High-Voltage Cable Accessories

72 kV up to 245 kV

nkt.com
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NKT: The Profile

NKT is a global front-line supplier to the energy sector and as such NKT developes, manufactures and markets high-quality cables and solutions for power grid infrastructure, construction sites, railways and the automotive industry. NKT supplies creative, high-tech and sustainable products.

NKT’s manufacturing plants are among the most modern, flexible and cost-effective facilities worldwide. At NKT we work tirelessly to reduce our carbon footprint; neutral production and waste prevention are high priorities. NKT invests heavily to ensure that the company maintains leading-edge capability.

The brand-new state-of-the-art factory in Cologne is an example of this commitment. Being among the most modern factories in the world, it is at the forefront of technological developments.

NKT is part of NKT Holding A/S, which is listed on the Danish Stock Exchange. NKT Holding owns a number of companies, which are active in different industries, and has production facilities on four continents.
The product range

High-Voltage Cable Accessories

All high-voltage cable accessories from NKT are developed by their R&D department, who take into account specific customer requirements as well as national and international standards in designing and producing customer defined solutions.

All materials are subjected to intensive quality control procedures. The production- and testing equipment from NKT guarantees the highest level of quality for all products. The complete product range has been type-tested in accordance with international standards.

The product range from NKT includes accessories for all applications in the 50 kV up to 550 kV voltage range, also as a modular component system.

NKT offers various technical versions of accessory systems like plug-in technology, dry-type technology and conventional technology with insulating oil.

The range of accessories covers the following applications:

- Self-supporting outdoor terminations, porcelain or composite
- Flexible outdoor terminations
- Terminations for gas-insulated switchgears
- Transformer terminations
- Straight-through joints
- Insulating joints/cross-bonding joints
- Transition joints, XLPE-insulated/oil-filled cables
- Products for the connection/installation of low-pressure oil-filled cables, 36 kV – 170 kV

Product Scope

Besides the accessories for XLPE insulated cables, NKT also produces and installs accessories for paper insulated high voltage cables, e.g. for re-routing, repair and renovation.

<table>
<thead>
<tr>
<th>$U_{in}$/kV</th>
<th>72.5</th>
<th>123</th>
<th>145</th>
<th>170</th>
<th>245</th>
<th>300</th>
<th>420</th>
<th>550</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outdoor Termination</td>
<td>X/O/D/P</td>
<td>X/O/D/P</td>
<td>X/O/D/P</td>
<td>X/D</td>
<td>X/D</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Switchgear Termination</td>
<td>X/O/D/P</td>
<td>X/O/D/P</td>
<td>X/O/D/P</td>
<td>X/D</td>
<td>X/D</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Transformer Termination</td>
<td>X/O/D/P</td>
<td>X/O/D/P</td>
<td>X/O/D/P</td>
<td>X/D</td>
<td>X/D</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Straight joint</td>
<td>X/O/D/P</td>
<td>X/O/D/P</td>
<td>X/O/D/P</td>
<td>X/O</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Stop joint</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Transition joint</td>
<td>X/O/P</td>
<td>X/O/P</td>
<td>X/O/P</td>
<td>X/O</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

X – for XLPE cable  O – for oil filled cable  D – dry type for XLPE cable  P – for gas pressure cable
Power Transmission Line
XLPE Cable Accessories
Dry type termination without supporting function

Application:
The versions of silicone rubber terminations are designed for indoor and outdoor conditions. Main components of the termination are the pretested push-on silicone components with integrated stress cone for electrical field control.

- Integrated capacitive stress control system
- Routine tested silicone components
- Screw type top bolt, no special tools are required
- Top bolt covered by top part of silicone rubber
- Quick and easy assembly
- Long creepage distance due to optimised shed design
- Type test certificate in accordance with IEC 60840 available

Technical details:

<table>
<thead>
<tr>
<th>Operating voltage</th>
<th>Type</th>
<th>Conductor Cu/Al max.</th>
<th>Diameter of cable insulation</th>
<th>Pollution level</th>
<th>Creepage distance min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Um (kV)</td>
<td></td>
<td>mm²</td>
<td>mm</td>
<td></td>
<td>mm</td>
</tr>
<tr>
<td>72.5</td>
<td>THV 72</td>
<td>...1600</td>
<td>40.0...78.0</td>
<td>e (IV)</td>
<td>&gt; 2248</td>
</tr>
<tr>
<td>100</td>
<td>THV 100</td>
<td>...1600</td>
<td>51.5...78.0</td>
<td>d (III)</td>
<td>&gt; 2500</td>
</tr>
<tr>
<td>145</td>
<td>THV 145</td>
<td>...1200</td>
<td>55.0...78.0</td>
<td>e (IV)</td>
<td>&gt; 4495</td>
</tr>
<tr>
<td>245</td>
<td>THV 245</td>
<td>...1200</td>
<td>55.0...78.0</td>
<td>per request*</td>
<td>&gt; 4495</td>
</tr>
</tbody>
</table>

* THV 245 = Lightning impulse voltage 650 kV

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Outdoor termination with composite insulator

The different versions of this outdoor termination type FEV-V are designed for operation under several outdoor conditions. Main components of the termination are the composite insulator with upper metal work, metal base plate with supporting insulators and premoulded stress cone for electrical field control and silicone oil for electrical insulation.

