

Cast Resin Transformers



Introduction

Works

Fuji Electric Corporation has two cast resin transformer production bases: Chiba works in Japan, and Shanghai Fuji Electric Transformer Co., Ltd. in China.

Chiba works



Shanghai Fuji Electric Transformer Co.,Ltd.



Production records

Fuji Electric's cast resin transformer works in Chiba was established in 1974, which became the first cast resin transformer works in Japan. Chiba works has produced over 90,000 cast resin transformers of which 3,000 units were exported to 55 countries all over the world.

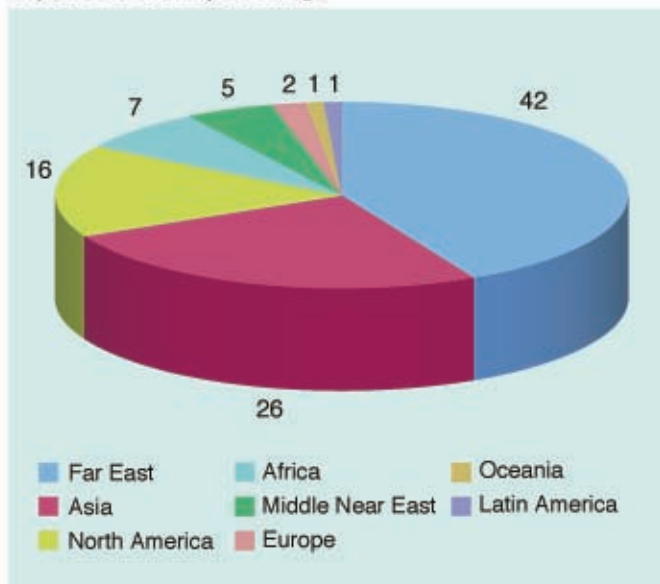
Since the beginning of operation in 1998, Shanghai Fuji Electric Transformer has been awarded various certifications including ISO 9001 and has produced over 10,000 cast resin transformers.

●Maximum rating

Primary voltage: 36 kV

Rated capacity: 24,000 kVA

Exported areas in percentage



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Advantages of Cast Resin Transformer

Fire resistant

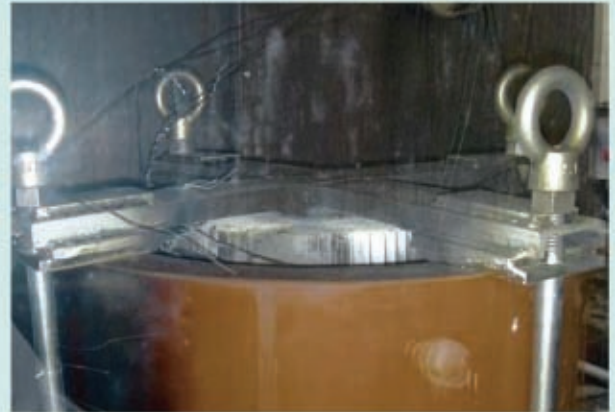
Epoxy resin is safe against fire since it has self-extinguishing properties and is fire resistant. Our cast resin transformer passed the all tests of IEC 60076-11 in 2006.

- Climatic class: C2
- Environmental class: E2
- Fire behavior class: F1

Start of fire-test



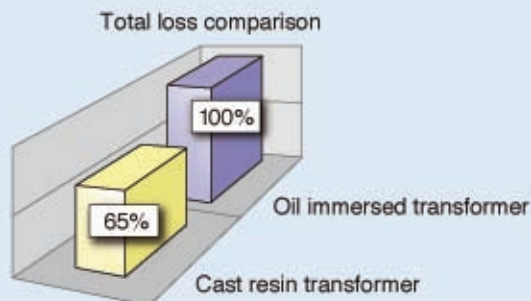
After test (completely extinguishing)



Energy saving effects

A sheet coil and wound core construction minimize total loss remarkably, thus reducing the electricity charges and saving energy.

