



Technical Specification of Huawan New Energy

Three Phase Oil Immersed Transformer

(Revision history)

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Huawan New Energy

Three Phase Oil Immersed Transformers

Overview

Huawan New Energy Co., Ltd is dedicated to providing high-quality, reliable, and efficient power transmission and distribution equipment for global customers. Within our product lineup, we manufacture a full range of single-phase pole-mounted distribution transformers, encompassing diverse specifications and configurations to cater to the demands of different application scenarios—whether it is rural power grids, urban distribution networks, or industrial auxiliary power systems, our single-phase transformers can fulfill the customized needs of various users.



Standard Features

Oil type transformers are manufactured in accordance with the following national and international standards:

- NTP 370.400
- TS EN
- IEC 60076, IEEE
- CENELEC EN, DIN EN 50588-1

Table 1
Three-phase oil immersed transformer technical specs

Rated power (kVA)	Up to 5000kVA (Requests greater than 5000kVA are evaluated on a project-by-project basis)
Phase	Three-phase
Cooling class	ONAN
Connection Symbol	Yd7
Rated frequency (HZ)	As per request
Insulating fluid	Mineral oil
Winding temperature rise	65K
Top-oil temperature rise	60K
Impedance voltage	4 ±10%
Rated noise level	< 55dB
high-voltage tap changer	± 2 x 2.5%
Primary bushings	As per request
Secondary bushings	As per request
Installation method	Exterior

