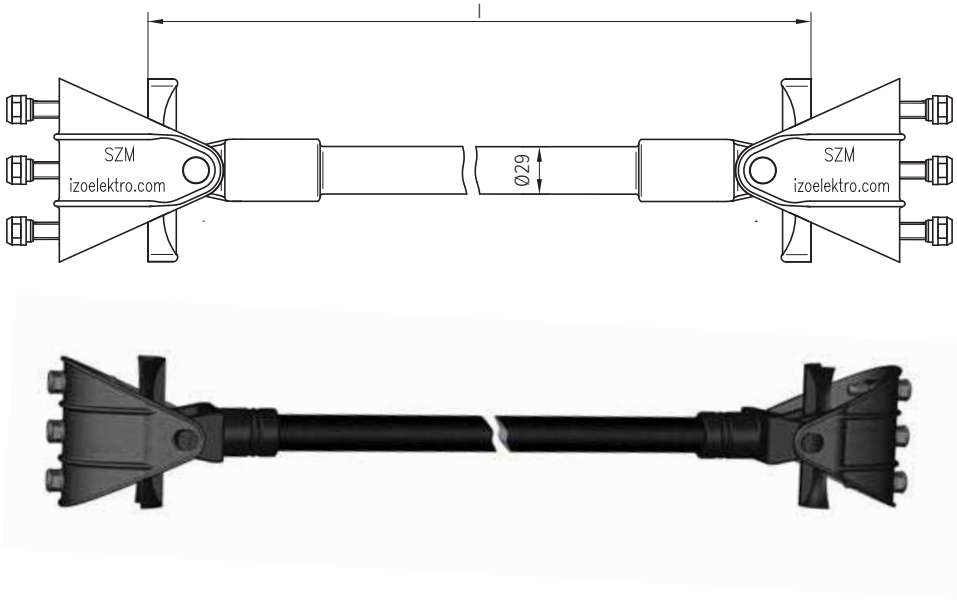
Izvedba: z vijačno sponko
l (mm): 0400 - 4100
Koda: **25 xxxx ***

* xxxx = dolžina (l) v mm

5.6 *DSI M insulating spacer with a screw clamp*

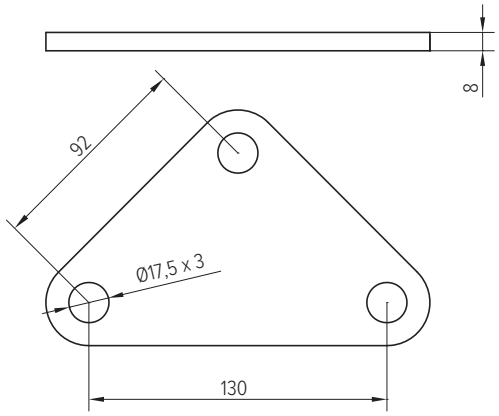
Version: with screw clamp
l (mm): 0400 - 4100
*Code: **25 xxxx ****