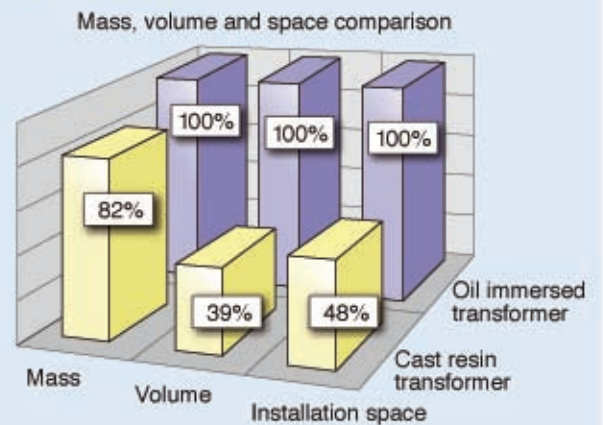
Three-phase 500 kVA



Compact and light

Cast resin transformer is made smaller and lighter comparing with oil-immersed transformer. Thus it can be installed in slim type cubicle, which minimizes the installation space.

Three-phase 500 kVA



Easy maintenance

No insulation oil is required, so maintenance and inspection are easy.

Features of Product

1. Vacuum-casting
2. Aluminum winding (Optional: copper winding)
3. Sheet-winding
4. Partial discharge free
5. Various product lineups
6. Swift delivery

Standard type
High efficiency type
Low-noise type
For rectifier

Vacuum-casting

Cast resin transformer is manufactured with vacuum casting method using metal pattern, its resin layer is thick and the surface is smooth. Thus it has following excellent characteristics.

Void-less

Vacuum-casting method realizes highly reliable, voidless molded winding with excellent partial discharge characteristics.

Fire prevention

Molded insulated parts are fire resistant since they have self-extinguishing properties.

Resistance to humidity and dust

All winding conductors are molded. They have remarkable humidity resistance which prevents insulation materials from deteriorating due to dust and dirt during operation.

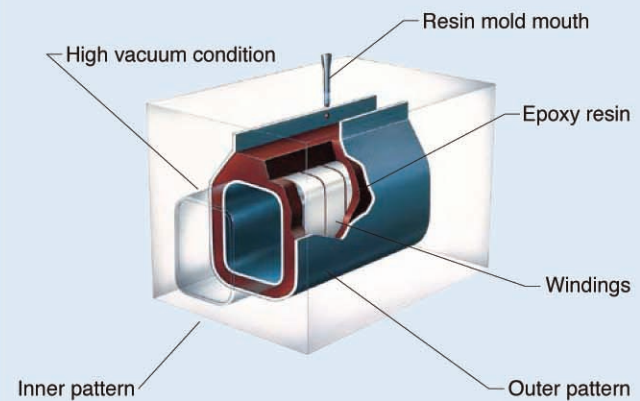
Robust construction

Molded winding is highly resistant to secondary short-circuit fault and surface cracking.

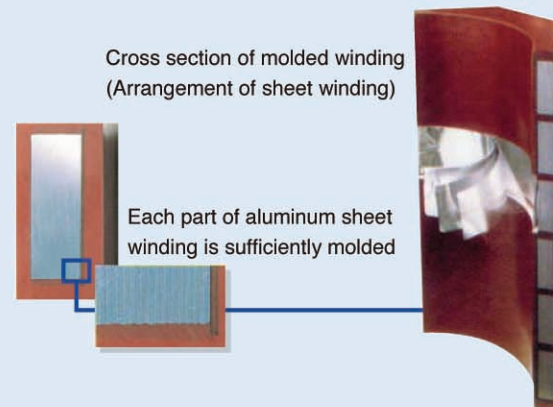
High reliability

Vacuum-casting process is carried out automatically with advanced customized facilities, to manufacture highly reliable molded winding.

Condition of molding epoxy resin



Cross section of molded winding (Arrangement of sheet winding)



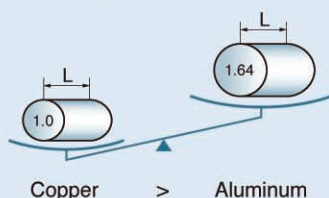
Aluminum winding

(1) Weight reduction

The aluminum winding weights approximately one half of the copper winding.