- Integrated premoulded stress control system made of silicone rubber
- All metal parts made of corrosion resistant aluminum alloy
- Termination is standing on supporting pedestal insulators, so that the cable screen can be isolated from earth
- Top bolt available in two versions, screw type or compression type
- Different top bolt diameters available suiting to the cable dimensions
- Type test certificate in accordance with IEC 60840 available
- Cold applied insulating fluid

<table>
<thead>
<tr>
<th>Operating voltage</th>
<th>Type</th>
<th>Conductor Cu/Al max.</th>
<th>Diameter of cable insulation</th>
<th>Length (L) approx.</th>
<th>Pollution level</th>
<th>Creepage distance min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Um (kV)</td>
<td></td>
<td>mm²</td>
<td>mm</td>
<td>mm</td>
<td></td>
<td>mm min.</td>
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<tr>
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<td>...2500</td>
<td>34.5...97.0</td>
<td>1060</td>
<td>e (IV)</td>
<td>&gt; 2250</td>
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<tr>
<td>145</td>
<td>FEV 145-V</td>
<td>...2500</td>
<td>34.5...108.0</td>
<td>1700</td>
<td>e (IV)</td>
<td>&gt; 4500</td>
</tr>
<tr>
<td>170</td>
<td>FEV 170-V</td>
<td>...2500</td>
<td>34.5...108.0</td>
<td>1950</td>
<td>e (IV)</td>
<td>&gt; 5270</td>
</tr>
<tr>
<td>245</td>
<td>FEV 245-V</td>
<td>...2500</td>
<td>64.0...116.0</td>
<td>2650</td>
<td>e (IV)</td>
<td>8400</td>
</tr>
</tbody>
</table>

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Outdoor termination with porcelain insulator

Application:

The different versions of this outdoor termination type FEV-P are designed for operation under several outdoor conditions. Main components of the termination are the porcelain insulator with upper metal work, metal base plate with supporting insulators and premoulded stress cone for electrical field control and silicone oil for electrical insulation.

- Integrated premoulded stress control system made of silicone rubber
- All metal parts made of corrosion resistant aluminum alloy
- Termination is standing on supporting pedestal insulators, so that the cable screen can be isolated from earth
- Top bolt available in two versions, screw type or compression type
- Different top bolt diameters available suiting to the cable dimensions
- Type test certificate in accordance with IEC 60840 available
- Cold applied insulating fluid

Technical details:

<table>
<thead>
<tr>
<th>Um (kV)</th>
<th>Type</th>
<th>Operating voltage</th>
<th>Conductor Cu/Al max.*</th>
<th>Diameter of cable insulation</th>
<th>Length (L) approx.</th>
<th>Pollution level</th>
<th>Creepage distance min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>72.5</td>
<td>FEV 72-P</td>
<td>...1200</td>
<td>34.5...82.0</td>
<td>1250</td>
<td>e (IV)</td>
<td>&gt; 2248</td>
<td></td>
</tr>
<tr>
<td>145</td>
<td>FEV 145-P</td>
<td>...1200</td>
<td>34.5...82.0</td>
<td>1650</td>
<td>e (IV)</td>
<td>&gt; 4495</td>
<td></td>
</tr>
<tr>
<td>170</td>
<td>FEV 170-P</td>
<td>...1200</td>
<td>34.5...90.0</td>
<td>2100</td>
<td>e (IV)</td>
<td>&gt; 5270</td>
<td></td>
</tr>
<tr>
<td>245</td>
<td>FEV 245-P</td>
<td>...1200</td>
<td>56.0...120.0</td>
<td>3000</td>
<td>e (IV)</td>
<td>&gt; 8400</td>
<td></td>
</tr>
</tbody>
</table>

* bigger cross-section on request

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Dry type outdoor termination

Application:

This new generation of dry type termination is free of any liquid and gaseous insulation medium. Main components of the termination are the push-on silicone components with integrated stress cone for electrical field control and the liquid free epoxy resin insulator with silicone sheds.

- Free of insulation liquid, no filling procedure
- Less parts to be assembled therefore faster installation
- Prefabricated capacitive silicone stress control system
- Plug-in part comprising four components (stress cone made of silicone rubber, cable gland, connection bolt, spring loaded compression device)
- Easy to fit screw type conductor connector
- All metal parts made of corrosion resistant aluminum alloy
- Type test certificate in accordance with IEC 60840 available
- Explosion proof

Technical details:

<table>
<thead>
<tr>
<th>Operating voltage</th>
<th>Type</th>
<th>Conductor Cu/Al max.</th>
<th>Diameter of cable insulation</th>
<th>Pollution level</th>
<th>Creepage distance min.</th>
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<tbody>
<tr>
<td>Um (kV)</td>
<td>KFEV 123 size 6</td>
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<td>40.7...100.0</td>
<td>e (IV)</td>
<td>&gt; 4495</td>
</tr>
<tr>
<td>123</td>
<td>KFEV 145 size 4</td>
<td>...1200</td>
<td>34.5...76.0</td>
<td>e (IV)</td>
<td>&gt; 4495</td>
</tr>
<tr>
<td>245</td>
<td>KFEV 245 size 6</td>
<td>...2500</td>
<td>40.7...100.0</td>
<td>e (IV)</td>
<td>&gt; 7595</td>
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</tbody>
</table>

