士林電機廠股份有限公司
Shihlin Electric & Engineering Corporation

Cast Resin Transformer User Manual

1. This manual includes the handling, installation, connection, operation and maintenance of cast resin transformers up to 36kV.
2. Hope you can fully understand and apply its superior performance so that our products can make the best effort.

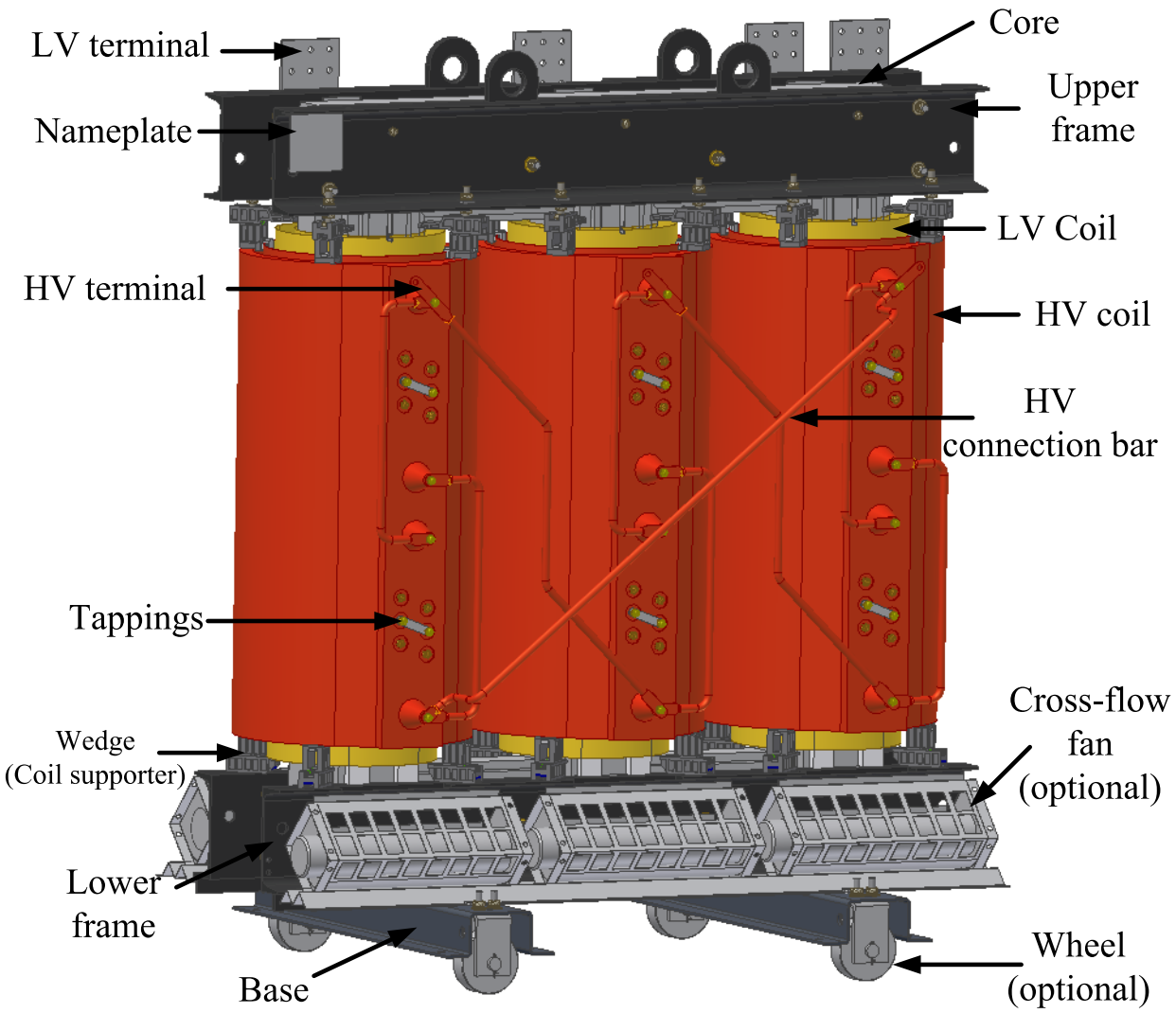
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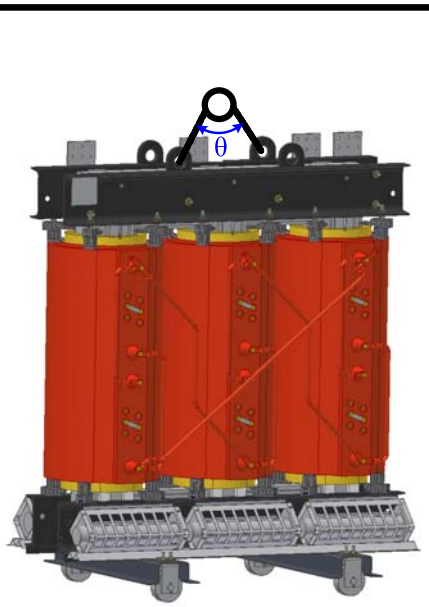
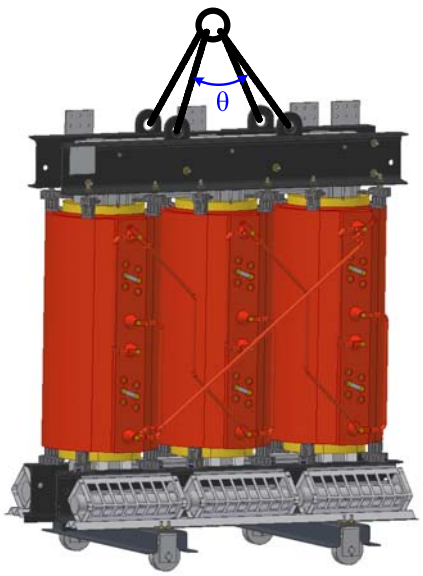
I. Features