	Copper : Aluminum
Conductivity [%]	100 : 61
Cross sectional area ratio	1 : 1.64
Gravity [g/cm ³]	8.9 : 2.7
Gravity ratio	3.3 : 1
Mass ratio	100 : 50

Comparison of the weight in the same resistance

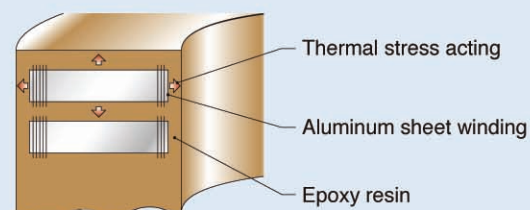


(2) Large mechanical strength

Aluminum's thermal expansion coefficient is close to resin, thus reducing thermal stress effectively.

Material	Thermal expansion coefficient [mm/mm.h.°C]
Aluminum	2.3×10^{-5}
Copper	1.6×10^{-5}
Epoxy resin	3.3×10^{-5}

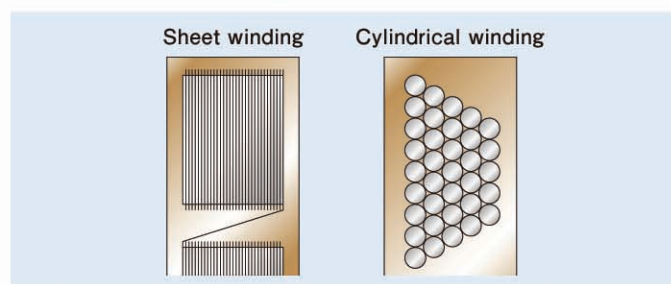
Thermal stress acting on winding



Sheet winding

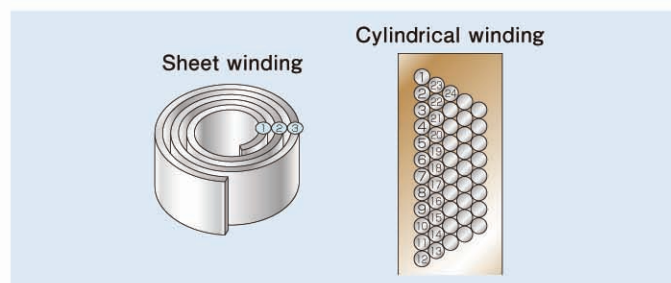
(3) Downsizing

Sheet winding has high lamination factor.



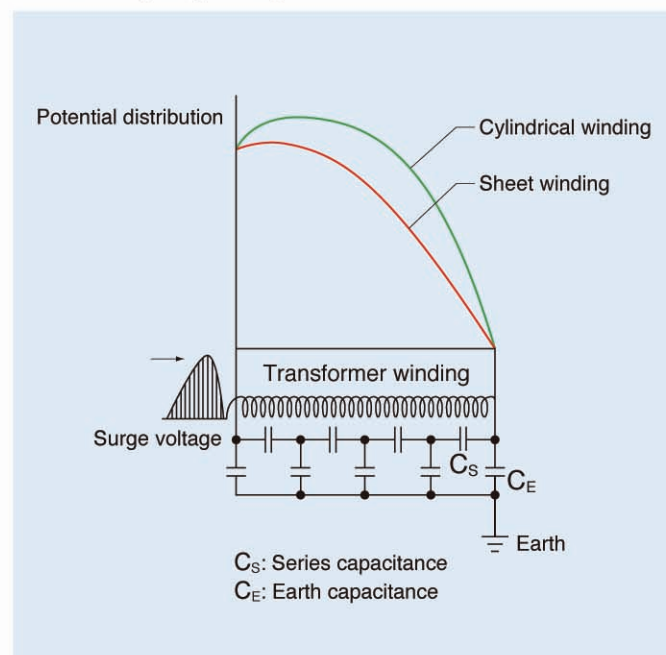
(4) High insulation reliability

In case of sheet winding, the voltage between turns is only for one turn.



(5) Surge stability

Sheet winding is effective to reduce potential oscillation caused by surge voltage.



Partial discharge free

We have developed the materials, structures and manufacturing systems that realize excellent partial discharge characteristics. From the viewpoint of cast resin transformer's reliability, the excellent partial discharge characteristics is the most important. Thus we have adopted the following stricter standard than any other standards.

