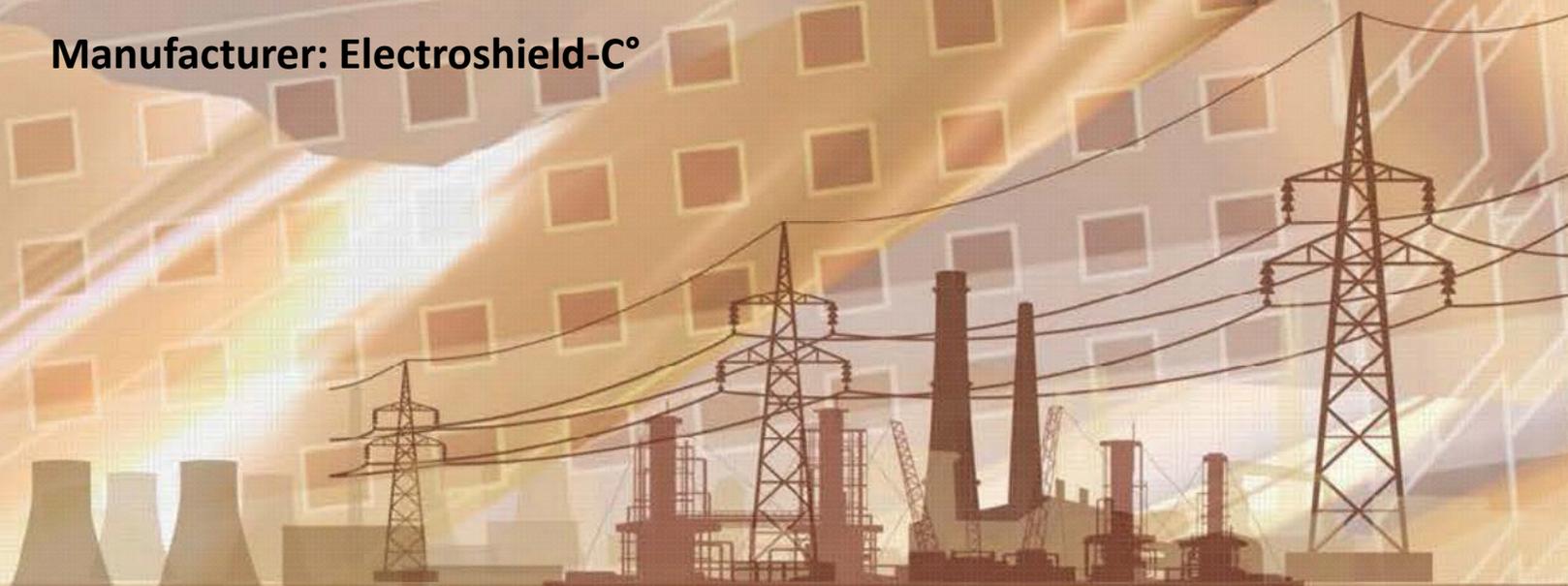


Instrument Transformers (IT) 6-35 kV Automatic Pressure Gelation Technology (APG)

Manufacturer: Electroshield-C°





The automatic pressure gelation technology implemented at Electroschild-C° in 2016 is the most up to date and efficient technology for producing instrument transformers (IT) in the global electrical engineering industry, and it is used by the world leading companies producing IT: RITZ, ABB, ELEQ etc.

In Russia, earlier there were no IT producers applying the above casting technology, and customers had to order imported equipment.

The automatic pressure gelation technology enables to produce instrument transformers:

- ❖ **outdoor** transformers with high **hydrophobic characteristics**, with water-repelling effect;
- ❖ with high tracking resistance level;
- ❖ **metallized** (with screened surface);
- ❖ with advanced reliability and safety due to **ideal** insulation quality;
- ❖ with improved surface, **low roughness level**.

Products manufactured with APG technology



Indoor



ZNOLP-EK M6



TLO-10 M11



Metalized transformers

Outdoor



ZNOL-EK MH31



NOL-EK MH31



TL-EK-35 M1

Advantages of IT produced with automatic pressure gelation technology



1. Low level of partial discharges in insulation (4 times better than GOST requirements);
2. Outdoor transformers for up to 35kV with hydrophobic characteristics, maximum effect of using cycloaliphatic epoxy. Used silanised silica flour ensures the **water-repelling effect**. At the moment Russian producers also use the above epoxy, but the hydrophobic properties with vacuum casting are low as ambient pressure is not enough to fill in the intermolecular (nano-level) voids;
3. **Resistance to cracking** of the outdoor transformer cast insulation caused by cyclic exposure to temperature differentials;
4. Metallised transformers ensure a considerable enhancement of the safety of **maintenance, including fire safety**. Consequently, a high level of interference resistance and low levels of electromagnetic emission;
5. Improved surface, roughness decreased by times if compared to the surface formed with vacuum casting, consequently, lower level of the surface contamination;
5. High tracking resistance level;
6. Enhanced resistance to mechanical effects (MSK-64 not less than 9 points even at lower temperatures);
7. **Import substitution** – in terms of quality the instrument transformers fully meet similar products of global producers, and are superior to them in terms of the value for money factor.

