

Cast Resin Transformers TSL and TSZL: Technical Specifications

What is a Cast Resin Transformer?

A **cast resin transformer** is a dry-type transformer in which the windings are completely filled with epoxy resin under vacuum. This technology ensures **complete hermeticity**, protection from external influences, and increased mechanical strength. Cast resin insulation is an advanced technology used in the most demanding applications.

[Engineering audit for TSL transformers](#)

TSL and TSZL Designation Decoding

Basic Designation

Element	Decoding
T	Three-phase
S	Dry
L	Cast insulation
Z	Encapsulated (in enclosure)
D	With forced cooling
F	With protective enclosure

Designation Examples

TSL-1000/10/0.4-U3

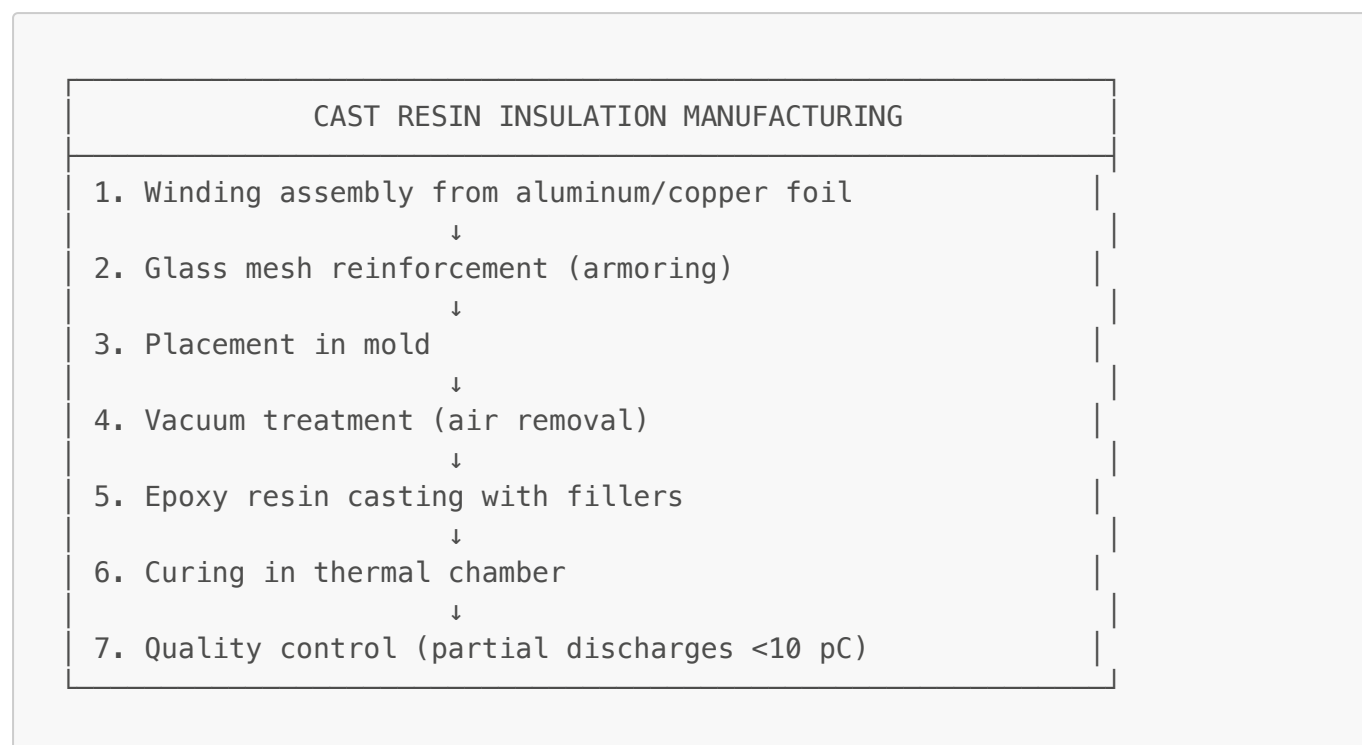
- TSL — three-phase dry with cast insulation
- 1000 — rated power (kVA)
- 10 — HV voltage (kV)
- 0.4 — LV voltage (kV)
- U3 — climate design

