TAIKAI

TAIKAI

TAIKAI TRANSFORMER

Honesty Sincerity Practical Innovation

Pursue excellent, Return society

SHANDONG TAIKAI TRANSFORMER CO., LTD

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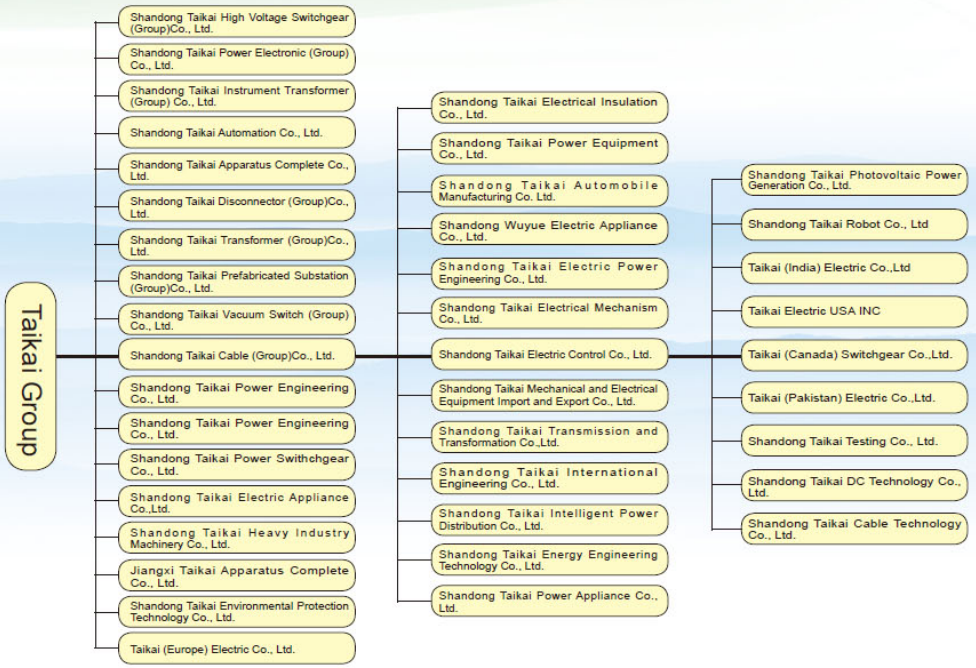

CONTACT INFORMATION

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Company Profile

Shandong Taikai Transformer Co., Ltd. (Hereinafter referred to as Taikai transformer) is a wholly-owned subsidiary of Taikai Group, located at the foot of Taishan-Tai'an high-tech industrial development zone, Shandong province, eastern of China. The company covers an area of 330,000 m2, with the domestic first-class modern workshop 100,000 m2. Taikai transformer is an excellent enterprise who has a professional design and mass production of 1000kV and below oil- immersed power transformer, special transformer, reactor, dry type transformer, intelligent online monitoring system, especially 110kV transformer production and sales ranked first in China for many years.

Taikai transformer is the provincial strategic emerging industry demonstration base and up-market equipment manufacturing and production base, with advanced equipment and excellent staff team, always adheres to the management idea of standardization, normalization, and quality priority. With perfect QA system, Taikai transformer has passed the PCCC quality system certification and attains ISO-9001, ISO-14001, ISO 28001 certifications. Products comply with GB1094 series standards of China, IEC60076 international standards and IEEE C57 series standards of North American, and some of them have passed the type tests carried out in KEMA, Netherlands and CESI, Italy which are both STL members.

The company has first-class enterprise management talents and first-class transformer industry R & D manufacturing, inspection and testing experts, which are the basis for the company to create top-quality products. Taikai transformer has more than 1,400 employees, among them, more than 67% have college degree or higher including 23 personnel owning graduate degree. There are 3 professor-level senior engineers, 42 senior engineers and 111 engineers in R & D team. Taikai transformer has obtained 104 national authorized patents, including 4 invention patents and 100 model-utility patents.

The technical performance of the transformer designed and manufactured by Taikai transformer has reached the international advanced level, such as reasonable structure, reliable insulation, low loss, low partial discharge levels, low temperature rise, low noise, strong short circuit withstand ability, lightning impulse resistance, no leakage etc.

At present, tens of thousands of our products have been operating safely around the world. Five large generating groups constitute our main domestic clients such as China State Grid, China Southern Power Grid, Huaneng, Datang. The company's products cover industries such as steel, petroleum, chemical industry, coal, railway, hydropower, wind power generation, photovoltaic power generation, etc. In overseas markets, our customers mainly include the Los Angeles Hydropower Department (main products: 230kV transformers and 500kV reactors), the State Grid Corporation of Indonesia (main products: 500kV and 150kV transformers), Uzbekistan National Grid (Main products: 220kV and 110kV transformers) and Hydro One of Canada (Taikai is one of the qualified suppliers of more than 20 types of transformers). Taikai transformer has actively explored overseas markets for many years and has excellent service in more than 40 countries and regions all over the world.

Adhering to the principle of " Quality First, User Priority", "Everything for Users" and advanced design and manufacturing technology and high quality, Taikai transformer has won the reputation and good corporate image from user side. It has made great development in both domestic and overseas marketing share.

Production and Test Equipment

Double-million Workshop

Pulsating & Modular production base

UHV test hall with a net height of 43 meters, CNAS certification , 1000kV and 1000kVA power transformer test base

CNC Length-cutting Line for Silicon Steel Sheet, GEORG Germany

Two 300T Bridge Crane, Up to 540 tons

45t Ultra Heavy Load and High-torque Vertical Winding Machine, 1000kV Voltage Level or a Single Coil Weighing up to 23t

10,000W Class Optical Fiber Laser Cutting Machines

3000kV Generator Unit

Offline programming automatic welding robot , CLOOS Germany

500kV Power Frequency Withstand Voltage Equipment

Automatic processing center for Winding Spacer, Zero burr and 0.05mm Deviation

Automatic CNC Insulation Machining Center

The company has more than 200 sets of equipment, among which, the main equipment is as follows:

No.	Equipment Name	Type
1	Optical fiber laser cutting machine	QL-FCP2512GY
2	CNC flame plasma cutting machine	MESSER OMNIMAT T
3	CNC double-gun flame cutting machine	CNCSG-4000
4	Optical fiber laser cutting machine	LT-9080E
5	CNC band sawing machine	GS320
6	CNC lathe	CJK6180
7	Vertical machining center	JNVC1600
8	Sandblasting room	TZ-FL01
9	Spray paint room	TZ-Q01
10	Drying room	TZ-HG01
11	CLOOS welding robot	QRC-E 410
12	Robot for welding pipe joints	FANUC，M-10LA，R-30B
13	CNC bending machine	WS67K-800/6000
14	Laser scanning tracking welding workstation	Flex Pendant
15	Width-splitting line	XBJ1-12/10
16	Length-cutting line	TBA/ME/HY800x5000PB/T
17	Length-cutting line	XBJ36BL-900
18	Shearing line for reactor	SX-500-LW4
19	Overturning platform	Various models
20	Epoxy resin vacuum pressure pouring tank	VPRC20-φ2400 Ⅲ
21	Electric blast and constant temperature drying oven	
22	Winding machine	Various models
23	Coil pressure machine	GPEM3340E
24	Constant pressure system	DZZL9L/DZZL120T
25	Vacuum oil filter	2JA30KY
26	Vacuum unit	2J-1200A
27	Crane	300*2
28	Drying furnace	KDP-140-W
29	Dry air generator	AD-100
30	Kerosene vapor-phase drying furnace	VPD-450
31	Active part assembly frame	2J5815
32	Air cushion transit vehicle	AEROGO
33	Hot glue machine	RZL-4
34	Dovetailed spacer milling machine	DKJ-35
35	Grinding machine	K60MT
36	Strip molding machine	DDJ4012
37	CNC step-saw machine tool	JDJ600
38	Electrostatic board bandaging machine	YBZ-3300
39	Hot press machine	JHR3000x2500-4/2500T

Product Performance and Characteristics

◆ Product Characteristics:

- Reasonable structure based on modern calculation technology, analysis of the electrical, magnetic, force and thermal characteristics of the transformer.
- Advanced performance based on IEC standards, specially designed as customer requirements, obviously lower PD than the value in IEC60076-3.
- High reliability based on the analysis of electrical, magnetic, force and thermal characteristics, reasonable transformer insulation structure, proper ampere tun distribution and the cooling system resulting in high ability of withstanding over-voltage and short-circuit current, no possibility of local overheat.
- Optimal accessories
  Superior user experience based on good visual, leak-free, un-tanking, maintenance-free.

◆ Introduction to Structure and Performance:

- Core:
  Adopting highest quality, non-aging, cold-rolled, grain-oriented, and high permeability silicon steel lamination silicon steel sheets.
  Processed on the GEORG length-cutting line from Germany.
  Fully mitered joint, step lapping and polyester tape binding structure making the transformer with low no-load losses and low noise level.
  Placing vibration isolation pads between the body and the tank to reduce vibration that transmits to the tank .
- Winding:
  Winded by high-quality oxygen free copper with lower resistivity.
  Processed and manufactured on horizontal winding machines and large CNC vertical winding machines from both radial and axial directions.
  Reasonable transposition applied between paralleling wires, magnetic shielding used guiding flux leakage when necessary to reduce the stay losses of the transformer.
  Reasonable design of insulation structure improving the ability of withstanding overvoltage.
  Optimizing the ampere turns distribution of the winding, increasing the radial support and axial compression of the winding, using the pre-densification of spacers, constant pressure drying, to resist the impulse current.
- Tank:
  Bell type or cover bolted type tank.
  Carbon dioxide shielded welding process.
  High-quality gaskets and the limit groove.
  Strict leak detection test procedures.
- Others:
  Cold-weld connection technology of leads to improve the cleanliness of active part.
  The vacuum treatment and the vacuum filling technology measures reduce the partial discharge level effectively and enhance the transformer operating reliability.
  The structure of "Six Direction Positioning" between the active part and the tank assures that the transformers have a strong ability of anti-transportation impact or anti-earthquake.
  Surface treatment and coating, fine processing to tank surface, 7 steps such as acid-washing and phosphating,etc. special anti-fouling paint, ensuring not falling off or rusting away.

6-1000kV Oil-immersed Transformer

◆ Model explanation

Taking the energy consumption class II OSFPSZ - 120000/220 as an example, it stands for three-phase, on-load voltage regulation, air forced cooling, forced oil circulation, three-winding, 120000kVA, 220kV, auto-transformer.
O-auto-transformer , no symbol for general transformer
S-three-phase, D-single-phase
F-forced air cooling, no symbol for natural air cooling
P-forced oil circulation, no symbol for natural oil circulation
S-three-winding, no symbol for two-winding
Z-on-load voltage regulation, no symbol for no-excitation voltage regulator
20-loss level code, no symbol for special situation
120000-Capacity, kVA
220-HV nominal voltage, kV

◆ Normal Service Conditions

(1) Altitude: ≤1000m;
(2) Ambient temperature
Maximum temperature: +40℃ ;
Maximum monthly average temperature:+30℃ ;
Maximum yearly average temperature+20℃ ;
Minimum temperature: -25℃ .
(3) Power supply: approximate sinusoidal wave, three-phase symmetrical approximately
(4) Installation site: indoor or outdoor, without the obvious contamination.
Note: The transformer used in special conditions should be specified when ordered.