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Dry type plug-in GIS/transformer termination

Application:

All versions of dry-type termination are designed for installation in SF6 gas insulated switchgear (GIS) or for installation in oil filled cable box of transformers. The complete termination consists of epoxy resin insulator with embedded electrode, fixing ring which is fitting to the cable, comprising metal cable gland, compression device and premoulded plug-in stress cone for electrical field control.

- Plug-in part comprising four components (stress cone made of silicone rubber, cable gland, connection bolt, spring loaded compression device)
- Insulator according to IEC 62271-209 for GIS and DIN EN 50299 for transformer termination
- Conductor connection bolt designed as mechanical screw type connector
- Type test certificate in accordance with IEC 60840 available

Technical details:

<table>
<thead>
<tr>
<th>Operating voltage</th>
<th>Type</th>
<th>Conductor Cu/Al max.</th>
<th>Diameter of cable insulation</th>
<th>Insertion length short</th>
<th>Insertion length long</th>
</tr>
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<tbody>
<tr>
<td>Um (kV)</td>
<td></td>
<td>mm²</td>
<td>mm</td>
<td>mm</td>
<td>mm</td>
</tr>
<tr>
<td>72.5</td>
<td>KSEV 72/KTEV 72 size 1</td>
<td>...1000</td>
<td>35.5...76.0</td>
<td>310±1</td>
<td>583±1</td>
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<tr>
<td>145</td>
<td>KSEV 145/KTEV 145 size 4</td>
<td>...1200</td>
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<td>470±1</td>
<td>757±1</td>
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<td>170</td>
<td>KSEV 170/KTEV 170 size 6</td>
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<td>47.0...100.0</td>
<td>470±1</td>
<td>757±1</td>
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<tr>
<td>245</td>
<td>KSEV 245/KTEV 245 size 6</td>
<td>...2500</td>
<td>47.0...100.0</td>
<td>620±2</td>
<td>960±2</td>
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<tr>
<td>245</td>
<td>KSEV 245/KTEV 245 size 9</td>
<td>...3200</td>
<td>81.0...140.0</td>
<td>620±2</td>
<td>960±2</td>
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</table>

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The termination is designed for direct installation in SF6 gas insulated switchgear (GIS) or in oil filled cables box of transformer. Major components of the termination are the pressure tight epoxy resin insulator with embedded electrode, metal fixing ring, metal cable gland and prefabricated stress cone for electrical field control and silicone oil for electrical insulation.

- Integrated prefabricated stress control system with silicon rubber
- Pressure tight epoxy resin insulator is cast in one piece with integrated insulation ring at the bottom allowing to separate the cable screen from earth
- Cable gland made of corrosion resistant aluminum alloy
- Possible installation position vertical up to 45° then up to 90° oil expansion vessel required
- Type test according to IEC 60840 is available
- Cold applied silicone oil
- According to EN 50299 (Transformers)
- According to IEC 62271-209 (GIS)

### Technical details:

<table>
<thead>
<tr>
<th>Operating voltage</th>
<th>Type</th>
<th>Conductor Cu/Al max.</th>
<th>Diameter of cable insulation</th>
<th>Insertion length</th>
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<tbody>
<tr>
<td>Um (kV)</td>
<td></td>
<td>mm²</td>
<td>mm</td>
<td>mm</td>
</tr>
<tr>
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<td>SEV 72 / TEV 72</td>
<td>...1000</td>
<td>34.4...74.0</td>
<td>583±1</td>
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<tr>
<td>145</td>
<td>SEV 145 / TEV 145</td>
<td>...2500</td>
<td>41.6...108.0</td>
<td>757±1</td>
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<tr>
<td>170</td>
<td>SEV 170 / TEV 170</td>
<td>...2500</td>
<td>41.6...108.0</td>
<td>757±1</td>
</tr>
<tr>
<td>245</td>
<td>SEV 245 / TEV 245</td>
<td>...2500</td>
<td>50.0...120.0</td>
<td>960±1</td>
</tr>
</tbody>
</table>

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Straight single piece joint

Application:

This premoulded straight joint in one piece design with compact dimensions is made of silicone rubber. Main components of the standard straight joint are conductor connection sleeve, main joint sleeve and outer protective covering.

