

The Power of **WE**

The New T&R Industrial Transformer Division

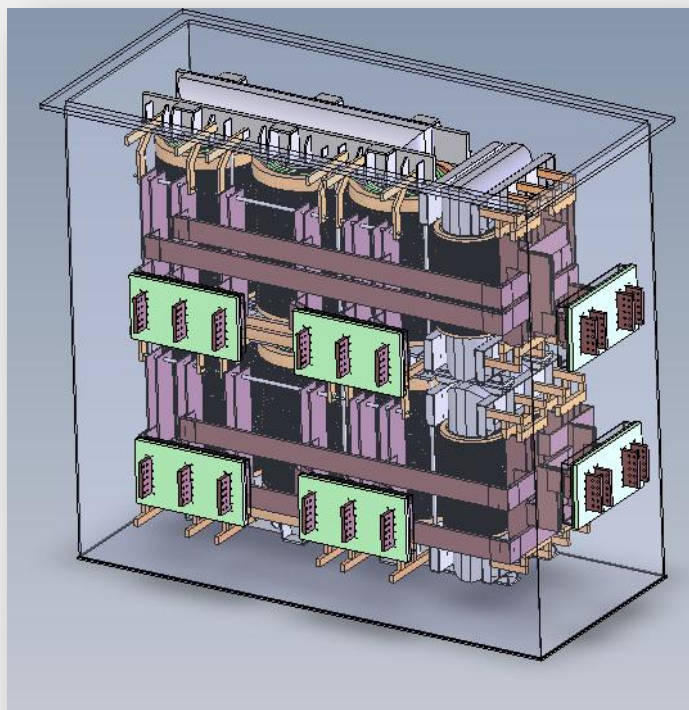


The Design Team for EAF furnace transformers

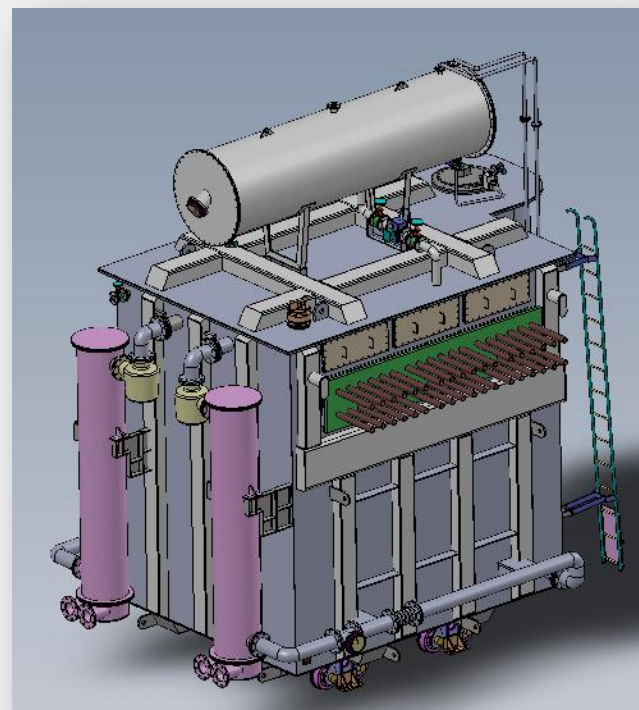
- Design team leader **Mr. Stefano Talassi** with 10 years experience in the field of furnace transformers now join the company as the C.O.O. of the Industrial Transformer Division
- Design Review for furnace transformer followed by **Mr. G.L. Sigaudi**, well known TRAIL advisor with more than 40 years in the field of special and furnace transformers
- Mechanical engineers and electric engineers dedicated only to industrial and furnace transformers
- The design for EAF applications will take care about the unbalance of the current and bi-phase load
- Designed and installed transformer with 100 DC current with harmonic content: all the secondary layout is designed to avoid local hot spots on the tank due to 3D FEM analysis and Heat Run test during the FAT