TSDZLF-1600/10/0.4-UHL3

- TSDZLF — three-phase, dry, with forced cooling, encapsulated, in enclosure
 - 1600 — power (kVA)
 - UHL3 — cold-resistant design (-60°C)
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Cast Resin Insulation Manufacturing Technology

Vacuum Casting Process



Insulation Materials

Epoxy resin with fillers:

- Quartz sand (hardness, thermal conductivity)
- Aluminum oxide hydrate (fire resistance)
- Pigments (color identification)

Epoxy Resin Properties:

- Dielectric strength: >20 kV/mm
- Thermal resistance: up to 180°C (Class H)
- Mechanical strength: high
- Moisture resistance: excellent

TSL Technical Specifications

TSL 10/0.4 kV Specifications Table

Power (kVA)	HV Current (A)	LV Current (A)	Uk (%)	No-Load Losses (W)	SC Losses (W)	Efficiency (%)	Weight (kg)
TSL-100/10/0.4	5.77	144.3	4	280	1750	98.0	650
TSL-160/10/0.4	9.24	230.9	4	400	2350	98.3	850

Power (kVA)	HV Current (A)	LV Current (A)	Uk (%)	No-Load Losses (W)	SC Losses (W)	Efficiency (%)	Weight (kg)
TSL-250/10/0.4	14.4	360.8	4	550	3250	98.5	1100
TSL-400/10/0.4	23.1	577.4	4	800	4600	98.6	1550
TSL-630/10/0.4	36.4	909.3	4	1100	6500	98.7	2100
TSL-1000/10/0.4	57.7	1443.4	5	1550	9500	98.8	2800
TSL-1250/10/0.4	72.2	1804.2	5	1850	11500	98.8	3300
TSL-1600/10/0.4	92.4	2309.4	6	2200	14000	98.9	4000
TSL-2000/10/0.4	115.5	2886.8	6	2600	17000	98.9	4800
TSL-2500/10/0.4	144.3	3608.4	6	3100	20000	98.9	5600

TSL Dimensions (in Enclosure)

Power (kVA)	Length (mm)	Width (mm)	Height (mm)
100	1200	800	1300
160	1350	850	1400
250	1500	950	1500
400	1700	1100	1700
630	1950	1250	1900
1000	2200	1500	2200
1600	2600	1700	2400
2500	3000	2000	2700

[TSL transformer selection by specifications](#)

Connection Schemes and Winding Groups

Standard Schemes

Designation	Description	Application
Y/Yn-0	Star-star with neutral	Standard 0.4 kV distribution
D/Yn-11	Delta-star	3rd harmonic suppression
Y/Zn-11	Star-zigzag	Unbalanced load balancing

Connection Scheme Purposes

Y/Yn-0:

- Neutral output on 0.4 kV side
- Four-wire network
- Standard for most applications

D/Yn-11:

- 30° phase shift
- Current harmonic filtering
- Recommended for non-linear loads (UPS, converters)

Voltage Regulation

OLTC (Off-Load Tap Changer)

Range: $\pm 2 \times 2.5\%$ of rated voltage

Position	HV Voltage	Coefficient
I	+5%	1.05
II	+2.5%	1.025
III	0%	1.0
IV	-2.5%	0.975
V	-5%	0.95

Features:

- Switching only with de-energized transformer
- Manual control
- Standard equipment

LTC (Load Tap Changer)

Range: $\pm 10\%$ ($\pm 8 \times 1.25\%$ or $\pm 16 \times 1.0\%$)

Advantages:

- Automatic switching under load

- Continuous voltage maintenance
- SCADA integration

B2B supply of TSL with LTC

Insulation Classes and Temperature Mode

Insulation Classes

Class	Temperature	Designation	Application
F	155°C	Standard	Most applications
H	180°C	Enhanced	Heavy operating conditions