Note: Illustration only, components may be varied on demands.

II. Handling

1. Use appropriate slings and hooks to lift cast resin transformers.
2. All lifting lugs should be occupied and angles between slings (or chains) must less than 60 degrees to ensure safe lifting.
3. Every hasty lifting action is prohibited to avoid crashing risks.

Wrong	Correct
●2 lifting lugs occupied only or slings angle θ>60°	●4 lifting lugs occupied and slings angle θ<60°
	

4. Handling plenty of transformers, timber planks are suggested as spacers between lower frames to avoid collision.
5. Trussing transformers up, the area contacting to slings should be protected by cloth or similar material.
6. Lifting with a fork, settle forks firmly under the bottom of lower frames, keep low speed steadily, prohibit risky driving such like sudden accelerating or braking.

III. Installation

1. Altitude: The transformer should not be installed above 1000 meters (3300 feet); a higher altitude is specified at the time of enquiry.
2. Ambient temperature:

Conditions	Temperature
Maximum	40℃
Daily average	30℃
Yearly average	20℃

3. Maximal special ambient temperatures higher than 40℃:

Maximum ambient temperature	Permissible load
40℃	P (Full capacity)
45℃	0.97 × P
50℃	0.94 × P
55℃	0.90 × P

4. Indoor installation in electrical operating rooms or in various sheet-metal enclosures is the preferred method of installation. Sufficient ventilation must be provided by the installation location or the enclosure. In the general case of natural cooling, a total loss of 1kW needs a 3 m^3/min air flow to ventilate.

IV. Connection

1. Verify the position identify of tapping links on the three phases are in accordance with the diagram on the nameplate. Make sure that each phase selects the same tapping in series or parallel connection.
2. Confirm tapping links on the coil and the diagram on the nameplate.
3. Connection tightening torque on the HV, LV terminal and tapping links:

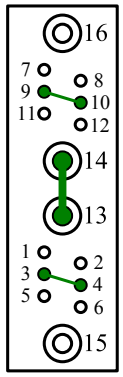
Bolts / Parts	M8	M10	M12
HV terminal	----	200 kgf-cm	350 kgf-cm
LV terminal	125 kgf-cm	250 kgf-cm	450 kgf-cm
Tapping links	80 kgf-cm	150 kgf-cm	----