- Very short and compact design
- Easy push on installation
- Minimum tools and installation space needed
- Easy conductor connection screw or compression type possible
- Available as cross bonding or straight through application
- Wide range of applications, from 40 to 120 mm Ø
- Advanced production technology
- Optimized cover housing in size and material
- Routine tested piece by piece
- Insulating material LSR silicone rubber of the highest quality
- Type test certificate in accordance with IEC 60840/62067 available
- Available as straight through, crossbonding or grounded version

Technical details:

<table>
<thead>
<tr>
<th>Operating voltage</th>
<th>Type</th>
<th>Conductor max. Cu/Al max.</th>
<th>Diameter over prepared cable core min.-max.</th>
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</thead>
<tbody>
<tr>
<td>Um (kV)</td>
<td></td>
<td>mm²</td>
<td></td>
</tr>
<tr>
<td>72.5</td>
<td>SME 72</td>
<td>...1200</td>
<td>51.5...78.0</td>
</tr>
<tr>
<td>145</td>
<td>SME 145</td>
<td>...2500</td>
<td>40.0...84.0</td>
</tr>
<tr>
<td>170</td>
<td>SME 170</td>
<td>...2500</td>
<td>56.0...120.0</td>
</tr>
<tr>
<td>245</td>
<td>SME 245</td>
<td>...2500</td>
<td>56.0...120.0</td>
</tr>
</tbody>
</table>

Versions of outer Protection

- Heat shrink tube
- Insulating housing
- Metal housing and shrink tube
- Metal and Insulating housing

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SM 145-245

Straight three piece joint

Application:

This premoulded straight joint in three piece design with compact dimensions is made of silicone rubber. Main components of the standard straight joint are conductor connection sleeve, cable adapters, main joint sleeve and outer protective covering.

- Integrated premoulded stress control system with silicone rubber
- Three piece design with compact dimensions
- Screw type conductor connector
- Minimum tool requirement
- Version with screen separation available
- Type test certificate in accordance with IEC 60840/62067 available
- Various possibilities to connect different cable cross sections
- Different versions of outer protection available

Technical details:

<table>
<thead>
<tr>
<th>Operating voltage</th>
<th>Type</th>
<th>Conductor Cu max.</th>
<th>Diameter of cable insulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Um (kV)</td>
<td></td>
<td>mm²</td>
<td>mm</td>
</tr>
<tr>
<td>145</td>
<td>SM 145</td>
<td>≥2500</td>
<td>34.5...108.0</td>
</tr>
<tr>
<td>170</td>
<td>SM 170</td>
<td>≥2500</td>
<td>50.0...108.0</td>
</tr>
<tr>
<td>245</td>
<td>SM 245</td>
<td>≥2500</td>
<td>50.0...108.0</td>
</tr>
</tbody>
</table>

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Silicone rubber and Stress control

Silicone rubber is the preferred material for cable accessories due to its excellent mechanical and electrical properties. For more than 50 years silicone has been used successfully as high-quality electrical insulation for voltages up to 550 kV. Silicone rubber features high quality electrical insulation, superior corona and tracking resistance, combined with high elasticity. It facilitates multi range application, where one silicone rubber body can be used for various conductor cross sections. Optimal flexibility ensures easy assembly of the accessories.

Outstanding features of the silicone rubber insulation material are:
- UV and ozone resistant
- Durable water rejection
- Weather and aging resistance
- Non-flammable, self-extinguishing, heat resistant/applicable for use at temperatures between −50 °C and +180 °C
- High degree of elasticity
- High tracking resistance
- Unlimited shelf life
- Environment friendly
Wide range of different sizes
Low-Pressure-Oil-Filled Cable Systems

LPOF cables and gas pressure cables are used for the transmission of electrical power for several decades. But since the 70-ies it was more and more supplanted by XLPE insulated cables. But today there are still thousands of kilometers of LPOF- and gas pressure cab in operation globally huge demand on services, like repair, maintenance or transition to XLPE insulated cables are necessary.

NKT offers the full range of products up to 145kV: Outdoor terminations and GIS/transformer terminations for installations or repair works. Transition joints for the connection of LPOF cables or gas pressure cables, either single-core cables or three-core cables, to XLPE insulated cables. Straight through or Oil-stop joints for new installations or repair works on LPOF cables or gas pressure cables.

In addition to the products, NKT offers various services related to LPOF cables (max. 6 bar)/gas pressure cables. More than 90 years experience and know how in design, production and execution of cables systems and related accessories, make NKT highly competent for service and maintenance, repair and reconstruction as well as dismantling and disposal of oil-filled cable systems:

- Expertises on state of the oil-cable system
- Tests and preventive measures
- Condition of insulating oil
- Filling factor
- Gas-in-oil analysis
- Pressure volume tests on tanks
- High voltage test
- Location of leaks
- Repair of leaks
- Disposal of dismantled materials according to local regulations
- Flushing of oil cables in case of bad oil quality
Power Transmission Line
Single Core Oil Cable Accessories
EPO/EROW 72-145

Outdoor termination with porcelain/composite insulator for single core LPOF cables

Application:

The different types of this outdoor termination type EPO/EROW are designed for operation under several outdoor conditions. Main components of the termination are the porcelain/composite insulator with upper metal parts, metal base plate with supporting insulators and stress cone made of carbon paper and copper mesh for electrical field control and cable oil for electrical insulation.