10kV Oil-immersed Substation Transformer

Rated capacity (kVA)	Voltage combination and tapping range			Vector group	Energy consumption class I		Energy consumption class II		Energy consumption class III		Short-circuit impedance (%)
	HV (kV)	HV tapping range(%)	LV (kV)		No-load loss(kW)	On-load loss (kW)	No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss (kW)	
30	6 6.3 10 10.5 13.8	±5% or ±2×2.5%	0.4 0.433 0.48 0.57 0.69	Dyn11 / Yyn0	0.065	0.455/0.43	0.07	0.505/0.48	0.08	0.63/0.60	4
50					0.08	0.655/0.625	0.09	0.73/0.695	0.1	0.91/0.87	
100					0.12	1.14/1.08	0.135	1.265/1.20	0.15	1.58/1.50	
160					0.16	1.665/1.585	0.18	1.85/1.76	0.2	2.31/2.20	
200					0.19	1.97/1.87	0.215	2.185/2.08	0.24	2.73/2.60	
315					0.27	2.76/2.63	0.305	3.065/2.92	0.34	3.83/3.65	
400					0.33	3.25/3.095	0.37	3.615/3.44	0.41	4.52/4.3	
500					0.385	3.90/3.71	0.43	4.33/4.12	0.48	5.41/5.15	
630				Dyn11 / Yyn0	0.46	4.46	0.51	4.96	0.57	6.2	4.5 or 6
800					0.56	5.4	0.63	6	0.7	7.5	
1000					0.665	7.415	0.745	8.24	0.83	10.3	
1250					0.78	8.64	0.87	9.6	0.97	12	
200		±4×2.5% ±2×2.5%			0.243	2.755	0.27	2.9	0.3	2.9	4
315					0.34	3.895	0.38	4.1	0.42	4.1	
400					0.41	4.703	0.46	4.95	0.51	4.95	
630					0.614	6.897	0.69	7.26	0.76	7.26	4.5 or 6
800					0.71	8.45	0.8	8.89	0.89	8.89	

Note: 1. Transformers with various special parameters and performance can be manufactured according to customer requirements.
2. For transformers with capacity not higher than 500kVA, the load loss value in the table above oblique line applies to Dyn11, and the value below oblique line applies to Yyn0;

35kV Oil-immersed Substation Transformer

Rated capacity (kVA)	Voltage combination and tapping range			Vector group	Energy consumption class I		Energy consumption class II		Energy consumption class III		Short-circuit impedance (%)
	HV (kV)	HV tapping range(%)	LV (kV)		No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	
50	33 35 36.75 37 38.5	±5% or ±2×2.5%	0.4 0.433 0.48 0.57 0.69	Dyn11 / Yyn0	0.102	1.14/1.08	0.115	1.20/1.14	0.128	1.20/1.14	6 or 6.5
100					0.147	1.91/1.81	0.166	2.01/1.91	0.184	2.01/1.91	
160					0.179	2.68/2.55	0.202	2.82/2.68	0.224	2.82/2.68	
200					0.218	3.15/3.00	0.245	3.32/3.16	0.272	3.32/3.16	
315					0.307	4.51/4.30	0.346	4.75/4.53	0.384	4.75/4.53	
400					0.371	5.45/5.20	0.418	5.74/5.47	0.464	5.74/5.47	
500					0.435	6.56/6.25	0.49	6.91/6.58	0.544	6.91/6.58	
630				Dyn11 / Yyn0	0.531	7.47	0.598	7.86	0.664	7.86	
800					0.627	8.93	0.706	9.4	0.784	9.4	
400		±4×2.5% ±2×2.5%			0.371	4.90	0.418	5.16	0.464	5.16	
630					0.525	7.05	0.591	7.42	0.656	7.42	
800					0.627	8.44	0.706	8.88	0.784	8.88	
1250					0.896	13.2	1.008	13.9	1.12	13.9	
1600					1.082	15.8	1.217	16.6	1.352	16.6	

Note: 1. For transformers with rated capacity not higher than 500kVA, the load loss value in the table above oblique line applies to Dyn11, and the value below oblique line applies to Yyn0;
2.Transformers with various special parameters and performance can be manufactured according to customer requirements.

66kV Oil-immersed Substation Transformer

Rated capacity (kVA)	Voltage combination and tapping range			Vector group	Energy consumption class I		Energy consumption class II		Energy consumption class III		Short-circuit impedance (%)	Short-circuit impedance (%)
	HV (kV)	HV tapping range(%)	LV (kV)		No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)		
400	66 or 69	±2×2.5%	0.4	Dyn11	0.51	5.7	0.58	5.7	0.64	6	0.3/0.5	8
630					0.66	6.77	0.74	6.77	0.82	7.13	0.3/0.5	
800					0.77	7.98	0.86	7.98	0.96	8.4	0.3/0.5	
1000					0.87	9.31	0.98	9.31	1.09	9.8	0.3/0.5	
630		±4×2.5%			0.66	6.77	0.74	6.77	0.82	7.13	0.3/0.5	
800					0.77	7.98	0.86	7.98	0.96	8.4	0.3/0.5	
1000					0.87	9.31	0.98	9.31	1.09	9.8	0.3/0.5	
1250					1.02	11.4	1.15	11.4	1.28	12	0.3/0.5	
1600					1.27	13.3	1.43	13.3	1.59	14	0.3/0.5	
2500					1.54	18.05	1.73	18.05	1.92	19	0.3/0.5	

Note: 1. According to special technical specifications, the no-load current above the oblique line in the table is the rated requirement value, and the value below the oblique line is requirement value at 1.1 times of over-voltage.
2.Transformers with various special parameters and performance can be manufactured according to customer requirements.

35kV Oil-immersed Station Service Transformer

(1) 35kV Class 630kVA~31500KVA Three-phase Double-winding Power Transformer with Off-circuit Tap-changer

Rated capacity (kVA)	Voltage combination and tapping range			Vector group	Energy consumption class I		Energy consumption class II		Energy consumption class III		Short-circuit impedance (%)
	HV (kV)	HV tapping range(%)	LV (kV)		No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	
630	35	±2×2.5 ±5	3.15 6.3 10.5	Yd11	0.51	6.19	0.6	6.19	0.72	6.55	6.5
800					0.61	7.41	0.72	7.41	0.86	7.83	
1000					0.72	8.75	0.85	8.75	1.02	9.26	
1250					0.85	10.35	1	10.35	1.2	10.95	
1600					1.02	12.45	1.2	12.4-5	1.44	13.18	
2000					1.21	14.72	1.42	14.72	1.71	15.58	
2500					1.43	17.41	1.68	17.41	2.02	18.41	
3150	35 ~ 38.5	±2×2.5 ±5	3.15 6.3 10.5		1.7	20.7	2.0	20.7	2.4	21.9	7.0
4000					2.0	24.6	2.3	24.6	2.9	25.9	
5000					2.4	28.2	2.8	28.2	3.5	29.7	
6300					2.9	31.5	3.4	31.5	4.2	33.3	8.0
8000	35 ~ 38.5	±2×2.5	3.15 3.3 6.3 6.6 10.5	YNd11	4.0	34.6	4.7	34.6	5.8	36.5	
10000					4.8	40.8	5.7	40.8	7.0	43.0	
12500					5.5	48.4	6.5	48.4	8.0	51.1	
16000					6.7	59.2	7.9	59.2	9.7	62.5	
20000					7.9	71.6	9.4	71.6	11.5	75.5	
25000					9.4	84.6	11.1	84.6	13.6	89.3	10.0
31500					11.1	100.8	13.1	100.8	16.2	106.4	

Note: 1. For transformers with low voltage of 10.5kv, products with vector group Dyn11 can also be provided
2. Transformers with various special parameters and performance can be manufactured according to customer requirements.

(2) 35kV Class 2000kVA~31500KVA Three-phase Double-winding Power Transformer with On-load Tap-changer

Rated capacity (kVA)	Voltage combination and tapping range			Vector group	Energy consumption class I		Energy consumption class II		Energy consumption class III		Short-circuit impedance (%)
	HV (kV)	HV tapping range(%)	LV (kV)		No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	
2000	35	±3×2.5	6.3 10.5	Yd11	1.28	15.79	1.49	15.79	1.85	16.72	6.5
2500					1.51	18.67	1.77	18.67	2.19	19.76	
3150	35 ~ 38.5	±3×2.5	6.3 10.5		1.8	22.2	2.1	22.2	2.6	23.5	7.0
4000					2.1	26.2	2.5	26.2	3.1	27.6	
5000					2.6	30.8	3.0	30.8	3.7	32.5	
6300					3.1	33.0	3.7	33.0	4.5	34.9	8.0
8000	35 ~ 38.5	±3×2.5	6.3 6.6 10.5	YNd11	4.3	36.5	5.1	36.5	6.3	38.6	
10000					5.1	43.2	6.0	43.2	7.4	45.6	
12500					6.0	51.1	7.1	51.1	8.7	54.0	
16000					7.2	63.3	8.5	63.3	10.5	66.8	
20000					8.5	74.4	10.1	74.4	12.4	78.6	
25000					10.1	88.0	11.9	88.0	14.6	92.9	10.0
31500					12.0	104.4	14.2	104.4	17.4	110.2	

Note: 1. For transformers with low voltage of 10.5kV, products with vector group Dyn11 can also be provided
2.Transformers with various special parameters and performance can be manufactured according to customer requirements.

66kV Oil-immersed Station Service Transformer

(1) 66kV Class 630kVA~63000KVA Three-phase Double-Winding Power Transformer with Off-circuit Tap-changer

Rated capacity (kVA)	Voltage combination and tapping range		Vector group	Energy consumption class I		Energy consumption class II		Energy consumption class III		Short-circuit impedance (%)
	HV tapping range(%)	LV (kV)		No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	
630	63±5% 66±5% 69±5%	6.3 6.6 10.5	Yd11	0.66	6.19	0.78	6.19	0.96	6.55	8
800				0.79	7.41	0.93	7.41	1.14	7.83	
1000				0.93	8.75	1.1	8.75	1.35	9.26	
1250				1.1	10.35	1.3	10.35	1.6	10.95	
1600				1.32	12.45	1.56	12.45	1.93	13.18	
2000				1.56	14.72	1.85	14.72	2.28	15.58	
2500				1.85	17.41	2.19	17.41	2.69	18.41	
3150			YNd11	2.2	20.7	2.6	20.7	3.2	21.9	
4000				2.6	24.6	3.1	24.6	3.8	25.9	
5000				3.1	27.6	3.7	27.6	4.6	29.2	
6300	63±2×2.5% 66±2×2.5% 69±2×2.5%	6.3 6.6 10.5		4.0	30.8	4.7	30.8	5.8	32.5	9
8000				4.9	36.5	5.8	36.5	7.1	38.5	
10000				5.8	43.0	6.8	43.0	8.4	45.4	
12500				6.8	51.1	8.1	51.1	9.9	54.0	
16000				8.3	62.8	9.8	62.8	12.0	66.3	
20000				9.7	76.1	11.4	76.1	14.1	80.4	
25000				11.4	90.0	13.5	90.0	16.1	95.0	
31500				13.5	108.0	16.0	108.0	19.7	114.0	
40000				16.2	126.9	19.1	126.9	23.5	134.0	
50000				19.4	150.3	22.9	150.3	28.2	158.7	
63000				22.9	178.2	27.0	178.2	33.3	188.1	

Note: Transformers with various special parameters and performance can be manufactured according to customer requirements.

(2) 66kV Class 6300kVA~63000KVA Three-phase Double-winding Power Transformer with On-load Tap-changer

Rated capacity (kVA)	Voltage combination and tapping range		Vector group	Energy consumption class I		Energy consumption class II		Energy consumption class III		Short-circuit impedance (%)
	HV tapping range(%)	LV (kV)		No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	
6300	63±8×1.25% 66±8×1.25% 69±8×1.25%	6.3 6.6 10.5	YNd11	4.4	30.8	5.2	30.8	6.4	32.5	9
8000				5.3	36.5	6.2	36.5	7.7	38.5	
10000				6.2	43.0	7.3	43	9	45.4	
12500				7.4	51.1	8.7	51.1	10.7	54	
16000				8.9	62.8	10.5	62.8	12.9	66.3	
20000				10.6	76.1	12.5	76.1	15.4	80.4	
25000				12.5	90	14.8	90	18.2	95	
31500				14.8	108	17.5	108	21.5	114	
40000				17.7	126.9	20.9	126.9	25.8	134	
50000				20.9	150.3	24.7	150.3	30.4	158.7	
63000				24.7	178.2	29.2	178.2	35.9	188.1	

Note: Transformers with various special parameters and performance can be manufactured according to customer requirements.