Company standard:

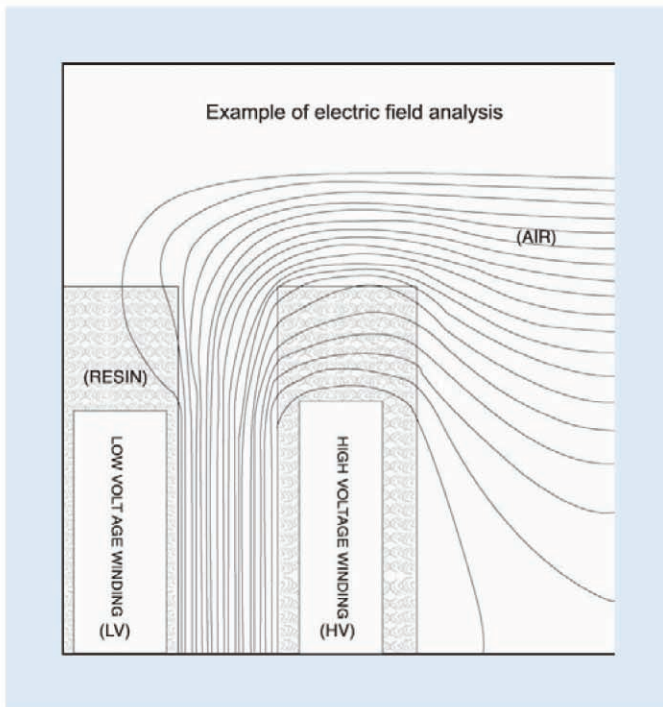
- All units are subject to partial discharge test.
- Applied voltage is twice the operating voltage.
- Partial discharge is less than 10 pC.

Electric field analysis

The insulation of cast resin transformer is composed of resin-air composite insulation.

The distributed voltages of individual transformer parts depend on their respective dimensions.

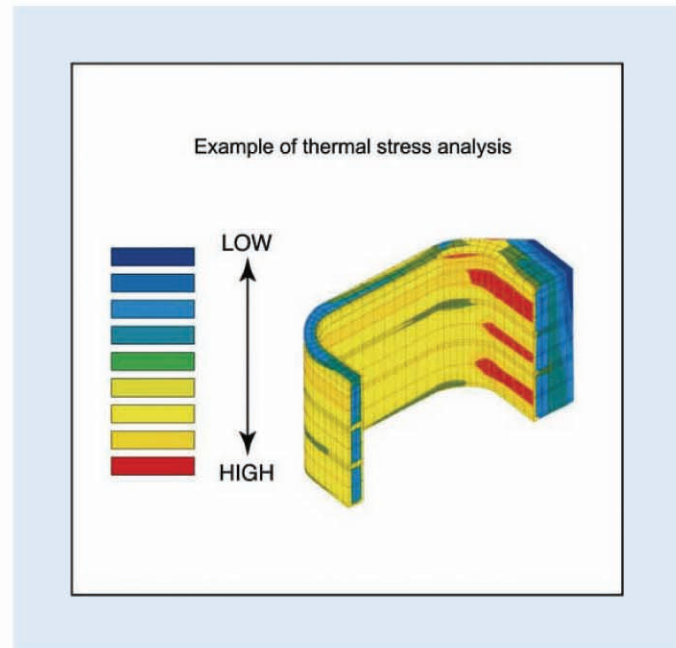
Thus, appropriate dimensions for insulation are designed with electric field analysis of the individual parts of the winding including air space.



Thermal stress analysis

Molded winding composed of conductor and insulating material (e.g resin) is subjected to thermal stresses due to the difference in the thermal expansion coefficient between conductor and resin, and the thermal distribution in the winding block, where the winding temperature varies with the load fluctuation of the transformer.

The stress value obtained in thermal stress analysis is used to design optimum winding structure for high crack-resistance of winding.



