

# VPI – INSULATION System – Coils for High Voltage Machines

For high and highest Voltage (3,0kV up to >13,0kV)

## A ~ Conductor:

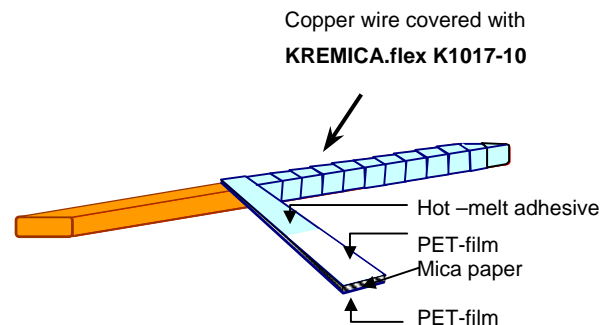
- rectangular Copper wires
- ⇒ dimensions: 5,0mm<sup>2</sup> up to 25mm<sup>2</sup>



## B ~ Conductor Insulation:

### 1. Mica tapes based on PET-film carrier

- ⇒ high dielectric strength
- ⇒ excellent corona resistance

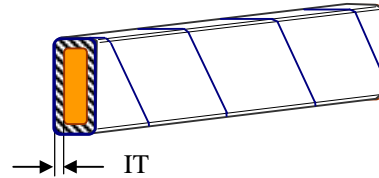


*Standard tapes from KREMPEL:*

- **KREMICA.flex K1002-09** > PET-film/ mica paper/ EP-resin
- ⇒ used when pre-consolidation of the coil is done prior to coil forming; HYPERSEAL NG is used for stackbonding.
- **KREMICA.flex K1015-09** > PET-film + hot-melt adhesive/ mica paper/ EP-resin
- ⇒ used when pre-consolidation of the coil is done after coil forming
- **KREMICA.flex K1017-10** > PET-film/ mica paper/ EP-resin/ PET-film + hot-melt
- ⇒ used when pre-consolidation of the coil is done after coil forming
- ⇒ other tape compositions are available on request, e.g. glass or Polyimide carriers.
- ⇒ Several standard methods of taping are possible:
  - ½ -lapped; butt-lapped; 1/3 –lapped (decided by customer and conductor manufacturer).

**2. Insulation Thickness (=IT) after pressing**

$$\Rightarrow IT = \frac{(n + 2 \times n \times p) \times d \times (100 - c)}{100}$$



- n= number of layers
- p= type of overlapping ( butt-lapped 0%; 1/2 lapped ; 1/3 lapped;...)
- d= thickness of tape (mm)
- c= compression of the tape (%)

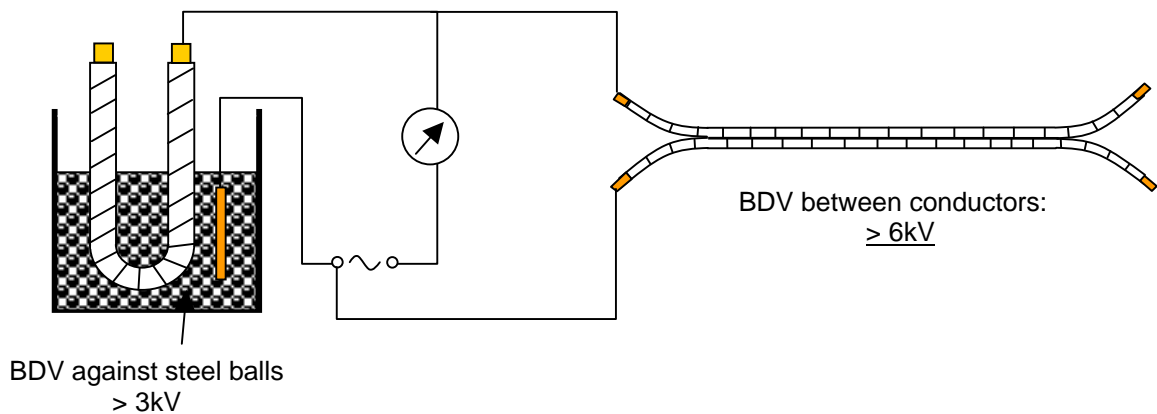
⇒ Example: KREMICA.flex K1002-09; 2 x 1/3 lapped

$$\Rightarrow IT = \frac{(2 + 2 \times 2 \times \frac{1}{3}) \times 0,09 \times (100 - 25)}{100} = \underline{0,225mm}$$

