# Definition of Dry Type Transformer IEC 60076-11


**Presenter:**

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**NHD Electrical Engineering (H/C)**

**Company:**

## Power Transformers (Pty)Ltd

**based in Cape Town South Africa**

**(not to be confused with another company…..**

**Hint: very old probably oldest oil transformer manufacturer in South Africa)**

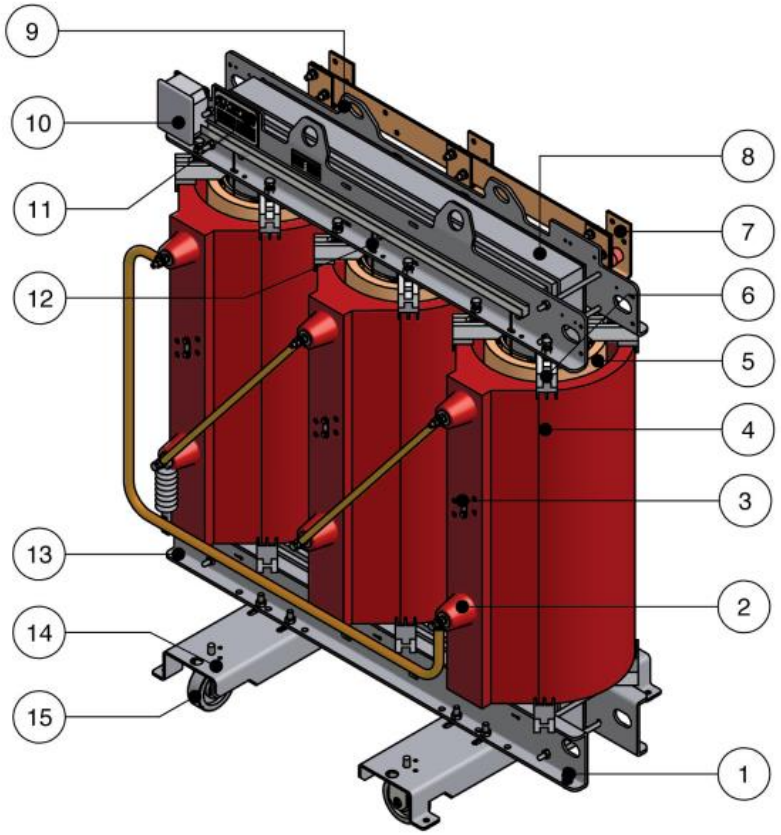
**Southern African Representative for:**

## GBE SpA

**based close to Venice, Italy**

**(not to be confused with the sinking city of Venice!)**

# Definition of Dry Type Transformer IEC 60076-11




***TECHNICAL PARAMETERS***

***1*** *Earthing Terminal*
***2*** *Medium Voltage Output Insulator*
***3*** *Primary Voltage Regulating Tapping*
***4*** *High Voltage Regulating Tapping*
***5*** *Low Voltage Windings*
***6*** *Windings Pressure Plugs*
***7*** *Low Voltage Output Bars*
***8*** *Magnetic Core*
***9*** *Lifting Eyebolts*
***10*** *Centralization Auxiliary Box*
***11*** *Name Plate*
***12*** *Thermal Sensors*
***13*** *Lamination Holder*
***14*** *Eyebolts for Horizontal Movement*
***15*** *Orthogonal Revolving Wheels*

**Dry Type transformer ( IEC 60076-11 ) –** This part of IEC 60076 applies to dry-type power transformers (including auto-transformers) having values of highest voltage for equipment up to and including 36 kV and at least one winding operating at greater than 1,1 kV.

# Advantages of Cast Resin Transformers



- Low energetic content, similar to the vacuum pressure impregnated transformers
- It is self-extinguishing in case of fire
- Superior short-circuit withstand, both from thermal and dynamic point of view, compared to the oil filled transformers
- Easy on site maintenance

# Main International Standards ECODESIGN Directive (2009/125/EC)

IEC 60071-1 – general

IEC 60076-2 – temperature rise

IEC 60076-3 – insulation levels, dielectric tests and external clearances in air

IEC 60076-4 – guide to lightning and switching impulse testing

IEC 60076-5 – ability to withstand short circuit

IEC 60076-10 – determination of sound levels

**IEC 60076-11 – dry type transformers**

IEC 60146-1 - converter

**TIER 1**:

From July 1st 2015:

- Reduced losses: $A_0$ $C_k$ – $B_k$ 0 % tolerance;
- CE marking according to according to2009/125/CE;
- All transformers purchased, sold and commissioned until June 30th 2021 can not have higher losses

**TIER 2** :

- Ultra reduced losses: $A_0$ -10% $A_k$, 0% tolerance
- CE marking according to according to2009/125/CE;
- All transformers purchased, sold and commissioned can not have higher losses

# Magnetic Core

- **CRGO**:Cold Rolled Grain Oriented steel foil with high permeability carlyte insulation. Made with 45° Step Lap technology to guarantee low losses, low no load current and low noise.

- **Amorphous**: obtained by rapid solidification of metal alloy, it presents a non-crystalline structure. Amorphous metal provides extremely low losses, way better than any grade of Cold-Rolled Grain-Oriented (CRGO) steel, potentially 70% - 80% lower.

# LV Windings

- Wound in Aluminium or Copper
- Insulation in class F material / vacuum impregnated with oven-dry coat
- Connection of the aluminium/copper foil between winding and terminal bar made with automatic welding in protective atmosphere

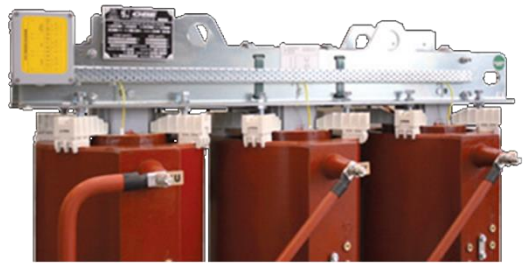
# MV Windings

- Manufactured with aluminium or copper conductors using full automatic machines
- Class F insulated, or class H  for special applications
- Regulation of the primary voltage obtained directly on the coil
- Measured Partial Discharges on MV windings lower than 5pC at 2Un
- IEC specification at <10pC

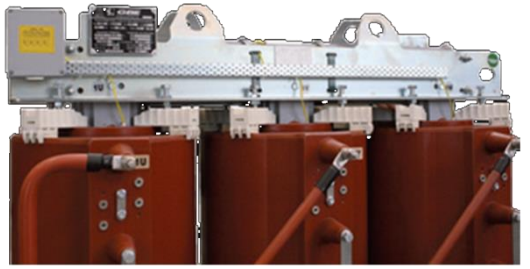
# Control Systems

Gbe can offer three kind of control systems:

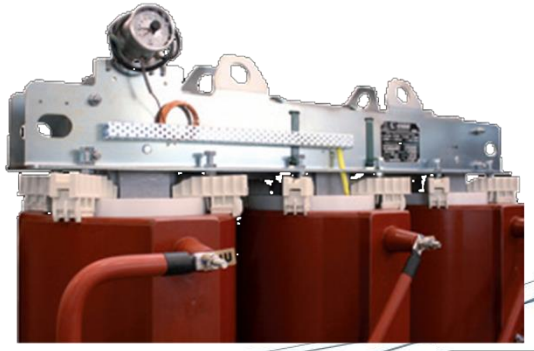
- **Dial type thermometer:**
  - 2 electrical contacts NA - NC
  - Pre-Alarm: 140 °C - Trip 150 °C,
  - Contacts capacity: 2,5 A – 250 V



- **Electronic relay for thermal contacts or PTC Sensors:**
  - 3 + 3 probes placed in the three phases
  - 3 probes for fan cooling control (optional)
  - Alarm 140°C – Trip 150°C – Fan 90 °C
  - Universal Power
  - Contacts capacity: 2,5 A – 250 V



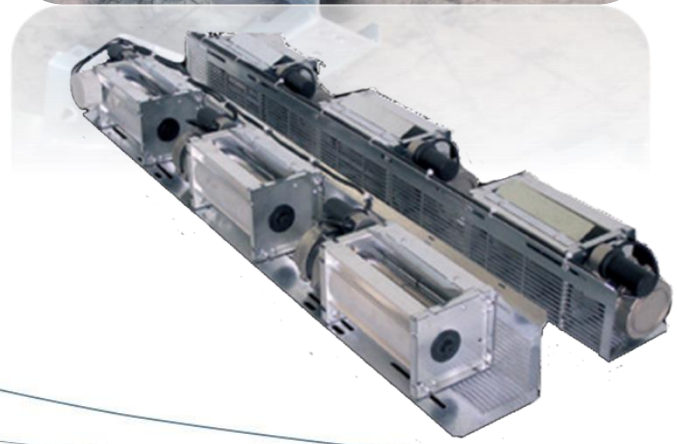
- **Electronic Relay for PT100 Sensors:**
  - PT 100 probes in the three phases and/or (optional) in the core
  - Alarm 140 °C; Trip 150 °C
  - Fan 90 °C
  - Universal Power
  - Contacts capacity: 5A - 250V



# Protection Housings

- Applications: outdoor and/or indoor
- Protection class from IP 21 up to IP 54
- Metal sheet: galvanized, stainless steel or aluminium
- Thickness: 15/10 – 20/10 mm
- Polyester painting
- Suitable for every kind of environment (high rate of pollution, humidity, extreme weather condition)

# Forced Cooling System

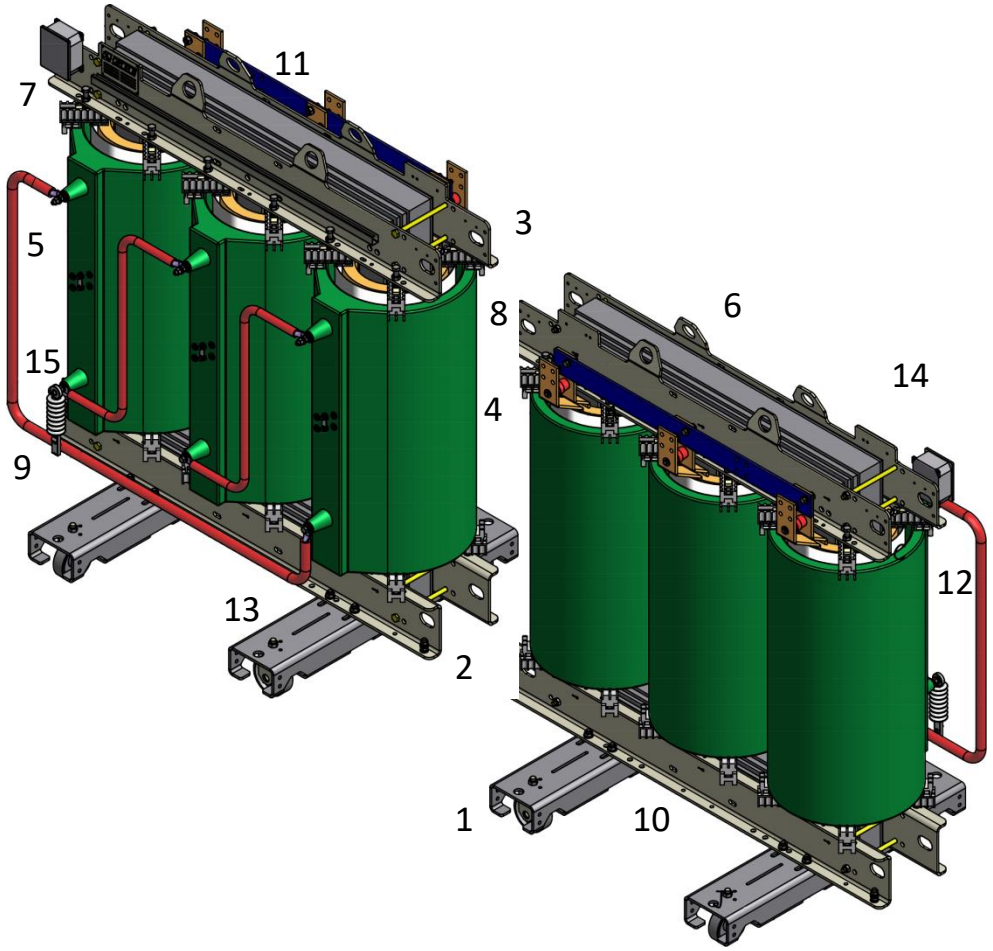


- Up to 40% more power for every kind of transformer up to 10 MVA
- Bearing or centrifugal tangential fan bar kit
- Guaranteed  working hours: up to 50.000 hours (standard fan system: 10.000 hours)