** xxxx = length (l) in mm*



5.7 Distančnik jeklen

Minimalna prelomna sila: 90 kN
Koda: **43 29 407**

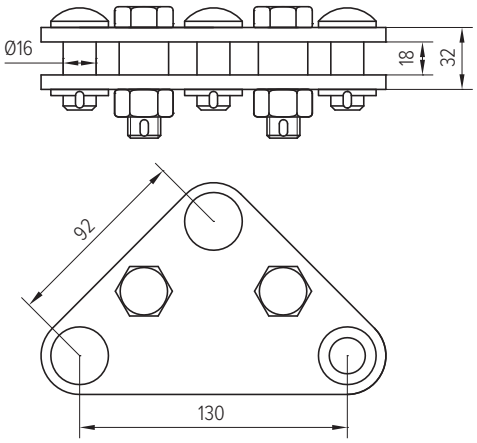


5.7 *Steel yoke*

Minimum breaking load: 90 kN
*Code: **43 29 407***

5.8 Distančnik jeklen dvojni

Minimalna prelomna sila: 90 kN
Koda: **43 29 408**

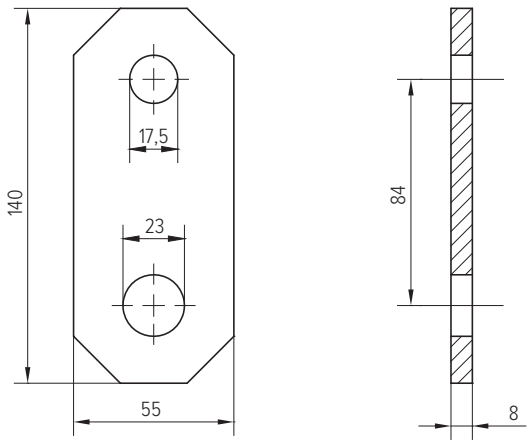


5.8 *Steel yoke double*

Minimum breaking load: 90 kN
*Code: **43 29 408***

5.9 Podaljšek jeklen

Minimalna prelomna sila: 90 kN
Koda: **80 60 30**

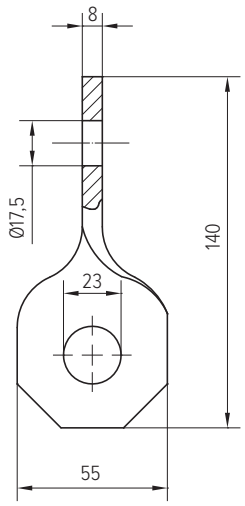


5.9 *Steel extension link*

Minimum breaking load: 90 kN
*Code: **80 60 30***

5.10 Podaljšek jeklen 90°

Minimalna prelomna sila: 90 kN
Koda: **80 60 31**

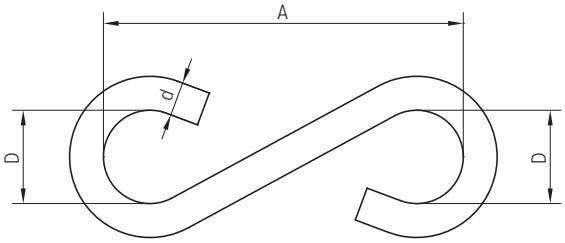


5.10 *Steel extension link 90°*

Minimum breaking load: 90 kN
*Code: **80 60 31***

5.11 S - kavelj

Naziv: S - kavelj 4 kN, dimenzije (mm) A=85, D=22, d=8
Naziv: S - kavelj 6 kN, dimenzije (mm) A=80, D=22, d=10

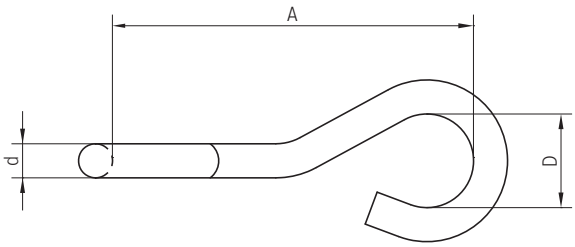


5.11 *S - hook*

Name: S - hook 4 kN, dimension (mm) A=85, D=22, d=8
Name: S - hook 6 kN, dimension (mm) A=80, D=22, d=10

5.12 S - kavelj 90°

Naziv: S - kavelj 90° 4 kN, dimenzije (mm) A=85, D=22, d=8
Naziv: S - kavelj 90° 6 kN, dimenzije (mm) A=80, D=22, d=10

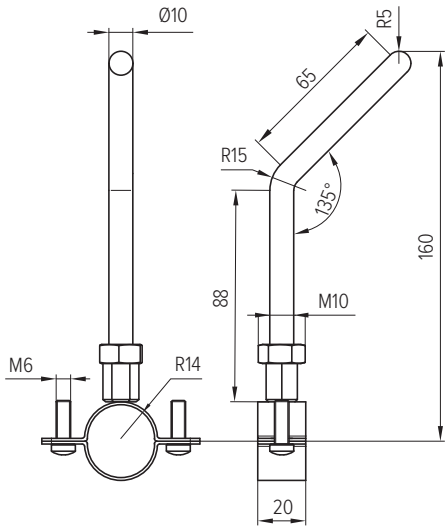


5.12 *S - hook 90°*

Name: S - hook 90° 4 kN, dimension (mm) A=85, D=22, d=8
Name: S - hook 90° 6 kN, dimension (mm) A=80, D=22, d=10