The Industrial Division Range

Rectifier transformers up to
160 DC current

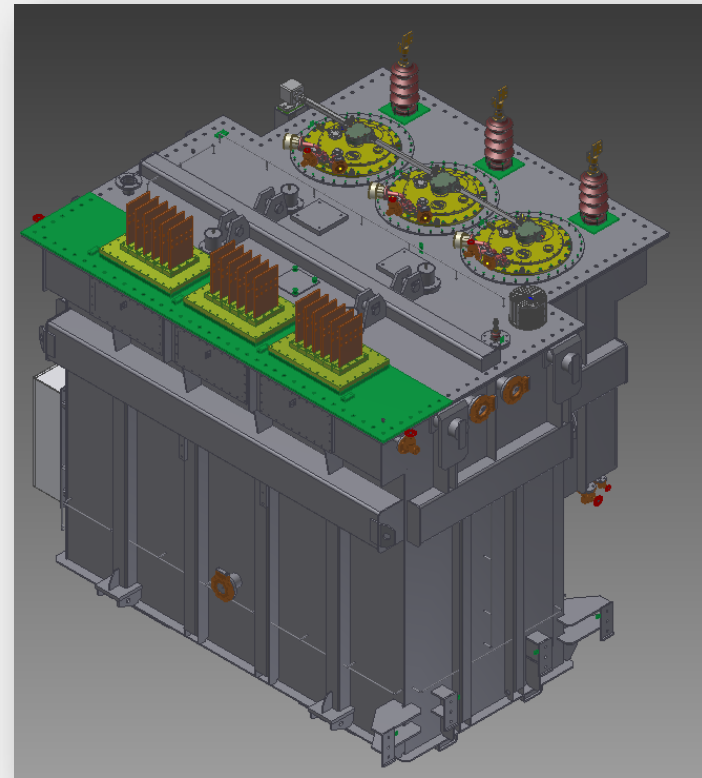
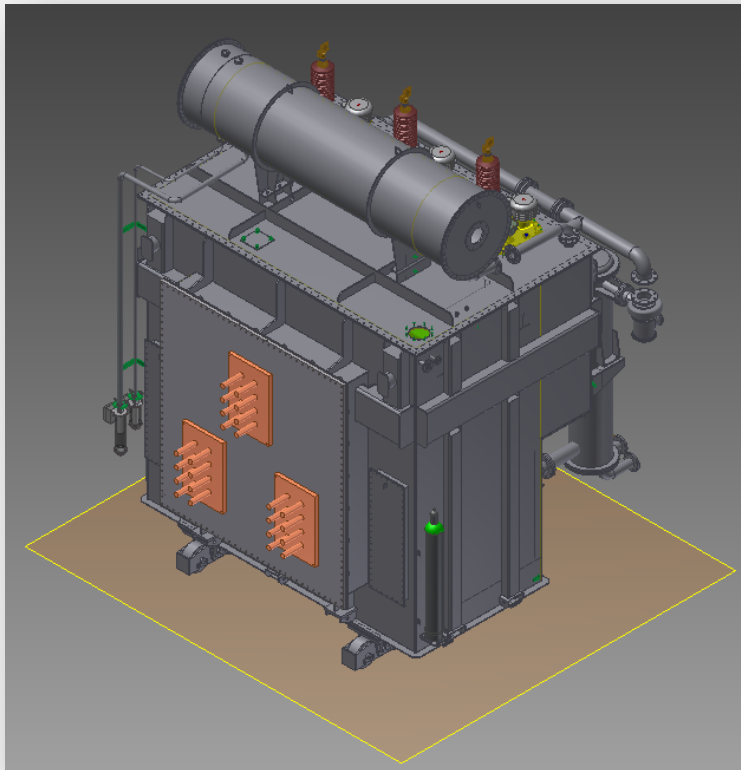