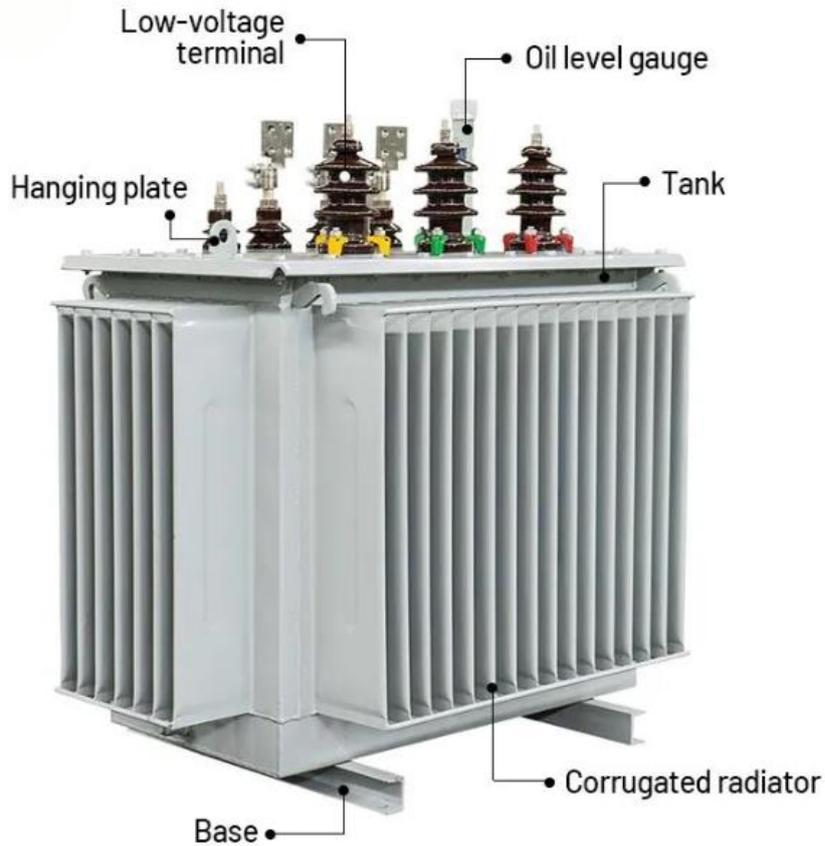


Figure 1. Structure of Three-phase oil immersed transform

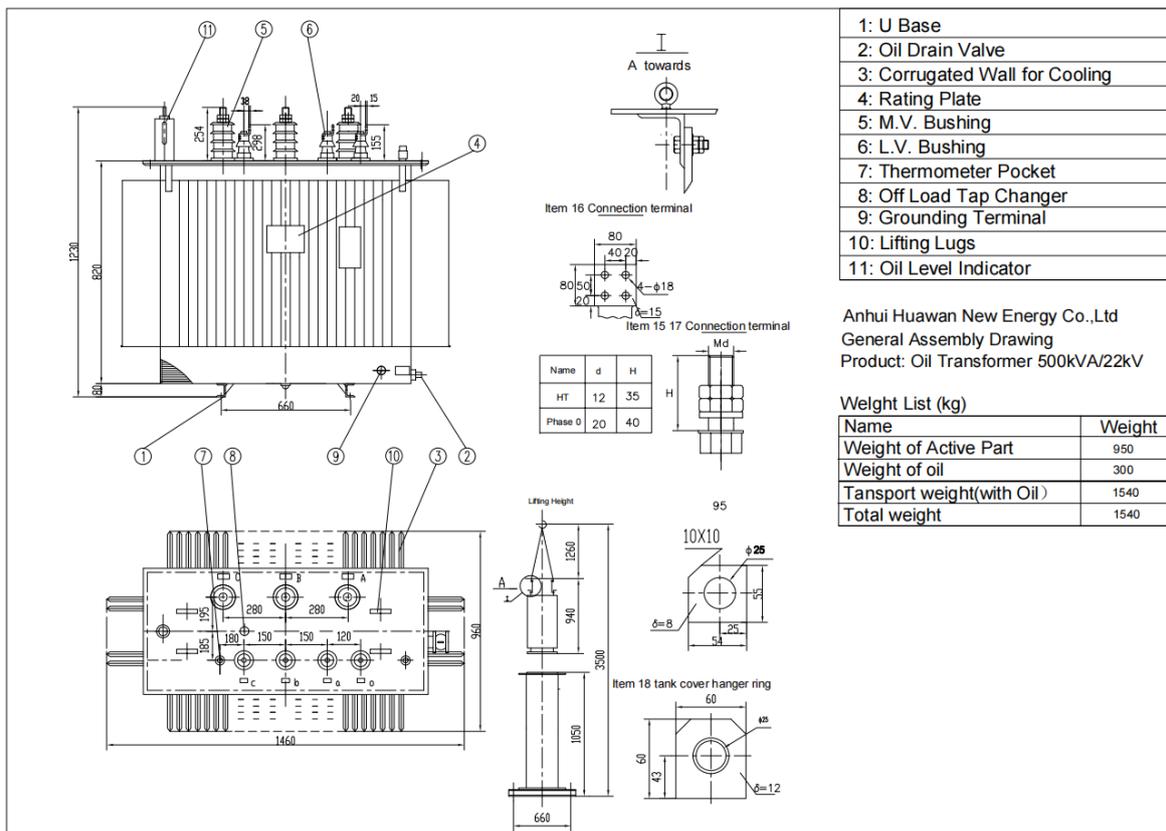


Figure 2. Outline of 500kVA Three-phase oil immersed transformer

Accessories

<p>◆ Pressure Relief Valve</p> <p>The pressure relief valve is provided to automatically release excessive internal pressure caused by internal faults such as short circuits or overheating, preventing tank deformation or rupture. The valve automatically reseals after pressure normalization and is suitable for oil-immersed transformers of various ratings.</p>	 A close-up photograph of a white pressure relief valve with a white knurled top and a blue body. The words "Pressure Relief Valve" are printed in black on the side of the blue body.
<p>◆ High Voltage Cable Box</p> <p>The high-voltage cable box is designed to protect the HV terminals of the transformer. The enclosure protection degree can be configured according to tender requirements.</p>	 A photograph of a rectangular, silver-colored metal enclosure with a green base. It has several terminals on the front face.
<p>◆ Low Voltage Cable Box</p> <p>The low-voltage cable box protects the LV terminals of the transformer, with enclosure protection degree configurable as per technical specifications.</p>	 A photograph of a rectangular, light-colored metal enclosure with a green base, similar in design to the high voltage cable box but smaller.
<p>◆ Contact Oil Temperature Thermometer</p> <p>The oil temperature thermometer is used to indicate the operating temperature of the insulating oil. A contact-type thermometer can be provided for alarm or trip signaling as required.</p>	 A close-up photograph of a circular oil temperature thermometer with a white face and a red needle. The face has two scales: one in degrees Celsius (0 to 150) and one in degrees Fahrenheit (32 to 300). The word "THERMOMETER" is printed on the face.
<p>◆ Buchholz Relay</p> <p>The Buchholz relay is installed to detect internal faults such as gas accumulation or abnormal oil flow, providing alarm or trip signals to protect the transformer.</p>	 A photograph of a blue Buchholz relay with a red button on top. The model number "QJ4-50" is printed at the bottom of the device.

<p>◆ Magnetic Oil Level Indicator</p> <p>The magnetic oil level indicator displays the oil level in the conservator. A contact-type oil level indicator can be provided for remote monitoring if required.</p>	
<p>◆ Dehydrating Breather</p> <p>The dehydrating breather prevents moisture ingress into the conservator. The desiccant changes color when saturated, indicating the need for replacement.</p>	
