

## RYMEL TRANSFORMERS FOR SOLAR GENERATION



The generation of energy through renewable sources has been consolidating in the world. Rymel, aware of new technologies and committed to caring for the environment, has developed special transformers, designed to work with inverters in solar applications.

This kind of equipment are used to adjust the voltage produced by the inverters in a photovoltaic system and interconnect it to the electricity supply network, additionally providing galvanic isolation between the electricity grid and the photovoltaic system.

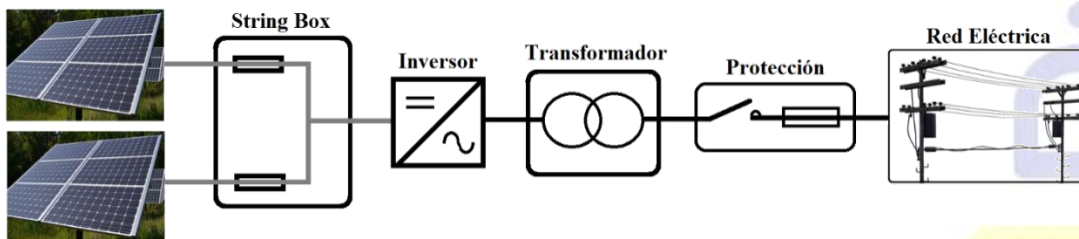


Figure 1. Photovoltaic system connected to the grid.

This kind of transformers are designed to withstand the harmonics produced by the inverters, the insulation system of their windings is designed to withstand the high earth voltages produced by electronic circuits, as well as high slopes of voltage ( $du/dt$ ) from the inverter during operation.

As a special feature, include an electrostatic screen between the windings, which facilitates galvanic isolation and allows capacitively decoupling high frequency pulses from the network, protecting electronic circuits. In addition, this screen serves as an additional  $du/dt$  filter and has a design that minimizes losses due to the Eddy effect.

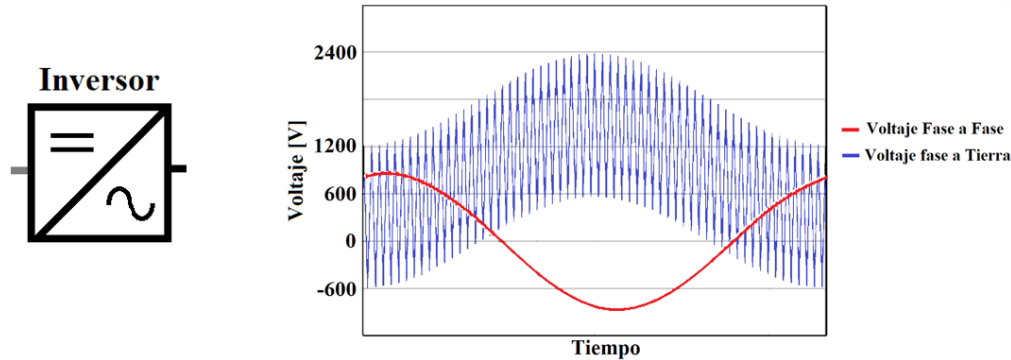


Figure 2. Typical response of an inverter.

These transformers can also be manufactured with 3 windings, which are used to raise the low voltage and provide galvanic isolation of two inverters independently.

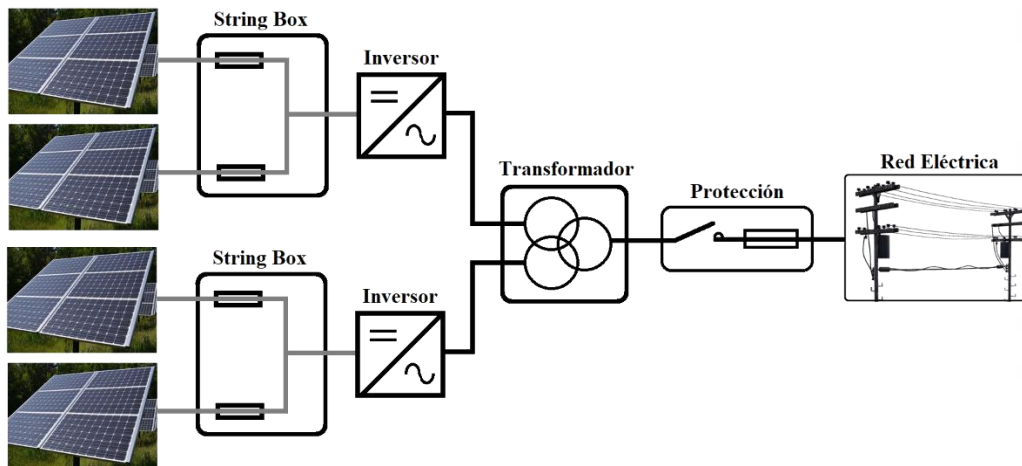


Figure 3. Photovoltaic system connected to the grid with three-winding transformer.

