



ENGLISH 

# TTH Transformers

Dry type transformers with **air insulated** MV windings



TTR



TTO



OTN, OTR, OTF



REACTORS



TTH

## TECHNOLOGY

### Magnetic Core

The core is made of grain oriented magnetic sheets characterized by high permeability and low specific loss of voltage separated by an inorganic insulation (carlite).

The magnetic sheets are pressed with galvanized core clamps.

### Low Voltage Windings

The secondary winding is made of an electrolytic aluminum sheet conductor wounded with a class "H" or "F" insulation film, in compliance with the customer's request.

The outlet terminals are made of aluminum busbars welded in inert atmosphere and firmly locked to the frame with spacing insulators.

This structure ensures:

- high resistance to humidity and industrial aggressive atmospheres
- great dielectric strength excellent mechanic performance in case of short circuit stresses

Upon customer's request, copper windings even in compliance with the customer's specification, may be realized. For lower

powers the windings are realized in rectangular shape.

### Medium Voltage Windings

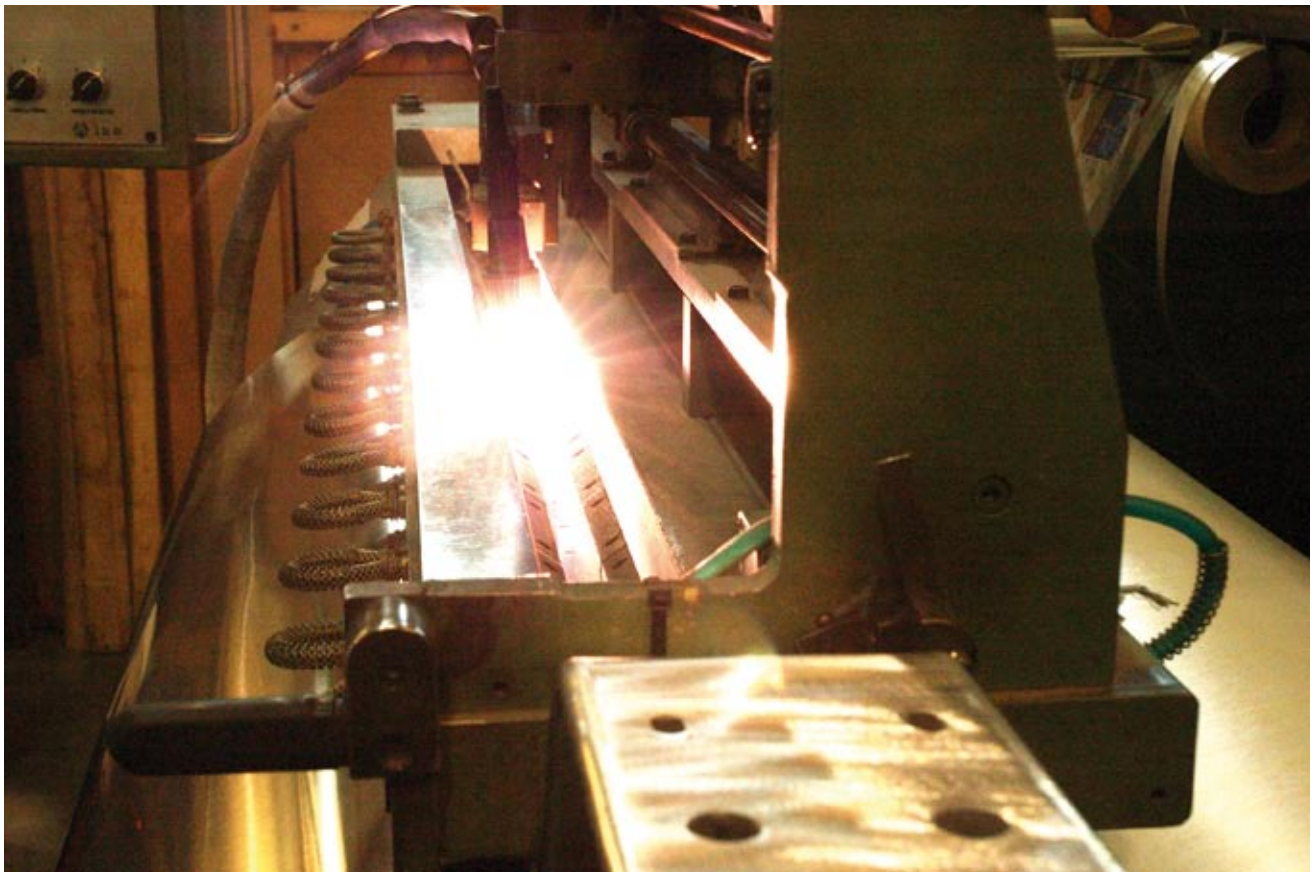
The winding is composed by coils in copper or aluminum wire. Sometime a continuous disc by copper strip is realized.