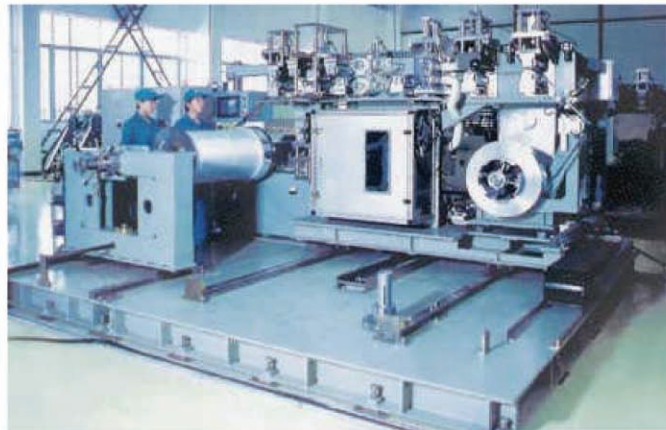
Production Facilities Tests and Inspections



Vacuum-casting plant



High voltage foil winding machine



Core cutting machine



Partial discharge measurement



The test items:

a) Routine tests:

- Measurement of insulation resistance
- Measurement of winding resistance
- Measurement of voltage ratio and check of phase displacement
- Measurement of short-circuit impedance and load loss
- Measurement of no-load loss and current
- Separate-source AC withstand voltage test
- Induced AC withstand voltage test
- Partial discharge measurement

b) Type tests:

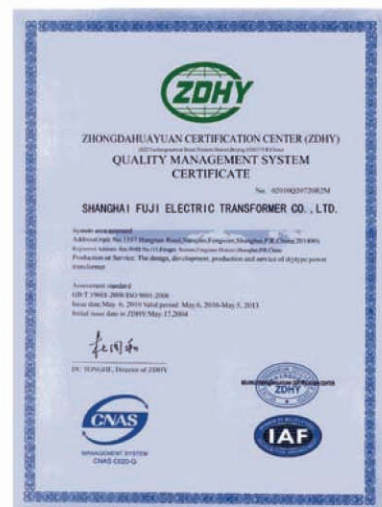
- Lightning impulse test
- Temperature-rise test
- Measurement of sound level



ISO 9001
JIS Q 9001
MS JAB
CM004
ISO9001
Original registration: 23rd August 1994
Registration date: 23rd August 2009



ISO14001
Original registration: 24th March 1996
Registration date: 24th March 2007
ISO certifications of Chiba works



ISO certification of Shanghai Fuji Electric Transformer Co., Ltd.

Applications

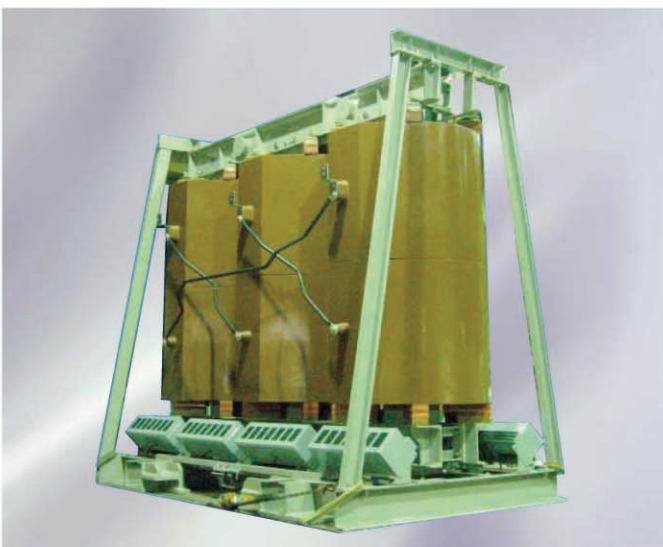
- Multistory buildings
- Hospitals
- Hotels
- Laboratories
- Shopping centers
- Building complexes
- Schools
- Art galleries
- Theaters
- Underground shopping centers
- Petrochemical plants
- Industrial complexes
- Underground railways
- Railway substations
- Tunnels
- Cranes
- Water and sewerage plants
- Power supply for construction sites
- Ships
- Refuse disposal plants
- Wind power sites



Sites where compact size and light weight are required
(Urban multistory buildings, etc.)



Sites where high reliability is required
(Public facilities, etc.)



The exterior appearance of transformer
(17000 kVA, 22/6.6 kV)



Sites where fire prevention is the highest priority
(Stadiums, hospitals, underground shopping centers, hotels, etc.)