- Insulation with oil-impregnated crepe- and/or kraft-papers
- All metal parts made of corrosion resistant aluminum alloy
- Termination is standing on supporting pedestal insulators, so that the cable screen can be isolated from earth
- Different top bolt diameters available suiting to the cable dimensions
- The insulator has alternating sheds (extended creepage distance) or sheds according to DIN 48115
- Al- or Cu-bolt for compression connection of the conductor
- Inlet funnel with oil-feeding and earthing point
- Flexible terminal lug between conductor and the cable wire to avoid applying unnecessary external force against the sealing end
- Type test certificate in accordance with IEC 141-1 08/1993 available

Technical details:

<table>
<thead>
<tr>
<th>Operating voltage</th>
<th>Type</th>
<th>Description</th>
<th>Conductor Cu/Al max.*</th>
<th>Diameter of cable insulation</th>
<th>Pollution level</th>
<th>Creepage distance min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Um (kV)</td>
<td></td>
<td></td>
<td>mm²</td>
<td>mm</td>
<td>mm</td>
<td>mm</td>
</tr>
<tr>
<td>72.5</td>
<td>EPO 72</td>
<td>Porcelain insulator</td>
<td>...1200</td>
<td>...62.0</td>
<td>e (IV)</td>
<td>&gt; 2320</td>
</tr>
<tr>
<td>123</td>
<td>EPO 123</td>
<td>Porcelain insulator</td>
<td>...1200</td>
<td>...62.0</td>
<td>e (IV)</td>
<td>&gt; 3800</td>
</tr>
<tr>
<td>145</td>
<td>EPO 145</td>
<td>Porcelain insulator</td>
<td>...1200</td>
<td>...62.0</td>
<td>e (IV)</td>
<td>&gt; 5100</td>
</tr>
<tr>
<td>72.5</td>
<td>EROW 72</td>
<td>Silicone insulator</td>
<td>...1200</td>
<td>...62.0</td>
<td>e (IV)</td>
<td>&gt; 2320</td>
</tr>
<tr>
<td>123</td>
<td>EROW 123</td>
<td>Silicone insulator</td>
<td>...1200</td>
<td>...62.0</td>
<td>e (IV)</td>
<td>&gt; 3250</td>
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<tr>
<td>145</td>
<td>EROW 145</td>
<td>Silicone insulator</td>
<td>...1200</td>
<td>...62.0</td>
<td>e (IV)</td>
<td>&gt; 4682</td>
</tr>
</tbody>
</table>

* bigger cross-section on request

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EYOK/EYOT 145

Fluid filled GIS/transformer termination for single core LPOF cables

Application:

The termination is designed for direct installation in SF6 gas insulated switchgear (GIS) or in oil filled cables box of transformer. Major components of the termination are the pressure tight epoxy resin insulator with embedded electrode, metal fixing ring, metal cable gland and stress cone made of carbon paper and copper mesh for electrical field control and cable oil for electrical insulation.

- Insulation with oil-impregnated crepe- and/or kraft-papers
- Pressure tight epoxy resin insulator is cast in one piece with integrated insulation ring at the bottom allowing to separate the cable screen from earth
- Possible installation position vertical up to 45° then up to 90° SF6 gas indicator required
- Inlet housing with protection against kinking
- Inlet funnel with oil-feeding and earthing point
- According to EN 50299 (Transformer)
- According to IEC 62271-209 (GIS)

Technical details:

<table>
<thead>
<tr>
<th>Operating voltage Um (kV)</th>
<th>Type</th>
<th>Description</th>
<th>Conductor Cu/Al max. (mm²)</th>
<th>Diameter of cable insulation (mm)</th>
<th>Insert Length (L) approx. (mm min.)</th>
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</thead>
<tbody>
<tr>
<td>145</td>
<td>EYOK 145</td>
<td>GIS Termination</td>
<td>...800</td>
<td>...62.0</td>
<td>757±1</td>
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<tr>
<td>145</td>
<td>EYOT 145</td>
<td>Transformer termination</td>
<td>...800</td>
<td>...62.0</td>
<td>757±1</td>
</tr>
</tbody>
</table>

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The different versions of the straight joint MVEO/i are designed for operation voltage up to 170 kV. Main components of the joint are conductor connection sleeve, joint sleeve made of insulation paper, carbon paper and copper mesh and stress relief ring, copper housing and outer protective covering.

- Conductor connection by compression
- Inner Copper housing
- Oil paper insulation made of insulation paper, impregnated in cable insulation oil, to reinforce cable insulation and make the stress cone
- Stress cone electrode made of carbon paper, copper mesh and stress relief ring at end of the winding
- Version with screen separation available
- All necessary assembling accessories are part of the kit
- Outer protection by heat shrink tube or plastic housing

### Application:

The different versions of the straight joint MVEO/i are designed for operation voltage up to 170 kV. Main components of the joint are conductor connection sleeve, joint sleeve made of insulation paper, carbon paper and copper mesh and stress relief ring, copper housing and outer protective covering.