At the design stage, the distribution of the dielectric stresses along the column may be studied to keep their value way below the limits admitted by the air, a primary condition to guarantee a long lasting and reliable service to our TTH transformers.

The coils or disks are separated by proper class H insulating spacers.

The entire coil wound on a glass fiber cylinder is dried in depth and then vacuum impregnated with class H insulating varnish. This allows a great resistance of the winding to atmospheric moisture.

The adjustment links (generally  $\pm 2 \times 2,5\%$ ) are obtained directly at the center of the coil and connection is made by specific bolted brass bars.



### FINAL ASSEMBLY

Final assembly is carried out with care and accuracy.

The assembly accuracy is fundamental to guarantee an optimal performance of the transformer versus the electrodynamic stresses caused by possible short circuits.

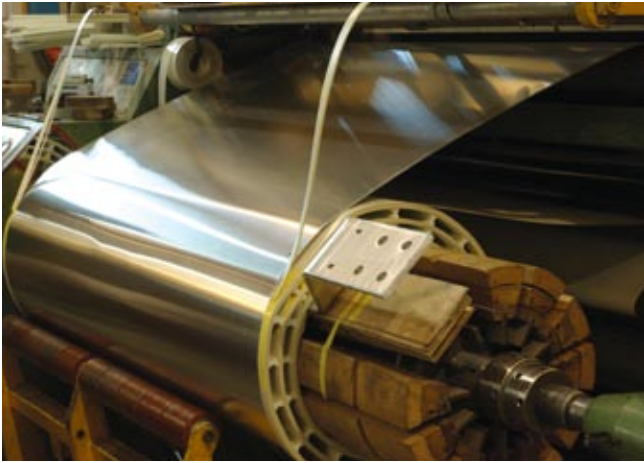
Besides, since the insulation is assigned to air, the electric connection paths and the bend radius of the live parts need special care in order to prevent dangerous increasing of the electric field.

The Low Voltage winding is mounted on the core leg and held in position by special glass fiber spacers.

The LV connection bars are kept one to the other and to the core clamps through glass fiber spacers.

The Medium Voltage winding is locked by insulating spacers which in any case let the small axial dilations of the coil free when the load current runs through the winding. The connections to the MV line are realized on suitable insulating spacers.





## TESTING

All transformer are tested at our test room with routine tests in compliance with IEC60076-11, that is:

- measurement of the winding resistance
- measurement of the transformation ratio and control of the connection group
- measurement of the losses and of the short circuit voltage
- measurement of the losses and no load current
- checking of the insulation with applied voltage
- checking of the insulation with induced voltage

All type tests and special tests provided by the regulations are available on customer's request:

- heat run test by simulated load method
- heat run test by opposition method
- impulse withstand test with full and chopped wave
- measurement of the noise level

- measurement of the harmonic contents of the no load current
- measurement of the homopolar impedance
- measurement of the winding capacitance
- dynamic short circuit withstand test (to be carried out by an external authorized lab)
- other special tests to be agreed upon from time to time with the customer (electromagnetic emissions, thermal shocks...)

### Archive of type tests

SEA has a large archive of type and special tests carried out on many dry type transformers delivered to customers worldwide. The archive is available at all times for our customers to consult.

## INSTALLATION

### Environment and load conditions

The TTH resin transformers have been designed to supply the nominal power within a regular distribution network the conditions of which are defined by IEC 60076-11 Standards. Heights over than 1000 meters, room temperatures higher than 40 °C or special conditions of the network or load (presence of overvoltages, harmonics, overloads...) cause a dielectric, mechanic or thermal stress to the transformer which should be considered at design in order to not compromise its reliability and duration.