EAF transformers up to
200 MVA

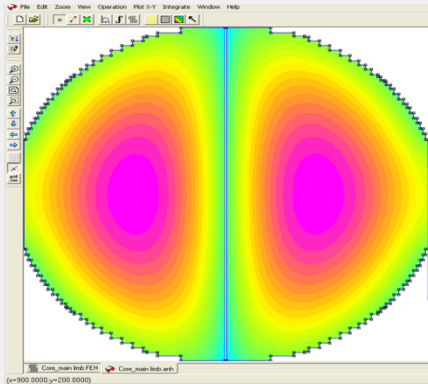


T&R Strengths for EAF furnace transformer

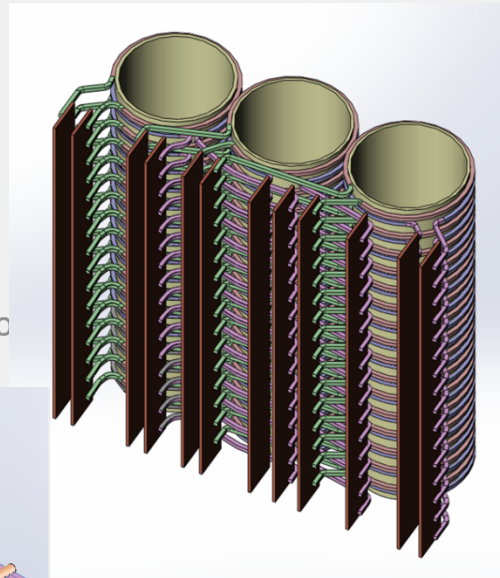
- Different solution and layouts according to customer requirements



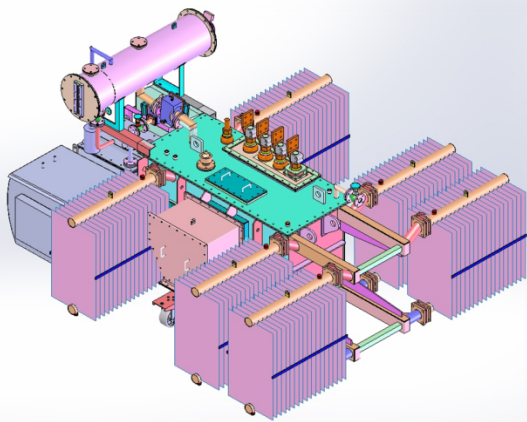
Software & Design Validation



Ascertaining core hot spot temperatures using 2D FEM Tool



3D modeling for complex LV connections for Furnace and Rectifier Transformers.

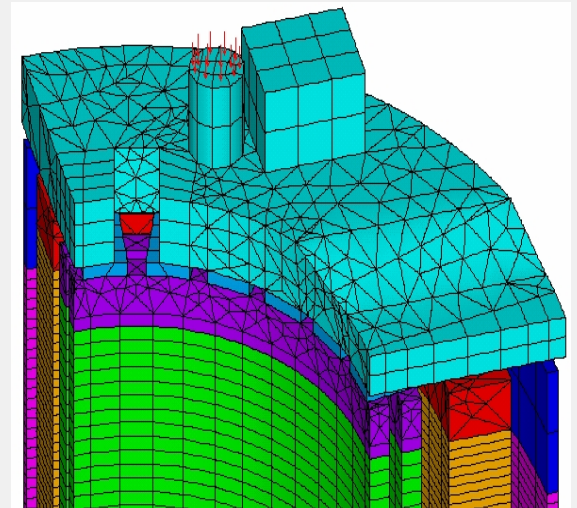
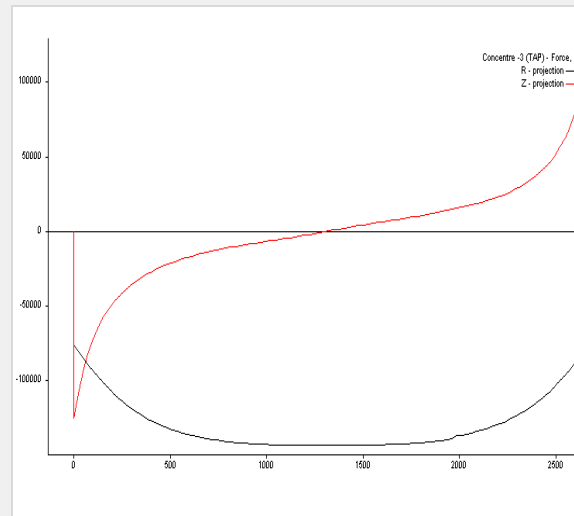
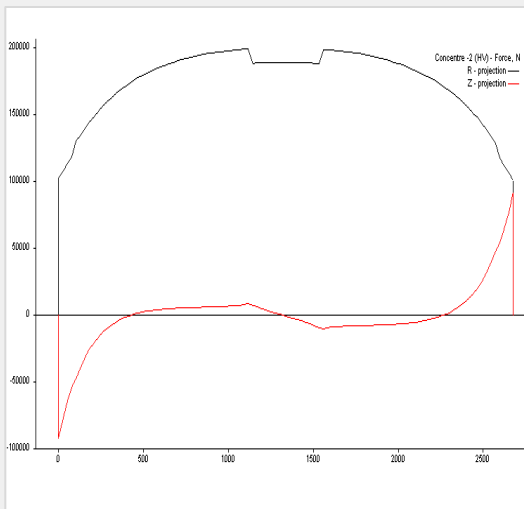