<table>
<thead>
<tr>
<th>Operating voltage</th>
<th>Type</th>
<th>Description</th>
<th>Diameter of cable insulation</th>
<th>Conductor Cu/Al max.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>145</td>
<td>MVEO 145</td>
<td>Straight Joint</td>
<td>…60</td>
<td>…800</td>
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<tr>
<td>145</td>
<td>MVEOi 145</td>
<td>Screen separation Joint</td>
<td>…60</td>
<td>…800</td>
</tr>
<tr>
<td>170</td>
<td>MVEO 170</td>
<td>Straight Joint</td>
<td>…76</td>
<td>…1200</td>
</tr>
<tr>
<td>170</td>
<td>MVEOi 170</td>
<td>Screen separation Joint</td>
<td>…76</td>
<td>…1200</td>
</tr>
</tbody>
</table>

* bigger cross-section on request

### Versions of outer Protection

- Metal housing and shrink tube
- Metal and Insulating housing

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Straight through joint for three core LPOF cables

Application:

The two versions of the straight through joint MVDO are designed for operating voltage up to 145 kV. This joint connects two three-core oil filled cables via the main components: conductor connection sleeve, main joint sleeves made of insulation paper, carbon paper and copper mesh and stress relief ring, oil-stop housing, inner copper housing and outer protective covering.

- Conductor connection by compression
- Inner copper housing
- Oil paper insulation made of insulation paper, impregnated in cable insulation oil, to reinforce cable insulation and make the stress cone
- Stress cone electrode made of carbon paper, copper mesh and stress relief ring at end of the winding
- Version with screen separation available
- All necessary assembling accessories are part of the kit
- Outer protection by heat shrink tube or plastic housing
- Oil-stop-housing to reduce severely oil loss during installation

Technical details:

<table>
<thead>
<tr>
<th>Operating voltage</th>
<th>Type</th>
<th>Diameter of cable core insulation</th>
<th>Conductor Cu/Al max.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Um (kV)</td>
<td></td>
<td>mm</td>
<td>mm²</td>
</tr>
<tr>
<td>72</td>
<td>MVDO 72</td>
<td>...50</td>
<td>...630</td>
</tr>
<tr>
<td>145</td>
<td>MVDO 145</td>
<td>...50</td>
<td>...630</td>
</tr>
</tbody>
</table>

* bigger cross-section on request

Versions of outer Protection

- Metal housing and shrink tube
- Metal and Insulating housing

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Stop joint for single core LPOF cables

Application:

The stop joint MEYOSL is designed for operating voltage up to 145 kV. The complete joint enables a hydraulic independent connection between two low-pressure oil filled cables. Main components of the joint are the conductor connection sleeve via the embedded insulator electrode, two separate joint sleeves made of insulation paper, carbon paper and copper mesh and stress relief ring, copper housing and outer protective covering.

- Insulator according to IEC 62271-209
- Inner Copper housing
- Oil paper insulation made of insulation paper, impregnated in cable insulation oil, to reinforce cable insulation and make the two stress cones
- Stress cone electrodes made of carbon paper, copper mesh and stress relief ring at end of the winding
- Screen separation possible
- All necessary assembling accessories part of the kit
- Connection of different cable cross sections are possible
- Both sided oil feed-in
- GRP housing for outer protection
- Stop joint is suitable for three-core oil-filled cable in connection with trifurcating box AGOW
- Type test certificate in accordance with IEC 60840/62067 available
- Available as straight through, crossbonding or grounded version

Technical details:

<table>
<thead>
<tr>
<th>Operating voltage</th>
<th>Type</th>
<th>Diameter of cable insulation</th>
<th>Conductor CU/AL max.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Um (kV)</td>
<td>MEYOSL 145</td>
<td>mm</td>
<td>mm²</td>
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<tr>
<td>145</td>
<td>...62</td>
<td>...800</td>
<td></td>
</tr>
</tbody>
</table>

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USM 170-OX

Transition joint for single core LPOF cables to XLPE cables

Application:

The transition joint USM is designed for operating voltage up to 170 kV and connects a single core oil filled cable with a single core XLPE cable. Main components of the joint are the common epoxy resin insulator with embedded electrode, the XLPE plug-in part from switchgear termination, oil-stress cone made of insulation paper, carbon paper and copper mesh and stress relief ring and outer protective covering.

- Common epoxy resin insulator for XLPE and oilfilled cables
- Plug-in system from switchgear termination
- Pre-moulded stress-cone of silicone rubber for tight fit in epoxy insulator
- Easy conductor connection screw or compression type for XLPE-side possible
- Insulation with oil-impregnated crepe- and/or kraftpapers
- Stress cone electrode made of carbon paper, copper mesh and stress relief ring at end of the winding
- Screen separation possible
- All necessary assembling accessories are part of the kit
- Connection of different cable cross sections are possible
- GRP housing for outer protection
- Filling of cable insulation oil, only approx. 15 litre
- Flexible and time-independent installation of both types of cables
- Transition joint is suitable for three-core oil-filled cable in connection with trifurcating box AGOW

Technical details:

<table>
<thead>
<tr>
<th>Operating voltage</th>
<th>Type</th>
<th>Diameter of XLPE cable insulation</th>
<th>Diameter of Oil cable insulation</th>
<th>Conductor Cu/Al max.* Oil-side</th>
</tr>
</thead>
<tbody>
<tr>
<td>Um (kV)</td>
<td>USM 170-OX</td>
<td>mm</td>
<td>mm</td>
<td>mm²</td>
</tr>
<tr>
<td>170</td>
<td></td>
<td>47…100</td>
<td>...67</td>
<td>...2500</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>...1200 Cu</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>...800 Al</td>
</tr>
</tbody>
</table>

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The transition joint MUDC is designed for operating voltage up to 52 kV and connects a three-core oil filled cable with three single-core XLPE cables. Main components of the joint are three XLPE plug-in parts from switchgear termination, GIS insulator, oil stress cone made of insulation paper, carbon paper and copper mesh and stress relief ring, inner copper housing, oil-stop-housing and outer protective covering.