# Optional Fittings

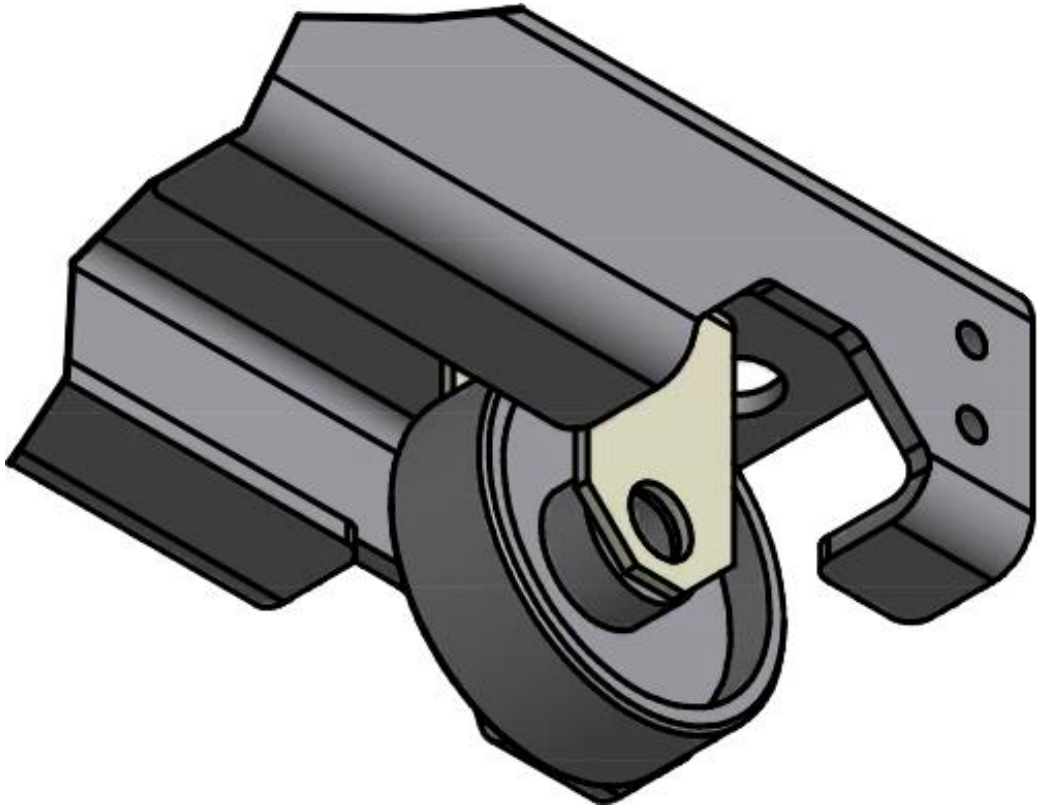
- Tangential forced cooling system up to 16 MVA with fan  bar kit from 1200 m³/h up to 7200 m³/h
- Antivibration pads for the wheels: Ø 100, 125, 150, 200
- Earthing bolts Ø 20 and Ø 25
- PT100, PTC and Medium Voltage PT100 probes with maximum insulation 30 kV
- Electronic Relay for PTC and PT100 sensors
- Thermometer with No 2 or more electrical contacts
- Resin Delta connection with Elastimold bushings up to 400A class 36 kV
- Elastimold from 250A /400° up to class 36kV
- Bi-metal plates
- Etc…

# Why choosing a GBE Cast Resin Transformer



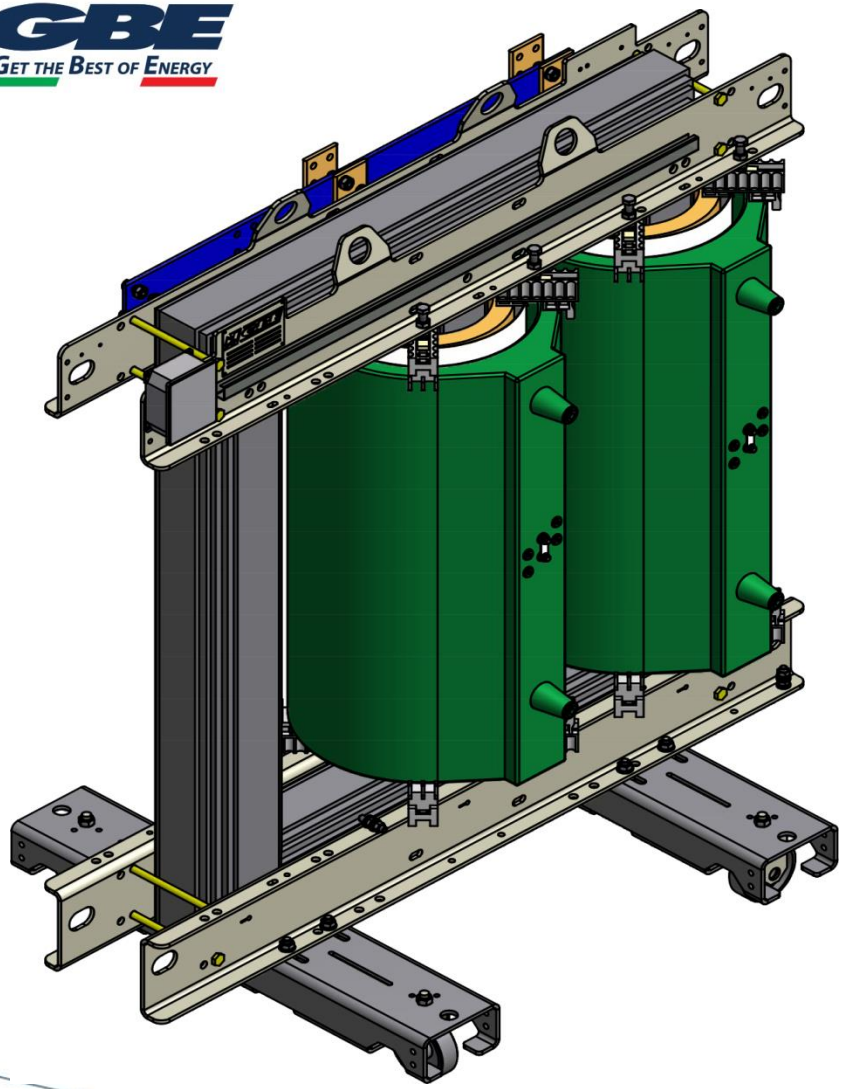

1. Anti-tilting skids
2. Galvanized steelwork frames
3. Non hygroscopic pressure plugs
4. Top gap between primary and secondary windings
5. Nickel-plated terminals
6. Tilted lifting eyebolts
7. Aluminium Auxiliary Box
8. Galvanized wiring tray for sensors and cables
9. Fiberglass delta connection bushing support
10. Self-blocking bolts and screws
11. Fiberglass straps for core sheet tightening
12. Patented clamping system
13. Truck setup for tangential fans installation
14. Steelwork frames made without welding
15. Silicone rubber insulated delta connection (with different thickness)