110kV Oil-immersed Station Service Transformer

(1) 110kV Class 6300kVA~180000KVA Three-phase Double-winding Power Transformer with Off-circuit Tap-changer

Rated capacity (kVA)	Voltage combination and tapping range		Vector group	Energy consumption class I		Energy consumption class II		Energy consumption class III		Short-circuit impedance (%)
	HV tapping range(%)	LV (kV)		No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	
6300	110±2×2.5% 115±2×2.5% 121±2×2.5%	6.3 6.6 10.5	YNd11	4.1	32	4.8	32	5.9	33	10.5
8000				4.9	38	5.8	38	7.1	40	
10000				5.8	45	6.8	45	8.4	48	
12500				6.8	53	8.1	53	9.9	56	
16000				8.3	65.7	9.8	65.7	12	69	
20000				9.7	79	11.4	79	14.1	84	
25000				11.4	94	13.5	94	16.6	99	
31500				13.5	111	16	111	19.7	117	
40000				16.2	133	19.1	133	23.5	141	
50000				19.4	158	22.9	158	28.2	166	
63000				22.9	187	27	187	33.3	198	
75000		13.8 15.75 18 21		26	212	30.7	212	37.8	224	12 ~ 14
90000				29.9	245	35.4	245	43.5	258	
120000				37.3	303	44.1	303	54.2	320	
150000				44.1	359	52.1	359	64.1	379	
180000				49.5	411	58.5	411	72.0	434	

Note: Transformers with various special parameters and performance can be manufactured according to customer requirements.

(2) 10kV Class 6300kVA~63000KVA Three-phase Three-winding Power Transformer with Off-circuit Tap-changer

Rated capacity (kVA)	Voltage combination and tapping range			Vector group	Energy consumption class I		Energy consumption class II		Energy consumption class III		Short-circuit impedance	
	HV tapping range(kV)	MV (kV)	LV (kV)		No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load oss(kW)	boost	decompression
6300	110±2×2.5% 115±2×2.5% 121±2×2.5%	36 37 38.5	6.3 6.6 10.5 21	YN yn0d11	4.9	40	5.8	40	7.1	42	HV-MV 17.5 ~ 18.5 HV-LV 10.5 MV-LV 6.5	HV-MV 10.5 HV-LV 17.5 ~ 18.5 MV-LV 6.5
8000					5.8	48	6.9	48	8.5	50		
10000					6.9	56	8.2	56	10.1	59		
12500					8.1	67	9.6	67	11.8	70		
16000					9.8	81	11.6	81	14.3	86		
20000					11.6	95	13.7	95	16.9	101		
25000					13.5	113	16	113	19.7	120		
31500					16.2	134	19.1	134	23.5	142		
40000					19.1	161	22.6	161	27.8	170		
50000					22.9	192	27	192	33.3	202		
63000					27.1	230	32	230	39.4	243		

Note: 1. The winding capacity of HV, MV and LV is (100/100/100) %.
2.Transformers with various special parameters and performance can be manufactured according to customer requirements.

(3) 110kV 6300kVA~63000kVA Three-phase Double-winding Power Transformer with On-load Tap-changer

Rated capacity (kVA)	Voltage combination and tapping range		Vector group	Energy consumption class I		Energy consumption class II		Energy consumption class III		Short-circuit impedance (%)
	HV tapping range(%)	LV (kV)		No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	
6300	110±8 ×1.25%	6.3 6.6 10.5 21	YNd11	4.4	32	5.2	32	6.4	33	10.5
8000				5.3	38	6.2	38	7.7	40	
10000				6.2	45	7.3	45	9	48	
12500				7.4	53	8.7	53	10.7	56	
16000				8.9	66	10.5	66	12.9	69	
20000				10.6	79	12.5	79	15.4	84	
25000				12.5	94	14.8	94	18.2	99	
31500				14.9	111	17.6	111	21.6	117	
40000				17.8	140	21	140	25.8	148	
50000				21	175	24.8	175	30.6	184	
63000				25	209	29.5	209	36.3	220	

Note: .Transformers with various special parameters and performance can be manufactured according to customer requirements.

(4) 110kV 6300kVA~63000kVA Three-phase Three-winding Power Transformer with On-load Tap-changer

Rated capacity (kVA)	Voltage combination and tapping range			Vector group	Energy consumption class I		Energy consumption class II		Energy consumption class III		Short-circuit impedance
	HV tapping range(kV)	MV (kV)	LV (kV)		No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load oss(kW)	
6300	110±8 ×1.25%	36 37 38.5	6.3 6.6 10.5 21	YNyn0d11	5.3	40	6.2	40	7.7	42	HV-MV 10.5 HV-lV 17.5 ~ 18.5 MV-LV 6.5
8000					6.3	48	7.5	48	9.2	50	
10000					7.5	56	8.8	56	10.9	59	
12500					8.9	67	10.5	67	12.9	70	
16000					10.6	81	12.5	81	15.4	86	
20000					12.5	95	14.8	95	18.2	101	
25000					14.9	113	17.6	113	21.6	120	
31500					17.7	134	20.9	134	25.7	142	
40000					21.2	161	25	161	30.8	170	
50000					25	192	29.6	192	36.4	202	
63000					29.8	230	35.2	230	43.3	243	

Note: 1.The winding capacity of HV, MV and LV is (100/100/100) %.
2.Transformers with various special parameters and performance can be manufactured according to customer requirements.

(5) 110kV 6300kVA~63000kVA Three-phase Double-winding Power Transformer with Off-circuit Tap-changer with 35kV LV voltage

Rated capacity (kVA)	Voltage combination and tapping range		Vector group	Energy consumption class I		Energy consumption class II		Energy consumption class III		Short-circuit impedance (%)
	HV tapping range(%)	LV (kV)		No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	
6300	110±2×2.5% 115±2×2.5% 121±2×2.5%	36 37 38.5	YNd11	4.4	33	5.2	33	6.4	35	10.5
8000				5.3	40	6.2	40	7.7	42	
10000				6.2	47	7.3	47	9	49	
12500				7.2	56	8.5	56	10.5	59	
16000				8.6	68	10.1	68	12.5	72	
20000				10.2	85	12	85	14.8	89	
25000				12.1	99	14.2	99	17.5	105	
31500				14.3	120	16.8	120	20.7	126	
40000				16.9	140	20	140	24.6	147	
50000				20.3	174	24	174	29.5	183	
63000				24	209	28.3	209	34.9	220	

Note: Transformers with various special parameters and performance can be manufactured according to customer requirements.

220kV Oil-immersed Power Transformer

(1) 220kV 31500kVA~420000kVA Three-phase, Double-winding Power Transformer with Off-circuit Tap-changer

Rated capacity (kVA)	Voltage combination and tapping range		Vector group	Energy consumption class I		Energy consumption class II		Energy consumption class III		Short-circuit impedance (%)
	HV tapping range(%)	LV (kV)		No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	
31500	220±2×2.5% 242±2×2.5%	6.3 6.6 10.5	YNd11	15	115	18	115	22	122	12 ~ 14
40000				18	134	21	134	26	142	
50000				21	161	25	161	31	170	
63000				25	188	30	188	37	199	
75000		10.5 13.8		29	213	34	213	42	225	
90000				34	246	40	246	49	259	
120000				41	304	49	304	60	321	
150000		10.5 13.8 15.75 18 20		49	360	58	360	71	380	
160000				51	378	60	378	74	399	
180000				56	413	66	413	82	436	
240000				70	484	83	484	102	511	
300000		15.75 18 20		83	577	98	577	121	609	
360000				95	662	112	662	138	698	
370000				97	675	114	675	141	713	
400000				103	716	122	716	150	755	
420000				106	742	125	742	154	783	

Note: Transformers with various special parameters and performance can be manufactured according to customer requirements.

(2) 220kV 31500kVA~300000kVA Three-phase, Three-winding Power Transformer with Off-circuit Tap-changer

Rated capacity (kVA)	Voltage combination and tapping range			Vector group	Energy consumption class I		Energy consumption class II		Energy consumption class III		Short-circuit impedance	
	HV tapping range(kV)	MV (kV)	LV (kV)		No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load oss(kW)	Boost	Decompression
31500	220±2×2.5% 230±2×2.5% 242±2×2.5%	69 115 121	6.3 6.6 10.5 21 36 37 38.5	YN yn0d11	18	138	21	138	26	145	HV-MV 22 ~ 24 HV-LV 12 ~ 14 MV-LV 7 ~ 9	HV-MV 12 ~ 14 HV-LV 22 ~ 24 MV-LV 7 ~ 9
40000					21	165	25	165	30	174		
50000					24	194	29	194	35	205		
63000					29	231	34	231	42	244		
90000			10.5 13.8 21 36 37 38.5		37	300	44	300	54	316		
120000					46	369	55	369	67	390		
150000			10.5 13.8 15.75 21 36 37 38.5		55	438	65	438	80	463		
180000					62	500	73	500	90	527		
240000					72	616	91	616	112	650		
300000					91	726	108	726	133	767		

Note: 1.The capacity load loss in the table is (100/100/100)%, for step-up type is (100/50/100)%; for step-down type can be (100/100/50)% or (100/50/100)%
2.Transformers with various special parameters and performance can be manufactured according to customer requirements.

(3) 220kV 31500kVA~240000kVA Three-phase Double-winding Power Transformer with Off-circuit Tap-changer(LV 66kV)

Rated capacity (kVA)	Voltage combination and tapping range		Vector group	Energy consumption class I		Energy consumption class II		Energy consumption class III		Short-circuit impedance (%)
	HV tapping range(%)	LV (kV)		No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	
31500	220±2×2.5% 230±2×2.5%	63 66 69	YNd11	17	129	20	129	24	136	12 ~ 14
40000				20	150	23	150	29	159	
50000				23	180	27	180	34	190	
63000				28	211	33	211	40	222	
90000				36	275	43	275	53	291	
120000				45	330	53	330	65	349	
150000				53	387	63	387	78	409	
180000				61	438	72	438	88	463	
240000				75	543	88	543	109	573	

Note: Transformers with various special parameters and performance can be manufactured according to customer requirements.

(4) 220kV 31500kVA~240000kVA Three-phase Double-winding Power Transformer with On-load Tap-changer

Rated capacity (kVA)	Voltage combination and tapping range		Vector group	Energy consumption class I		Energy consumption class II		Energy consumption class III		Short-circuit impedance (%)
	HV tapping range(%)	LV (kV)		No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	
31500	220±8×1.25% 230±8×1.25%	6.3 6.6 10.5 21 36 37 38.5	YNd11	17	115	20	115	24	122	12 ~ 14
40000				20	134	23	134	29	142	
50000				24	161	28	161	34	170	
63000				28	188	33	188	40	199	
90000				35	246	42	246	51	259	
120000		10.5 21 36 37 38.5		43	304	51	304	63	321	
150000				51	360	60	360	74	380	
180000				59	413	70	413	86	436	
120000		66 69		45	303	53	303	65	320	
150000				53	355	62	355	77	374	
180000				62	406	73	406	90	428	
240000				77	504	91	504	112	532	

Note: Transformers with various special parameters and performance can be manufactured according to customer requirements.

(5) 220kV 31500kVA~240000kVA Three-phase Three-winding Power Transformer with On-load Tap-changer

Rated capacity (kVA)	Voltage combination and tapping range			Vector group	Energy consumption class I		Energy consumption class II		Energy consumption class III		Capacity assignment (%)	Short-circuit impedance (%)
	HV tapping range(kV)	MV (kV)	LV (kV)		No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load oss(kW)		
31500	220±8×1.25% 230±8×1.25%	69 115 121	6.3 6.6 10.5 21 36 37 38.5	YN yn0d11	19	138	23	138	28	145	100/100/100 100/50/100 100/100/50	HV-MV 12 ~ 14 HV-LV 22 ~ 24 MV-LV 7 ~ 9
40000					23	165	27	165	33	174		
50000					26	194	31	194	38	205		
63000					31	231	36	231	45	244		
90000			10.5 21 36 37 38.5		40	300	47	300	58	316		
120000					51	369	60	369	74	390		
150000					59	438	70	438	86	463		
180000					68	538	81	538	99	568		
240000					85	667	100	667	123	704		

Note: 1. The data in the above sheet applies to the step-down type transformer, and the step-up type transformer are also available as requested.
2.Transformers with various special parameters and performance can be manufactured according to customer requirements.

(6) 220kV 31500kVA~24000kVA Three-phase Three-winding Autotransformer with On-load Tap-changer

Rated capacity (kVA)	Voltage combination and tapping range			Vector group	Energy consumption class I		Energy consumption class II		Energy consumption class III		Capacity assignment (%)	Short-circuit impedance (%)
	HV tapping range(kV)	MV (kV)	LV (kV)		No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load oss(kW)		
31500	220±8×1.25% 230±8×1.25%	115 121	6.3 6.6 10.5 21 36 37 38.5	YNa0d11	11	92	13	92	16	97	100/100/50	HV-MV 8 ~ 11 HV-LV 28 ~ 34 MV-LV 18 ~ 24
40000					13	113	16	113	19	119		
50000					15	134	18	134	22	142		
63000					18	161	21	161	26	170		
90000					22	211	26	211	32	222		
120000			10.5 21 36 37 38.5		28	263	33	263	41	277		
150000					33	311	39	311	48	329		
180000					37	358	44	358	54	378		
240000					46	462	54	462	66	487		

Note: 1. The data in the above sheet applies to the step-down type autotransformer.
2. Transformers with various special parameters and performance can be manufactured according to customer requirements.