<p>◆ Tap Changer</p> <p>The transformer is equipped with an off-circuit tap changer (OCTC) for voltage adjustment under de-energized conditions, in accordance with IEC 60214 and related standards.</p>	
<p>◆ Oil Drain Valve</p> <p>The oil drain valve is installed at the bottom of the tank for oil draining during maintenance or oil replacement, with reliable sealing performance meeting the requirements of IEC 60076 and NF EN 60076 standards, and applicable to harsh environments such as outdoor, coastal and alpine regions.</p>	
<p>◆ Oil Conservator Tank</p> <p>The oil conservator compensates for oil volume variations caused by temperature changes, isolates air and moisture, and ensures stable and safe operation of the transformer.</p>	

Oil Type Transformer Manufacturing Technology

1. Windings

Windings are manufactured with the latest technology and fully automated machines. Electrolytic copper conductors are used in low voltage and high voltage windings in accordance with standards and as per customer request. Windings are divided into low voltage and high voltage windings.

Types of conductors according to the voltage level and the load loss value:

- In low voltage coils: foil (sheet metal) or paper insulated rectangular section
- In high voltage coils: round or rectangular conductors with enamel or paper insulation.

Resin-coated DDP (Diamond Dotted Press paper) with high-impact and electrical resistance and specially produced Kraft paper are used as insulation materials in windings. In high voltage windings, graded insulation is provided with edge strips and floor seals. This results in more compact coils with higher impulse resistance. Radial and axial clamps are applied to the coils to prevent short circuit forces.

The rated primary voltage and basic insulation level (BIL) of the windings shall comply with the provisions specified in Table 2.

Table 2
High Voltage Ratings and Insulation Levels of Transformer

	Primary voltage (kV)	Primary voltage (kV)	BIL (kV)	AC (kV)
Transformer high voltage	10	12	75	28
	10.5	12	75	28
	13.2	17.5	95	38
	13.8	17.5	95	38
	19.07	24	125	50
	22.9	24	125	50
	10-22.9	24	125	50
	10-33	36	150	70
Minimum kVA rating , for low voltage ratings	33-22.9	36	150	70
	0.231	1.0	7.5	2.5
	0.46-0.23	1.0	7.5	2.5
	0.40-0.231	1.0	7.5	2.5

2. Core

The transformer core is composed of cold rolled electrons with high magnetic permeability siliconized sheets (CRGO).

Sheet types are selected according to the desired idle loss value. Sheet metal is cut quickly to avoid burrs on high precision machines and are stacked using the step-lap method to minimize losses and noise.