4. Select appropriate wire dimension and connection for earthing.

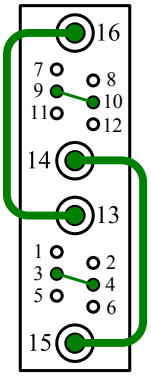
5. HV Tap changer connections: should be at **de-energized (off circuit)**

i. HV rated voltage (alternative): 22800/11400V

Series ：13 - 14			Taps
Connection		HV Voltage	
7-8	1-2	F 24000V	
8-9	2-3	F 23400V	
9-10	3-4	R 22800V	
10-11	4-5	F 22200V	
11-12	5-6	F 21600V	



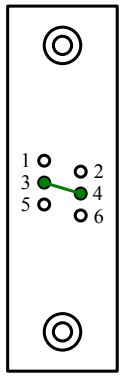
Parallel ：16-13, 14-15			Taps
Connection		HV Voltage	
7-8	1-2	F 12000V	
8-9	2-3	F 11700V	
9-10	3-4	R 11400V	
10-11	4-5	F 11100V	
11-12	5-6	F 10800V	



ii. HV rated voltage (single):

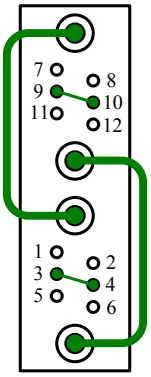
Type A

HV rated voltage: (Tap3) V		Taps
Connection	HV Voltage	
1-2	Tap 1	
2-3	Tap 2	
3-4	Tap 3	
4-5	Tap 4	
5-6	Tap 5	



Type B

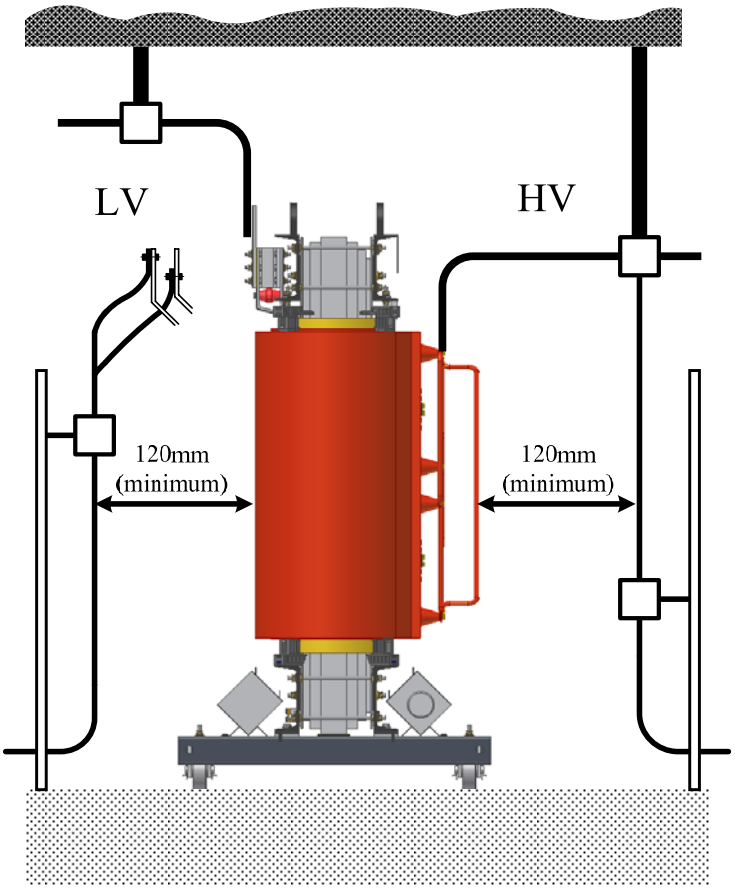
HV rated voltage: (Tap3) V			Taps
Connection		HV Voltage	
7-8	1-2	Tap 1	
8-9	2-3	Tap 2	
9-10	3-4	Tap 3	
10-11	4-5	Tap 4	
11-12	5-6	Tap 5	