330kV Oil-immersed Power Transformer

(1) 330kV 90000kVA~720000kVA Three-phase Double-winding Power Transformer with Off-circuit Tap-changer

Rated capacity (kVA)	Voltage combination and tapping range		Vector group	Energy consumption class I		Energy consumption class II		Energy consumption class III		Short-circuit impedance (%)
	HV tapping range(%)	LV (kV)		No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	
90000	345 345±2×2.5% 363 363±2×2.5%	10.5 13.8 15.75 18 20	YNd11	37	247	44	247	54	260	14 ~ 15
120000				47	306	55	306	68	323	
150000				56	362	66	362	81	382	
180000				64	415	75	415	93	438	
240000				80	515	94	515	116	543	
360000				109	722	129	722	158	762	
370000				111	736	131	736	162	777	
400000				118	780	139	780	171	824	
720000				183	1212	216	1212	266	1280	

Note: Transformers with various special parameters and performance can be manufactured according to customer requirements.

(2) 330kV 90000kVA~240000kVA Three-phase Three-winding Power Transformer with Off-circuit Tap-changer

Rated capacity (kVA)	Voltage combination and tapping range			Vector group	Energy consumption class I		Energy consumption class II		Energy consumption class III		Capacity assignment (%)	Short-circuit impedance (%)
	HV tapping range(kV)	MV (kV)	LV (kV)		No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load oss(kW)		
90000	330±2×2.5% 345±2×2.5%	121	10.5 13.8 15.75	YN yn0d11	42	302	50	302	62	318	HV-MV 24 ~ 26 HV-LV 14 ~ 15 MV-LV 8 ~ 9	100/100/100
120000					53	374	62	374	77	394		
150000					63	442	74	442	91	466		
180000					72	507	85	507	104	535		
240000					89	629	105	629	130	664		

Note: 1. The data in the above sheet are applicable to step-up transformer.
2. The capacity allocation of the step-up type can also be (100/50/100)%.
3. Step-down type transformer can be provided as required, its short circuit impedance: HV-LV 24%~26%, HV-MV14%~15%, MV-LV 8%~9%, and its capacity can be (100/100/50)% or (100/50/100)%.
4. Short circuit impedance in the sheet is based on 100% rated capacity.
5. Transformers with various special parameters and performance can be manufactured according to customer requirements.

(3) 330kV 90000kVA~360000kVA Three-phase Three-winding Autotransformer with Off-circuit Tap-changer (Regulating in Series Winding)

Rated capacity (kVA)	Voltage combination and tapping range			Vector group	Energy consumption class I		Energy consumption class II		Energy consumption class III		Short-circuit impedance (%)	Capacity assignment (%)
	HV tapping range(kV)	MV (kV)	LV (kV)		No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load oss(kW)		
90000	330±2×2.5%	121	10.5 11 35 38.5	YN a0d11	25	237	29	237	36	250	HV-MV 10 ~ 11 HV-LV 24 ~ 26 MV-LV 12 ~ 14	100/100/30
120000					31	292	36	292	45	308		
150000					37	347	44	347	54	366		
180000					42	396	50	396	62	418		
240000					53	492	62	492	77	520		
360000					72	668	85	668	104	705		

Note: 1. The data in the above sheet are applicable to step-down type transformer.
2. The step-up type transformer can be provided as required, and its short circuit impedance: HV-LV 10%~11%, HV-MV 24%~26%, MV-LV 12%~14%.
3. Short circuit impedance in the sheet is based on 100% rated capacity.
4. Transformers with various special parameters and performance can be manufactured according to customer requirements.

(4) 330kV 90000kVA~360000kVA Three-phase Three-winding Autotransformer with On-load Tap-changer (Regulating at the End of Series Winding)

Rated capacity (kVA)	Voltage combination and tapping range			Vector group	Energy consumption class I		Energy consumption class II		Energy consumption class III		Short-circuit impedance (%)	Capacity assignment (%)
	HV tapping range(kV)	MV (kV)	LV (kV)		No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load oss(kW)		
90000	330±8×1.25% 345±8×1.25%	121	10.5 11 35 38.5	YN a0d11	26	235	31	235	38	248	HV-MV 10 ~ 11 HV-LV 24 ~ 26 MV-LV 12 ~ 14	100/100/30
120000					32	292	38	292	47	308		
150000					38	345	45	345	55	364		
180000					43	396	51	396	63	418		
240000					54	492	64	492	79	520		
360000					74	668	87	668	107	705		

Note: 1. The data in the above sheet are applicable to step-down type transformer. Step-up type transformer can be provided as required.
2.Short circuit impedance in the sheet is the value based on 100% rated capacity.
3. Transformers with various special parameters and performance can be manufactured according to customer requirements.

(5) 330kV 90000kVA~360000kVA Three-phase Three-winding Autotransformer with On-load Tap-changer (Regulating at MV 110kV Line End Side)

Rated capacity (kVA)	Voltage combination and tapping range			Vector group	Energy consumption class I		Energy consumption class II		Energy consumption class III		Short-circuit impedance (%)	Capacity assignment (%)
	HV (kV)	MV tapping range(kV)	LV (kV)		No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load oss(kW)		
90000	330 345	121±8×1.25%	10.5 11 35 38.5	YNa0d11	27	251	32	251	39	265	HV-MV 10 ~ 11 HV-LV 26 ~ 28 MV-LV 16 ~ 17	100/100/30
120000					34	311	40	311	49	329		
150000					40	369	47	369	58	390		
180000					46	423	54	423	66	447		
240000					56	526	66	526	82	555		
360000					76	713	90	713	111	752		

Note: 1. The data in the above sheet are applicable to step-down type transformer. Step-up type transformer can be provided as required.
2.Short circuit impedance in the sheet is the value based on 100% rated capacity.
3.Transformers with various special parameters and performance can be manufactured according to customer requirements.

(6) 330kV 90000kVA~360000kVA Three-phase Three-winding Autotransformer with Off-circuit Tap-changer (Regulating at MV 220kV line end side)

Rated capacity (kVA)	Voltage combination and tapping range			Vector group	Energy consumption class I		Energy consumption class II		Energy consumption class III		Short-circuit impedance (%)	Capacity assignment (%)
	HV (kV)	MV tapping range(kV)	LV (kV)		No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load oss(kW)		
90000	330 345	230±2×2.5% 230±3×2.5% 242±2×2.5% 242±3×2.5%	10.5 11 35 38.5	YNa0d11	13	264	15	264	18	278	HV-MV 10 ~ 11	100/100/30
120000					16	327	19	327	23	345		
150000					19	388	22	388	27	409		
180000					21	445	25	445	31	469		
240000					27	552	32	552	39	582		
360000					37	752	44	752	54	794		

Note: 1. The data in the sheet above are applicable to step-down type transformer. Step-up type transformer can be provided as required.
2.Short circuit impedance in the sheet is the value based on 100% rated capacity.
3.Short circuit impedance for HV-MV and MV-LV shall be agreed by the manufacturer and the user.
4.Transformers with various special parameters and performance can be manufactured according to customer requirements.

(7) 330kV 90000kVA~360000kVA, Three-phase, Three-winding Autotransformer with On-load Tap-changer (Regulating at MV 220kV line end side)

Rated capacity (kVA)	Voltage combination and tapping range			Vector group	Energy consumption class I		Energy consumption class II		Energy consumption class III		Short-circuit impedance (%)	Capacity assignment (%)
	HV (kV)	MV tapping range(kV)	LV (kV)		No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load oss(kW)		
90000	330 345 363	230±4×1.25% 230±8×1.25% 242±4×1.25% 242±8×1.25%	10.5 11 35 38.5	YNa0d11	14	264	16	264	20	278	HV-MV 10 ~ 11	100/100/30
120000					17	327	20	327	25	345		
150000					20	388	24	388	30	409		
180000					23	445	27	445	34	469		
240000					29	552	34	552	42	582		
360000					40	753	47	753	58	795		

Note: 1. The data in the sheet above are applicable to step-down type transformer. Step-up type transformer can be provided as required.
2.Short circuit impedance in the sheet is the value based on 100% rated capacity.
3.Short circuit impedance for HV-MV and MV-LV shall be agreed by the manufacturer and the user.
4.Transformers with various special parameters and performance can be manufactured according to customer requirements.

500kV Oil-immersed Power Transformer

(1) 500kV 100MVA~484MVA Single-phase, Double-winding Power Transformer with Off-circuit Tap-changer

Rated capacity (kVA)	Voltage combination and tapping range		Vector group	Energy consumption class I		Energy consumption class II		Energy consumption class III		Short-circuit impedance (%)
	HV tapping range(%)	LV (kV)		No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	
100	$500/\sqrt{3}$ $525/\sqrt{3}$ $535/\sqrt{3}$ $550/\sqrt{3}$	13.8;15.75	Ii0	34	203	40	203	49	214	14
120		15.75;18;20		39	234	46	234	56	247	
200		15.75;18;20;24		63	342	74	342	91	361	
223		18		68	371	81	371	99	391	
240		18;20;24		72	392	85	392	105	413	
260		18;20		77	414	91	414	112	437	
380		24;27		102	549	121	549	149	580	16 or 18
400				106	570	125	570	154	601	
410				108	581	128	581	158	613	
484				123	657	145	657	178	694	

Note: Transformers with various special parameters and performance can be manufactured according to customer requirements.

(2) 500kV 120MVA~1170MVA Three-phase, Double-winding Power Transformer with Off-circuit Tap-changer

Rated capacity (kVA)	Voltage combination and tapping range		Vector group	Energy consumption class I		Energy consumption class II		Energy consumption class III		Short-circuit impedance (%)
	HV tapping range(%)	LV (kV)		No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	
120	500 525 550	13.8; 15.75	YNd11	41	356	49	356	60	375	14
160				50	441	59	441	72	466	
240				69	599	81	599	100	632	
300		13.8; 15.75; 18		80	707	94	707	116	746	
370		15.75; 18; 20		94	810	111	810	136	855	
400		18; 20; 24		96	855	114	855	140	903	
420		15.75; 18; 20		102	860	120	860	148	907	14 or 16
480		15.75; 18; 20		110	954	130	954	160	1007	
600		15.75; 18; 20; 24		143	1202	169	1202	208	1268	
720		18; 20; 24		168	1382	198	1382	244	1458	
750		20; 22		173	1422	205	1422	252	1501	16 or 18
780		22		176	1467	208	1467	256	1549	
860				190	1575	224	1575	276	1663	
1140		27		237	1949	280	1949	344	2057	
1170				242	1980	286	1980	352	2090	

Note: Transformers with various special parameters and performance can be manufactured according to customer requirements.

(3) 500kV 120MVA~1170MVA Three-phase, Double-winding Power Transformer with Off-circuit Tap-changer

Rated capacity (kVA)	Voltage combination and tapping range			Vector group	Energy consumption class I		Energy consumption class II		Energy consumption class III		Short-circuit impedance (%)	Capacity assignment (MVA)
	HV (kV)	MV tapping range(kV)	LV (kV)		No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load oss(kW)		
120					28	207	33	207	40	219	HV-MV 12	120/120/40
167					33	248	39	248	48	261		167/167/40
250					47	333	55	333	68	352	HV-LV 34 ~ 38	167/167/60
334					58	428	68	428	84	451		250/250/60
400					66	491	78	491	96	518	MV-LV 20 ~ 22	250/250/80
120	$500/\sqrt{3}$	$230/\sqrt{3}$	35		28	221	33	221	40	233		334/334/100
167	$525/\sqrt{3}$	$230/\sqrt{3}$	36		33	261	39	261	48	276	HV-MV 12	400/400/120
250	$550/\sqrt{3}$	±2×2.5%	37		47	356	55	356	68	375		120/120/40
334		$242/\sqrt{3}$	38.5		58	459	68	459	84	485	HV-LV 42 ~ 46	167/167/60
400		±2×2.5%	63		66	522	78	522	96	551		250/250/60
120			66		28	221	33	221	40	233	MV-LV 28 ~ 30	250/250/80
167					33	261	39	261	48	276		334/334/80
250					47	356	55	356	68	375	HV-MV 14 ~ 15	334/334/100
334					58	459	68	459	84	485		400/400/120
400					66	522	78	522	96	551	HV-LV 42 ~ 46	120/120/40
				Ia0i0								167/167/60
											MV-LV 28 ~ 30	250/250/80
												334/334/80
												334/334/100
												400/400/120

Note: Transformers with various special parameters and performance can be manufactured according to customer requirements.