The high-voltage side of the transformer shall be equipped with 3–4 high-voltage bushings, and the low-voltage side with 3–4 low-voltage bushings. The bushings are made of porcelain insulating materials, with a minimum creepage distance of 25 mm/kV. The manufacturing standards of the bushings comply with the provisions of IEC 60137 and NTP370.400-2013. The supplied voltage and Basic Insulation Level (BIL) shall conform to the requirements specified in Table 3.

Table 3
Rated Voltage and Insulation Withstand Levels of Transformer Bushings (BIL / Power Frequency)

Bushing Insulator		Rated Voltage (kV)	Maximum Voltage of the Material (kV)	Power-Frequency Withstand Voltage (kV)	Impulse Withstand Voltage 1.2/50 μ s (kVp)	Altitude (m)
HT		10	17.5	38	95	0 - 4,500
		10.5	17.5	38	95	0 - 4,500
		13.2	24	50	125	0 - 4,500
		13.8	24	50	125	0 - 4,500
		19.07	36	70	170	0 - 4,500
		22.9	36	70	170	0 - 4,500
		10-22.9	36	70	170	0 - 4,500
		33-10	52	95	250	0 - 4,500
BT		0.231	1.0	3	10	0 - 4,500
		0.46-0.23	1.0	3	10	0 - 4,500
		0.40-0.231	1.0	3	10	0 - 4,500
<p>Note: In accordance with IEC 60815, the minimum creepage distance shall be 25 mm/kV under all circumstances. To determine the minimum creepage distance of the primary insulator, the nominal voltage or the specified voltage shall be taken into account. The design altitude of the transformer has been standardized at 4500 meters. Therefore, the technical characteristics of the standardized insulators in this table have been verified to be suitable for operation at this altitude.</p>						

3. Active Part

The active part is created by placing the coils concentrically on the core legs and the upper core arrangement. Chocks and clamping devices hold the coils in place. Cover, terminal and tap changer connections should be made ready for the first preliminary tests.

Positioning of insulators, accessories and other equipment on the cover is in accordance with customer requests.

4. Tank — Paint

Tanks are available in two types: radiator and corrugated wall. The tank is made of rolled steel with a coating thickness of not less than 6 mils. Corrugated walls that form the front and side surfaces of the tank also form the transformer cooling surface.

The front and side surfaces of the radiator tank type are also made of steel sheet metal.

The tank cover and tank body are connected by bolts, lock washers and galvanized iron nuts.

Boiler welds are leak-proof. When tank production is complete, it is tested for leakage.

A grounding connection bolt shall be provided at the lower part of the tank.

Lifting lugs with different tensile strengths shall be provided on the tank according to the product weight.

Tanks are cleaned and dried with sanding and special chemicals before painting. Top coat paint colors RAL7033 - RAL9006 are used (all RAL colors can be changed as per customer request). The inner surface of the tank can be covered with lacquer as per customer request.

Corrosion classes are specified in the table on page 8. Transformers in the desired corrosion class can be produced as per customer request.

*Hot-dip galvanizing treatment can be provided upon customer request, which is suitable for climatic environments such as coastal areas, alpine regions or jungles.

5. Core - Coil

The core and coils shall be vacuum treated to ensure maximum penetration of the dielectric fluid into the coil insulation system. The transformer shall be filled with preheated, filtered, degassed dielectric fluid under vacuum. The core shall be made of burr-free, grain-oriented silicon steel and precisely laminated to eliminate gaps in corner joints and fixed with cold-annealed pressing plates. The coils are made of electrolytic copper conforming to ASTM B 187 standard Class E insulating material is adopted and shall be insulated with B-stage, epoxy-coated, diamond-patterned insulating paper and heat cured under pressure to ensure proper bonding of the conductor and paper.