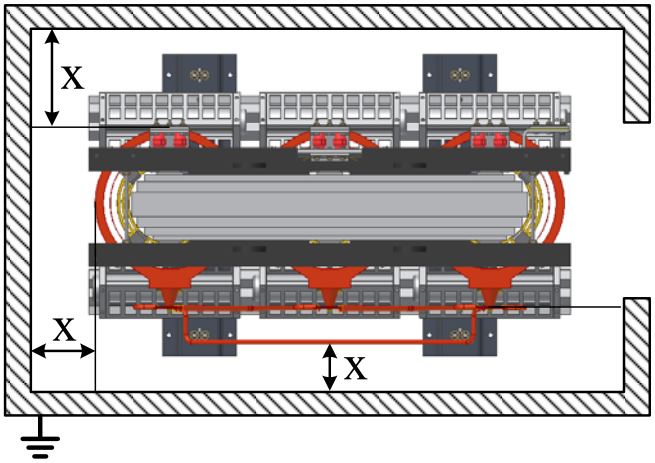
No.	HV Voltage					Type
	Tap 1	Tap 2	Tap 3 (rated)	Tap 4	Tap 5	
1	F24000	F23400	R22800	F22200	F21600	A
2	F12000	F11700	R11400	F11100	F10800	A or B
3	F3600	F3450	R3300	F3150	F3000	A or B
4	F21000	F20500	R20000	F19500	F19000	A
5	F10500	F10250	R10000	F9750	F9500	A or B

V. Insulation Distance

1. The minimum clearance between cables and the surface of winding is shown in the following figure.



2. The transformer in metal enclosure must be protected against direct contact. Maintain minimum clearance to the walls according to the following table.



System Voltage (kV)	Impulse Voltage (kV)	Insulation distance X(mm)
12	75	130
24	125	210
36	170	320

VI. Commissioning

1. Insulation test

   i. Using a 1000V/2000MΩ above insulation tester (Megger).

   ii. The approximate values of resistances (based on 25℃) are :

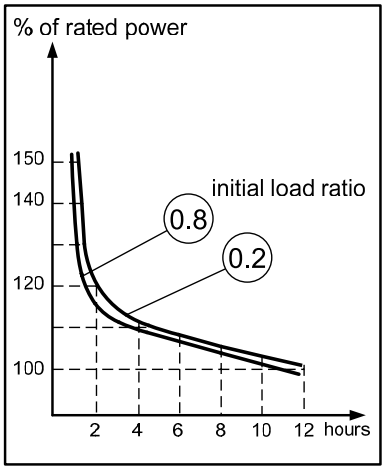
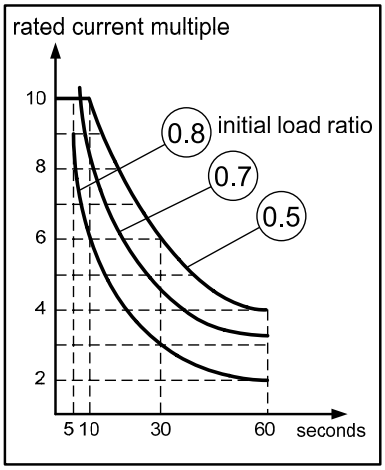
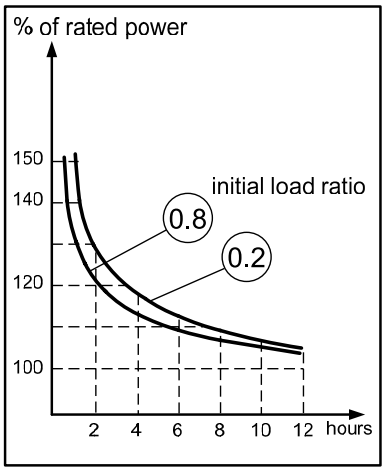
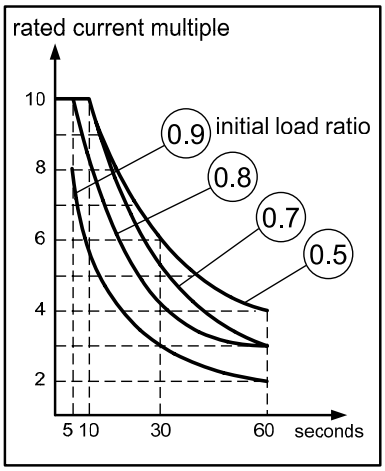
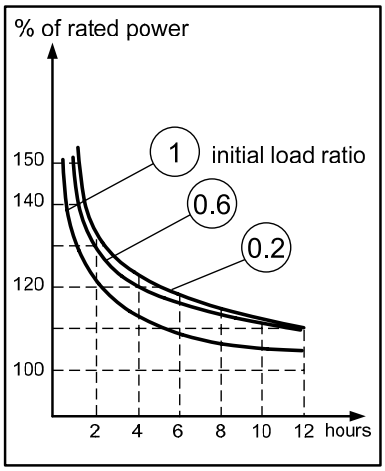
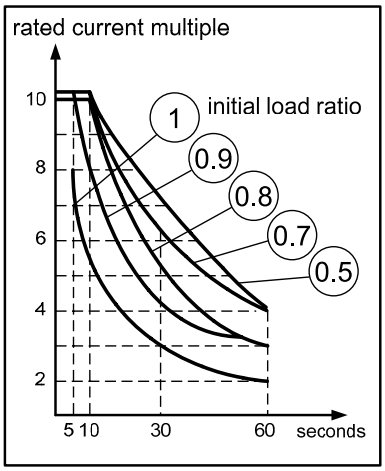
Measuring circuit	Insulation resistance
HV to LV	250 MΩ
HV to earth	250 MΩ
LV to earth	50 MΩ

