

# Oil-Immersed Power Transformers: Complete Technical Specifications Guide

## Introduction

Oil-immersed power transformers represent a critical component of modern power supply systems, providing voltage conversion of alternating current at 50 Hz frequency in 6-10 kV distribution networks. As a power equipment engineer with extensive supply experience, I have prepared this comprehensive technical guide covering all aspects of selection, operation, and logistics for oil-immersed transformers.

[Our services](#) include complete engineering audit and equipment selection.

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## 1. Classification of Oil-Immersed Transformers

### 1.1 TM Series Transformers (Three-Phase Oil-Immersed)

The TM series represents classic oil-immersed transformers with conservator tanks, designed for operation in enclosed transformer substations and indoor facilities.

#### Marking decoding:

- **T** — Three-phase
- **M** — Oil-immersed
- **XXX** — Rated power (kVA)
- **10(6)** — HV voltage class (kV)
- **0.4** — LV voltage (kV)

#### Technical specifications of TM series:

Power (kVA)	Connection Scheme/Group	SC Losses (W)	Uk (%)	No-Load Losses (W)
TM-25/10/0.4	Y/Yn-0; Y/Zn-11	600	4.5	105
TM-40/10/0.4	Y/Yn-0; Y/Zn-11	900	4.5	150
TM-63/10/0.4	Y/Yn-0; D/Yn-11; Y/Zn-11	1270	4.5	200
TM-100/10/0.4	Y/Yn-0; D/Yn-11; Y/Zn-11	1970	4.5	270
TM-160/10/0.4	Y/Yn-0; D/Yn-11; Y/Zn-11	2700	4.5	400
TM-250/10/0.4	Y/Yn-0; D/Yn-11; Y/Zn-11	3900	4.5	540
TM-400/10/0.4	Y/Yn-0; D/Yn-11; Y/Zn-11	5400-5600	4.5	770
TM-630/10/0.4	Y/Yn-0; D/Yn-11	7600-7800	5.5	1050
TM-1000/10/0.4	Y/Yn-0; D/Yn-11	10500	5.5	1050

[Engineering selection and procurement](#) optimizes technical parameters for specific projects.

### 1.2 TMG Series Transformers (Three-Phase Oil-Immersed Hermetic)

The TMG series represents modern hermetic design with corrugated tank walls, eliminating oil contact with the atmosphere.

#### Key advantages of TMG:

- No conservator tank and no oil contact with the environment
- Prevention of moisture absorption, oxidation, and sludge formation
- Maintenance of dielectric oil properties throughout service life
- Minimal maintenance requirements
- Environmental safety

**Technical specifications of TMG series:**

Power (kVA)	Connection Scheme/Group	SC Losses (W)	Uk (%)	No-Load Losses (W)
TMG-25/10/0.4	Y/Yn-0; Y/Zn-11	600	4.5	105
TMG-40/10/0.4	Y/Yn-0; Y/Zn-11	900	4.5	150
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TMG-630/10/0.4	Y/Yn-0; D/Yn-11	7600-7800	5.5	1050
TMG-1000/10/0.4	Y/Yn-0; D/Yn-11	10500	5.5	1050
TMG-1600/10/0.4	Y/Yn-0; D/Yn-11	14500	5.5	1550
TMG-2500/10/0.4	Y/Yn-0; D/Yn-11	20500	6.0	2200

[B2B supply services](#) include direct contracts with manufacturers.

**1.3 TMGS Series Transformers (Pole-Mounted Type)**

The TMGS series features compact hermetic transformers designed for installation on overhead line poles.

**Power range:** 16-100 kVA **Voltage class:** 6-10/0.4 kV

**TMGS applications:**

- Oil rigs and gas stations
- Cellular communication towers
- Agricultural farms
- Individual buildings and cottage settlements
- Small settlements

## 2. Technical Specifications and Parameters

### 2.1 Rated Power and Voltage Class

**Standard power series (kVA):** 25; 40; 63; 100; 160; 250; 400; 630; 1000; 1250; 1600; 2000; 2500; 4000; 6300

**Voltage classes:**

- HV: 6 kV; 6.3 kV; 10 kV; 10.5 kV; 35 kV; 110 kV
- LV: 0.23 kV; 0.4 kV; 0.525 kV; 0.69 kV

### 2.2 Connection Scheme and Winding Group

**Main connection schemes:**

Designation	Description	Application
Y/Yn-0	Star-star with neutral	Standard distribution
D/Yn-11	Delta-star	3rd harmonic suppression
Y/Zn-11	Star-zigzag	Special neutral modes

[Equipment selection by specifications](#) ensures proper connection scheme matching.