TARIL/DT-3D automation tool for generation of drawings

- Impulse voltage distribution across windings
- Dielectric Strength of insulations
- Losses & temperature in tank, frames & other structures
- Hot spots calculations
- Electric field distribution at the bottom of bushings
- Position of transposition in helical coils
- Short circuit withstand capacity & impedance calculations

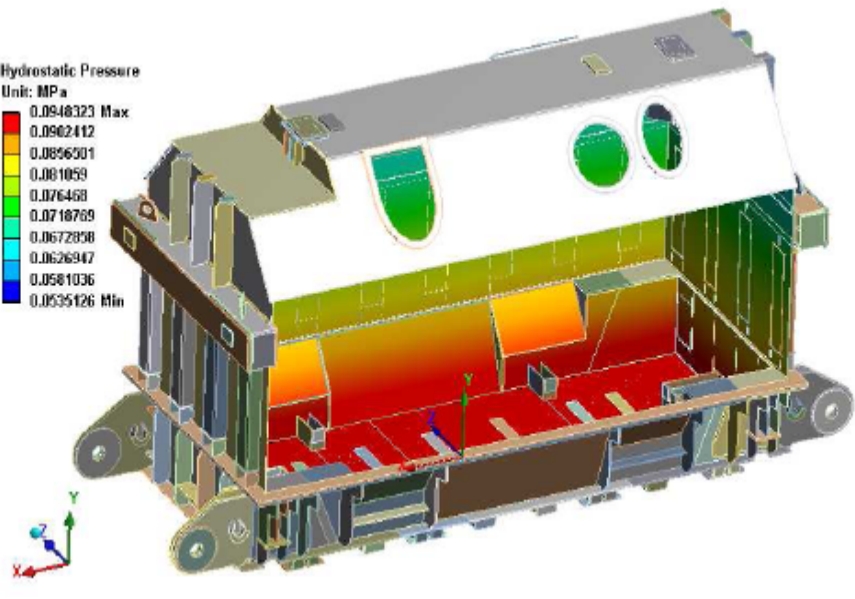
Tools for determining **Short Circuit Withstand Capability**:

- Andersons Software for Calculating forces in winding.
- ELDINST from VIT Ukraine to analyze dynamic stability of winding coils against short circuit
- ANSYS for Structural Analysis of Pressure Ring, Flitch Plate etc. (Proposed)



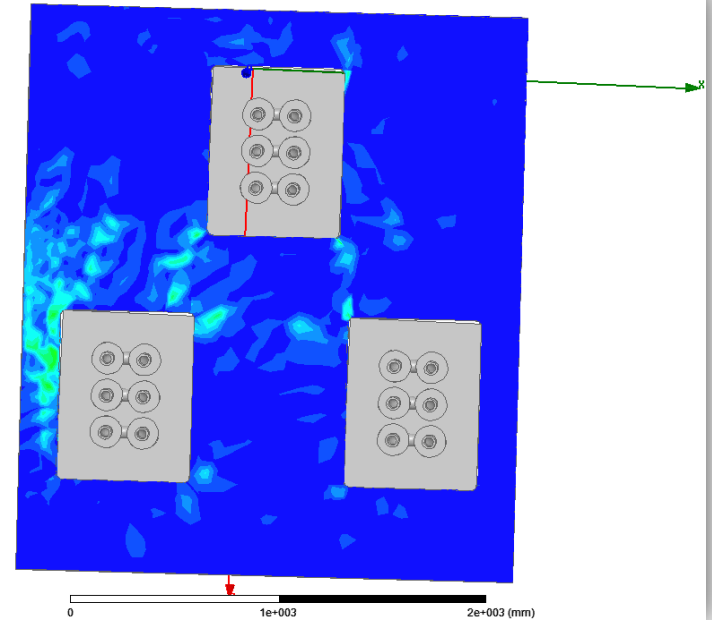


Hydrostatic Pressure
Unit: MPa
0.0948323 Max
0.0962412
0.0896301
0.081059
0.076458
0.0718769
0.0672938
0.0626947
0.0581036
0.0535126 Min