If the values measured are significantly below, verify the transformer is not moist. If it is, dry it with a rag and repeat the verification.

2. Parallel operation: Verify the identity of HV and LV voltages, phase angle difference, vector group and the compatibility of characteristics , especially the impedance voltage. If the impedance voltages are various, verify load distribution of each transformer.

VII. Short-time Overload

Acceptable temporary overload curves of various ambient temperature and initial load condition for cast resin transformers

Ambient temperature condition	Admissible temporary overload for daily load cycle	Acceptable short time overload
Normal ambient temperature +10ºC		
Normal ambient temperature ■maximum: 40ºC ■daily average: 30ºC ■yearly average: 20ºC		
Normal ambient temperature -10ºC		

VIII.Maintenance

Item	Precaution	Unusual state	Probable cause	Strategy
Operation state	Observe and record voltage, current and ambient temperature	Unusual indicating	Abnormal circuit	Repair or replacement
			Measuring fault	Find causes and strategies
Temperature	Record temperature in windings	Unusual temperature rising	Poor instruments	Repair or replacement
			Overload	Unload, check capacity
			Winding inner-fault	Find causes and strategies
Noise or vibration	Abnormal noise checking	Core (exiting) noise	Over voltage	Proper tap changer
			Rectification device	Customized transformer
		Vibrating, oscillating noise	Oscillation	Remove oscillation
			Uneven placing	Adjust placing
		Core bee-sound	Loosen bolts and screws	Tighten bolts, prevent core gaps
		Discharging sound	Incomplete earthing	Earthing maintenance
			Corona	Find causes and strategies
Stink	Stink detecting	Unusual temperature rising	Overload	Unload
			Partial overheated	Find causes and strategies
Appearance inspection	Observing terminals and tap changers	Color changed due to overheat	Overload	Unload
			Loosen bolts	Tighten bolts
	Core and coil appearance	Stained	Uncleaned	Dusting
		Resin cracks	Unusual temperature varies	Find causes and strategies
	Discharging track detecting	Insulation carbonized	Abnormal voltage invading	Find causes and strategies

Note:1. The above are visional inspection, if any strategy is proceeding, be de-energized to keep maintenance staff from danger.

2. If any abnormal phenomenon appears and not be able to find causes and strategies, please contact our sales department. We will provide technical support or local staff service.

IX. Regular Inspections

Item	Precaution	Unusual state	Cause	Strategy
Winding Insulation	Stain observing	Stained	Uncleaned	Dusting
	Aging	Insulator aging, cracking	Partial overheat	Contact manufactor
		Discharging track or carbide attached	aging	
	Insulation Measurement	Behind specific	Moist	Drying
			Stained	Dusting
Core	Stain observing	Stained	Uncleaned	Dusting
		Rusty	Antirust material aging	155℃- thermal paint
Tap links	Connection inspection	Color changed due to overheat	Overload	Unload
			Loose connection	Fasten with proper torque
Thermometer Protective Device	Indicating state	Poor performance	Fault	Repair or replacement

Note: 1. Annual off load inspection is proposed.

2. If any abnormal phenomenon appears and not be able to find causes and strategies, please contact our sales department. We will provide technical support or local staff service.