(4) 500kV 120MVA~400MVA Single-phase, Three-winding Autotransformer with On-load Tap-changer (Regulating at MV line end side)

Rated capacity (kVA)	Voltage combination and tapping range			Vector group	Energy consumption class I		Energy consumption class II		Energy consumption class III		Short-circuit impedance (%)	Capacity assignment (MVA)
	HV (kV)	MV tapping range(kV)	LV (kV)		No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load loss(kW)	No-load loss(kW)	On-load oss(kW)		
120					28	212	33	212	40	223	HV-MV 12	120/120/40
167					33	257	39	257	48	271		167/167/40
250					47	342	55	342	68	361	HV-LV 34 ~ 38	167/167/60
334					61	441	72	441	88	466		250/250/40
400					72	504	85	504	104	532	MV-LV 20 ~ 22	250/250/80
120					28	225	33	225	40	238		334/334/100
167	$500/\sqrt{3}$		35		33	270	39	270	48	285	HV-MV 12	400/400/120
250	$525/\sqrt{3}$	$230\sqrt{3}$	36		47	365	55	365	68	385		120/120/40
334	$550/\sqrt{3}$	±8×1.25%	37		61	477	72	477	88	504	HV-LV 42 ~ 46	167/167/60
400			38.5		72	549	85	549	104	580		250/250/60
120			63		28	225	33	225	40	238		250/250/80
167			66		33	270	39	270	48	285	MV-LV 28 ~ 30	334/334/80
250					47	365	55	365	68	385		334/334/100
334					61	477	72	477	88	504	HV-MV 14 ~ 15	400/400/120
400					72	549	85	549	104	580		120/120/40
120					28	225	33	225	40	238		167/167/60
167					33	270	39	270	48	285	HV-LV 42 ~ 48	250/250/80
250					47	365	55	365	68	385		334/334/80
334					61	477	72	477	88	504	MV-LV 28 ~ 30	334/334/100
400					72	549	85	549	104	580		400/400/120

Note: 1. Short circuit impedance is the value based on 100% rated capacity.
2.Transformers with various special parameters and performance can be manufactured according to customer requirements.

750kV Oil-immersed power transformer

Rated capacity (kVA)	Voltage combination and tapping range			Vector group	No-load loss(kW)	On-load loss(kW)	No-load current (%)	Short-circuit impedance (%)	Capacity assignment (MVA)
	HV (kV)	MV tapping range(kV)	LV (kV)						
334	$765/\sqrt{3}$	$230/\sqrt{3}$ ±2×2.5%	63	Ia0I0	95	570	0.15	HV-MV14 HV-LV50 MV-LV33	334/334/100
500					110	860	0.15	HV-MV 19 ~ 22 HV-LV46 MV-LV 23 ~ 24	500/500/150
500		$345/\sqrt{3}$ ±2×2.5%			125	860	0.15	HV-MV14 HV-LV50 MV-LV33	500/500/150
700					130	1225	0.15	HV-MV18 HV-LV58 MV-LV36	700/700/233

Note: Transformers with various special parameters and performance can be manufactured according to customer requirements.

1000kV Oil-immersed power transformer

Rated capacity (kVA)	Voltage combination and tapping range			Vector group	No-load loss(kW)	On-load loss(kW)	No-load current (%)	Short-circuit impedance (%)	Capacity assignment (MVA)
	HV (kV)	MV tapping range(kV)	LV (kV)						
1000	$1050/\sqrt{3}$	$525/\sqrt{3}$ ±4×1.25%	110	Ia0i0	180	1500	0.15	HV-MV18 HV-LV62 MV-LV40	1000/1000/334

Special transformer

◆ Model definition

1. Rectifier transformer model is ZHSSPT-24000/110

ZH-Electrochemical application S-three-phase S-water-cooled P-forced oil circulation T-voltage regulating transformer 24000-capacity, kVA 110-system nominal voltage at HV side, kV

2. Furnace transformer, model is HCDSPZ-22000/35

HC-Calcium carbide furnace transformer D-single phase (S for three phase) S-water cooled P-forced oil circulation Z-with on-load tap changer 22000-capacity (kVA) 35-System nominal voltage at HV side (kV)

3.Railway traction transformer, model is QYS- (16000 + 20000) / 110

QY-traction transformer S-three-phase (D for single phase) (16000 + 20000) -Capacity (kVA) 110-Nominal system voltage at HV side(kV)

4. Reactor, model is: BKD-50000 / 500

B-Shunt type K-reactor D-single phase (S for three-phase) 50000-Capacity (kvar) 500-System nominal voltage at HV side(kV)

◆ Normal service conditions

（1）Altitude above sea level:≤1000m;
（2）Ambient temperature
Maximum temperature:+40℃ :
Maximum monthly average temperature:+30℃ ;
Maximum yearly average temperature+20℃ ;
Minimum temperature:-25℃
（3）Power supply: Approximate sine wave, three-phase roughly symmetrical
（4）Installation: Indoor or outdoor, without the obvious contamination.
Note: Special conditions should be noted before order.

Rectifier transformer

（1）10kV Rectifier transformer

Capacity(kVA)	Model	AC Network side voltage(V)	DC Network side voltage(V)	Connection displacement	Number of pulse wave(single set)
2720	ZS-2720/6	6000	575(DC)	△/Y-△	12
4000	ZS-4000/10	10000	575(DC)	△/Y-△	12
5000	ZS-5000/10	10000	575(DC)	△/Y-△	12
5300	ZS-5300/10	10000	3550(DC)	△/Y-△	6
7200	ZSF-7200/10	10000	575(DC)	△/Y-△	12
9000	ZSF-9000/10	10000	600(DC)	△/Y-△	12
10000	ZSF-10000/10	10000	600(DC)	△/Y-△	12
11250	ZPS-11250/10	10000	2300(communication)	△/Y-△	12

Note:
1. The above DC voltage is the reference value, which can be designed according to the user requirements;
2.Rectifier transformers can be manufactured according to user requirements.

（1）35kV,110kV,220kV Rectifier transformer

Capacity (kVA)	Model	AC Network side voltage(V)		DC Network side voltage(V)	Connection displacement	Number of pulse wave(single set)
		The primary side	Secondary side			
6000	ZHSZ-6000/35	35000	/	240-130	△/Y-△	12
8000	ZHSZ-8000/35	36000	/	380-170	△/Y-△	12
10500	ZHSZ-10500/35	33000	/	440-150	△/Y-△	12
12500	ZHSSPT-12500/35	35000	33410-1590	366-17	YNao or YNd11	12
18000	ZHSSPT-18000/35	36500	37220-25390	417-282		12
21000	ZHSSPT-21000/35	35000	36210-24400	440-300		12
24000	ZHSSPT-24000/35	33000	36890-34740	770-520		12
38800	ZHSSPT-38800/35	36400	36220-5880	480-80		12
24000	ZHSSPT-24000/110	110000	116400-98560	1480-300		12
38000	ZHSSPT-38000/110	115000	120800-95680	72-460		12
120000	ZHSSPT-120000/220	Design as the user requirements				

Note: 1. The above AC voltage and DC voltage is the reference value, which can be designed according to the user requirements;
2.The pulse wave number is for one set, which can be designed with different pulse waves (such as 12 / 24 / 36 / 48 / 72) according to user requirements.
3.Rectifier transformers can be manufactured according to user requirements.

Furnace transformer

(1) Mine submerged arc furnace transformer with On-load Tap-changer

Application industries	Rated capacity kVA	Primary voltage kV	Secondary voltage V	No.of taps	Regulating type	Vector group	Short-circuit impedance (%)
Ferroalloy: ferrosilicon, ferrochromium, ferrotungsten, ferrovanadium, etc Silicon compounds: industrial silicon, silicon calcium, silicon manganese, silicon chromium, silicon aluminum, etc Others: calcium carbide, magnesium oxide	5000	10 35 66 110	70 ~ 210 110 ~ 330 400 ~ 850 Select different voltage ranges for users according to different smelting types and capacities	From 11 to 47 taps, also determined according to customer requirements	with single-phase Tap changer (maximum allowable tap difference of each phase is 3)	single-phaseli0 (Yd11, YNd11, Dd0 Connected in Three phases Yd11, YNd11, Dd0 Yd11, YNd11, Dd0) , three-phase Yd11, YNd11, Dd0	4 ~ 8 (35 kV) 5 ~ 9 (≥ 66 kV)
	6300						
	8000						
	10000						
	12500						
	16000						
	10000						
	12500						
	16000						
	20000						
	25000						
	31500						
	40000						
	50000						

(2) Electric arc furnace transformer with On-load Tap-changer for steel industry

Rated capacity kVA	Primary voltage kV	Secondary voltage V		Regulating type	No.of taps	Vector group	Short-circuit impedance (%)
		Constant power	Constant current				
10000	35 38.5	280 ~ 240	240 ~ 100	with single-phase Tap changer (maximum allowable tap difference of each phase is 3)	From 11 to 23 taps, also determined according to customer requirements	D d 0 ; Y d 11 ; YN d11	7 ~ 8
12500		314 ~ 270	270 ~ 116				
16000		353 ~ 305	305 ~ 137				
20000	35 38.5 66 110 121	392 ~ 340	340 ~ 158			35 kV D d 0 ; Y d 11 ; YN d11 110 kV YN d11	35 kV 6 ~ 7 110 kV 7.5 ~ 8.5
25000		436 ~ 380	380 ~ 184				
31500		489 ~ 425	425 ~ 201				
40000		547 ~ 475	475 ~ 223				
50000		610 ~ 530	530 ~ 250				
63000		673 ~ 585	585 ~ 277				
80000		760 ~ 660	660 ~ 310				
100000		1065 ~ 865	865 ~ 665				

Note: Transformer cooling method may be force oil water cooling (OFWF) or force oil air cooling (OFAF). The rated capacity, rated voltage, Vector group and performance parameters can also be designed according to user requirements.

Railway traction transformer

(1) 110kV "V,v" Railway traction transformer

Rated capacity (kVA) AB+BC	Rated voltage kV		Vector group	No-load loss kW	On-load loss kW	No-load current %	Short-circuit impedance (%)
	The primary side	Secondary side					
6300+10000	110kV±4×2.5%	27.5kV	Vv0 or Vv6	15	70	0.6	8.4 or 10.5
8000+10000				17	82	0.6	
10000+10000				19	90	0.5	
10000+12500				20	100	0.5	
12500+12500				23	105	0.5	
12500+16000				25	110	0.5	
16000+16000				27	115	0.5	
16000+20000				28	120	0.5	
20000+20000				29	128	0.5	
20000+25000				34	140	0.5	
25000+25000				37	145	0.5	
25000+31500				42	160	0.5	
31500+31500				47	175	0.5	

Note: Rated capacity, rated voltage, Vector group and performance parameters can also be designed according to user requirements.

(2) 110kV "V,x" Railway traction transformer

Rated capacity (kVA) AB+BC	Rated voltage kV		Vector group	No-load loss kW	On-load loss kW	No-load current %	Short-circuit impedance (%)
	The primary side	Secondary side					
6300+10000	110kV±4×2.5%	2×27.5kV	I, i0, i6+ I, i0, i6	19.5	88	0.6	8.4 or 10.5
8000+10000				22	102	0.6	
10000+10000				25	112	0.5	
10000+12500				26	125	0.5	
12500+12500				30	132	0.5	
12500+16000				32.5	137	0.5	
16000+16000				35	144	0.5	
16000+20000				36.5	150	0.5	
20000+20000				38	160	0.5	
20000+25000				44	170	0.5	
25000+25000				48	184	0.5	
25000+31500				55	200	0.5	
31500+31500				61	219	0.5	

Note: Rated capacity, rated voltage, Vector group and performance parameters can also be designed according to user requirements.