Stress Distribution in tank for pressure loading

J[A_per_cm2]
1.7192e+002
1.6117e+002
1.5043e+002
1.3968e+002
1.2894e+002
1.1819e+002
1.0745e+002
9.6704e+001
9.5959e+001
7.5214e+001
6.4470e+001
5.3725e+001
4.2980e+001
3.2235e+001
2.1491e+001
1.0746e+001
1.0983e+000



Eddy Current FEM simulation

How can We do That ?



Transformer & Rectifier (India) Ltd.



- More than **7.500** transformers installed globally
- Integrated Installed capacity of **30,000 MVA** up to 1.200 kV Class
- Closed the Financial year 2013/14 with our sales turnover crossing **80 M€**.

Key Details



- 3 Transformer Manufacturing Facilities in Ahmedabad - Western India
Location **Moraiya, Changodar and Odhav**
- Total Land area 65,000 sq. mtrs with Production facility of 27,000 sq.mtrs
- Synergistic diversification through backward integration
 - Radiators
 - Transformer Tanks
 - Insulation
 - Equipment manufacturing : Vapour Phase Drying Plants, Oil Conditioning Plants, Winding machines etc.

Moraiya Facility

Range: Large Power Transformer Plant of 16000 MVA

Products:

- Large Rating Power and Auto Transformers up to 500 MVA 765 kV (EHV).
- Large Rating Transformers of 220 kV, 400 kV above 160 MVA and **Furnace Transformers up to 200 MVA**
- Shunt Reactors of 420 kV Class
- **Series Furnace Reactors up to 70 Mvar**



Manufacturing Technology



- State-of-art modern fully air conditioned and pressurized plant, dust levels at Class 8 or better, at Moraiya plant near Ahmedabad.
- Plant has all the equipment for manufacturing and testing of Transformers up to 1,200 kV & Reactors up to 765 kV.

Manufacturing Technology - Winding



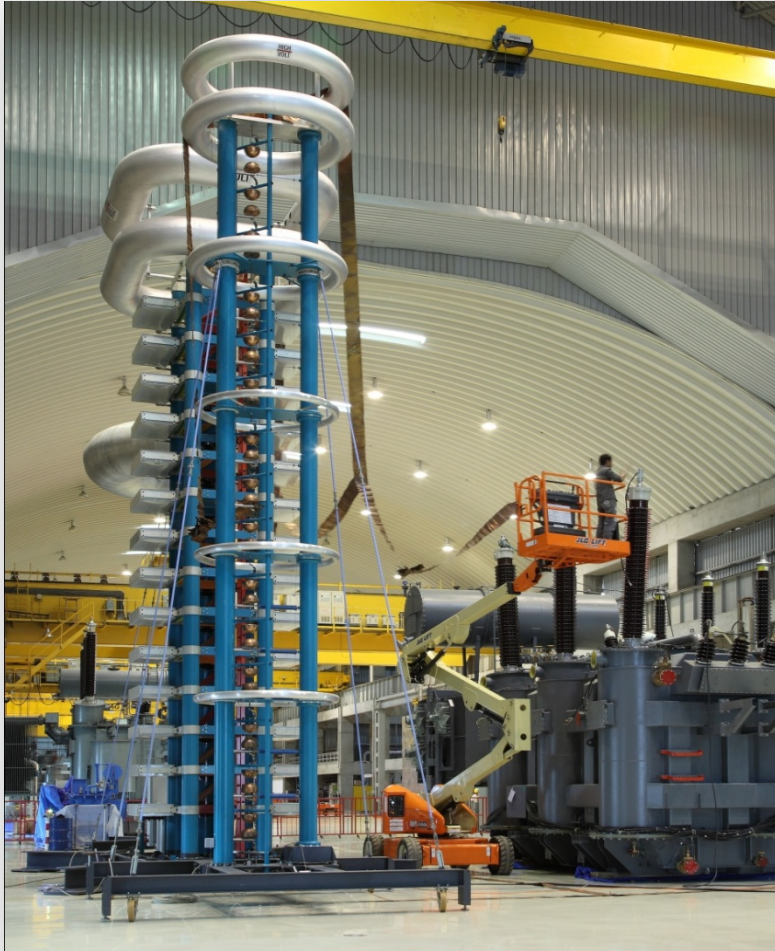
- 26 Horizontal & **9 Vertical winding machines**
- 2 Auto claves with VPD and 2 standard auto claves for coil drying
- Mobile hydraulic power pack for coil pressing
- Isostatic presses for coil pressing and sizing
- **3 VPD Plant suitable for up to 1,200 kV, 1,000 MVA Transformers & Reactors**