Description of the Automatic Pressure Gelation technology



The best material and structure give no guarantees of reliable and long-lasting operation of equipment if there is no appropriate production technology ensuring process manageability and reproducibility of results.

Now producers in Russia use simple vacuum treatment for molds. The technology cycle (mold casting, polymerizing and demolding) takes over 10 hours. And the casting process does not ensure 100% control of the mold filling in with the compound.

Under APG technology, pressure casting is performed into a preliminary heated mold, which results in the **cycle time decreased** to 1.5 hours.

The modern IT production technology includes an APG unit together with a material preparation and supply system, where compound components can be mixed in the needed proportion, thus ensuring optimal characteristics for the mixture at the stage of casting, impregnation, polymerizing, and **ensures 100% control of the mold filling in with the compound**, minimizing void formation, preventing from compound shrinkage and internal stress generation.

This results in the high stable quality of the product.

Description of the Automatic Pressure Gelation technology



Casting molds are important elements of the automatic pressure gelation technology. Mold production process should consider all parameters of the raw materials, components and characteristics of the future transformer:

- ❖ a three-dimension computer-aided calculation of the electrical field along the surface and inside the cast insulation body;
- ❖ by varying the structure geometry and dielectric intervals, field distribution with the minimum stress levels are chosen;
- ❖ defining key process parameters, such as temperature of compound, mold and embedded parts, pressure, feeder position and sizes, chemical and thermal shrinkage.

Detailed physical and mathematical calculations at the mold designing stage prevent from typical technological problems of the vacuum casting: premature gel formation, generation of layering and voids, high internal stresses, micro cracks.



size A

size B

The degree of accuracy and detailed elaboration of the calculations makes it possible that sizes at different areas of the feeding channels may vary depending on the system requirements.

Example: Size A and Size B

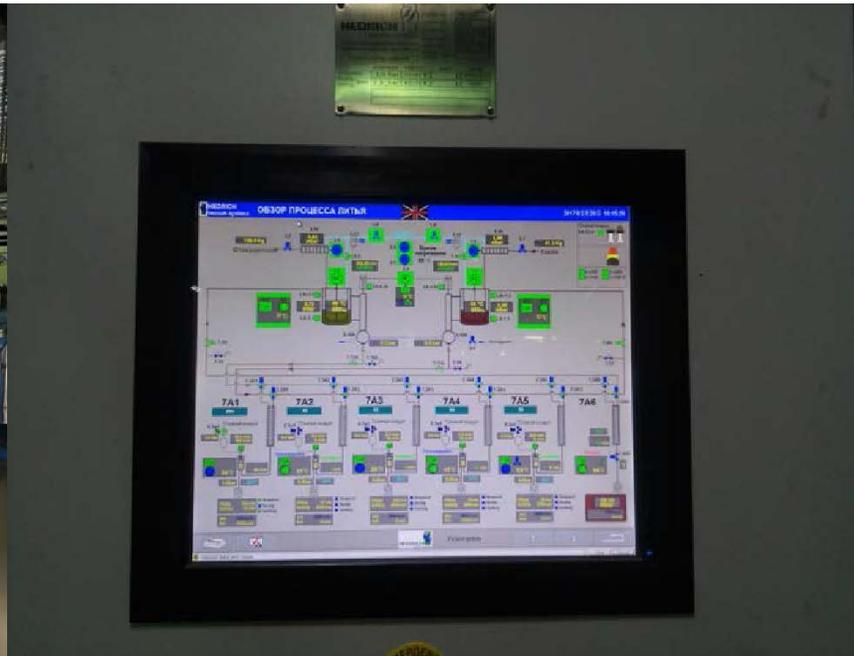


Description of the Automatic Pressure Gelation technology

The equipment system manufactured by Hedrich GmbH, Germany. The system consists of:

- ❖ equipment for accurate component dosing;
- ❖ equipment for mixing and vacuum treatment of prepared compound;
- ❖ casting machine for automatic pressure gelation;
- ❖ automation system and process control;
- ❖ set of highly-accurate molds following the required product drawing;
- ❖ oven for curing (drying) the finished product.

The system operates automatically in accordance with the specified component mixing formula.





We are sure that usage of APG technology transformers at PJSC Rosseti facilities will contribute to **enhancement of operation reliability and safety**.

Thank you for your attention!