Temperature Control

Standard Thermostat TR-100 Settings:

Level	Winding Temperature	Action
Alarm	130°C	Fan activation
Warning	150°C	Fault alarm
Shutdown	170°C	Transformer shutdown

Magnetic Core Overheating:

- Warning: 120°C
 - Shutdown: 140°C
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Special TSL Designs

Cold-Resistant Design (UHL3)

Characteristics:

- Temperature range: from -60°C to +40°C
- Brown winding color (visual identification)
- Special epoxy resin composition
- Application: Siberia, Far North

Low-Noise Design

Step-lap Technology:

- Core laminations cut at angle
- Reduced noise level by 5-10 dB
- No-load loss reduction by 15-25%

TSL Noise Levels:

Power (kVA)	Standard (dB)	Low-Noise (dB)
100	55	48
250	58	51
630	62	55
1000	65	58
1600	68	61

Seismic-Resistant Design**Characteristics:**

- Seismic resistance up to 9 points (MSK-64 scale)
- Power: 40-2500 kVA
- Seismic resistance certificate
- Application: Seismic hazard regions

Reduced Losses Design**Amorphous Steel in Magnetic Core:**

- No-load losses reduced by 70%
- Electricity savings
- Payback period 3-5 years

TSL vs Oil-Immersed Transformers Comparison

Parameter	TSL (Cast Resin)	Oil TMG
Fire Safety	K0 (self-extinguishing)	K3 (flammable)
Environmental Friendliness	High	Requires protection
Maintenance	Minimal	Regular
Dimensions	Compact	More bulky
Cost	30-50% higher	Lower
Overload Capability	Limited	High
Noise	3-5 dB higher	Standard
Service Life	30-40 years	25-30 years
Installation	Indoor buildings	Outdoor/Indoor
Repairability	Complex	Simple

TSL Application Areas

Healthcare

- Hospitals and clinics
- Diagnostic centers
- Laboratories
- Pharmaceutical production
- *Criterion: no toxic emissions during fire*

Residential and Commercial Real Estate

- Apartment buildings
- Business centers
- Shopping malls
- Hotels
- *Criterion: fire safety, low noise*

Transport

- Metro/Subway
- Airports
- Railway stations
- Tunnels
- *Criterion: seismic resistance, reliability*

Industry

- Chemical production
- Food industry
- Flammable materials warehouses
- Nuclear power plants (auxiliary needs)
- *Criterion: chemical resistance, fire safety*

Energy

- Wind farms
- Solar power plants
- Inverter substations
- Distribution networks
- *Criterion: harmonic tolerance*

TSL Supply Package

Standard Equipment

Item	Description	Quantity
1	TSL Transformer	1 pc.

Item	Description	Quantity
2	Thermostat TR-100	1 pc.
3	PT100 Temperature Sensors	3-4 pcs.
4	Transformer Passport	1 copy
5	Operating Manual	1 copy
6	Test Protocols	1 set

Optional Accessories

- **Protective Enclosure** (IP20, IP21, IP23, IP54)
- **Forced Cooling Fans**
- **Online Monitoring System**
- **LTC (Load Tap Changer)**
- **Spare Parts Kit**
- **Control Cabinet**

[Customs and logistics services for TSL](#)

Why Buy TSL from Metal-Asia.pw

✔ **Direct contracts** with Transformer factories, China, Turkey ✔ **Technical expertise** — optimal configuration selection ✔ **Quality control** — factory inspection ✔ **Certification** — complete VED documentation package ✔ **Warranty** 3-5 years from manufacturer

[Engineering selection and procurement of TSL](#)

Useful Links

- [Power transformers](#)
 - [Electrical equipment](#)
 - [Quality control NDT](#)
 - [Audit China B2B](#)
 - [Contacts](#)
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Document prepared based on GOST R 52719-2007, IEC 60076-11 and technical documentation from PAO "Transformer".