We recommend not to install and store the transformer in particularly damp, polluted or dusty environments in order to ensure its maximum duration, a reliable customer service and a reduced maintenance. For any further question, please contact SEA's Commercial Department.

### Room dimensions

Many parts of the TTH transformer can be easily touched

when the machine is working, so a proper segregation is fundamental.

The room should guarantee proper air exchange (at least 4,5 m<sup>3</sup>/minute of air for each kW of loss). The distance from the walls should comply with the current site regulations and in any case not shorter than indications given in table 1.

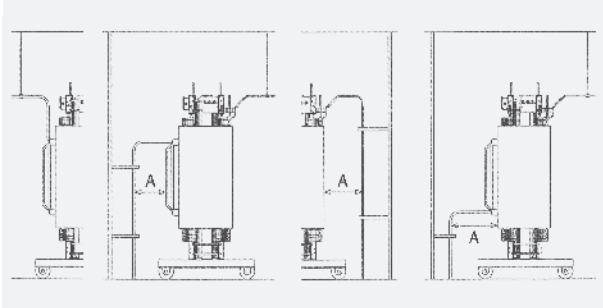
### Protection enclosure

The transformer is generally delivered in IP00 protection degree. On customer's request the transformer may be supplied with an enclosure for indoor installations with protection degree in compliance with the customer's specification. In this case it is the enclosure itself that protects the transformer from accidental contacts. In any case, the installation room should feature dimensions and distances such as to ensure proper air exchange (approximately, at least 500 mm between enclosure wall and room wall, to allow for both proper air circulation and regular inspection/maintenance of the transformer.

Table 1

Insulation Class	Distance from solid and smooth walls	Distance from meshed or sharp-cornered walls
7,2	90	300
12	120	300
17,5	160	300
24	220	300
36	320	400

Table 2



kV	12	17,5	24	36
A (mm)	120	180	240	360

## CONNECTIONS

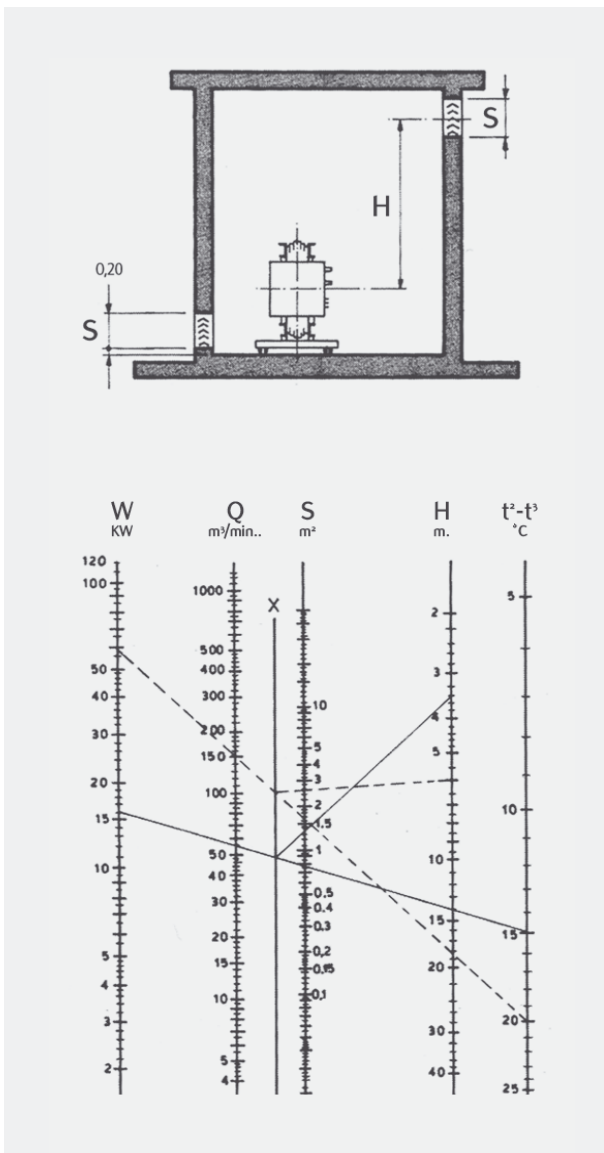
SEA TTH transformers with standard design provide LV busbar and MV connection from the top.