**3. Breakdown Voltage of KREMICA.flex insulated wires**

- ⇒ Type of KREMICA.flex
- ⇒ Type of overlapping
- ⇒ Number of layers
- ⇒ BDV (average): 3,0 – 5,0kV

Example: KREMICA.flex K1002-09; 1 layer x 1/2-overlapping

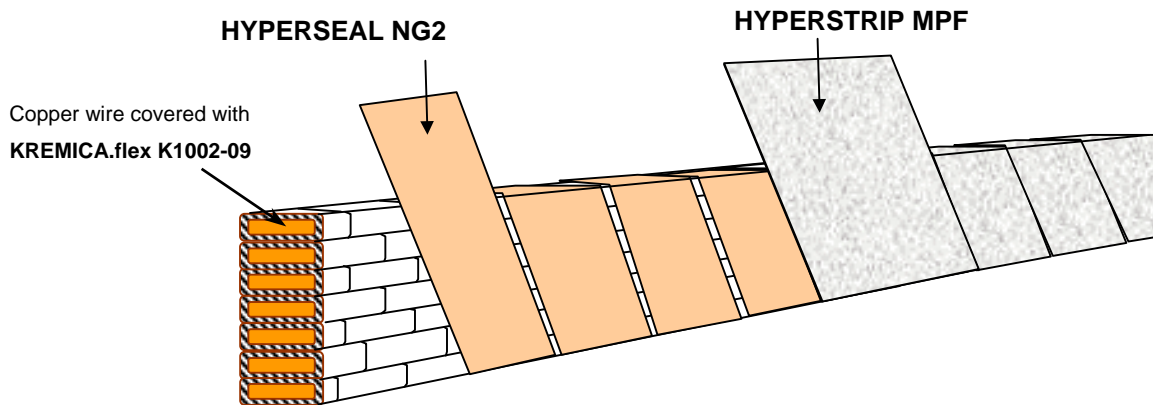


All values stated are to be seen as typical values. We reserve the right to introduce changes within the framework of further technical development. We do not accept any obligations or liabilities in respect of this information. Status: 09/2007  
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**C ~ Pre-consolidation:**

**1. Conductor Insulation with KREMICA.flex K1002-09**

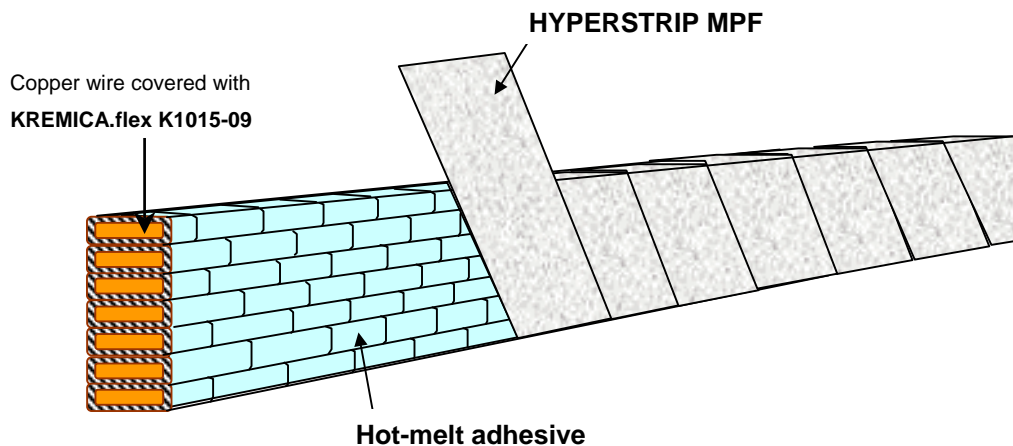
- ⇒ HYPERSEAL NG2 0,13x25mm: Glass-EP Prepreg  
1 x butt-lapped layer or open spiral wound
- ⇒ HYPERSTRIP MPF2 0,05x40mm: Release film  
1 x ½ lapped layer; removed after pressing