### 2.3 No-Load and Short-Circuit Losses

**No-load losses (P<sub>0</sub>):**

- Depend on core material
- Modern transformers use cold-rolled oriented steel grades E3409, E3410, E3411
- Step-lap technology reduces losses by 15-25%

**Short-circuit losses (P<sub>sc</sub>):**

- Determined by winding resistance
- Depend on conductor material (copper/aluminum)
- Affect efficiency under load

**Short-circuit voltage (U<sub>k</sub>):**

- 4.5% — for power up to 400 kVA
- 5.5% — for power 630-1000 kVA
- 6.0% — for power 1600-2500 kVA

### 2.4 Cooling Systems

**ONAN (Oil Natural Air Natural):**

- Natural oil circulation and natural air cooling
- Standard for distribution transformers
- Silent operation

**ONAF (Oil Natural Air Forced):**

- Natural oil circulation with forced air cooling
- Adding fans increases power by 25-40%

**OFAF (Oil Forced Air Forced):**

- Forced oil and air circulation
  - For powerful transformers above 10 MVA
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### 3. Design Features

#### 3.1 Tank Types

**Corrugated tank (corrugated wall):**

- Flexible walls compensate for oil volume changes
- No conservator tank required
- Compact dimensions
- Used in TMG series

**Radiator tank:**

- Removable coolers (radiators)
- Increased cooling surface
- Used in powerful transformers
- Radiator replacement capability

#### 3.3 Voltage Regulation

**OLTC (Off-Load Tap Changer):**

- Manual tap switching with transformer de-energized
- Range:  $\pm 2 \times 2.5\%$  of rated voltage
- Standard for TM and TMG

**OLTC positions:** I, II, III, IV, V

**LTC (Load Tap Changer):**

- Automatic switching under load
- Continuous voltage maintenance
- Option for critical facilities

[Customs and logistics services](#) include all permitting documentation.

### 3.4 Accessories and Options

#### Standard equipment:

- Temperature sensors (PT100 thermoresistors)
- Buchholz relay (for transformers with conservator)
- Oil level indicator
- Pressure relief valve
- Grounding terminals

#### Additional options:

- Digital thermostat TR-100 with RS-485 MODBUS RTU interface
  - Online parameter monitoring system
  - Biodegradable ester oil
  - Stainless steel tank for aggressive environments
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## 4. Operating Conditions and Climate Design

### 4.1 Climate Designs

#### U1 (Temperate climate):

- Temperature: from -45°C to +40°C
- Humidity: up to 80% at +20°C
- Standard for most regions

#### UHL1 (Cold temperate climate):

- Temperature: from -60°C to +40°C
- Humidity: up to 80% at +20°C
- For northern regions and Siberia

#### Tropical design T1, T2:

- Temperature: from -10°C to +50°C
- Humidity: up to 100% at +35°C
- Protection against fungi and mold

### 4.2 Installation Conditions

#### Indoor installation:

- Enclosed transformer substations (ZTP)
- Electrical facility rooms
- Ventilation required

#### Outdoor installation:

- Open installations
- Complete transformer substations (KTP)
- Resistance to atmospheric influences

## 5. HS Codes and Certification

### 5.1 HS Codes

**Main transformer codes:**

HS Code	Description
8504 31 000 0	Power transformers, rated power not exceeding 650 kVA
8504 31 800 0	Power transformers, rated power exceeding 650 kVA but not exceeding 10,000 kVA
8504 31 950 0	Power transformers, rated power exceeding 10,000 kVA
8504 90 000 0	Parts of transformers

[Quality control NDT](#) ensures inspection of all equipment before shipment.