5.13 Rogljič NKI

Moment M6: **16 Nm**
Koda: **80 70 54**

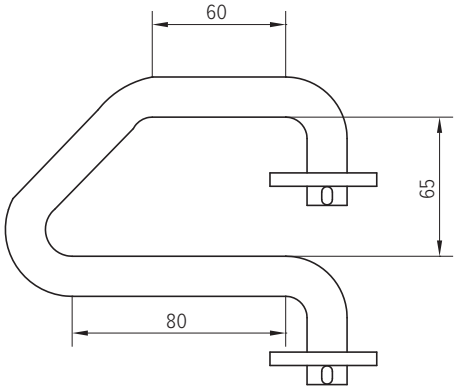


5.13 *Arcing horn NKI*

*Torque M6: **16 Nm***
*Code: **80 70 54***

5.14 G streme OS 65

Minimalna prelomna sila: **90 kN**
Koda: **20 150**

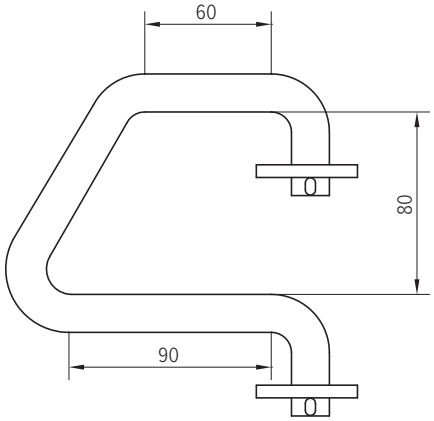


5.14 *G shackle OS 65*

*Minimum breaking load: **90 kN***
*Code: **20 150***

5.15 G streme OS 80

Minimalna prelomna sila: **90 kN**
Koda: **20 151**



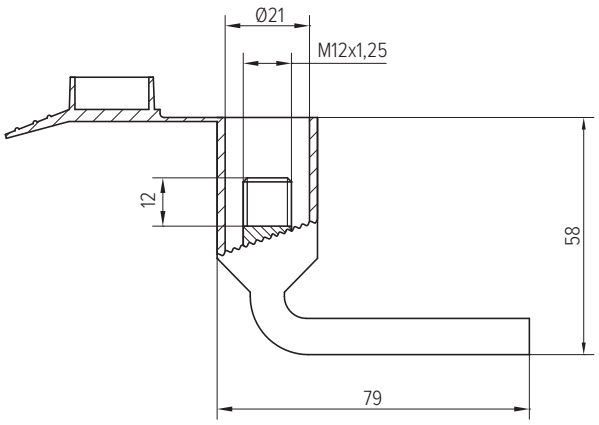
5.15 *G shackle OS 80*

*Minimum breaking load: **90 kN***
*Code: **20 151***

5.16 Vijak ozemljitveni

Naziv: Vijak ozemljitveni – rumen; koda: **70 76 01**
Naziv: Vijak ozemljitveni – črn; koda: **70 76 02**
Material: CuZn28, PA6
Moment M12: 8 Nm

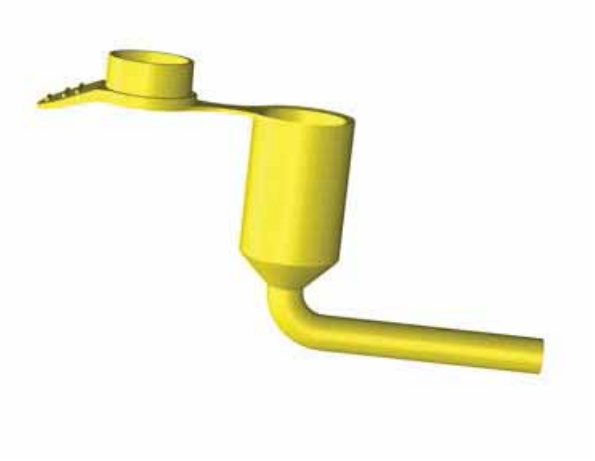
Naziv: Vijak ozemljitveni – rumen Cu; koda: **70 76 03**
Naziv: Vijak ozemljitveni – črn Cu; koda: **70 76 04**
Material: Cu, PA6