Sites where there are airborne contaminants and extremely severe environments (Chemicals, steels, automobiles, underground construction sites etc.)



Sites where easy maintenance is required (Power stations, industrial complexes, buildings, underground railways, etc.)



Transformer cubicle for substation in building (5000 kVA)



Sites where high reliability and easy maintenance are required (Public facilities such as museums, airports, etc.)



The exterior appearance of transformer (2700 kVA, 33/0.59 kV)



Wind power site

Standard Specifications

Standard		IEC 60076-11: 2004			IEEE Std C57.12.01-1998			
Normal service condition	Highest	[°C]	40			40		
	Average	[°C]	30/day, 20/year			30/day		
	Lowest	[°C]	-25 (Outdoor), -5 (Indoor)			-30		
Altitude		[m]	Not more than 1000			Not more than 1000		
Number of phases			3			3		
Frequency		[Hz]	50, 60			60		
Highest voltage		[kV]	12	24	36	15	25	34.5
Separate-source voltage withstand	Standard (Option)	[kV]	28	50	70	31 (34, 37)	37 (40, 50)	50 (70)
Lightning impulse insulation class	Standard (Option)	[kV]	75	95 (125)	145 (170)	60 (95, 110)	110 (125, 150)	150 (200)
Insulation class			F			-		
Insulation system temp.		[°C]	155			150		
Average temp. rise limit		[K]	100			90		
Rated capacity		[kVA]	30			15		
			50			30		
			80			45		
			100			75		
			125			112.5		
			160			150		
			200					
			250			225		
			315			300		
			400					
			500			500		
			630					
			800			750		
			1000			1000		
			1250					
			1600			1500		
			2000			2000		
			2500			2500		
			3150					
			4000			3750		
	5000			5000				
	6300							
	8000			7500				
	10000			10000				
	12500			12500				
	16000			15000				
	20000			20000				

※: Contact us for any other requests.

20 kV Series for IEC

Standard specifications

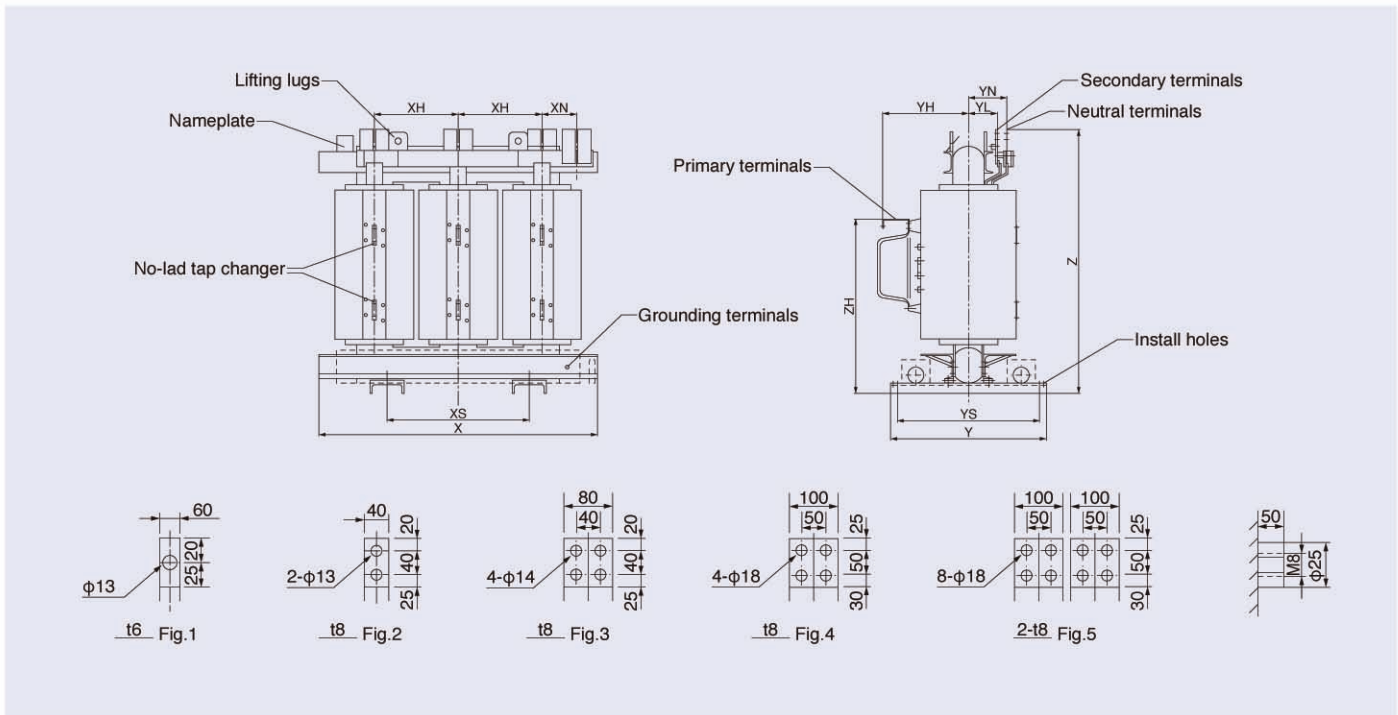
Standard		IEC 60076-11: 2004	
Number of phases		3	
Frequency [Hz]		50	
Rated primary voltage and tap voltage [kV]		F21.0-F20.5-R20.0-F19.5-F19.0	
Rated secondary voltage [kV]		0.4	
Rated capacity [kVA]		315-2500	
Connection symbol		Dyn11	
Insulation class		F	
Insulation levels[kV]	Separate-source voltage withstand	Primary	50
		Secondary	3
	Lightning impulse	Primary	125