- IXLPE plug-in system from switchgear termination
- Pre-moulded stress-cone of silicone rubber for tight fit in epoxy insulator
- Easy conductor connection compression type for XLPEside
- Oil insulation with oil-impregnated crepe- and/or kraftpapers
- Stress cone electrode made of carbon paper, copper mesh and stress relief ring at end of the winding
- Screen separation possible
- All necessary assembling accessories part of the kit
- Connection of different cable cross sections are possible
- GRP housing for outer protection
- Oil-stop-housing to reduce severely oil loss during installation
- Integrated trifurcating box
- **Flexible and time-independent** installation of both types of cables

### Technical details:

<table>
<thead>
<tr>
<th>Operating voltage</th>
<th>Type</th>
<th>Diameter of XLPE cable insulation mm</th>
<th>Diameter of Oil cable core insulation mm</th>
<th>Conductor Cu/Al max.* mm²</th>
<th>Conductor Cu/Al max.* mm²</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>Um (kV)</code></td>
<td>MUDC 52</td>
<td><code>...55</code></td>
<td><code>...50</code></td>
<td><code>...630</code></td>
<td><code>...630 Cu</code></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><code>...500 Al</code></td>
</tr>
</tbody>
</table>

* bigger cross-section on request

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The different versions of the transition joint TJ are designed for operating voltage up to 170 kV, and connect an oil filled cable with a XLPE cable. Main components of the joint are the pressure tight epoxy resin insulator with embedded electrode, prefabricated stress cone for electrical field control and silicone oil for electrical insulation of the XLPE cable. The oil stress cone is made of insulation paper, carbon paper and copper mesh and stress relief ring, stainless steel housing, conductor connection sleeve and oil-stop housing.

- Pre-moulded stress-cone of silicone rubber
- Conductor connection compression type
- Oil insulation with oil-impregnated crepe- and/or kraftpapers
- Stress cone electrode made of carbon paper, copper mesh and stress relief ring at end of the winding
- Screen separation possible
- All necessary assembling accessories are part of the kit
- Connection of different cable cross sections are possible
- GRP housing for outer protection of the XLPE cable
- Oil-stop-housing to reduce severely oil loss during installation
- Integrated trifurcating box for three core cable

### Technical details:

<table>
<thead>
<tr>
<th>Operating voltage</th>
<th>Type</th>
<th>Description</th>
<th>Diameter of XLPE cable insulation (mm)</th>
<th>Diameter of Oil cable metallic sheath (mm)</th>
<th>Conductor Cu/Al max.* (XLPE-side)</th>
<th>Conductor Cu/Al max.* (Oil-side)</th>
</tr>
</thead>
<tbody>
<tr>
<td>84</td>
<td>TJ 84-1</td>
<td>Single-Core LPOF Cable to Single-Core XLPE Cable</td>
<td>...66</td>
<td>...78</td>
<td>...800 Cu ...1000 Al</td>
<td>...500 Cu ...400 Al</td>
</tr>
<tr>
<td>84</td>
<td>TJ 84-3</td>
<td>Three-Core LPOF Cable to Three Single-Core XLPE Cables</td>
<td>...66</td>
<td>...114</td>
<td>...800 Cu ...1000 Al</td>
<td>...500 Cu ...400 Al</td>
</tr>
<tr>
<td>170</td>
<td>TJ 170-3</td>
<td>Three-Core LPOF Cable to Three Single-Core XLPE Cables</td>
<td>...83.5</td>
<td>...114</td>
<td>...1200 Cu ...1200 Al</td>
<td>...800 Cu ...630 Al</td>
</tr>
</tbody>
</table>

* bigger cross-section on request

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Tools

Installation tools, Special tools, Oil tanks, gauge cabinets

Application:
NKT offers the full scope of material for the installation of high voltage cable systems. Special oil equipment for service and maintenance is also available.

