Distribution Transformers 10/0.4 kV: Technical Specifications and Applications

Introduction

Distribution transformers with 10/0.4 kV voltage are the primary link in electrical power distribution systems, providing voltage reduction from medium voltage distribution network levels to low voltage levels for end consumers. In this guide, I will examine the technical characteristics, types, and application areas of distribution transformers with power ratings from 25 to 2500 kVA.

Our services include professional load calculations and transformer selection.

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1. Purpose and Application Areas

1.1 Main Functions

Distribution transformers are designed for:

- Receiving electrical energy from 6-10 kV distribution networks
- Voltage reduction to 0.4 kV level
- Electrical energy distribution among consumers
- Providing galvanic isolation between different voltage networks

1.2 Application Areas by Power Rating

Small transformers (25-100 kVA):

- Individual residential houses and cottages
- Small enterprises and shops
- Agriculture and farms
- Telecommunication infrastructure facilities
- Street and road lighting

Medium transformers (160-400 kVA):

- Multi-apartment residential buildings
- Administrative buildings
- Medical institutions
- Educational institutions
- Small industrial enterprises

Large transformers (630-2500 kVA):

- Residential complexes and neighborhoods
- Shopping centers and hypermarkets
- Industrial enterprises

- Energy facilities
- Large infrastructure objects

Engineering selection and procurement ensures optimal power selection.

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2. Types of Distribution Transformers

2.1 Oil-Immersed Distribution Transformers

TMG Series — Hermetic Design:

- Corrugated tank compensates for oil volume changes
- No oil-atmosphere contact
- Minimal maintenance
- Service life 30+ years

Technical specifications of TMG:

Power (kVA)	HV Current (A)	LV Current (A)	Uk (%)	No-Load Losses (W)	SC Losses (W)
TMG-25/10/0.4	1.44	36.1	4.5	105	600
TMG-40/10/0.4	2.31	57.7	4.5	150	900
TMG-63/10/0.4	3.64	90.9	4.5	200	1270
TMG-100/10/0.4	5.77	144.3	4.5	270	1970
TMG-160/10/0.4	9.24	230.9	4.5	400	2700
TMG-250/10/0.4	14.4	360.8	4.5	540	3900
TMG-400/10/0.4	23.1	577.4	4.5	770	5500
TMG-630/10/0.4	36.4	909.3	5.5	1050	7700
TMG-1000/10/0.4	57.7	1443.4	5.5	1450	10500
TMG-1250/10/0.4	72.2	1804.2	5.5	1750	12500
TMG-1600/10/0.4	92.4	2309.4	6.0	2100	15000
TMG-2000/10/0.4	115.5	2886.8	6.0	2500	18000
TMG-2500/10/0.4	144.3	3608.4	6.0	3000	22000

B2B supply services include all transformer types.

2.2 Dry-Type Distribution Transformers

TSL Series — with Cast Epoxy Insulation:

- Fire safety class K0
- Installation in buildings possible
- Minimal maintenance
- Environmental safety

Technical specifications of TSL:

Power (kVA)	HV Current (A)	LV Current (A)	Uk (%)	No-Load Losses (W)	SC Losses (W)
TSL-100/10/0.4	5.77	144.3	4	280	1750
TSL-160/10/0.4	9.24	230.9	4	400	2350
TSL-250/10/0.4	14.4	360.8	4	550	3250
TSL-400/10/0.4	23.1	577.4	4	800	4600
TSL-630/10/0.4	36.4	909.3	4	1100	6500
TSL-1000/10/0.4	57.7	1443.4	5	1550	9500
TSL-1250/10/0.4	72.2	1804.2	5	1850	11500
TSL-1600/10/0.4	92.4	2309.4	6	2200	14000
TSL-2000/10/0.4	115.5	2886.8	6	2600	17000
TSL-2500/10/0.4	144.3	3608.4	6	3100	20000

2.3 Pole-Mounted Transformers

TMGS Series — for Installation on Overhead Line Poles:

- Compact dimensions
- Power 16-100 kVA
- Voltage class 6-10/0.4 kV
- Hermetic design

TMGS applications:

- Rural electrification

- Cottage settlements
- Telecommunication facilities
- Oil rigs and gas stations
- Temporary construction sites

Equipment selection by specifications considers installation method.

