



Cast Resin Transformers



Tadeo Czerwony Tesar



CRT



Since their appearance and introduction in the electric market, Cast Resin Transformers (CRT) have won an important position in every sector due to:

- The use of special epoxy self-extinguishing resins which are flame-retardant and also very stable during service, complying with E2 C2 F1 classification.
- Less inorganic content as compared to the oil-based transformers.
- Highly resistant structure in front of short-circuits and non-hygrosopic windings.
- The simple localization of failures, caused by internal or external factors make them suitable for all kinds of facilities; they are specially recommended for the so-called strategic usages.

STANDARD FITTINGS

- Off-load Jumper switch with $\pm 2 \times 2,5\%$ steps, on high voltage (HV) side.
- Primary terminals for wire connection.
- Secondary terminals for bar connection.
- Hoisting eyebolts.
- Grounding terminals.
- Bidirectional wheeled-wagon.
- Specifications plate.

OPTIONAL FITTINGS

Upon client request, CRT can be provided with:

- Forced air cooling system to increase available nominal power.
- Terminal box for auxiliary circuits.
- Protective cabinets to comply with Ingress Protection standards (IP21, IP23 and IP31).
- Bimetallic terminal adaptors, since main terminals (HV and LV sides) are in aluminium.
- 7 points Off-load Jumper switch with $\pm 3 \times 2,5\%$ steps, other options on request.
- Electrostatic shields
- Client requirements not listed above will be evaluated by our R&E Department.



Figure 1

- Temperature Monitoring Unit (TMU) fully programmable with alarm, trip and forced ventilation outputs (Figure 1). If necessary, it also handles installation room blowers.

The basic provision includes three (3) Pt100 sensors to be installed inside pre-conceived ventilation channels in each LV winding. A fourth Pt100 thermal probe, to monitor room temperature and eventually to drive room blowers, is also available upon request.

More sophisticated monitoring units are available in the market, like TMU that handles six (6) Pt100 sensors and TMU that can integrate measurements and signals sending them to a Control/Monitoring PC or a SCADA system.

REMARKABLE ADVANTAGES

- Compact design, requiring no important surfaces for installation if compared to oil filled transformers type.
- Very easy to install; they can be directly placed close to the load, without the need for conditioning and space installations, like: tanks, flame arrestors and/or space foundations.
- Very low risk of fire due to the usage of self-extinguishing materials, which require no special fire precautions.
- Since cooling fluid is not used, they require very low maintenance; only cleaning and periodical adjustment of connections. For indoor clean facilities, they can be considered maintenance-free.
- Important nominal power reserve. The adding of forced ventilation, acting directly on HV and LV windings, allows an increase of up to 25% in the original plate capacity. For other rates, please contact us.
- Due to their nature, the manufacturing materials are environmental-friendly and their behaviour towards fire, caused by an external source or by internal electrical arcs do not produce toxic gases and just a minimum amount of smoke.
- Extra capacity during temporary overcharges. Their windings design with low current density and the use of resins with high mechanical resistance and optimum temperature behaviour, allow higher capacity to withstand short-period overcharges.

Two important parameters to consider when analysing Overcharges for CRT transformers are room temperature and loading status prior to overcharge. (Figure 2)

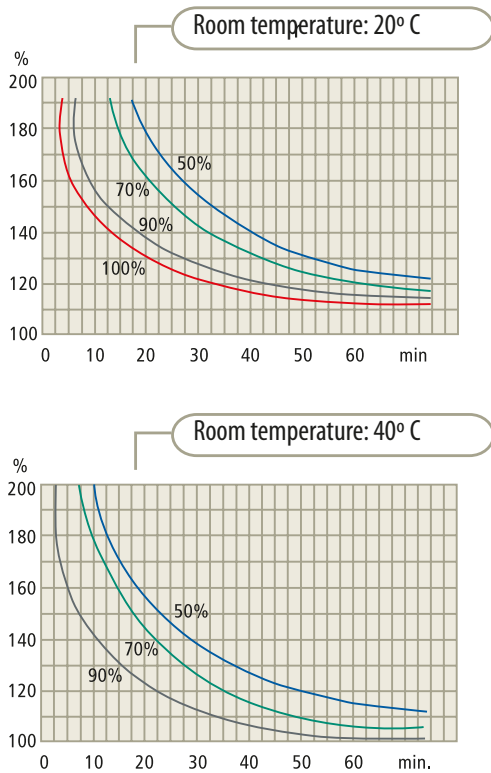


Figure 2

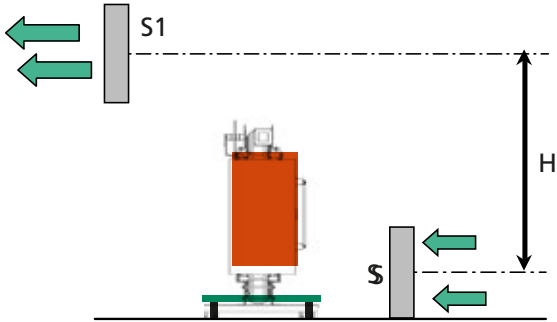


Figure 3

INDOOR INSTALLATION (Figure 3)

To be able to use the maximum capacity of the transformer, the installation room must have a fresh air inlet through a lower ventilation window S (m²) and a hot air outlet through a higher ventilation window S1 (m²). S1 must be located on the opposite wall and at a certain height H (m). Being P, transformer total losses (in kW), they should verify:

$$S = \frac{0,188 \times P}{\sqrt{H}} \quad S_1 = 1,10 \times S$$

H(m): Diferencia de altura entre S y S1.

If required natural ventilation is not possible, forced ventilation must be provided. This should be able to remove 4,5 m³/min of air for every kW of transformer total losses.