Technical data

Rated capacity [kVA]	No-load loss [W]	Load loss at 120°C [W]	No-load current [%]	Impedance voltage [%]
315	960	4060	0.7	6
400	1140	4820	0.6	
500	1330	5760	0.5	
630	1510	6800		
800	1730	8220	0.4	
1000	2040	9730		
1250	2360	11480		
1600	2760	13790	0.4	
2000	3200	16280		
2500	3820	19270		

Dimensions and masses (Without protection enclosure)

Rated capacity [kVA]	Dimensions [mm]											Total mass[kg]	Hole[φ]	Terminals	
	X	Y	Z	XS	YS	XH	XN	YH	YL	ZH	YN			P	S
315	1600	920	1619	820	820	500	155	587	174	1113		1500	20	Fig. 1	Fig. 2
400	1600	920	1628	820	820	500	155	587	180	1127		1650	20		Fig. 3
500	1600	920	1695	820	820	522	130	598	183	1199		1900	20		Fig. 4
630	1600	920	1729	820	820	532	130	607	194	1203		2100	20		
800	1690	920	1794	820	820	552	130	613	191	1243		2500	20		
1000	1800	1100	1824	820	1000	568	155	619	208	1208		2900	20	Fig. 5	
1250	2000	1200	1919	820	1100	588	155	630	215	1303		3400	20		
1600	2100	1170	1991	1070	1070	628	260	650	217	1315	289	4500	20		
2000	2150	1170	2061	1070	1070	672	260	672	236	1365	308	5500	20	Fig. 5	
2500	2200	1170	2067	1070	1070	714	260	692	285	1450	360	6500	20		



Accessories



■ Lifting lugs

Four lifting lugs are provided as standard fixtures on the transformer body.



■ Nameplate

The nameplate is easy to read with white letters on a black background.

RESIN INSULATION DRY-TYPE TRANSFORMER	
PRODUCT TYPE	SC3B
STANDARD NO.	TEC60076
MADE DATE	
WINDING SYSTEM	155°C (F)
PHASES	3
WIND CONNECTION	Hz
PRIMARY VOLTAGE	TAP CONNECTION
+ 5%	V
+ 2.5%	V
RATED	V
- 2.5%	V
- 5%	V
RATED CURRENT	PRIMARY CURRENT
	A
	SECONDARY CURRENT
	A
DIRECTION (IMP)	Dyn11
COIL WINDING	AN
TOTAL WEIGHT	kg
DISPERSED WEIGHT	%
INSULATION LEVEL	LI / AC / AC

SHANGHAI FUJI ELECTRIC TRANSFORMER CO., LTD.