6. Fluid Options

The transformer can be filled with standard electrical grade mineral insulating oil, vegetable oil or other dielectric coolant. Natural Ester Insulating Fluid is a flame-retardant natural ester-based coolant designed for power equipment such as transformers. It exhibits outstanding environmental, fire safety, chemical, and electrical performance characteristics. This insulating fluid contains no petroleum, halogens, silicone resins, or other hazardous substances. In soil and aquatic environments, it undergoes rapid and complete biodegradation. Tests confirm Natural Ester Insulating Fluid achieves 98% biodegradation within 28 days. Flame-retardant (meets IEC 61039 standards)

Flame retardant (compliant with IEC 61039)

High biodegradability (>98% in 28 days per OECD 301)

Superior dielectric properties (compatible with IEC 60296)

Excellent dielectric properties (compliant with IEC 60156)

Excellent dielectric properties (compliant with NTP370.400)

Table 4
Corrosion Categories and Typical Environmental Conditions (ISO 12944)

Corrosion Category	Examples of Suitable Environmental Conditions in Temperate Climate (for Informational Purposes)	
	Open Spaces	Closed Spaces
C1	-	Ventilated and heated buildings E.g.: offices, stores, schools, hotels, etc.
C2	Low pollution and mostly rural areas	Unheated buildings where condensation may occur. E.g.: warehouses, gyms, etc.
C3	Urban and industrial environments, areas where a certain degree of sulfur dioxide pollution is present, seaside areas with low salinity, etc.	Manufacturing rooms with a certain amount of air pollution and high humidity. E.g.: food production factories, laundries, breweries, dairy farms, etc.
C4	Industrial and marine areas with a certain degree of salinity, etc.	Buildings and areas with constant condensation and heavy pollution, etc.
C5-1	Industrial areas, etc., with aggressive atmospheric conditions and excessive humidity.	Buildings or areas with constant condensation and pollution, etc.
C5-M	Coastline and high sea areas with high salinity, etc.	Buildings and areas with constant condensation and heavy pollution, etc.

7. Drying and Oil Filling

In oil type transformers, the insulation materials used must be dried before oil filling. This drying process directly affects the quality of the transformer. Two drying methods are used for this process. The first is low frequency heating (LFH) vacuum drying where the drying and filling process occurs under a maximum vacuum pressure of 0.1mbar. The second is classical hot air drying. These processes reduce moisture to a minimum in both the tank's active part and in the oil.