5.16 *Earthing screw*

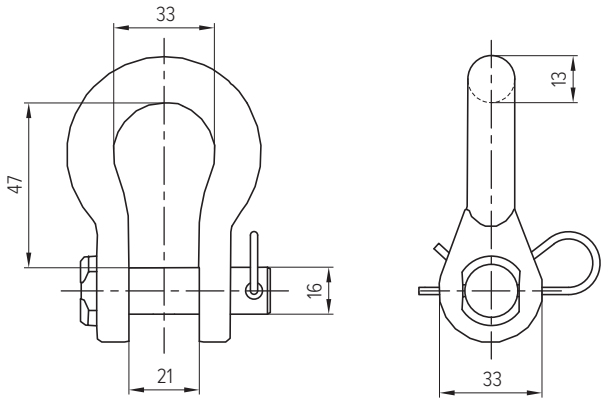
*Name: Earthing screw – yellow; code: **70 76 01***
*Name: Earthing screw – black; code: **70 76 02***
Material: CuZn28, PA6
Torque M12: 8 Nm

*Name: Earthing screw – yellow Cu; code: **70 76 03***
*Name: Earthing screw – black Cu; code: **70 76 04***
Material: Cu, PA6



5.17 Škopec

Minimalna prelomna sila: 80 kN
Koda: **27 08 10**



5.17 *Anchor shackle*

Minimum breaking load: 80 kN
*Code: **27 08 10***

Beležke

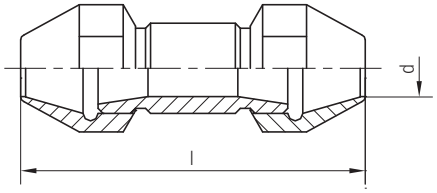
Notes

SN koncentrični material
MV connecting sleeves

6

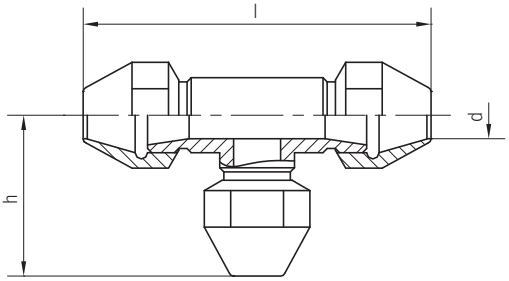
IZOELEKTRO

6.1 R sponka ravna z dvojnim konusom 6.1 *R double conical flat clamp*



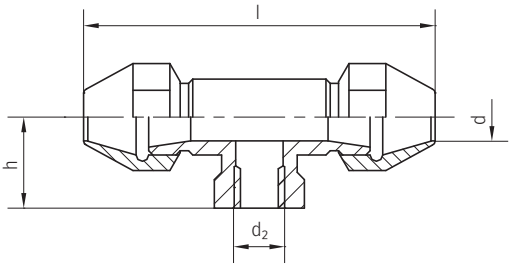
Premer vodnika (mm) Conductor diameter (mm)	Koda *Code*	Tip *Type*	d (mm)	l (mm)	Ključ (mm) Wrench (mm)
7 – 10	**42 40 00**	R10	11,3	70	22
7 - 13	**42 40 01**	R13	14,2	88	27
10 - 16	**42 40 02**	R16	16,6	102	32
16 - 20	**42 40 03**	R20	20,5	120	41

6.2 T sponka odcepna z dvojnim konusom 6.2 *T double conical branch clamp*



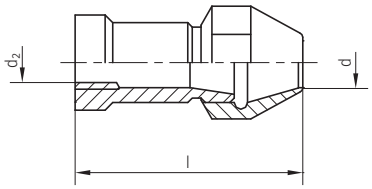
Premer vodnika (mm) Conductor diameter (mm)	Koda *Code*	Tip *Type*	h (mm	d (mm)	l (mm)	Ključ (mm) Wrench (mm)
7 - 10	**42 41 00**	T10	41	11,3	82	22
7 - 13	**42 41 01**	T13	47	14,2	93	27
10 - 16	**42 41 02**	T16	60	16,6	118	32
16 - 20	**42 41 03**	T20	69	20,5	137	41