(3) 220kV "V,v" Railway traction transformer

Rated capacity (kVA) AB+BC	Rated voltage kV		Vector group	No-load loss kW	On-load loss kW	No-load current %	Short-circuit impedance (%)
	The primary side	Secondary side					
20000+20000	110kV±4×2.5%	27.5kV	Vv0 or Vv6	42	140	0.60	10.5 or 12.0
20000+25000				46	153	0.60	
25000+25000				50	166	0.5	
25000+31500				54	182	0.5	
31500+31500				58	198	0.5	
31500+40000				64	217	0.5	
40000+40000				70	236	0.5	
40000+50000				76	253	0.5	
50000+50000				82	280	0.5	
50000+60000				88	305	0.5	
60000+60000				95	330	0.5	

Note: Rated capacity, rated voltage, Vector group and performance parameters can also be designed according to user requirements.

(4) 220kV "V,x" Railway traction transformer

Rated capacity (kVA) AB+BC	Rated voltage kV		Vector group	No-load loss kW	On-load loss kW	No-load current %	Short-circuit impedance (%)
	The primary side	Secondary side					
20000+20000	220kV±4×2.5%	2×27.5kV	I, i0, i0+ I, i0, i0 or I, i0, i6+ I, i0, i6	42	154	0.60	10.5 or 12.0
20000+25000				46	168	0.60	
25000+25000				50	184	0.5	
25000+31500				54	200	0.5	
31500+31500				58	218	0.5	
31500+40000				64	239	0.5	
40000+40000				70	260	0.5	
40000+50000				76	278	0.5	
50000+50000				82	308	0.5	
50000+60000				88	336	0.5	
60000+60000				95	363	0.5	

Note: Rated capacity, rated voltage, Vector group and performance parameters can also be designed according to user requirements.

Reactor

(1) Basic parameters for 35kV and 66kV three-phase reactors

Rated capacity Mvar	Rated voltage kV	Permissible long-term overexcitation multiple	Connectionism	The rated reactive Ω	Loss kW
7.2	37	1.1	Three-phase Y connection, not grounded	190.2	30
10				136.9	40
20				68.5	80
45				45	120
60				22.8	140
60	66	1.1	Three-phase Y connection, not grounded	72.6	130

(2) Basic parameters of 110kV Single-phase, Three-phase reactors

Rated capacity Mvar	Rated voltage kV	Permissible long-term overexcitation multiple	Connectionism	The rated reactive Ω	Loss kW
10	115/√3	1.05	Three sets of single-phase reactor are connected into Y group, grounded directly or through the neutral grounded reactor	440.8	40
	121/√3			488	
20	115/√3			220.4	75
	121/√3			244	
30	115/√3			146.9	105
	121/√3			162.7	
40	115/√3			110.2	130
	121/√3			122	
60	115/√3			73.5	180
	121/√3			81.3	
80	115/√3			55.1	210
	121/√3			61	
30	115	1.05	Three phase, Y connection, grounded directly or through neutral grounded reactor	440.8	120
	121			488	
60	115			220.4	200
	121			244	
90	115			146.9	270
	121			162.7	
120	115			110.2	330
	121			122	

(3) Basic parameters for 220kV Single-phase or Three-phase reactors

Rated capacity Mvar	Rated voltage kV	Permissible long-term overexcitation multiple	Connectionism	The rated reactive Ω	Loss kW
10	230/√3	1.05	Three sets of single-phase reactor are connected into Y group, grounded directly or through the neutral grounded reactor	1763.3	40
	242/√3			1952.1	
15	230/√3			1175.6	55
	242/√3			1301.4	
20	230/√3			881.7	65
	242/√3			976.1	
25	230/√3			705.3	80
	242/√3			780.9	
30	230/√3			587.8	90
	242/√3			650.7	
40	230/√3			440.8	110
	242/√3			488	
30	230	1.05	Three phase, Y connection, grounded directly or through neutral grounded reactor	1763.3	120
	242			1952.1	
45	230			1175.6	160
	242			1301.4	
60	230			881.7	180
	242			976.1	
75	230			705.3	210
	242			780.9	
90	230			587.8	240
	242			650.7	
120	230			440.8	300
	242			488	

(4) Basic parameters for 330kV Single-phase or Three-phase reactors

Rated capacity Mvar	rated voltage kV	Permissible long-term overexcitation multiple	connectionism	The rated reactive Ω	loss kW
10	345/√3	1.05	Three sets of single-phase reactor are connected into Y group, grounded directly or through the neutral grounded reactor	3967	60
	363/√3			4392	
20	345/√3			1984	70
	363/√3			2196	
30	345/√3			1322	80
	363/√3			1464	
40	345/√3			992	90
	363/√3			1098	
50	345/√3			793	110
	363/√3			878	
30	345	1.05	Three phase, Y connection, grounded directly or through neutral grounded reactor	3967	160
	363			4392	
60	345			1984	210
	363			2196	
90	345			1322	240
	363			1464	
120	345			992	270
	363			1098	
150	345			793	330
	363			878	

(5) Basic parameters for 500kV Single-phase or Three-phase reactors

Rated capacity Mvar	Rated voltage kV	Permissible long-term overexcitation multiple	Connectionism	The rated reactive Ω	Loss kW
30	525/√3	1.05	Three phase, Y connection, grounded directly or through neutral grounded reactor	3062	80
	550/√3			3361	
40	525/√3			2297	90
	550/√3			2521	
50	525/√3			1838	110
	550/√3			2017	
60	525/√3			1532	135
	550/√3			1681	
70	525/√3			1312	160
	550/√3			1440	
80	525/√3			1148	180
	550/√3			1260	

Product Standards

IEC60076-1	Power transformers Part1:General
IEC60076-2	Power transformers Part2: Temperature rise
IEC60076-3	Power transformers Part3:Insulation level, dielectric tests and external clearances in air
IEC60076-4	Power transformer Part4:Guide to the lightning impulse and switching impulse testing-Power transformers and reactors
IEC60076-5	Power transformers Part5: Ability to withstand short circuit
IEC60076-6	Power transformers Part6:Reactors
IEC60076-7	Power transformers Part7：Loading guide for oil-immersed power transformers
IEC60076-8	Power transformers-Application guide
IEC60076-10	Power transformers Part10：Determination of sound levels
IEC60071-1	Insulation co-ordination Part1：Definitions, principles and rules
IEC60296	Fluids for electrotechnical applications-Unused mineral insulating oils for transformers and switchgears
IEC60137	Insulated bushings for alternating voltages above 1000V
IEC60214-1	Tap-changers Part1:Performance requirements and test methods
IEC60270	High-voltage test techniques-Partial discharge measurements
IEC60529	Degrees of protection provided by enclosures (IP code)

统一社会信用代码
91370900760983900W

营业执照

（副 本） 8-1

名 称 山东泰开变压器有限公司

类 型 有限责任公司(自然人投资或控股的法人独资)

法定代表人 赵兴迎

经营范围 各类输变电设备、变压器、电抗器、高压试验设备、材料及配件的设计、开发、制造、销售、技术及咨询服务；五金交电、检测仪器、机电设备及零配件和原辅材料、变压器油、润滑油、自产产品的销售、技术服务及进出口；承装（修、试）电力设施业务；发电设备及配件的销售及进出口业务；电力工程设计、施工总承包。（依法须经批准的项目，经相关部门批准后方可开展经营活动）。

注册资本 陆亿元整

成立日期 2004 年 04 月 14 日

营业期限 2004 年 04 月 14 日至 年 月 日

住 所 泰安市高新技术开发区龙潭南路

登记机关 泰安市工商行政管理局 (2)

2019 年 04 月 29 日

国家企业信用信息公示系统网址：http://www.gsxt.gov.cn

市场主体应当于每年1月1日至6月30日通过国家企业信用信息公示系统报送公示年度报告

国家市场监督管理总局监制

Business License

Unified Social Credit Code:
91370900760983900W

(COPY) 8-1

Company name: Shandong Taikai Transformer Co., Ltd.

Company property: Limited Company

Name of legal representative: Zhao Xingying

Business scope: All kinds of electric transmission and transformation equipment, transformers, reactors and high voltage test equipment's design, development, manufacture, sales and technical and consulting services; the import business of mechanical equipment, spare parts and raw materials; export business of products made by ourselves.

Registered Capital: 600 million RMB

Founding Date: April 14th, 2004

Operation period: April 14th, 2004 to Now

Address: Southern Longtan Road, High-tech Development Zone, Tai' an City, Shandong Province, P. R. China.

Tai 'an Administration for Industry and Commerce

April 29, 2019

华信技术检验有限公司
VOLUCHING TECHNICAL INSPECTION LTD
质量管理体系认证证书
QMS CERTIFICATE OF REGISTRATION
VTI certifies herewith that

Shandong Taikai Transformer Co., Ltd.

Unified social credit identifier 91370900760983900W

Longtan south Road, Tai'an hi-tech Development Zone, P.R. China

demonstrated a Quality Management Systems
that complies with the requirements of

GB/T19001-2016 idt ISO9001:2015

The scope of certification:

Design and manufacture of transformer, reactor, special transformer up to 1000kV

Registration Number: 0422Q10076R1L Valid from: 2022-01-25 Valid until: 2025-01-24
Issue Date: 2022-01-20

IAF CNAS

华信技术检验有限公司
VOLUCHING TECHNICAL INSPECTION LTD
环境管理体系认证证书
EMS CERTIFICATE OF REGISTRATION
VTI certifies herewith that

Shandong Taikai Transformer Co., Ltd.

Unified social credit identifier 91370900760983900W

Longtan south Road, Tai'an hi-tech Development Zone, P.R. China

has demonstrated an Environmental Management System
that complies with the requirements of

GB/T24001-2016 idt ISO14001:2015

The scope of certification:

Design and manufacture of transformer, reactor, special transformer up to 1000kV

Registration Number: 0422E10077R4L Valid from: 2022-01-25 Valid until: 2025-01-24
Issue Date: 2022-01-20

IAF CNAS

华信技术检验有限公司
VOLUCHING TECHNICAL INSPECTION LTD
职业健康安全管理体系认证证书
OHSMS CERTIFICATE OF REGISTRATION
VTI certifies herewith that

Shandong Taikai Transformer Co., Ltd.

Unified social credit identifier 91370900760983900W

Longtan south Road, Tai'an hi-tech Development Zone, P.R. China

has demonstrated an Occupational Health and Safety Management System
that complies with the requirements of

GB/T45001-2020 idt ISO 45001:2018

The scope of certification:

Design and manufacture of transformer, reactor, special transformer up to 1000kV

Registration Number: 0422S10074R4L Valid from: 2022-01-25 Valid until: 2025-01-24
Issue Date: 2022-01-20

CNAS

China National Accreditation Service for Conformity Assessment

LABORATORY ACCREDITATION CERTIFICATE

(Registration No. CNAS L9974)

Shandong Taikai Transformer Co,. Ltd

Quality Inspection Center

Longtan South Road, High-Tech Development Zone, Tai'an, Shandong, China

is accredited in accordance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories(CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence to undertake the service described in the schedule attached to this certificate.

The scope of accreditation is detailed in the attached schedule bearing the same registration number as above. The schedule form an integral part of this certificate.

Date of Issue：2017-05-22

Date of Expiry：2023-05-21

Date of Initial Accreditation：2017-05-22

Signed on behalf of China National Accreditation Service for Conformity Assessment

China National Accreditation Service for Conformity Assessment(CNAS) is authorized by Certification and Accreditation Administration of the People's Republic of China (CNCA) to operate the national accreditation schemes for conformity assessment. CNAS is a signatory of the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement (ILAC MRA) and the Asia Pacific Laboratory Accreditation Cooperation Mutual Recognition Arrangement (APLAC MRA).
The validity of the certificate can be checked on CNAS website at http://www.cnas.org.cn/english/findanaccreditedbody/index.shtml

DNV·GL

KEMA INSPECTION REPORT

3101-17

Object	A single-phase power transformer
Type	Autotransformer ODFS-250000/500 **Serial No.** 160150
	250 MVA – 525/√3 kV –824,8 A - 50 Hz
Client	Shandong Taikai Transformer Co., Ltd., Shandong, China
Manufacturer	Shandong Taikai Transformer Co., Ltd., Shandong, China
Inspected by	DNV GL Netherlands B.V., Arnhem, the Netherlands
Test location	Southern High-Tech Development Zone Taian City, Shandong, China
Date of tests	21 to 24 August 2017
Test specification	The tests were in accordance with client's instructions. Test procedure and test parameters were based on IEC 60076-1:2011, IEC 60076-2:2011, IEC 60076-3:2013, IEC 60076-10:2016, IEC 60076-18:2012.
Regarding	Type Tests, Special tests, Routine tests
Summary and conclusion	The object passed the tests.