⇒ Pressing cycle: e.g. 10min at 160°C

**2. Conductor Insulation with KREMICA.flex K1015-09 (or K1017-10)**

- ⇒ HYPERSTRIP MPF2 0,05x40mm: Release film  
1 x ½ lapped layer; removed after pressing



⇒ Pressing cycle: e.g. 5min at 130°C

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## D ~ Main-Insulation (slot & endwinding)

### 1. Slot part/ Main wall insulation

Material	mm	Carrier	Mica	Resin System	Accelerator
KREMICA.por K3033-14	0,14x20-25	Glass fabric	unc. Mica	Epoxy Resin	
KREMICA.por K3032-14	0,14x20-25	Glass fabric	unc. Mica	Epoxy Resin	ZN-accelerator
KREMICA.por K3002-14	0,14x20-25	PET-film	unc. Mica	Epoxy Resin	
KREMICA.por K3009-14	0,14x20-25	PET-film	unc. Mica	Epoxy Resin	ZN-accelerator
Inner Corona Protection (ICP): Cond. tape 03 EFR 13AA	0,08x20-40	PET-Fleece - thread reinforced	-	Synthetic Resin	
Outer Corona Protection (OCP): Cond. tape 06 ELR 14AA	0,08x20-40	PET-Fleece	-	Synthetic Resin	
Inner Corona Protection (ICP): Cond. tape 05 GGR 32AA	0,05x20-40	Glass fabric	-	Synthetic Resin	
Outer Corona Protection (OCP): Cond. tape 10 GGR 32AA	0,10x20-40	Glass fabric	-	Synthetic Resin	

### 2. Endwinding

Material	mm	Carrier	Mica	Resin System	Accelerator
KREMICA.por K3033-14	0,14x20-25	Glass fabric	unc. Mica	Epoxy Resin	
KREMICA.por K3032-14	0,14x20-25	Glass fabric	unc. Mica	Epoxy Resin	ZN-accelerator
KREMICA.por K3002-14	0,14x20-25	PET-film	unc. Mica	Epoxy Resin	
KREMICA.por K3009-14	0,14x20-25	PET-film	unc. Mica	Epoxy Resin	ZN-accelerator
Semi conductive tape: Akasic 4b	0,20x20-25	Glass/ PET-fabric	-	SIC-Epoxy Resin	
Sealing tape: HYPERSEAL V	0,09x20-25	Glass/ PET-fabric/ PET-film	-	Synthetic Resin	

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### 3. Lead out

Material	mm	Carrier	Mica	Resin System	Accelerator
KREMICA.por K3033-14	0,14x20-25	Glass fabric	unc. Mica	Epoxy Resin	
KREMICA.por K3032-14	0,14x20-25	Glass fabric	unc. Mica	Epoxy Resin	ZN-accelerator
KREMICA.por K3002-14	0,14x20-25	PET-film	unc. Mica	Epoxy Resin	
KREMICA.por K3009-14	0,14x20-25	PET-film	unc. Mica	Epoxy Resin	ZN-accelerator
Sealing tape: HYPERSEAL V	0,09x20-25	Glass/ PET-fabric/ PET-film	-	Synthetic Resin	

#### Impregnating resin:

Solvent free resins (catalyzed Epoxy-resins, Polyester- or Polyesterimide-resins) suitable for HV application, with appropriate viscosity, providing void-free insulation with mica-paper-insulation after VPI-process and curing. Where uncatalyzed Epoxy-Anhydride resin is used for impregnation, KREMICA.por K3032-14 shall be applied in place of KREMICA.por K3033-14 and KREMICA.por K3009-14 in place of KREMICA.por K3002-14.