# 1. Anti-tilting skids



Skids are shaped to allow safe anti tilting proof  fork lifting

# 2. Galvanized Steelwork Frames

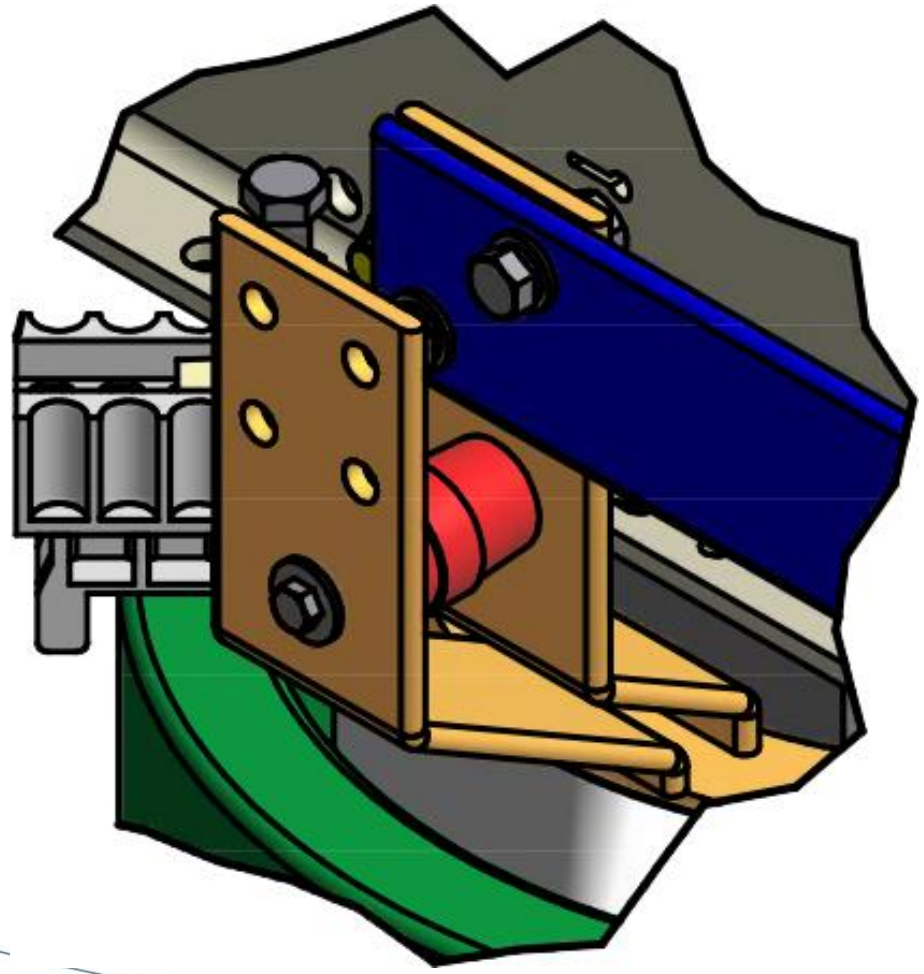


All the steelwork frames are galvanized to avoid rust in every kind of installation

# 3. Non hygroscopic pressure coil supports

- Fiberglass, nylon and non hygroscopic pressure coil supports to permit no humidity absorption
- It prevents that humidity influences the partial discharge value
- Guaranteed Partial Discharge value on the windings < 5pC

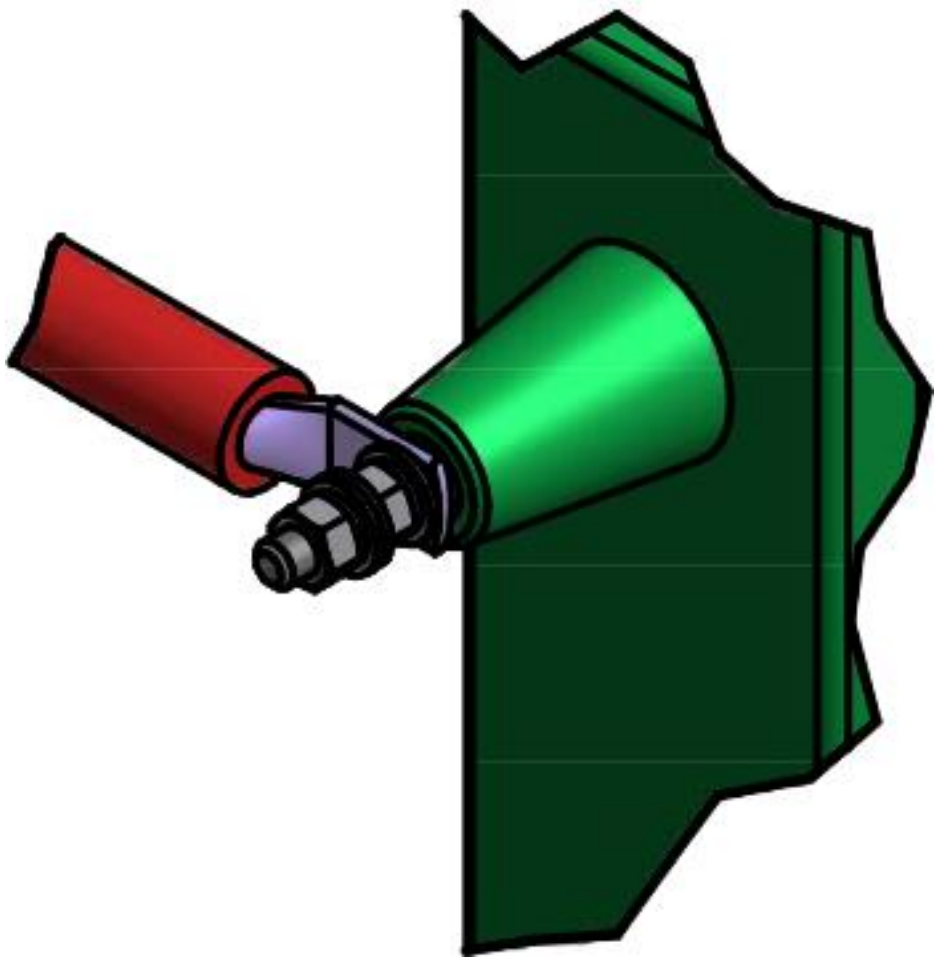
# 4. Top gap between primary and secondary windings