6.3 Td sponka odcepna s konusom 6.3 *Td conical branch clamp*



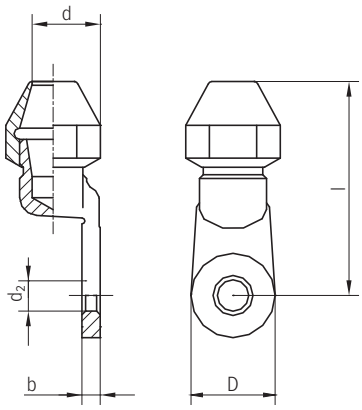
Premer vodnika (mm) Conductor diameter (mm)	Koda *Code*	Tip *Type*	h (mm	d (mm)	d_2 (mm)	l (mm)	Ključ (mm) Wrench (mm)
7 - 10	**42 43 00**	Td10	25	11,3	M12	85	22
7 - 13	**42 43 01**	Td13	25	14,2	M16	95	27
10 - 16	**42 43 02**	Td16	30	16,6	M20	121	32
16 - 20	**42 43 03**	Td20	30	20,5	M24	140	41

6.4 Rp priključek ravni 6.4 *Rp flat fitting*



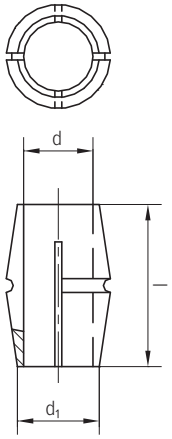
Premer vodnika (mm) Conductor diameter (mm)	Koda *Code*	Tip *Type*	h (mm	d (mm)	d_2 (mm)	l (mm)	Ključ (mm) Wrench (mm)
7 - 10	**42 42 00**	Rp10	55	11,3	M12	22	22
7 - 13	**42 42 01**	Rp13	64	14,2	M16	27	27
10 - 16	**42 42 02**	Rp16	74	16,6	M20	32	32
16 - 20	**42 42 03**	Rp20	80	20,5	M24	41	41

6.5 P priključek ploščat 6.5 *P plane fitting*



Premer vodnika (mm) Conductor diameter (mm)	Koda *Code*	Tip *Type*	D (mm	d (mm)	d_2 (mm)	l (mm)	b (mm)	Ključ (mm) Wrench (mm)
7 - 10	**42 44 00**	P10	30	11,3	13	55	6	22
7 - 13	**42 44 01**	P13	33	14,2	17	64	7	27
10 - 16	**42 44 02**	P16	36	16,6	21	74	9	32
16 - ø20	**42 44 03**	P20	39	20,5	25	80	12	41

6.6 V konus 6.6 *V cone*



Premer vodnika (mm) Conductor diameter (mm)	Koda *Code*	Tip *Type*	d (mm)	l (mm)	d_1 (mm)
7 - 10	**42 54 01**	V1007	7	23,5	11,8
7 - 10	**42 54 02**	V1008	8	23,5	11,8
7 - 10	**42 54 03**	V1009	10	23,5	11,8
7 - 13	**42 55 01**	V1307	7	26	15,1
7 - 13	**42 55 02**	V1308	8	26	15,1
7 - 13	**42 55 04**	V1310	10	26	15,1
7 - 13	**42 55 06**	V1312	12	26	15,1
7 - 13	**42 55 07**	V1313	13	26	15,1
10 - 16	**42 56 01**	V1610	10	34	18
10 - 16	**42 56 04**	V1613	13	34	18
10 - 16	**42 56 05**	V1614	14	34	18
10 - 16	**42 56 07**	V1616	16	34	18
10 - 16	**42 56 07**	V1616	16	34	18

Beležke

Notes

7

VN laboratorij
HV laboratory

IZOELEKTRO

VN laboratorij

7.1 Splošno

Obratovanje

V podjetju imamo laboratorij, opremljen z napravami za opravljanje električnih in mehanskih meritev. V glavnem je namenjen lastnim potrebam za izvajanje preskusov od razvoja do validacije izdelka. Vršimo tudi usluge za podjetja, raziskovalne institucije in izobraževalne ustanove. Na osnovi dobljenih rezultatov naši strokovnjaki izdajajo preskusna poročila in strokovna mnenja. Natančnost meritev in verodostojnost podatkov zagotavljamo z rednim umerjanjem instrumentov s strani pooblaščene institucije.