### 5.2 Technical Regulations of the Customs Union

**TR CU 004/2011 “On safety of low-voltage equipment”:**

- Applies to transformers with voltage up to 1000 V AC
- Electrical safety requirements
- Insulation resistance tests

**TR CU 020/2011 “Electromagnetic compatibility of technical means”:**

- EMC requirements for power transformers
- Electromagnetic interference levels

**TR CU 012/2011 “On safety of equipment for operation in explosive atmospheres”:**

- For transformers in hazardous areas
- Ex marking

### 5.3 Manufacturer Documentation

**Mandatory documents:**

- Transformer passport
- Operating manual
- Factory test reports
- Certificate of conformity
- Verification certificate (for measuring)

## 6. Packing List for Oil-Immersed Transformers

### 6.1 Document Structure

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Field	Description
<b>Header</b>	Contract number, invoice, date. Shipper and consignee details
<b>Description of Goods</b>	Exact name in two languages. Serial number
<b>Quantity</b>	Number of pieces and cargo places
<b>Weight</b>	Net/Gross. For oil-filled —separate oil weight and weight without oil
<b>Dimensions</b>	Dimensions of each place (L×W×H) in mm
<b>Volume</b>	Total volume in m <sup>3</sup>
<b>Shipping Marks</b>	Handling marks: “Top”, “Fragile”, “Sling here”, “Center of gravity”
<b>Package Type</b>	Marine wooden crate, fumigated pallet

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### 6.2 Customs Technical Details

#### For oil-immersed transformers mandatory:

- Document on PCB (polychlorinated biphenyls) content in oil
- Transformer oil analysis report
- PCB-free declaration (if new oil)

#### Accessories in packing list:

- Temperature sensors with box number indication
- Buchholz relay
- High-voltage bushings
- Spare parts kit
- Maintenance tools

[Audit China B2B](#) — manufacturer verification service.

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## 7. Application Areas

### 7.1 Industrial Facilities

- Power plants and substations
- Metallurgical plants
- Oil refineries
- Chemical production
- Mining enterprises

### 7.2 Civil Construction

- Residential complexes and neighborhoods
- Shopping centers and office buildings
- Hospitals and medical centers

- Educational institutions

### **7.3 Infrastructure Facilities**

- Railway transport facilities
  - Airports and ports
  - Rural electrification
  - Telecommunication facilities
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## **8. Advantages of Working with Metal-Asia.pw**

### **8.1 Why It Is Profitable to Contract with Us**

#### **Direct factory supplies:**

- No intermediary markups
- Equipment authenticity guarantee
- Production control at all stages

#### **Technical expertise:**

- Team of qualified engineers
- Equipment selection by customer specifications
- Technical audit of manufacturers

#### **Full range of services:**

- Engineering audit and consulting
- Equipment selection and procurement
- Logistics and customs clearance
- Quality control (NDT)
- Supervision of installation and commissioning

#### **Guarantees and service:**

- Manufacturer warranty (minimum 3 years)
- Service maintenance
- Spare parts supply
- 24/7 technical support

[Electrical equipment](#) — complete product catalog.

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## **9. TM vs TMG Comparison**

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Parameter	TM (with conservator)	TMG (hermetic)
Oil-atmosphere contact	Yes	No
Maintenance	Regular	Minimal
Oil leak risk	Medium	Eliminated
Environmental friendliness	Standard	Enhanced
Cost	Lower	Higher
Service life	25 years	30+ years
Application	ZTP, indoor	KTP, outdoor

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## 10. Conclusion

Oil-immersed power transformers remain the optimal solution for most applications due to high reliability, efficient cooling, and cost-effectiveness. Hermetic transformers of the TMG series represent a modern development of technology, ensuring minimal maintenance and maximum environmental safety.

When selecting a transformer, it is necessary to consider not only technical parameters but also operating conditions, maintenance requirements, and logistics aspects. Our company is ready to provide full support at all stages — from engineering audit to equipment commissioning.

[Power transformers](#) — catalog with prices and delivery times.

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## Contact Information

**Metal-Asia.pw** — your reliable partner in electrical equipment supplies.

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*Document prepared based on technical documentation from leading manufacturers and current GOST, IEC 60076, TR CU standards.*