Manufacturing Technology - Tanking



- Mobile Hydraulic power pack with multiple jacks to press all the coils simultaneously with control for individual phases.
- State-of-art oil handling system
- **Up to 250 ton crane capacity**
- **300 ton air castor for movement in test area.**

Testing Lab Facilities – NABL accredited



TESTING EQUIPMENT –

- 4,000 Amps/170kV Highly accurate loss measurement system (The most accurate system in the market today)
- Standard Capacitor 1,000/ $\sqrt{3}$ kV & Reactors loss measurement system
- Impulse voltage test system (2,800 kVp 280 kJ Impulse Generator, 2,800 kVp Damped capacitive impulse voltage divider. Controlled chopping gaps. Parallel resonant system, Glaninger circuit)

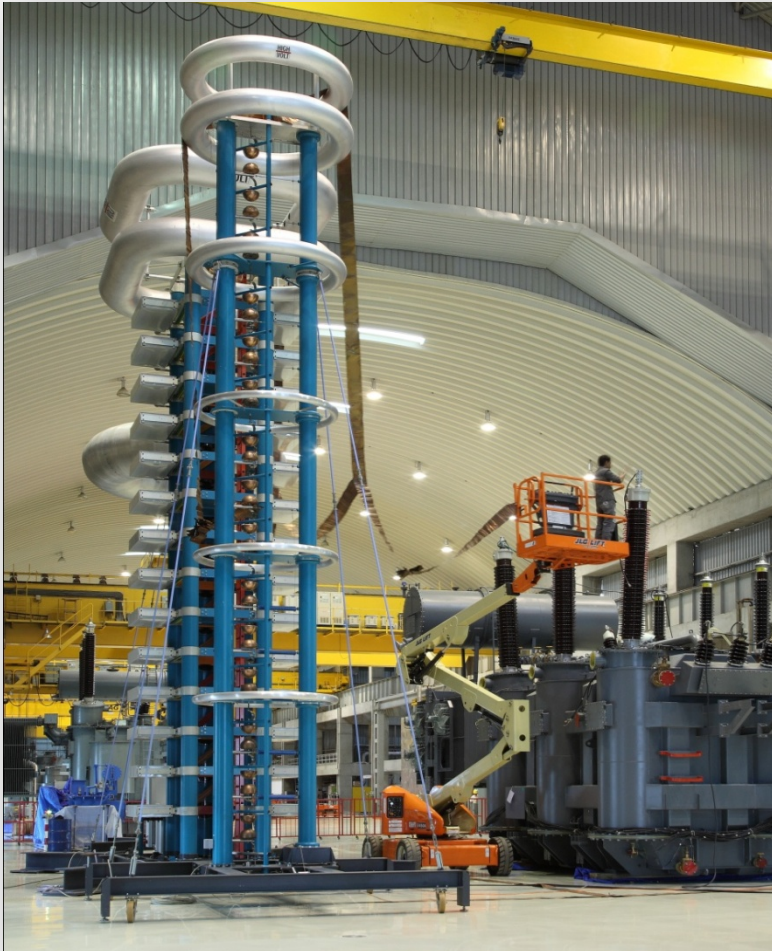


INFRASTRUCTURE

1,000 sq meter, 25 meter high test bay with shielding suitable for partial discharge measurements