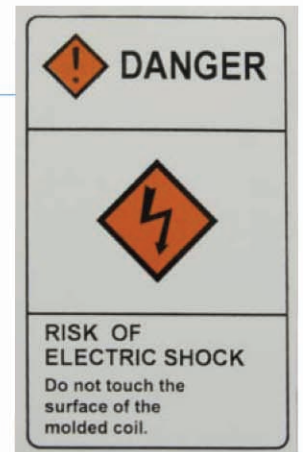
■ No-voltage tap changing terminals

The tap voltage can be changed by switching the shorting bar connector.



■ Warning label

A danger label is attached to warn against contacting the surface of the high-potential winding.



■ Earthing terminals with clamping bolts

Two ground terminals are provided at the lower frame ends: one on the primary side and one on the secondary side. (One of these ground terminals is in use.)



■ Protection enclosure

An optional simplified protective enclosure can be installed.



■ Thermometer

An optional Thermometer can be installed.



Inquiry Specification Sheet for Cast Resin Transformer

0)General			
1	Delivery date desired	Year	Month Day
2	Delivery condition	<input type="checkbox"/> FOB Shanghai	<input type="checkbox"/> Other
3	Applcation (Purpose to use)	Buildings, Factories, Crane and so on	
1)Basic specification(Essentials for quotation)			
4	Number of units		
5	Product type	Cast resin transformer	
6	Standards	<input type="checkbox"/> IEC60076-11	<input type="checkbox"/> Other
7	Ambient temperature	<input type="checkbox"/> Standard -5 ~ 40 °C	<input type="checkbox"/> Other
8	Altitude	<input type="checkbox"/> Standard 0 ~ 1000 m	<input type="checkbox"/> Other
9	Rated capacity	kVA	
10	Number of phases	<input type="checkbox"/> 1	<input type="checkbox"/> 3
11	Frequency	<input type="checkbox"/> 50Hz	<input type="checkbox"/> 60Hz <input type="checkbox"/> Other
12	Rated primary voltage	kV	
13	Rated secondary voltage	kV	
14	Tapping range of primary voltage	<input type="checkbox"/> ± 2.5% x 2	<input type="checkbox"/> Other
15	Vector group	<input type="checkbox"/> Dyn11	<input type="checkbox"/> Yyn0 <input type="checkbox"/> Other
	Connection of primary windings	<input type="checkbox"/> Delta	<input type="checkbox"/> Star
	Connection of secondary windings	<input type="checkbox"/> Delta	<input type="checkbox"/> Star <input type="checkbox"/> Star with newtral point
16	Impedance voltage	<input type="checkbox"/> Manufacturer standard	<input type="checkbox"/> Other %
17	Cooling method	<input type="checkbox"/> AN	<input type="checkbox"/> AF
2)Optional accessories			
18	Thermometer	<input type="checkbox"/> No	<input type="checkbox"/> Yes
19	Cooling fan	<input type="checkbox"/> No	<input type="checkbox"/> Yes
20	Wheels	<input type="checkbox"/> No	<input type="checkbox"/> Yes
21	Resistance thermometer bulb (Pt 100Ω)	<input type="checkbox"/> No	<input type="checkbox"/> Yes
22	Anti-vibration pads	<input type="checkbox"/> No	<input type="checkbox"/> Yes
23	Protection enclosure	<input type="checkbox"/> No	<input type="checkbox"/> Yes
	Degree of protection for enclosure	<input type="checkbox"/> IP20	<input type="checkbox"/> IP23 <input type="checkbox"/> Other
3)Special test (Option)			
24	Temperature rise test	<input type="checkbox"/> No	<input type="checkbox"/> Yes
25	Lightning impulse test	<input type="checkbox"/> No	<input type="checkbox"/> Yes
26	Measurement of sound level	<input type="checkbox"/> No	<input type="checkbox"/> Yes
4)Other request items (Option)			
27	Witness test	<input type="checkbox"/> No	<input type="checkbox"/> Yes
28	Other request item		

Notes)

Item No.15

Dyn11=Δ(Delta)/Y(Star)

Yyn0=Y(Star)/Y(Star)

Item No.17

AN ; Naturally-cooled type

AF ; Forced-air-cooled type with cooling fan



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