1. General tools
   • These are hand workshop tools which are standard for all jointers.
   • (screwdriver, universal pliers, spanner, box spanner, allen key, file etc…)

2. Cable preparation tools
   • These are tools needed for preparation of HV cables before start of installation works. Some of these tools are depending on cable dimensions.
   • (cable saw, sheath cutter, peeling devices etc…)

3. Special tools
   • These are unique tools made to simplify and secure the assembling procedure of the NKT HV accessories. The application range of the different tools is depending on the cable dimensions. The right choice is important. These tools are mandatory to install NKT HV accessories.
   • (push on tools, fix points for push on tools, belt strap tool)

4. Cable handling tools
   • These are tools we suggest for a professional and faster assembling procedure. With more professional handling also the quality increased

5. Special tools for oil filled systems
   • These are tools for oil filled cables and accessories. They are necessary for maintenance or installations and for the operation.
   • (Oil tanks according to customer requirements, gauge cabinets, mobile oil treatment plant, vacuum systems)

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Services

Service and Maintenance,
Repair- and Reconstruction-Works

Application:
The safe operation of an oil-filled-cable system is based on a permanent overpressure of the insulating oil inside the oil-filled-cable system and consequently the system requires to be absolutely leakproof. Due to increasing requirements for environmental protection – the German “Wasserhaushaltsgesetz” (WHG = Water Conservation Law) prohibits any ingress of oil into the soil – comprehensive control- and maintenance-services for the operation of an oil-filled-cable system are required. For all these Services, we have jointing teams and services engineers with many years of experience in the installation and maintenance of oil-filled-cable systems. In order to guarantee a safe and reliable operation, NKT offers the following services:

- Expertises on the state of the oil-cable systems, based on lifetime records, inspections and analyses
- Checks, tests and preventive measures
  - condition of the insulating oil
  - filling factor: measurement and evaluation
  - dielectrical strength
  - gas-in-oil analysis
  - jacket test (test on corrosion protection)
  - check of oil pressure tanks (pressure gauges, pipes, valves)
  - high voltage test
  - Measures to increase the lifetime, resulting in a reduction of life cycle costs

For emergency cases, NKT offers a 24h emergency services to evaluate the first steps to solve the issue.

- Recalculation of hydraulic systems
- Wide range of tests and preventive measure inspections and analyses
- Locating of leaks (freezing method with liquid nitrogen)
- Repair of oil leaks using special repair sleeves
- Repair of damages to the outer corrosion protection
- Repair of oil leaks at joints by rebuilding the wiping solder seal and reinforcement by cast resin and fibre glass, also as preventive measure
- Rebuilding of the corrosion protection of damaged joints
- Repair of failed accessories and cables (e.g. break-down due to mechanical damage)
- Disposal of all materials dismantled according to the national legislation

All necessary installation and measuring equipment as well as joints, terminations, repair-/replacement materials, special tools, cable oil, consumables and spare parts can be supplied by us. We offer our services either on the basis of individual single orders or under a long-term service contract. These service contracts include the repair of cable failures by us or with specified/trained local contractors.

Freezing method with liquid nitrogen

Repair of oil leaks

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Training Programmes

XLPE- and Oil-Trainings

Application:

NKT offers training courses for jointers including a practical (on-the-job) training regarding the installation of high voltage cable accessories

▪ nkt offers courses regarding the installation of accessories for XLPE-cables
▪ the training courses can be flexible to be adjusted to customer requirements and jointer skills
▪ the training course for the installation has a duration of approx. 2-3 weeks (depending on skills) and includes the installation of transition joints (oil-cables to XLPE-cables)

The training courses cover the theoretical basics of cable and accessory technique, conductor/sheath connection technique, environmental aspects of installation as well as safety provisions during installation works

▪ nkt issues certificates for the successful completion of the training course

If requested, NKT will submit a detailed training schedule for more information.
### Services

#### Cable data

**Requested information**

To supply the optimal accessories solution detailed cable data are required. Please send this completed cable data form with your inquiry.

<table>
<thead>
<tr>
<th>Customer Name:</th>
<th>Remarks:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Project Name:</th>
<th>Remarks:</th>
</tr>
</thead>
<tbody>
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<table>
<thead>
<tr>
<th>Offer No.:</th>
<th>Remarks:</th>
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</table>

<table>
<thead>
<tr>
<th>Date and Name:</th>
<th>Remarks:</th>
</tr>
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</table>

![Cable Diagram]

**Diameter (mm):**

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**Diameter (mm) min.:**

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</table>

**Diameter (mm) max.:**

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</table>

**Cross section (mm²):**

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</table>

**Thickness (mm):**

<table>
<thead>
<tr>
<th>Material</th>
<th></th>
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<tbody>
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**Diameter (mm):**

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</table>

**Diameter (mm) min.:**

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**Diameter (mm) max.:**

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**Cross section (mm²):**

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**Thickness (mm):**

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**kV:**

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**kA:**

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**System grounding:**

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**Material options:**

- Al
- Cu
- Solid round
- Solid sector
- Stranded Al wire
- Circular
- Milliken
- Keystone
- XLPE
- EPR
- Rubber
- Paper
- Cu wires
- Cu tapes
- Lead
- Al screen
- Al wire
- Al tape
- Steel wire
- Steel tape
- Corrug. Al
- Corrug. Cu
- Filler
- Laminated foil Al
- Laminated foil Cu
- PE
- PVC
- Graphite
- Extruded
- Laminated foil Al
- Laminated foil Cu
- Laminated foil Cu
- Solid
- Isolated
- Resonant
NKT is certified according to all main international standards and at all locations. High-voltage cable accessories from NKT are produced in Cologne, Germany. All certificates are available on our websites.
NKT is signatory of the Europacable Industry Charter: A commitment towards superior quality.

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