This report applies only to the object tested. The responsibility for conformity of any object having the same type references as that tested rests with the Manufacturer.

This report consists of 79 pages in total.

DNV GL Netherlands B.V.

J.P. Fonteijne
Executive Vice President
KEMA Laboratories

KEMA Laboratories

Arnhem, 16 October 2017

Version: 1

DNV·GL

KEMA TYPE TEST CERTIFICATE OF SHORT-CIRCUIT PERFORMANCE

2111-17

Object	A single-phase oil-immersed auto-transformer
Type	ODFS-250000/500 **Serial No.** 160150

Rated power	250 MVA
Rated voltage	525/√3 kV / 230/√3 kV ± 2 x 2,5% / 36 kV
Connection symbol	Ia0i0
Rated frequency	50 Hz

Manufacturer	Shandong Taikai Transformer Co. Ltd., Shandong, China *)
Client	Shandong Taikai Transformer Co. Ltd., Shandong, China
Tested by	DNV GL Netherlands B.V., Arnhem, the Netherlands
Date of tests	21 and 24 April and 21 to 25 August 2017

The object, constructed in accordance with the description, drawings and photographs incorporated in this Certificate, has been subjected to the series of proving tests in accordance with

IEC 60076-5 (2006)

This Certificate has been issued by DNV GL following exclusively the STL Guides.

The results are shown in the record of proving tests and the oscillograms attached hereto. The values obtained and the general performance are considered to comply with the above standard with respect to the dynamic ability to withstand short-circuits.

This Certificate applies only to the object tested. The responsibility for conformity of any object having the same type references as that tested rests with the Manufacturer.
*) as declared by the manufacturer

This Certificate consists of 89 pages in total.

DNV GL Netherlands B.V.

J.P. Fonteijne
Executive Vice President
KEMA Laboratories

KEMA Laboratories

Arnhem, 6 September 2017

Version: 1

CESI

INSPECTION REPORT CONFIDENTIAL APPROVED B2016089

Subject	Test Witnessing Activity on Single-Phase Power Transformer Rated Voltage 500/√3 + 14 - 4 x 1.25% / 168/√3 / 71.5 kV, Power 166670/166670/75000 kVA, Vector group I0i0+d, 50 Hz, Cooling system ONAN / ONAF / OFAF (50% / 75 %/100%) , Serial n. 12017.
Type	DFPSZ-166670/500
Manufacturer	Shandong Taikai Transformer Co., Ltd. Taian Shandong Province , China
Place and date of inspection	Shandong Taikai Transformer Co. Ltd. Testing Center Taian from May 22 Th to May 25rd, 2012
Test Result	The Single-Phase Power Transformer Serial n. 12017, Type DFPSZ-166670/500 manufactured by SHANDONG TAIKAI TRANSFORMER CO., LTD., passed the tests listed.
Notes	Test Inspector: Tiziano Bianchini

N. of pages	18	N. of pages annexed
Issue date	May 25th, 2012	
Prepared	TCE/CER/PRO	Tiziano BIANCHINI
Verified	TCE/CER/PRO	Giorgio CRIPPA
Approved	TCE/CER	Fiorenzo BREGANI

CESI S.p.A.
Testing & Certification Division
Business Area Certification
Il Responsabile
Fiorenzo Bregani

Mod. RAPP v. 6

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Capitale sociale € 8.550.000 interamente versato
C.F. e numero iscrizione Reg. Imprese di Milano 00793580150
P.I. IT00793580150
N. R.E.A. 429222

Intertek

Certificate No. 21476

ASTA Certificate
of Type Tests

Laboratory Ref. No:	170119
Apparatus:	A three phase, three windings, 225 / 225 / 75 MVA ONAN, 300 / 300 / 100 MVA ONAF, 230/132/33 kV(U_r), 50 Hz, Category III, YNa0d1, oil filled auto-transformer. The HV and MV windings have non-uniform insulation. The HV winding has 17 taps and the principal tap is tap 9. The transformer is fitted with an ABB on-load tap changer.
Designation:	OSFSZ-300000 / 220
Manufacturer:	Shandong Taikai Transformer Co., Ltd. Hi-tech Industrial Development Zone(southern part), Taian City, Shandong, P.R.China
Tested By:	Shandong Taikai Transformer Co., Ltd. Hi-tech Industrial Development Zone(southern part), Taian City, Shandong, P.R.China
Date(s) of tests:	28 October to 2 November 2017

The apparatus, constructed in accordance with the description, drawings and photographs incorporated in this certificate has been subjected to the series of proving tests in accordance with:

IEC 60076-1: Edition 3.0 2011-04 Clauses 11.1.2.1 i, 11.1.2.2, 11.1.3, 11.1.4 l, 11.2 to 11.8 and 11.12
IEC 60076-2: Edition 3.0 2011-02 Clauses 6 and 7
IEC 60076-3: Edition 3.0 2013-07 Clauses 9 to 11, 13 and 14
IEC 60076-10: Edition 2.0 2016-03 Clauses 11 and 12

The results are shown in the Record of Proving Tests attached hereto. The values obtained and the general performance is considered to comply with the above Standard(s) and to justify the ratings assigned by the manufacturer as stated below.

For ratings assigned by the manufacture and proved by the tests see page 1

The Certificate applies only to the apparatus tested. The responsibility for conformity of any apparatus having the same or other designations rests with the Manufacturer.

This Certificate comprises this front sheet, 1 ratings page plus 84 other pages and 15 drawings as detailed on pages 2 and 3.

UKAS PRODUCT CERTIFICATION 010

ASTA Observer
Hero Luo

Certification Manager

4TH January 2018 Date

Intertek

Certificate No. 19390

ASTA Certificate

of Type Tests

Laboratory Ref. No: CB14002

Apparatus: Three phase, three windings, 240000/240000/160000 KVA, 220 / 115 / 37 kV (rated voltages: LL), YNyn0d11, ONAN, 60 Hz Category III, oil filled transformer. The high voltage winding has 17 tap positions with the principal tapping on tap 9b. The HV and MV windings have non-uniform insulation. The transformer is fitted with an MR on-load tap changer.

Designation: SSZ13-240000/220. Serial number: BYQ-1407

Manufacturer: Shandong Taikai Transformer Co., Ltd.
Hi-tech Industrial Development Zone (southern part),
Taian City, Shandong, 271000, P. R. China

Tested By: China National Transformer Quality Supervision and Testing Center
Shenyang Transformer Institute Co., Ltd., Transformer Laboratory
No. 18 Hoshitai South Street, Shenbei New District,
Shenyang, Liaoning Province, China
and at
Shandong Taikai Transformer Co., Ltd.

Date(s) of tests: 8 to 19 April and 5 to 8 May 2014

The apparatus, constructed in accordance with the description, drawings and photographs incorporated in this certificate has been subjected to the series of proving tests in accordance with
IEC 60076 - 1 Edition 3.0, 2011-04 Clauses 11.1, 11.2, 11.3, 11.4, 11.5, 11.6, 11.7, 11.8 and 11.12.
IEC 60076 - 2 Edition 3.0 2011-02 Clauses 6 and 7.
IEC 60076 - 3 Edition 2.0, 2000-03 Clauses 7, 8, 11, 12, 13, 14 and 15.
IEC 60076 - 5 Edition 3.0, 2006-02 Clause 4.2.
IEC 60076 - 10 Edition 1.0, 2001-05 Clauses 11 and 13

The results are shown in the record of Proving Tests attached hereto. The values obtained and the general performance is considered to comply with the above Standard(s) and to justify the ratings assigned by this manufacturer as stated below.

For ratings assigned by the manufacturer and proved by the tests see page 1

This Certificate applies only to the apparatus tested. Responsibility for conformity of any apparatus having the same or other designations rests with the Manufacturer.
This Certificate comprises this front sheet, 1 ratings page plus 128 other pages and 9 drawings as detailed on pages 2 to 4.

UKAS PRODUCT CERTIFICATION 010

P. J. Ryan
ASTA Observer

Certification Manager

2nd December 2014 Date

Record of Proving Tests ASTA

Laboratory Reference No: CB14002

Certificate No 19390

RATINGS ASSIGNED BY THE MANUFACTURER AND PROVED BY THE TESTS ON TRANSFORMER SSZ13-240000/220. Serial Number BYQ-1407

Characteristic Verified	Clause	Verified Tests and Ratings
Rated Voltages, U_r	IEC 60076-1 Clause 6.4.1	U_r = 220 ± 8 x 1.25% / 115 / 37 kV
Routine tests	Clause 11.1.2	Verified
Load loss at Reference temperature of 75°C	Clause 11.4	HV to MV = 603.4 kW for Tap 9B HV to LV = 395.6 kW for Tap 9B MV to LV = 179.9 kW
Short-circuit impedance	Clause 11.4	HV to MV = 13.54 % for Tap 9B HV to LV = 16.32 % for Tap 9B MV to LV = 6.60 %
No-load loss and No-load current	Clause 11.5	128.4 kW at 100% rated voltage 0.06 % at 100% rated voltage
Rated Power ONAN, S_r	IEC 60076-2 Clause 7	240000 / 240000 / 160000 KVA
Rated Insulation Level	IEC 60076-3 * Clauses 11, 12, 13, 14 and 15	HV: U_m 252 / SI 750 / LI 950 / LIC 1050 / AC 395 kV
		MVN: U_m 126 / LI 480 / AC 200 kV
		MV: U_m 126 / LI 480 / LIC 530 / AC 200 kV
		MVR: U_m 72.5 / LI 325 / AC 140 kV
		LV: U_m 40.5 / LI 200 / LIC 226 / AC 95 kV
Ability to Withstand Short circuit	IEC 60076-5 Clause 4.2	Verified
Sound Pressure Level @ 0.3 m	IEC 60076-10 Clause 11	59 dB(A) Guaranteed 65 dB(A)
Sound Power Level	Clause 13	83 dB(A) Guaranteed 90 dB(A)

* All tests were performed in accordance with IEC 60076-3 2000. At the client's request some tests were performed at higher values of U_r, as per the standard's values defined in Tables 2 and 3 of GB 1094.3 2003.

Date of tests: 23 April to 23 July 2014

Peter Ryan ASTA Observer

Record Of Proving Tests ASTA

Laboratory Reference No: CB14002

SCHEDULE OF TESTS

The transformer was tested in accordance with the following standards:
IEC 60076 - 1 Edition 3.0, 2011-04 Clauses 11.1, 11.2, 11.3, 11.4, 11.5, 11.6, 11.7, 11.8 and 11.12
IEC 60076 - 2 Edition 3.0 2011-02 Clauses 6 and 7
IEC 60076 - 3 Edition 2.0, 2000-03 Clauses 7, 8, 11, 12, 13, 14 and 15
IEC 60076 - 5 Edition 3.0, 2006-02 Clause 4.2
IEC 60076 - 10 Edition 1.0, 2001-05 Clauses 11 and 13

Test	Standard	Clause No.	Page No.
Routine tests	IEC 60076-1	Clauses 11.1.2	
Measurement of winding resistance	IEC 60076-1	Clause 11.2	15 to 21
Measurement of voltage ratio and check of phase displacement	IEC 60076-1	Clause 11.3	22 to 24
Measurement of short-circuit impedance and load loss on taps 1, 9b and 17	IEC 60076-1	Clause 11.4	25 to 28
Measurement of no-load loss and current at 100% and 90% and 110% of rated voltage	IEC 60076-1	Clause 11.5 and Clause 11.1.2.2 e	29 and 30
Test on on-load tap changers	IEC 60076-1	Clause 11.7	32
Leak testing with pressure (tightness test)	IEC 60076-1	Clause 11.8	33
Check of core and frame insulation	IEC 60076-1	Clause 11.12	35
Check of ratio and polarity of built -in current transformers	IEC 60076-1	Clause 11.1.2.11	34
Determination of winding insulation capacitances	IEC 60076-1	Clause 11.1.2.2 e	37
Determination of bushing insulation capacitances	IEC 60076-1	Clause 11.1.2.2 e	38
d.c. insulation resistance	IEC 60076-1	Clause 11.1.2.2 b	38
Measurement of winding dissipation factor (tan δ)	IEC 60076-1	Clause 11.1.2.2 c	36
Measurement of bushing dissipation factor (tan δ)	IEC 60076-1	Clause 11.1.2.2 c	38
Measurement of dissolved gasses in oil (DGA)	IEC 60076-1	Clause 11.1.2.2 d	39
Switching Impulse – SI	IEC 60076-3	Clause 15	40, 41, 45
Separate source AC withstand voltage test	IEC 60076-3	Clause 11	42 and 45
Long duration induced AC voltage test with PD	IEC 60076-3	Clause 12	43 to 45

8 to 19 April and 5 to 8 May 2014
Dates of Tests

P. J. Ryan
ASTA Observer

intertek
Total Quality. Assured.