Technical Information

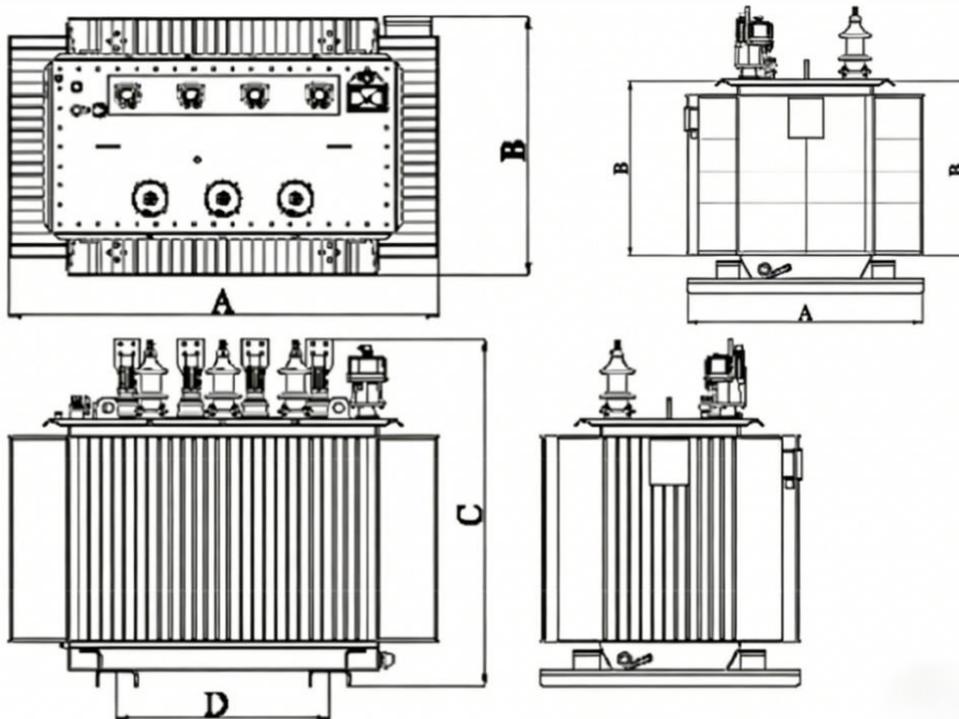


Figure 3. Outline of 500kVA Three-phase oil immersed transformer

Table 5
Losses comply with the mandatory requirements of NTP370.400-2013
HT ≤ 17,5 kV of BT ≤ 1,0 kV

tem#	Transformer Power	Maximum No Load Losses	Maximum Load Losses	No-Load Current	Short-Circuit Voltage	Total Loss	Oil Weight	Total Weight
Unit	kVA	W	W	% of In	% of Un	% of Pn	Kg	Kg
1	15	106	451	4.6	4±10%	3.71	90	190
2	25	146	595	4.26	4±10%	2.96	100	330
3	37.5	188	866	3.91	4±10%	2.81	110	380
4	50	232	1120	3.57	4±10%	2.7	130	440
5	75	300	1521	3.11	4±10%	2.43	150	530
6	100	374	1920	2.99	4±10%	2.29	180	640
7	160	537	2775	2.53	4±10%	2.07	90	790
8	200	606	3375	2.3	4±10%	1.99	200	950
9	250	734	3804	2.3	4±10%	1.82	240	1120
10	315	837	4533	2.19	4±10%	1.7	260	1260
11	400	968	5550	1.84	4±10%	1.63	270	1210
12	500	1179	6540	1.61	4±10%	1.54	320	1620
13	630	1411	8136	1.15	4±10%	1.52	350	1630

Table 6
Losses comply with the mandatory requirements of NTP370.400-2013
17.5 < HT ≤ 36 kV of BT ≤ 1.0 kV

Item#	Transformer Power	Maximum No Load Losses	Maximum Load Losses	No-Load Current	Short-Circuit Voltage	Total Loss	Oil Weight	Total Weight
Unit	kVA	W	W	% of In	% of Un	% of Pn	Kg	Kg
2	15	135	452	6.91	4±10%	3.91	90	190
3	25	174	653	6.34	4±10%	3.31	100	350
4	37.5	210	900	5.62	4±10%	2.96	110	400
5	50	248	1135	5.04	4±10%	2.77	120	470
6	75	327	1551	4.61	4±10%	2.5	130	550
7	100	417	1975	4.18	4±10%	2.39	160	660
8	160	571	2843	3.6	4±10%	2.13	200	890
9	200	606	3375	2.3	4±10%	1.99	220	1000
10	250	771	3737	3.31	4±10%	1.8	250	1170
11	315	866	4500	2.88	4±10%	1.7	280	1280
12	400	1050	5429	2.45	4±10%	1.62	310	1480
13	500	1221	6464	1.87	4±10%	1.54	340	1730
14	630	1486	8144	1.15	4±10%	1.53	350	1780

Tests

Routine Tests

- Measuring winding resistances
- Measuring the voltage-to-turn ratio and checking the connection group
- Measuring short circuit impedance and loss under load
- Measuring idle losses and currents
- Insulation resistance
- Power frequency with stand voltage test
- Induced with stand voltage test

Type Tests

- Temperature increase test
- Lightning impulse test
- Measuring noise levels

Special Tests

- Reasonable special test items can be added as per customer requirements.

Test Standard

- Test standards shall comply with the provisions of IEC 60076-1.

Packaging

Different packaging types may be requested (e.g.: wooden crate packaging, stretch film and Styrofoam packaging, wooden crate packaging for protection of bushings).



Figure 4. Sample of packaging