Področje dela

Laboratorij je namenjen preskušanju SN prenapetostnih odvodnikov in izolatorjev do 60 kV obratovalne napetosti. Pri prenapetostnih odvodnikih se meritve izvajajo na blokih do 6 kV. Uporabljajo se močni tokovni impulzi različnih oblik, kakor jih določata standarda IEC 60099-4 in IEC 61643.

Preskusi izolatorjev se izvajajo z izmenično napetostjo do višine 220 kV in z udarno napetostjo oblike vala 1,2/50 µs do višine 500 kV.

7.2 Tehnične zmogljivosti

Generator izmenične napetosti

Maksimalna amplituda trajne izmenične napetosti: 220 kV

Z generatorjem tvorimo trajno izmenično napetost, ki se pri izolatorjih uporablja za določanje zdržne napetosti v mokrem v skladu s standardi IEC 61109, IEC 61952 in IEC 60383.
Pri odvodnikih prenapetosti generator izmenične napetosti uporabljamo za meritev referenčne napetosti v skladu s standardi IEC 60099-4 in IEC 61643. Uporabljamo ga tudi za meritev ohmske komponente uhajavega toka odvodnikov prenapetosti.

Napetostni udarni generator

Maksimalna amplituda udarne napetosti 1,2/50 µs: 500 kV
S tem generatorjem tvorimo atmosfersko udarno napetost, ki služi za preskušanje izolatorjev v skladu s standardi IEC 61109, IEC 61952, IEC 60383 in preskušanje odvodnikov prenapetosti v skladu s standardom IEC 60099-4.

Tokovni udarni generator

Maksimalna amplituda udarnega toka:

- 10/350 µs 50 kA
- 8/20 µs 50 kA
- 4/10 µs 100 kA
- 2 ms 1000 A

HV laboratory

7.1 Generally

Operation

In the company, we have a laboratory equipped with devices for performing electrical and mechanical measurements. We use the laboratory mostly for our own needs to perform various tests from the early phase of development to the final validation of a product. We also perform services for other companies, research institutes, and educational institutions. Based on results they get, our experts issue test reports and expert opinions. We verify that our measurements are accurate and data credible with regular calibrations of instruments from an authorized institution.

Fields of application

The laboratory is designed for testing MV surge arresters and insulators of operating voltage up to 60 kV.
Surge arresters are tested on the blocks up to 6 kV. High current pulses of different shapes are used for testing, as defined by the IEC 60099-4 and IEC 61643 standards.

Insulators are tested using power frequency voltage of up to 220 kV and the lightning impulse voltage with wave shape of 1,2/50 µs and up to 500 kV.

7.2 Technical capabilities

Power frequency voltage generator

Peak value of the power-frequency voltage: 220 kV

The generator produces a continuous power frequency voltage which is used to define the isulator wet power frequency withstand voltage in accordance with the IEC 61109, IEC 61952 and IEC 60383 standards.
The same generator is used to define the reference voltage of surge arresters in accordance with IEC 60099-4 and IEC 61643. It is also used to measure the leakage current resistive component of surge arresters.

Lightning impulse voltage generator

Peak value of lightning impulse 1,2/50 µs: 500 kV With this generator, a lightning impulse voltage can be generated to test the insulators in accordance with the IEC 61109, IEC 61952 and IEC 60383 standards and to test surge arresters in accordance with the IEC 60099-4 standard.

Lightning current impulse generator

Peak value of the lightning impulse current:

- *10/350 µs 50 kA*
- *8/20 µs 50 kA*
- *4/10 µs 100 kA*
- *2 ms 1000 A*

Oblike udarnih tokov
Standardne:
- 4/10 µs
- 8/20 µs
- 10/350 µs
- dolgega vala 1 ms
- dolgega vala 2 ms

Nestandardne:
- od 4/10 do 30/60 µs
- od 250 do 2000 µs

Generator uporabljamo za delovne preskuse v skladu s standardoma IEC 60099-4 in IEC 61643.