The connection instructions are of common practice for installators.

We recommend proper supporting and connecting of busbar and connection cables so that their weight and most of all the electrodynamic stresses due to eventual short circuit do not affect the transformer.

Special attention should also be given to the MV cable: the outermost insulation of cables shall be considered at ground potential, therefore shall be kept at a certain distance from the transformer live parts in the same way as for the other accessories, in compliance with table 2.

On request we can supply connections and busbars based on customer's specification.



## MAIN FEATURES OF SEA TTH TRANSFORMERS

The TTH Transformers are dry transformers with air insulated MV windings. The percentage of insulation material in respect to the total weight of the transformer is really quite low; they should therefore be used as an alternative to the TTR resin transformers to subsequently reduce the smoke hazard in case of fire.

Since 1975 SEA has been designing and producing this type of transformers so it can be considered between the leaders in this market share.

Due to the special feature of the TTH Transformers (insulation is mainly based on atmospheric air) the TTH Transformers should not be installed in polluted or dusty environments.



## STANDARDS REFERENCE

The SEA Transformers are in compliance with the following Standards:

- IEC 60076-11
- CENELEC HD 464 - HD 538

On request (pls. contact our Technical or Sales Dept) the Transformers can be produced in compliance with other regulations or standards.

## RANGE

The standard catalogues cover up to 3150 kVA and 36 kV. Our design and development capacity can satisfy the most varied needs (autotransformers, applications for converters, traction, test rooms, etc.) with powers up to 15MVA. Particularly convenient is the TTH solution when transformers are required with low voltage on both windings. For any special request or need please do not hesitate to contact us.



## ACCESSORIES

### STANDARD ACCESSORIES

- N. 4 bidirectional wheels
- N. 2 grounding terminals
- N. 1 identification plate
- N. 2 or 4 lifting lugs (according to rated power)
- N. 4 connections for haulage
- Tapping terminal board on MV side
- Threaded pins equipped with bolts for MV terminal connection

### ACCESSORIES ON REQUEST

#### Dial thermometer with two-contacts

It's a cheap and reliable device for local temperature indication in the central column and to control (through the two contacts) alarm and trip relays in the control room.

#### PT 100 thermoresistances

May be requested on LV windings and/or on core. If connected to a proper electronic unit they allow logging (and possibly remote transmission) of windings and/or core temperature.

#### PT100 Electronic unit

Supplied loose to allow the assembly on the panel by the customer. It records the signals coming from the PT100s (max 4) and indicates the measured temperature. It includes two relays with

adjustable threshold for the alarm and release signal as well as an auxiliary contact to control a possible set of fans for forced ventilation.

#### PTC Thermoprobes

May be requested on LV windings and/or on core. If connected to a proper electronic relay, they allow a system signalling a prefixed threshold. PTC do not allow temperature indication, they just give a threshold control. It is therefore necessary to have a set of PTC and a relay for every threshold required.

#### PTC relays

They are assembled directly on the transformer, or on request, loose supplied.

#### Antivibration supports

Standard version is composed of special rubber supports loose supplied to be positioned by the customer under the transformer's wheels.

They allow a great reduction of the vibrations transmitted to the structure and therefore of the noise and possible structural resonances.

Antivibration supports may be designed and supplied for special application in compliance with customer's specification.

#### Auxiliary service terminal board, protected type

Centralizes the auxiliary services and protects the terminal board.

#### Electrostatic screen between primary and secondary

It greatly reduces coupling capacity between MV and LV winding. This drastically reduces the overvoltages transferred from MV to LV which in certain cases may damage any sensitive loads.

## CUSTOMER SERVICE

SEA SpA gives a qualified Technical Assistance for any problem or need that may arise during assembly or maintenance of TTR transformers.

#### Telephone assistance

Contact our offices (mon-fri 09,00 a.m. ÷ 5,30 p.m.) at +39 0444 482100 or Email: [info@seatrasformatore.it](mailto:info@seatrasformatore.it)

#### On site assistance

In case of problems and if the site allows it, one of our technicians will assist you in repairing or supervising the product on site.