ASTA CERTIFICATE OF TYPE TESTS

Project No: SHA445737 **Certificate No:** ASTA-TYPE-0001120

Applicant: Shandong Taikai Transformer Co., Ltd.
Hi-tech Industrial Development Zone(southern part), Taian City, Shandong, P.R.China

Apparatus: A three phase, 350 / 350 / 100 MVA ONAF, 252 / 252 / 72 MVA ONAN, (230 ± 8 x 1.25%) /135/34.5 kV, 50 Hz, Category III, YNa0d1, oil filled transformer. The HV and LV windings have non-uniform insulation. The HV winding has 17 taps and the principal tap is tap 9B. The transformer is fitted with an ABB on-load tap changer.

Manufactured By: Shandong Taikai Transformer Co., Ltd.
Hi-tech Industrial Development Zone(southern part), Taian City, Shandong, P.R.China

Test Report No: 212998

Designation: OSFZ11-350000/230

The apparatus which is representative of the designation, supplied drawings and photographs has been evaluated in accordance with:

IEC 60076-1:2011	Clauses 11.1.2.1 i), 11.1.2.2 a) to e), 11.1.3 d), 11.1.3 e), 11.1.4 l), 11.2 to 11.10 and 11.12
IEC 60076-2:2011	Clauses 6 and 7
IEC 60076-3:2013+A1:2018	Clauses 9, 10, 11.3, 12, 13.3, 13.4 and 14
IEC 60076-10:2016	Clauses 11 and 12
And the STL Guide to IEC 60076 Issue 7.0, 18th February 2021, where applicable	

The results are shown in the record of tests attached hereto. The values obtained and the general performance is considered to comply with the above Standard(s) and to justify the ratings assigned by the manufacturer as stated on the ratings page(s) of this Certificate. This Certificate applies only to the apparatus tested. Responsibility for conformity of any apparatus having the same or other designations rests with the Manufacturer.

UKAS PRODUCT CERTIFICATION 0010

Certification Engineer

Certification Officer

11th May 2021 Date

intertek
Total Quality. Assured.

ASTA CERTIFICATE OF TYPE TEST

Project No: SHA107302 **Certificate No:** ASTA-TYPE-0001202

Applicant: Shandong Taikai Transformer Co., Ltd.
Hi-tech Industrial Development Zone(southern part), Taian City, Shandong, P.R.China

Apparatus: A three phase, 20000 kVA, (35000±3×2.5%) / 10500 V (U_r), 50 Hz, ONAN, Category II, YNd11, oil transformer. The high voltage winding has 7 taps and the principal tap is tap 4.

Manufactured By: Shandong Taikai Transformer Co., Ltd.
Hi-tech Industrial Development Zone(southern part), Taian City, Shandong, P.R.China

Test Report No: B210077

Designation: SZ22-20000/35-NX1

The apparatus which is representative of the designation, supplied drawings and photographs has been evaluated in accordance with:

IEC 60076-1: 2011	Clauses 11.1.2.1 i), 11.1.3 e), 11.1.4 c), 11.1.4 d), 11.1.4 h), 11.1.4 l), 11.1.4 n), 11.2 to 11.10 and 11.12
IEC 60076-2: 2011	Clauses 6 and 7
IEC 60076-3: 2013+A1: 2018	Clauses 9, 10, 11.2, 13.3 and 13.4
IEC 60076-5: 2006	Clause 4.2
IEC 60076-10: 2016	Clauses 11 and 12

and the STL Guide to IEC 60076 Issue 7.0, 18 February 2021, where applicable

The results are shown in the record of tests attached hereto. The values obtained and the general performance is considered to comply with the above Standard(s) and to justify the ratings assigned by the manufacturer as stated on the ratings page(s) of this Certificate. This Certificate applies only to the apparatus tested. Responsibility for conformity of any apparatus having the same or other designations rests with the Manufacturer.

UKAS PRODUCT CERTIFICATION 0010

Certification Engineer

Certification Officer

19th July 2021 Date

intertek
Total Quality. Assured.

Project No: SHA107302 **Certificate No:** ASTA-TYPE-0001202

Verification of a transformer

Characteristic verified	Clause/ Subclause	Verified tests and ratings	
Rated voltages, U_r	IEC 60076-1	U_r = (35 ±3 x 2.5%) / 10.5 kV	
No load loss and No-load current	IEC 60076-1 Clause 11.1.3 e)	5540 W at 90 % rated voltage 8350 W at 110 % rated voltage 0.04 % at 90 % rated voltage 0.06 % at 110 % rated voltage	
Rated power, S_r	IEC 60076-2 Clause 7	20000 kVA ONAN	
Rated insulation level	IEC 60076-3* Clauses 10, 11.2, 13.3 and 13.4	HV: HVN: LV:	U_m 36 / LI 200 / LIC 220 / AC 85 kV U_m 36 / LI 200 / AC 85 kV U_m 12 / LI 75 / LIC 85 / AC 35 kV
Ability to withstand short-circuit	IEC 60076-5 Clause 4.2	Verified	
Sound pressure level @ 0.3 m under no-load current and rated voltage, ONAN	IEC 60076-10 Clause 11	40 dB(A)	
Sound power level @ 0.3 m under no-load current and rated voltage, ONAN	IEC 60076-10 Clause 12	58 dB(A), Guaranteed 75 dB(A)	
Sound pressure level @ 1.0 m under no-load current and rated voltage, ONAN	IEC 60076-10 Clause 11	38 dB(A)	
Sound power @ 1.0 m under no-load current and rated voltage, ONAN	IEC 60076-10 Clause 12	58 dB(A), Guaranteed 75 dB(A)	

Note: * the test values for the applied voltage test were higher than the standard's requirement, the LIC test value for the LV winding was higher than the standard's requirement.

RECORD OF PROVING TESTS
Laboratory Ref. No: B210077

ASTA
Page 8 of 85

SCHEDULE OF TESTS

The transformer was tested in accordance with the following standards:

IEC 60076-1: 2011 Clauses 11.1.2.1 i), 11.1.3 e), 11.1.4 c), 11.1.4 d), 11.1.4 h), 11.1.4 l), 11.1.4 n), 11.2 to 11.10 and 11.12
IEC 60076-2: 2011 Clauses 6 and 7
IEC 60076-3: 2013+A1: 2018 Clauses 9, 10, 11.2, 13.3 and 13.4
IEC 60076-5: 2006 Clause 4.2
IEC 60076-10: 2016 Clauses 11 and 12
and the STL Guide to IEC 60076 Issue 7.0, 18 February 2021, where applicable.

Test	Standard	Clause No.	Page No.
Routine tests			
Measurement of winding resistance	IEC 60076-1	Clause 11.2	15
Measurement of voltage ratio and check of phase displacement	IEC 60076-1	Clause 11.3	16
Measurement of short-circuit impedance and load loss	IEC 60076-1	Clause 11.4	17 and 18
Measurement of no-load loss and current at rated voltage	IEC 60076-1	Clause 11.5	19 and 20
Tests on on-load tap changers	IEC 60076-1	Clause 11.7	21
Leak testing with pressure for liquid-immersed transformers (tightness test)	IEC 60076-1	Clause 11.8	22
Check of the ratio and polarity of built-in current transformers	IEC 60076-1	Clause 11.1.2.1 i)	21
Check of core and frame insulation for liquid immersed transformers with core or frame insulation	IEC 60076-1	Clause 11.12	46
Applied voltage test (AV)	IEC 60076-3	Clause 10	23
Induced voltage withstand test (IVW)	IEC 60076-3	Clause 11.2	23
Insulation of auxiliary wiring (AuxW)	IEC 60076-3	Clause 6	24
Type tests			
Temperature rise type test	IEC 60076-2	Clauses 6 and 7	25 to 27
Determination of sound level	IEC 60076-10	Clauses 11 and 12	28 to 33
Measurement of no-load loss and current at 90 % and 110 % of rated voltage	IEC 60076-1	Clause 11.1.3 e)	19 and 20
Full wave lightning impulse test (LI)	IEC 60076-3	-	See the special test*
Special test			
Short-circuit withstand test	IEC 60076-5	Clause 4.2	34 to 38

Note: * the LI test was included in the LIC tests as per the standard.
Date of tests: 24 May to 01 June 2021 Daniel Zhu, ASTA Observer

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SCHEDULE OF TESTS (continued)

Test	Standard	Clause No.	Page No.
Special tests (Continued)			
Chopped wave lightning impulse test for the line terminals (LIC)	IEC 60076-3	Clause 13.3	39 to 42
Lightning impulse test on a neutral terminal on the HV neutral terminal (LIN)	IEC 60076-3	Clause 13.4	43
Determination of capacitances windings-to-earth and between windings	IEC 60076-1	Clause 11.1.4 c)	44
Measurement of dissipation factor (tan δ) of the insulation system capacitances	IEC 60076-1	Clause 11.1.4 d)	44
Measurement of zero-sequence impedance(s) on three-phase transformers	IEC 60076-1	Clause 11.6	45
Measurement of d.c. insulation resistance between each winding to earth and between windings	IEC 60076-1	Clause 11.1.4 n)	46
Vacuum deflection test for liquid immersed transformers	IEC 60076-1	Clause 11.9	47
Pressure deflection test for liquid immersed transformers	IEC 60076-1	Clause 11.10	48
Measurement of frequency response (Frequency Response Analysis or FRA)	IEC 60076-1	Clause 11.1.4 h)	49
Measurement of dissolved gasses in dielectric liquid	IEC 60076-1	Clause 11.1.4 n)	50
Measurement of the harmonics of the no load current and voltage	-	-	51
Transition resistance measurement on on-load tap-changers	-	-	52

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国际互认
检测
TESTING
CNAS L0681

CHPTL

TEST REPORT

№: CTQC/B-18.085

Test object name: Shunt reactor
Test object type: BKS-40000/420
Entrusted by: Shandong Taikai Transformer Co., Ltd.
Manufacturer: Shandong Taikai Transformer Co., Ltd.
Kind of testing: Trust inspection

CHINA NATIONAL TRANSFORMER QUALITY SUPERVISION AND TESTING CENTER
SHENYANG TRANSFORMER RESEARCH INSTITUTE CO., LTD.

▼ ODFPS-1000000/1000 UHV transformer

▼ ODFPS-500000/750 transformer

▼ ODFS-334000/500 transformer

▼ OSFPSZ-360000/500 transformer

Partial Users

OSFPSZ-360000/330 transformer, operated at JISCO Yuzhong Iron & Steel Co., Ltd

ODFS-334000/500 transformer, operated at Gaotang Substation in Liaocheng City, Shandong Province.

BKD-40000/500 reactor, operated at Xinjiang Hami Power Plant

BKD-70000/525, BKD-58300/525 Reactor, operated at the project site of LADWP

OSFZ-300000/230 transformer, operated at Barisal Substation in Bangladesh

QYS-(16000+12500)/110 Railway traction transformer, operated at Zunyi urban section of Sichuan-Guizhou Railway

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中国华电 CHD

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Quality and Service Commitment

1.Strengthen quality management, ensure the effective operation of the quality system, and ensure that products shall meet the relevant standards or contract requirements stipulated in the Standardization Law

2.Introduce the performance and application requirements of products to users, provide relevant technical information, and act as a good user adviser. If any quality problem is found during the use of the product, we will give the handling suggestion within 2 hours after receiving the notice from the user. If on-site solution is required, technical service personnel shall be dispatched within 8 hours.

3. Before operation, company will send service personnel to the site to be responsible for installation and debugging after receiving the service notice .

4.For products exceeding the warranty period, we guarantee to provide maintenance accessories and perform maintenance services according to user needs.