Test Sources

- 3,000 kW 50/60 Hz Generator
- 250 kV Transformer for High Voltage test
- 0-170 kV Source Transformer for losses measurement
- 1,500 kW 200 Hz Generator
- **50 Mvar Capacitor Bank (provision to increase up to 100 MVar)**
- 800 kV Source Transformer



TESTING EQUIPMENT

- Sound & Vibration analyzer (Bruel&Kjaer, Denmark)
- Advanced Partial Discharge measurement & analyzing System (Omicron, Austria)
- Sweep frequency response analyzer (Doble, USA)
- Moisture in oil measurement system (Vaisala, Finland)
- Fully automatic capacitance & Tan Delta Bridge. (Tettex, Switzerland)
- Digital insulation Tester
- Transformer Digital turns ratio tester suitable for Phase Shifting Transformers (Raytech, Switzerland)
- Digital Winding resistance meter of 50Amp (Avo Megger, England)

Quality Assurance



ISO 9001 & 14001



BS OHSAS 18001

- Other than traditional quality functions our focus is on:
- Total Quality Management
- Planning, implementation and monitoring improvement plan
- Investigations and preventive actions on critical quality issues
- Training & Development



Customer Portfolio

TARIL caters to a wide spectrum of transformer users in various industries such as:

- Petrochemicals
- Oil refining
- Cement
- Paper and pulp
- Pharmaceuticals
- Automotive
- Steel plant
- Alloy plant
- Power plant
- Railway applications
- Mining
- Minerals among others

Our customer base is also well-diversified both by geography and by end-user markets.

International Customers

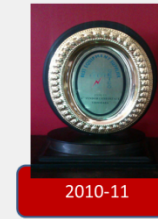
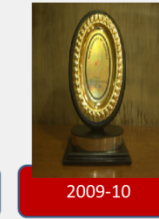
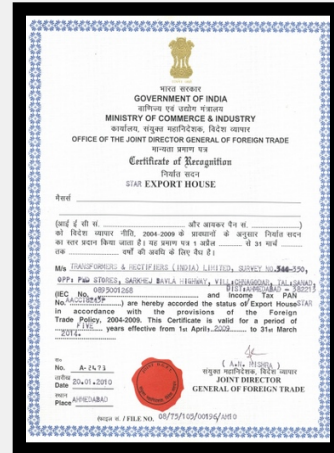


Registrations/Pre Qualifications

Successful registrations include:

- Successful registration in BECHTEL, USA (Engineering, Construction and Project Management Company)
- Successful registration at the most important EPC contractors in the steel market as **SMS SIEMAG, INTECO, DANIELI, TENOVA and TENOVA PYROMET**
- Successful registration in Fluor Daniel, USA (EPCM company)
- Successful pre qualification in Verbund, Austria. (VERBUND is Austria's leading electricity company and one of the largest producers of electricity from hydropower in Europe).
- Successful pre qualification in Sellihca for Nordic Region.

Awards & Accolades



- Awarded “**Best under a Billion**” company for the The Region’s Top **200** Small and Medium Size Companies by **FORBES ASIA**
- Adjudged as the Best Equipment Supplier by Gujarat Energy Transmission Corporation Ltd Consecutively for Four Years
- Star Export House Certificate from Ministry of Commerce Government of India for outstanding performance in Exports
- Valued Customer Award from Central Power Research Institute

The Advantages of Our Solution



- **European design & Design Review for furnace transformers**
- **Special terms of payment for Breakthrough Projects**
- **Market Share of 50 % in Industrial units in India**
- **Market Share of 10 % in Power Transformer in India**
- **Work Force of about 1150 people**
- **Capacity to manufacture wide range of transformers**
- **All facilities to test transformers up to 1200 kV**
- **Good Domestic and International market acceptability**



Significant Achievements

- More than 1000 Numbers of transformers having voltage class 132 kV and above installed globally.
- **One of the Six Manufacturers in India for development of 1200 kV Test Transformer for 1200 kV National Test Station Bina, India.**
- 20 Numbers of 765 kV, 500 MVA Single Phase Transformers are under Manufacturing.
- **Successfully Tested more than 40 number of transformers for dynamic short circuit withstand test with highest Capacity of 90 MVA, 132 kV Class.**
- **Order in progress to supply 70 MVA EAF furnace transformer and 11 MVA LF transformer in the Middle East.**

THANK YOU