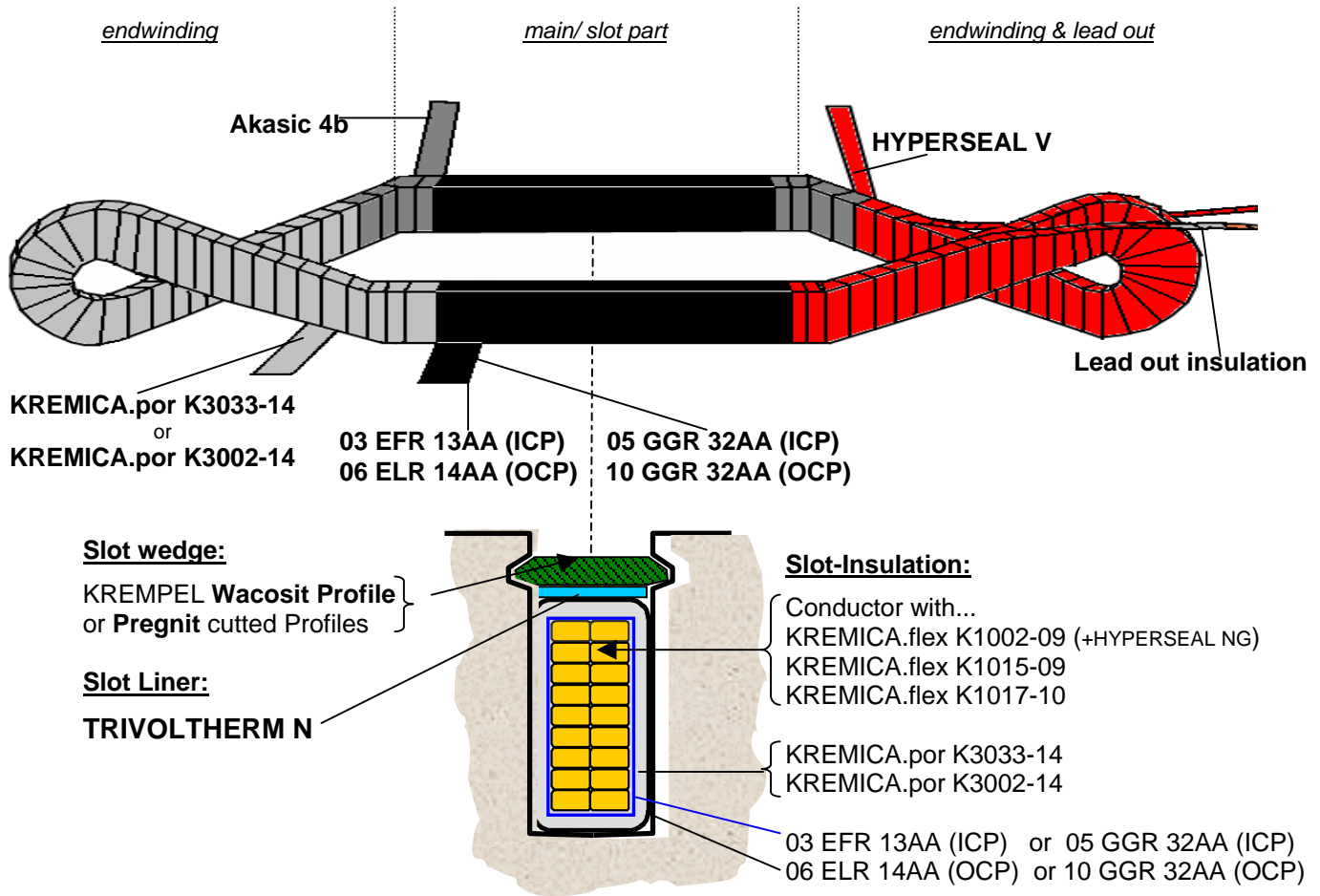
The InnerCoronaProtection and OuterCoronaProtection tapes are all available with ZN-accelerator for this System. An „S“ will be added to the product name, e.g. 10GGR 32AA „S“

#### Informations and Details

This information is to be used as a guideline and should give you the support to design your insulation system. Several other tapes and combinations are available on request.

More details and further information for these quality products from KREMPEL will be available upon your request. Please contact our sales team or any of the authorized KREMPEL Partners and Agents.

**E ~ Full Insulation System**



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