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3. Technical Parameters and Specifications

3.1 Connection Schemes and Winding Groups

Y/Yn-0 (Star-star with neutral):

- Standard scheme for distribution networks
- Neutral output on 0.4 kV side
- Used for four-wire networks

D/Yn-11 (Delta-star):

- 3rd order current harmonic suppression
- 30° phase shift
- Recommended for non-linear loads

Y/Zn-11 (Star-zigzag):

- Improved phase voltage balancing
- Used with significant load asymmetry
- Limited power (up to 250 kVA)

3.2 Voltage Regulation

OLTC (Off-Load Tap Changer):

- Range: $\pm 2 \times 2.5\%$ of rated voltage
- Tap positions: I, II, III, IV, V
- Switching only with de-energized transformer
- Standard design

LTC (Load Tap Changer):

- Automatic voltage maintenance
- Range: $\pm 10\%$ ($\pm 8 \times 1.25\%$ or $\pm 16 \times 1.0\%$)
- Switching without circuit interruption
- Optional design

Customs and logistics services include LTC permitting.

3.3 Losses and Efficiency

Energy efficiency classes per IEC 60076-1:

Class	No-Load Losses	SC Losses	Application
Standard	100%	100%	Basic design
Reduced losses	80%	90%	Economical design
Amorphous steel	30%	100%	Maximum savings

Annual losses calculation:

```
Wyear = P₀ × 8760 + Psc × (Savg/Srated)² × τ

Where:
Wyear — annual losses (kWh)
P₀ — no-load losses (kW)
Psc — short-circuit losses (kW)
Savg — average load (kVA)
Srated — rated power (kVA)
τ — maximum loss time (h)
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4. Transformer Power Selection

4.1 Load Calculation

Calculation methodology:

1. **Determine calculated power:**

   ```
   Scalc = Pcalc / cos(φ)
   ```

2. **Account for demand factor:**

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   Sdesign = Kd × Scalc
   ```

3. **Select transformer power:**

   ```
   Srated ≥ Sdesign / (Ko × Kt)

   Where:
   Ko = 0.65-0.75 — overload coefficient
   Kt = 0.9-0.95 — temperature coefficient
   ```

4.2 Recommended Power by Facility Type

Facility Type	Specific Load (kVA/m²)	Recommended Power
Residential (apartments)	0.08-0.12	25-100 kVA per building
Office buildings	0.08-0.15	160-630 kVA
Shopping centers	0.15-0.30	400-2500 kVA

Table 4 – continued

Facility Type	Specific Load (kVA/m²)	Recommended Power
Industry (light)	0.10-0.25	400-1600 kVA
Industry (heavy)	0.30-0.80	1000-6300 kVA
Hospitals	0.10-0.20	250-1000 kVA
Schools	0.05-0.10	100-400 kVA

4.3 Redundancy

Single-transformer substation:

- Reserve 20-30% of calculated load
- Overload capability in emergency mode

Two-transformer substation:

- Each transformer at 70-80% load
- 100% reserve when one is disconnected
- Automatic reserve transfer (ART)

Quality control NDT includes characteristic verification.

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5. Operating Conditions

5.1 Climate Designs

U1 (Temperate climate):

- Temperature: from -45°C to +40°C
- Humidity: up to 80% at +20°C
- For most regions of Russia

UHL1 (Cold temperate climate):

- Temperature: from -60°C to +40°C
- For Siberia and Far North

T1, T2 (Tropical climate):

- Temperature: from -10°C to +50°C
- Humidity: up to 100% at +35°C
- Fungus protection

5.2 Installation and Mounting

Oil-immersed transformers:

- Foundation with slope for oil drainage
- Oil separator or gutter (for TM)

- Room ventilation (for indoor installation)
- Fire safety distance 5-10 m

Dry-type transformers:

- Vertical installation
- Distance from walls 500 mm
- Natural or forced ventilation
- Maintenance access

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6. HS Codes and Certification

6.1 EAEU HS Codes

Code	Description	Duty
8504 31 000 0	Oil-immersed transformers 650 kVA	0-10%
8504 31 800 0	Oil-immersed transformers >650 kVA, 10 MVA	0-10%
8504 31 950 0	Oil-immersed transformers >10 MVA	0-5%
8504 33 000 0	Dry transformers 650 kVA	0-10%
8504 33 800 0	Dry transformers >650 kVA	0-10%
8504 90 000 0	Parts of transformers	0-15%

6.2 Mandatory Certification

TR CU 004/2011:

- Certificate of conformity
- Electrical safety tests
- Insulation check

TR CU 020/2011:

- Declaration of conformity
- EMC tests

TR CU 012/2011 (for explosive zones):

- Certificate of conformity
- Explosion protection tests

Audit China B2B — manufacturer certificate verification.

6.3 Documentation

Mandatory supply documents:

- Transformer passport
- Operating manual
- Factory test reports
- Certificate of conformity
- Packing list

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7. Packaging and Logistics

7.1 Packing List

Parameter	Oil TMG	Dry TSL
Package type	Wooden crate	Wooden crate/frame
Fumigation	IPPC ISPM-15	Per requirements
Marking	“Top”, “Fragile”, “Sling here”, “Center of gravity”	“Top”, “Danger of tipping”

Example TMG-1000/10 packing list:

- Net weight: 3200 kg (including oil 850 kg)
- Gross weight: 3800 kg
- Dimensions: 2800×1800×2500 mm
- Volume: 12.6 m^3
- Number of places: 1

7.2 Transportation

Oil-immersed transformer features:

- Transport in filled condition
- Prohibition on tilting more than 15°
- Use lifting lugs
- PCB content document in oil

Dry transformer features:

- Protection from moisture and mechanical damage
- Transport only in vertical position
- Exclude shocks and vibrations

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8. Maintenance and Repair

8.1 Oil-Immersed Transformers

Annual maintenance:

- Visual inspection
- Oil level check
- Silica gel color check
- Fastening and grounding check

Every 3-5 years:

- Oil analysis (breakdown voltage, acidity, moisture)
- Insulation resistance check
- Bolted connection tightening check

Every 10-15 years:

- Major overhaul
- Tap changer switching
- Seal replacement

8.2 Dry-Type Transformers

Annual maintenance:

- Dust cleaning
- Fan check (if installed)
- Temperature sensor check
- Fastening check

Every 5 years:

- Insulation resistance measurement
- Winding resistance check
- Cooling system operation check

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9. Why Work with Metal-Asia.pw

9.1 Our Advantages

Full cycle services:

- Engineering audit and load calculations
- Optimal power selection
- Transformer substation design “turnkey”
- Equipment supply

- Supervision and commissioning
- Service maintenance

Direct contracts:

- Russia, Belarus, Kazakhstan factories
- China and Turkey manufacturers
- European brands

Quality control:

- Factory inspection visits
- Acceptance tests
- Independent expertise

Logistics and customs:

- Optimal delivery routes
- Customs clearance
- Cargo insurance

Guarantees:

- 3-5 years factory warranty
- Spare parts supply
- 24/7 technical support

Electrical equipment — complete catalog.

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10. Conclusion

Proper selection of a distribution transformer requires consideration of many factors: calculated load, operating conditions, fire safety requirements, and economic indicators. Oil-immersed TMG series transformers remain the most economical solution for outdoor installation, while dry-type TSL transformers are preferred for indoor installation.

Our company is ready to provide full support at all stages — from load calculations to equipment commissioning. We work only with verified manufacturers and guarantee the quality of supplied equipment.

Power transformers — current prices and delivery times.

Contact Information

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- Homepage
- Contacts
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Document prepared based on GOST 11677-2011, IEC 60076, and practical experience in distribution network design and operation.