MEDIUM VOLTAGE

DRY-TYPE TRANSFORMERS

- **TYPE** - **ETH**
- **POWER** - **from 10 to 2500 kVA**
- **HV PRIMARY VOLTAGE** - **3 x (3; 6; 10; 11; 15) kV**
- **LV SECONDARY VOLTAGE** - **up to 3 x 1.0 kV**
- **VECTOR GROUP** - **Dyn5, Dd0, Yzn11, Dd0y1**
- **PROTECTION DEGREE** - **IP00; IP23; IP44; IP54**
- **CLIMATIC DESIGN** - **C2/E2**

DESIGN AND PRODUCTION:

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ETH transformers have HV and LV windings and are wound in the DRY technology. The product is made of fire-resistant materials, which is confirmed by appropriate tests and certificates. Therefore, it is a good solution designed for use in industrial installations where there is no high fire hazard, as well as in public utility buildings. They are suitable for indoor use, also as an alternative for resin ETR or ETO oil transformers.
In order to ensure their ability to operate in difficult environmental and climatic conditions and their compliance with national and international standards, **ETH** medium voltage dry transformers have been designed and tested according to the following environmental classes:

- **C2** – resistance to thermal shock. **ETH** transformers are resistant to significant changes in load and overload.
- **E2** – resistance to corrosive environments. **ETH** transformers can operate at high humidity and in polluted environments.

Advantages:

- High resistance to the moisture of insulation
- Flame-retardant airtight sealing insulation of windings
- High dielectric resistance
- High short-circuit resistance
- High resistance to external factors according to class C2, E2
- The level of partial discharge <10pc

Construction:
In the fourth quarter of 2015, we have implemented an innovative technology developed in our company for the production of dry-type medium voltage transformers. Thanks to it, they are characterized by high resistance to dynamic impact of short-circuit currents, vibrations and moisture as well as corrosive substances.
Transformer cores are made of cold-rolled magnetic sheets with a low loss. Careful production of the core is possible by using modern cutting technology STEPLAP and the use of mechanized tables for assembling and lifting the cores to the vertical position.
The LV winding, is made, depending on the requirements of the Customer, in the dry technology, with the use of aluminum or copper tape, or several parallel profiled wires in varnish insulation class H. The interwinding insulation is made of NOMEX or ERGOPREG, being a special composite which joins adjacent coils with a tape. Such a solution results in high resistance to short-circuit forces and air-tights the winding, preventing the penetration of moisture and chemical vapors, as well as a positively effects high dielectric strength.
The HV winding is also produced in the dry technology. The winding is wound using copper wires with a circular or profiled cross-section with double varnish insulation class H. The interwinding insulation is made of NOMEX or ERGOPREG. All windings (LV and HV) are impregnated with epoxy resin by means of vacuum-pressure impregnation (VPI). The selected parameters of the VPI process in our innovative technology guarantee excellent winding supersaturation with resin. Then the winding is thermally stiffened in a controlled annealing process, after the completion of which, it obtains full resistance to harsh climatic and environmental conditions. The used epoxy resin has a class H temperature resistance and provides for excellent dielectric strength, as well as ensures high thermal conductivity to facilitate the cooling of the coils.

Working conditions:
ETH transformers are designed for installation in naturally ventilated enclosed areas that meet the following requirements:

- the maximum cooling air temperature: 40 ° C
- the minimum ambient temperature: -25 ° C
- the average annual temperature of the cooling air: 25 ° C
- the maximum relative humidity: up to 95% at 20 ° C
- operating altitude: up to 1000 m above sea level

Quality control:
To ensure the highest quality of our products, **ETH** medium voltage dry type transformers are subject to product, type and special tests:
Product test (performed on each transformer):
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- insulation strength with testing voltage
- insulation strength with induced voltage
- measurement of winding resistance
- measurement of insulation resistance,
- measurement of voltage ratio and check of phase displacement
- measurement of no-load loss and no-load current,
- measurement of short-circuit impedance and load loss,
- measurement of partial discharges level

Type tests:

- temperature rise test
- measurement of emitted noise level

Special tests:

- other tests to be agreed with the customer.

All tests performed on our testing station are carried out with the use of the most modern equipment of world-class manufacturers: HAEFELY-HIPOTRONICS and TETTEX.