These special transformers are manufactured with electrical steel strip of very low losses, which increases the efficiency of the equipment, minimizes losses and vacuum currents and maintains a very low level of audible noise. Additionally, the transformers are designed to have the appropriate impedances for the coupling with the inverters and have a thermal design that allows working in places with high ambient temperature.

Rymel Transformers for solar applications can be insulated in dielectric oil; in this case, they are padmounted type with dead front terminals, which have a sealed cabinet and compartments for both high-voltage and low-voltage terminals. In addition, the pedestal transformer has built-in connection, protection and maneuver elements (typical of a substation), which protect the equipment.

On the other hand, also transformers with dry type insulation can be manufactured; in this case, they can be low voltage/low voltage transformers or medium voltage transformers, these last ones have their windings encapsulated in epoxy resin under vacuum that guarantees a minimum level of partial discharges. This type of transformer uses fire-resistant and self-extinguishing materials, which makes them very safe and maintenance-free. As this transformer does not use dielectric oil, facilitates its installation indoors, allowing space optimization.

## OIL INSULATED PADMOUNTED TRANSFORMER FOR SOLAR GENERATION

### Basic features:



- **Capacity:** Up to 10.000 kVA.
- **High Voltage:**
  - Windings in aluminum or copper.
  - Voltage up to 36 kV.
  - BIL up to 200 kV
  - Tap changer:  $\pm 2, 2.5\%$ .
  - Dead front terminals.
- **Low voltage:**
  - Windings in aluminum or copper.
  - Voltage up to 2500 V.
  - BIL up to 45 kV
  - Electrostatic screen.
  - **Cooling type:** ONAN, ONAF.
  - **Insulating liquid:** Mineral or biodegradable oil with high flame point.
  - **Protection devices:** Ejection fuses Bay-O-Net type, Current limiting fuse (depending on the power and voltage level), elbow type surge arresters.
  - **Maneuvering devices:** 2 or 4 position disconnecter.
  - Electrostatic powder painting system.
  - Manufactured according to the standards: IEEE Std C-57.12.34, IEEE Std C-57.12.28, IEEE Std C-57.12.29, NTC 3997 and RETIE.

## CAST RESIN MEDIUM VOLTAGE TRANSFORMERS FOR SOLAR GENERATION.



### Basic features:

- **Capacity:** Up to 2.500 kVA.
- **High Voltage:**
  - Windings in aluminum.
  - Voltage up to 15 kV.
  - Tap changer:  $\pm 2, 2.5\%$ .
  - Windings encapsulated in epoxy resin under vacuum.
  - Minimum level of partial discharges.
- **Low Voltage:**
  - Windings in aluminum.
  - Voltage up to 2.500 V.
- Electrostatic shield.
- Thermal class F (155 °C).
- Fire-resistant and self-extinguishing materials.
- Low loss and low noise magnetic core with dielectric coating.
- Electrostatic powder painting system.
- Temperature controller.
- Surge arresters.
- Minimum maintenance.
- Space optimization.
- Includes cabinet for outdoor use.
- Manufactured according to the standards: NTC 3654, IEC 60076, IEEE Std C57.12.91 and RETIE

## DRY TYPE LV/LV TRANSFORMERS FOR SOLAR GENERATION.



### Basic features:

- **Capacity:** Up to 500 kVA.
  - **High Voltage:**
    - Windings in aluminum.
    - Voltage up to 2.500 V.
    - Tap changer:  $\pm 2, 2.5\%$ .
  - **Low Voltage:**
    - Windings in aluminum.
    - Voltage up to 2.500 V.
  - Electrostatic shield.
  - Thermal class H (180 °C).
- Fire-resistant and self-extinguishing materials.
- Low loss and low noise magnetic core with dielectric coating.
  - Electrostatic powder painting system.
  - Minimum maintenance.
  - Space optimization.
  - Includes cabinet for outdoor/indoor use.
  - Manufactured according to the standards: NTC 3654, NTC 3445 and RETIE.