Digitalna naprava za merjene parcialnih praznitev
Napravo uporabljamo za merjenje parcialnih praznitev na odvodnikih prenapetosti in izolatorjih z izmenično napetostjo do 100 kV in natančnostjo 0,1 pC v skladu s standardom IEC 60270.

Current impulses generated
Standard:
- *4/10 µs*
- *8/20 µs*
- *10/350 µs*
- *long duration current 1 ms*
- *long duration current 2 ms*

Nonstandard:
- *from 4/10 µs to 30/60 µs*
- *from 250 µs to 2000 µs*

The generator is used for operating duty tests in accordance with IEC 60099-4 and IEC 61643 standards.

Digital partial discharge tester for measuring partial discharges
Digital PD tester is used for measure partial discharges on surge arresters and insulators with alternating voltage of up to 100 kV and sensitivity of 0,1 pC in accordance with IEC 60270 standard.

7.3 Preizkusni protokoli

NN odvodniki prenapetosti
Standard IEC 61643-1
- Meritve preostale napetosti z impulznim tokom 8/20 µs
- Delovni preskus
- Preskus termične stabilnosti
- Dielektrična vzdržnost

SN odvodniki prenapetosti
Standard IEC 60099-4
- Preskus vzdržnosti izolacije ohišja odvodnika
- Preskusi preostale napetosti
- Preskus z udarnim tokom dolgega vala
- Delovni preskus
- Preskus pospešenega staranja
- Rutinski preizkus

Standard IEC 60099-5
- Meritev ohmske komponente uhajavega toka

Natezni kompozitni izolatorji
Standard IEC 61109
- Vzdržna atm. udarna napetost v suhem
- Vzdržna izmenična napetost v mokrem
- Mehanski preskusi

Podporni kompozitni izolatorji
Standard IEC 61952
- Vzdržna atm. udarna napetost v suhem
- Vzdržna izmenična napetost v mokrem
- Mehanski preskusi
- Meritev penetracije po standardu za palice
- Meritev debeline nanosa cinka

7.3 *Test protocols*

LV surge arresters
Standard IEC 61643-1
- *Measuring residual voltage with 8/20 µs current impulses*
- *Operating duty test*
- *Test of thermal stability of SPDs*
- *Dielectric withstand*

MV surge arresters
Standard IEC 60099-4
- *Insulation withstand test on arrester housing*
- *Residual voltage tests*
- *Long-duration current impulse withstand test*
- *Operating duty test*
- *Accelerated ageing test*
- *Routine testing*

IEC 60099-5 standard
- *Measurement of the resistive leakage current*

Tension composite insulators
IEC 61109 standard
- *Dry lightning impulse withstand voltage test*
- *Wet power frequency voltage test*
- *Mechanical load-time tests*

Line post composite insulators
Standard IEC 61952
- *Dry lightning impulse withstand voltage test*
- *Wet power frequency voltage test*
- *Mechanical tests*
- *Dye penetration test*
- *Verification of zinc thickness*

Beležke

Notes

IZOELEKTRO

Naziv podjetja	**Izoelektro, proizvodnja in trgovina d.o.o.**	*Name of company*
Skrajšan naziv	**Izoelektro d.o.o.**	*Short 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*
Sedež družbe	**Limbuška cesta 2, 2341 LIMBUŠ, Slovenija, EU**	*Company headquarters*
Telefon	**+386 2 66 22 500**	*Phone*
Telefaks	**+386 2 66 22 505**	*Fax*
Internetni naslov	**www.izoelektro.com**	*Internet address*
E-pošta	**info@izoelektro.com**	*E-mail:*

ISO 9001 Q-262

ISO 14001 E-238

2019

Platinum Creditworthiness

Izjava o omejitvi odgovornosti: Dimenzije in teže izdelkov, ki so navedene v katalogu lahko odstopajo od dejanskih zaradi uporabe različnih materialov. Risbe v katalogu so simbolične. V primeru tiskarskih napak veljajo podatki s katerimi razpolaga proizvajalec.

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