The gap between primary and secondary windings permits:

- better airflow in the coil's channels
- superior core and coils cooling
- better insulation between primary and secondary windings
- higher performance in rigidity and impulse tests

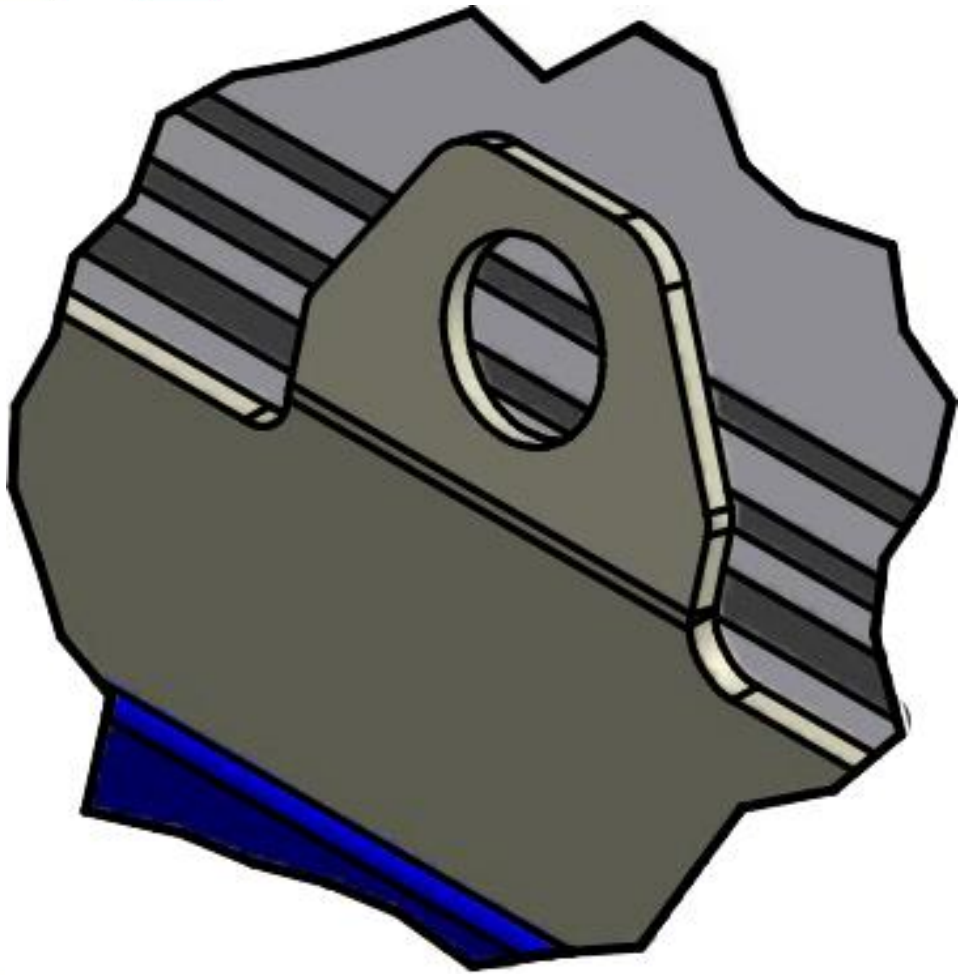
# 5. Nickel-plated terminals



All the terminals are nickel-plated, so the advantages are:

- No oxidation
- No false electrical contacts
- Overheating prevention in current transition points

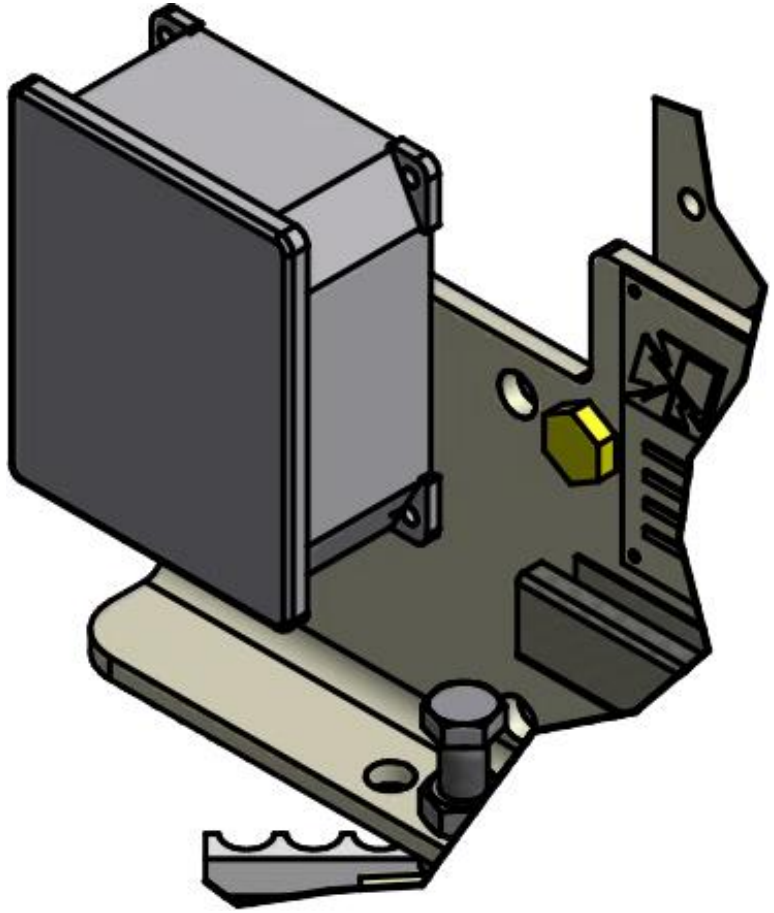
# 6. Tilted lifting eyebolts



The eyebolts are bent in order to:

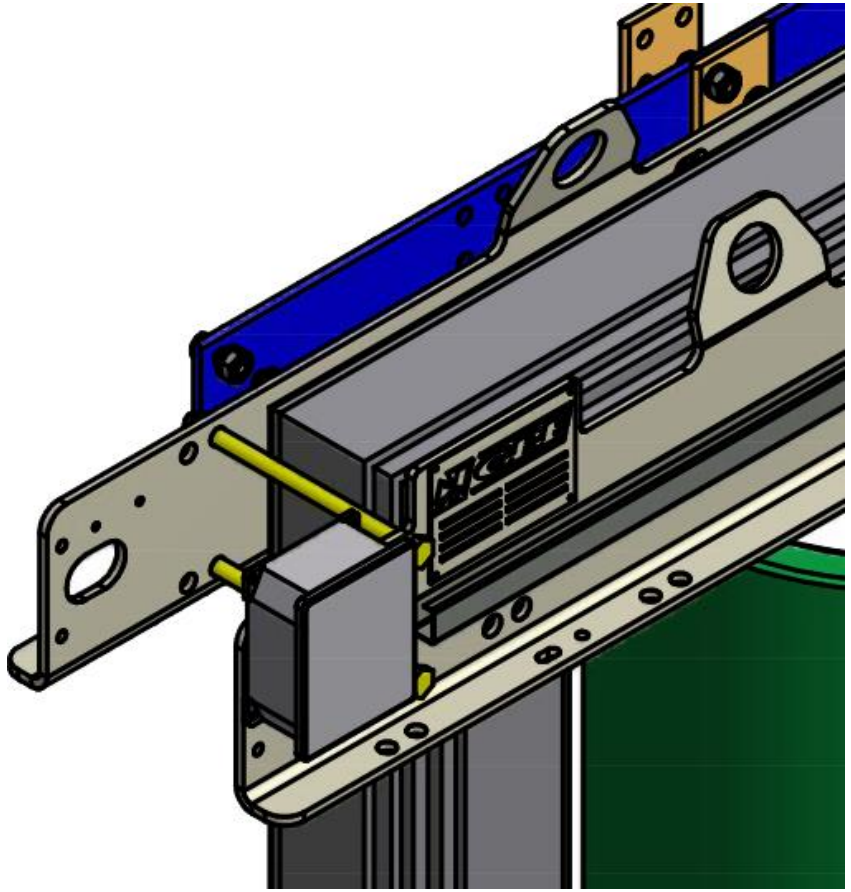
- distribute the strain when lifted with chain hooks
- better aesthetic appearance
- prevent cracks
- permit lower thickness of the steelwork frames
- reduce the weight

# 7. Auxiliary box



- Made of aluminium
- Protection class IP 54
- Fire resistant

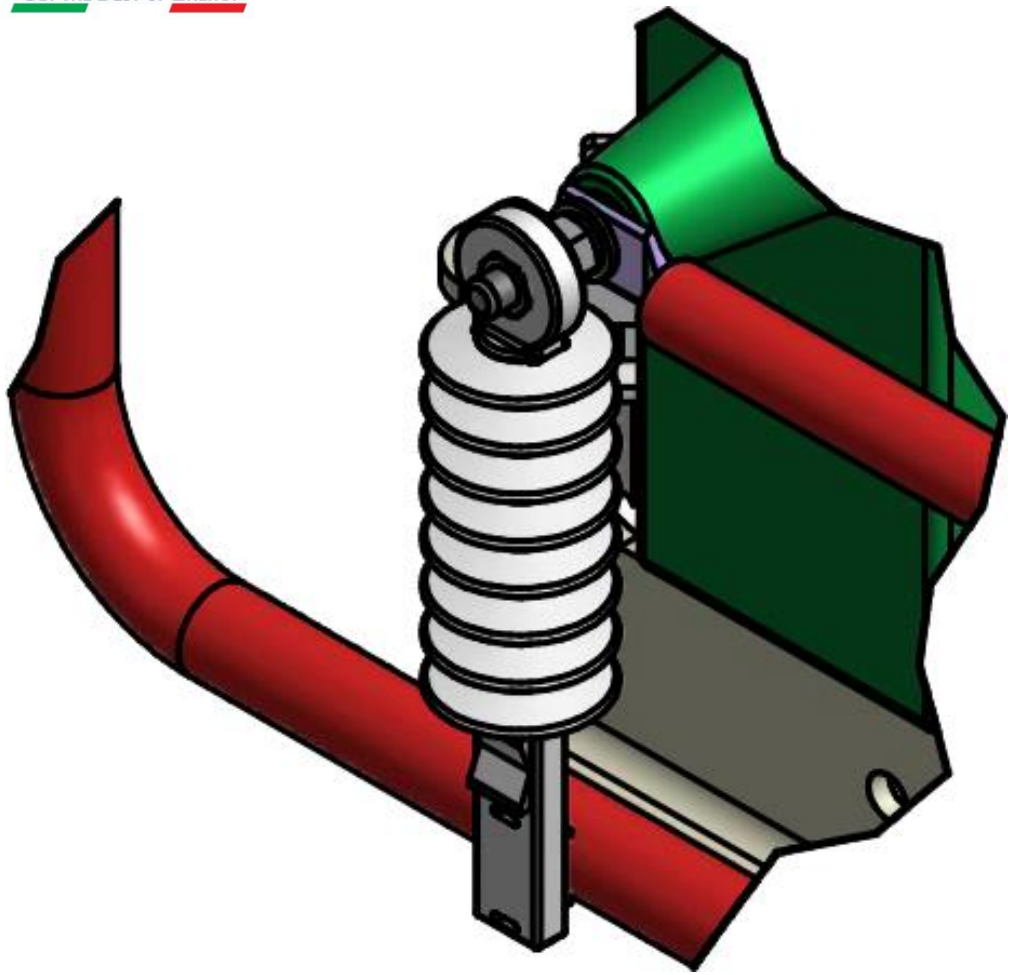
# 8. Galvanized wiring tray for sensors and cables



The wiring trays for sensors and cables are:

- Galvanized
- Fire resistant
- Well protected to avoid any kind of damage

# 9. Fiberglass delta connection bushing support



The delta connection is provided with shaped fiberglass support to permit:

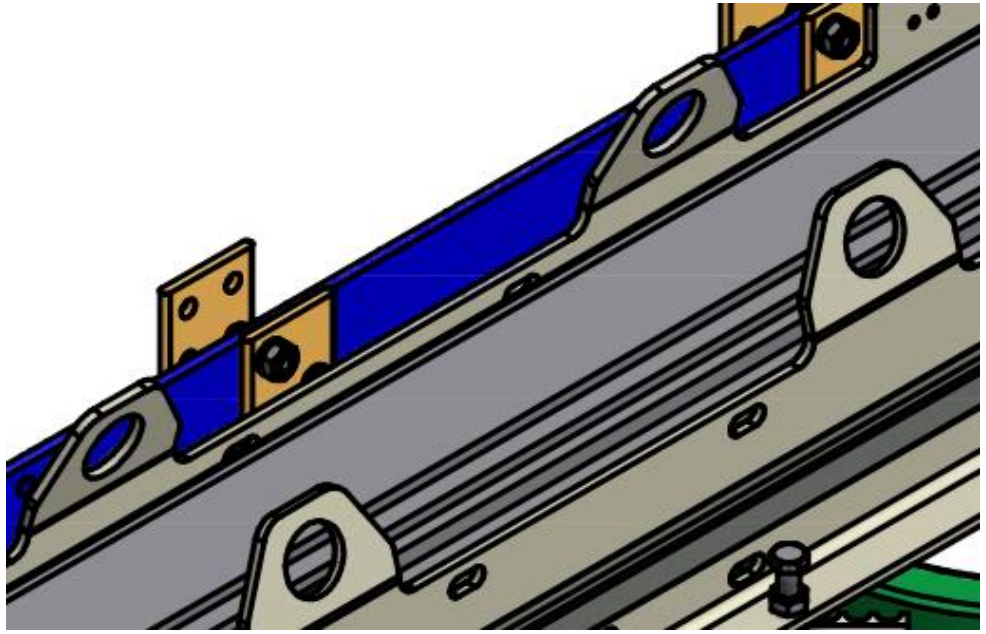
- A better resistance support at the bend to reduce strain and deformation
- Compact width of the complete unit
- Better insulation withstand

# 10. Self-blocking bolts and screws

The advantages of having self-blocking bolts and screws:

- Constant clamping
- Keep coils always in the right position
- Constant pressure on the magnetic steel
- No additional noise of the transformer
- No problems during transport or movement for transport or installation

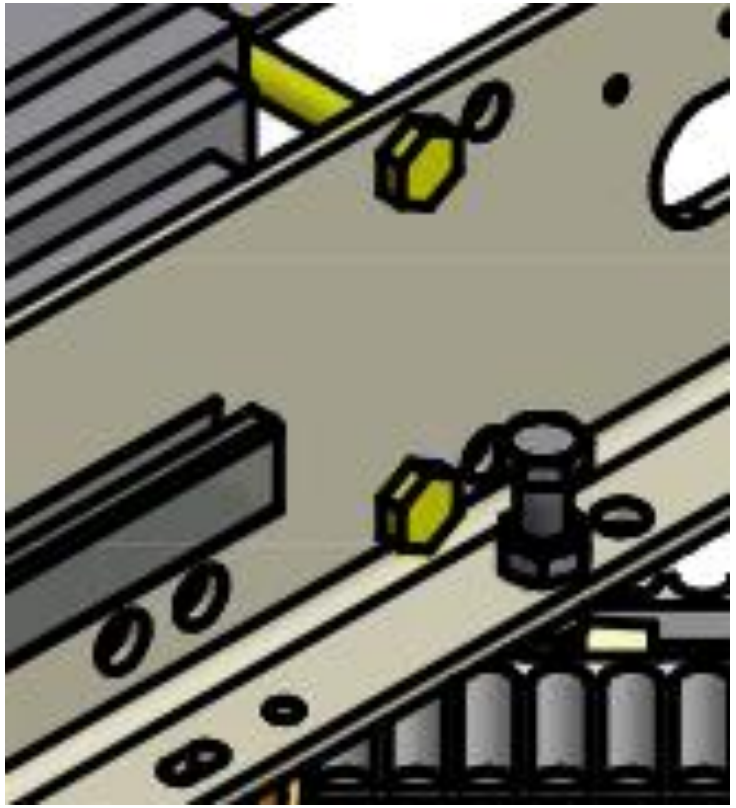
# 11. Fiberglass straps for core lamination tightening



The frames are tightened by a fiberglass strap positioned in the central part of the yoke to:

- prevent from insulation problems against the core sheet
- avoid the risk of a short circuit
- Reduce losses and magnetization current

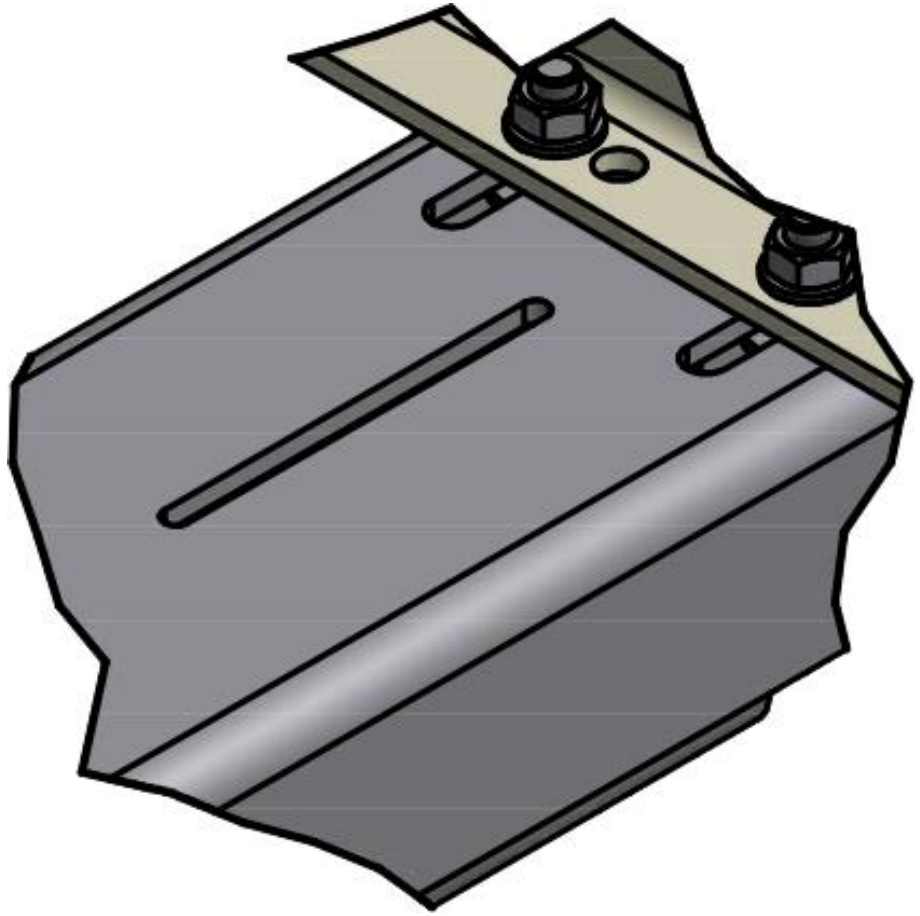
# 12. Patented clamping system



The GBE Patented clamping system between the core and the steelwork frame guarantees:

- Superior mechanical resistance
- Well balanced strain distribution
- Reduced vibrations between yokes and magnetic steel core when the transformer is energised

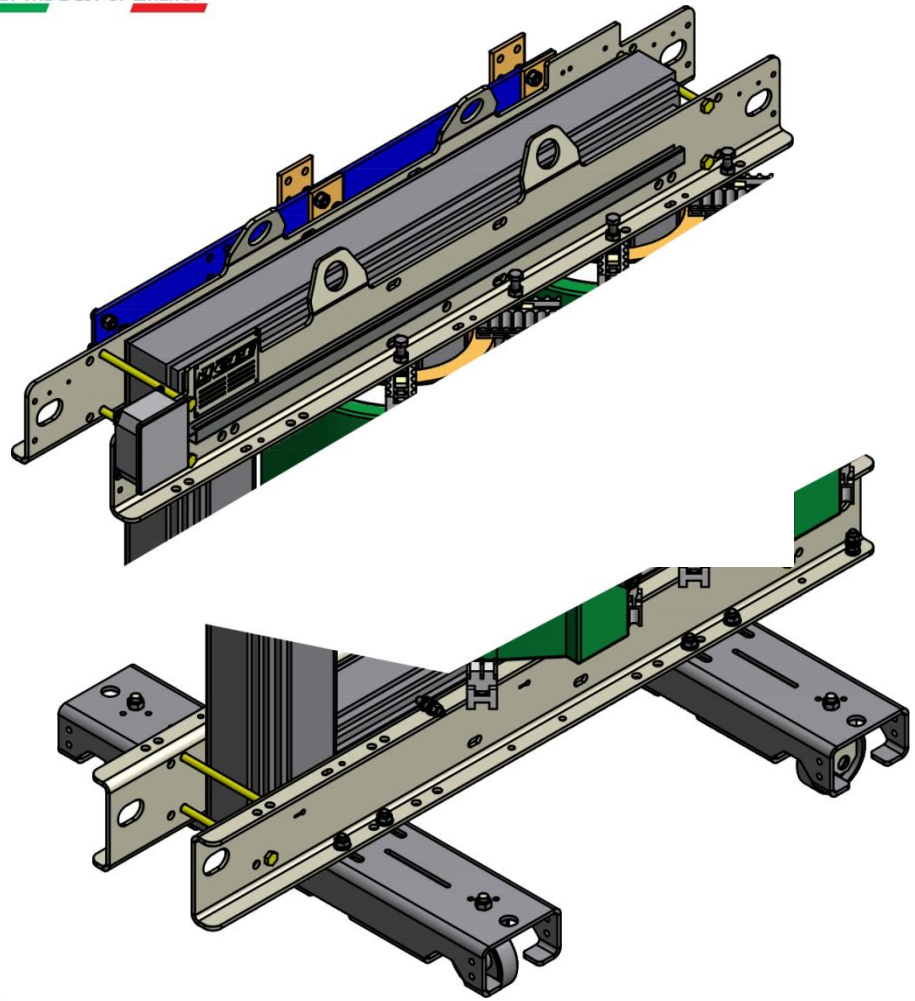
# 13. Base set up for tangential fans installation



The bottom yokes are properly drilled to permit:

- Future installation of the appropriate fans
- maintaining the right electrical insulation of the coils
- Installation of almost every kind of busbar system
- Easy set up to adjust the airflow for better performance in overloaded conditions

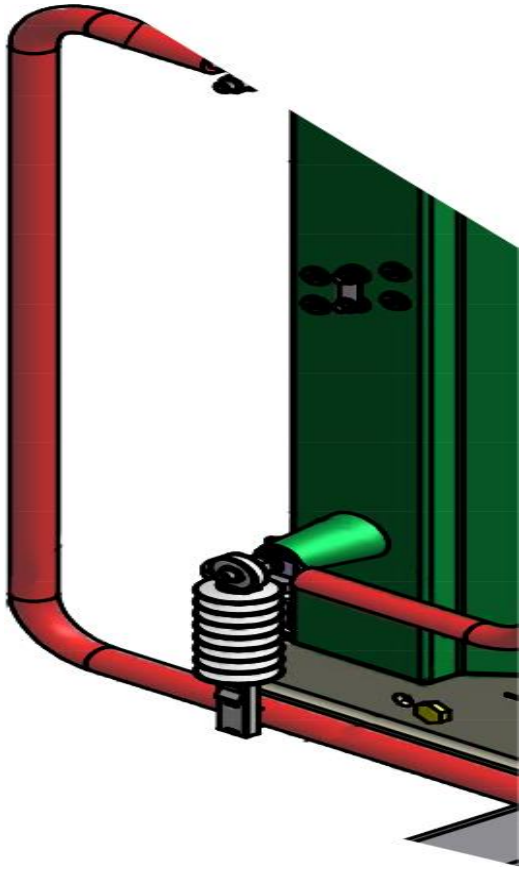
# 14. Steelwork frames made without welding



All the steelwork parts are realised with laser cut and bent metal sheets, therefore this means:

- No welding
- Maximum mechanical resistance
- No critical points due to welding process
- Best performance in every weather condition

# 15. Silicone rubber insulated delta connection



The delta connection can be in aluminium or copper material and without any welding to permit:

- Superior mechanical resistance
- No critical points due to welding process
- Maximum insulation obtained with different thicknesses of silicone rubber according to the insulation class
- Length reduction to permit nearer cable connection, maintaining the insulating distances according electrical standards

# CAST RESIN POWER TRANSFORMERS

Power: up to 30MVA  - Voltage: up to 52kV (BIL 250)

25 MVA

voltage 52 kV

25 MVA

12.5 MVA with OLTC

# CAST RESIN SPECIAL TRANSFORMERS

6, 12, 18, 24 PULSE CONVERTER TRANSFORMERS, THD VALUE UPON REQUEST;
EXCITATION TRANSFORMERS FOR METRO AND RAILWAYS, FREQUENCY 16,5HZ,
EARTHING TRANSFORMERS


# TRANSFORMERS WITH ON LOAD TAP CHANGER