To drive this ventilation system, one option is to use the fourth Pt100 sensor.



2000 kVA 13200 ± 2 x 2.5% / 400 - 231 V/V



500 kVA 33000 ± 2 x 2.5% / 400 - 231 V/V

ELECTRICAL DISTANCES

The minimum distances from the windings to the security enclosure should be as follows:

ISOLATION TYPE	MINIMUM DISTANCE IN mm
15 kV	220
36 kV	320

CLASSIFICATION E2 C2 F1

The European standard, handled by the CENELEC (Comité Européen de Normalisation Electrotechnique), for dry type transformers covers these aspects:

- Humidity, condensation and pollution
- Ambient temperature (indoor and outdoor conditions)
- Emission of toxic fumes in the event of pyrolysis or combustion
- Flammability or better still self-extinguishing properties when exposed to external flames.

E2: Frequent condensation and high pollution or a combination of both.

C2: Operation, transport and storage at ambient temperatures down to - 25°C; installation outside.

F1: Risk of fire exists, limited flammability is acceptable. Self extinguishing of the fire must occur within 60 minutes following the start of the special test in accordance with appendix Z.C.3 as per HD 464 S1; materials must be free from halogens; emission of toxic substances and thick smoke must be reduced to a minimum.

Only Certificates issued by International and approved Laboratories, validate the compliance with this important classification.

We reserve the right to modify the values herein this document without prior notice.



Technology and Special Designs

Tadeo Czerweny Tesar S.A. produces a wide variety of CRT transformers using high technological and guaranteed quality components to provide an excellent uninterrupted service, and therefore an improved return on investment (ROI).

The whole casting process of the windings is performed in modern installations automatically controlled, with hardware and software of latest generation.

Raw materials and supplies used to build the electrical windings are premium class and submitted to strict tests during Suppliers' selection and their reception at Industrial Plant.

High Voltage windings (figure 4) and Low Voltage windings (figure 5) are manufactured using the most advanced Foll Winding Machines.



CRT installed in an IP Cabinet

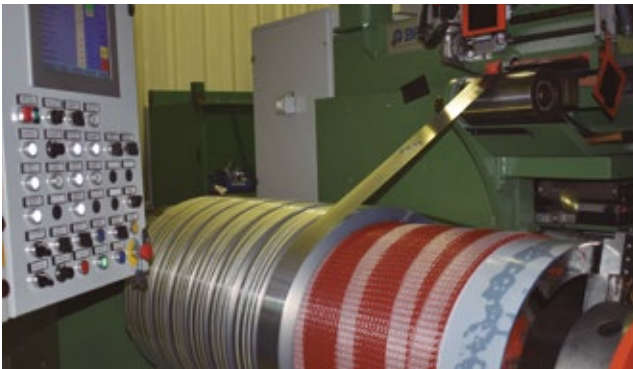


Figure 4



CRT with 7 Regulating points on HV side



Figure 5

As of June 21st 2010, the whole manufacturing process is certified under ISO 9001. At present, we are backed by the ISO 9001:2015 certification, by DET NORSKE VERITAS V.B.



Step-Up CRT (YNd11) with forced air cooling system.

Technical and electrical specifications

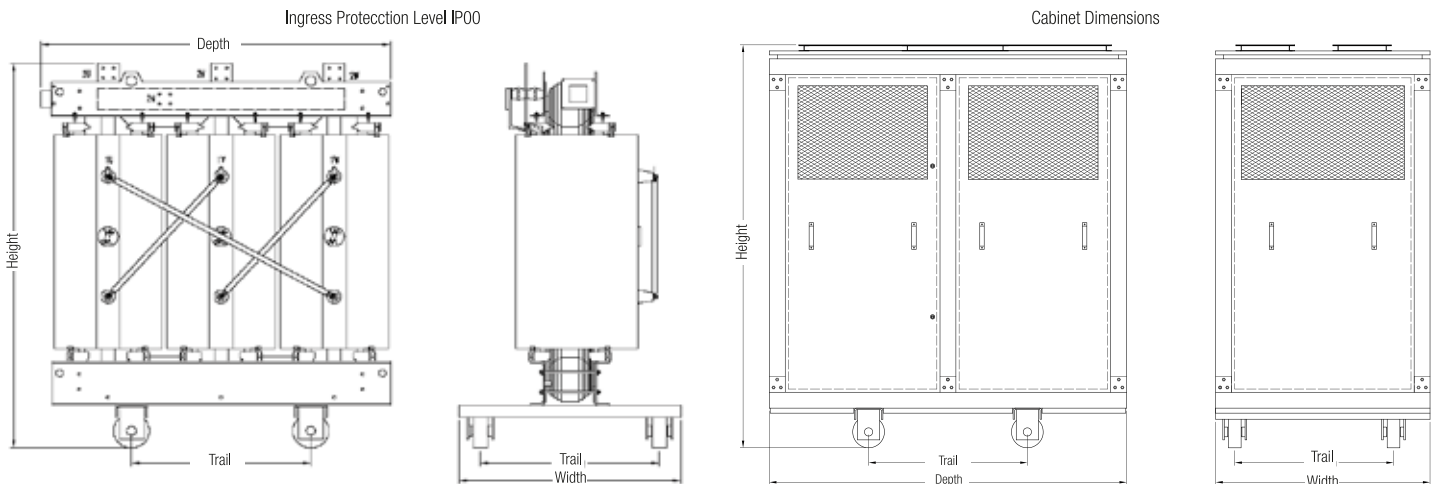
CLASS "F" 15 kV TRANSFORMERS - Ratio: 13,200 (± 2 x 25%) / 400-231 V/V												
Power (kVA)	Losses (W)		Vcc (%)	Sizes (mm) / Mass (kg) - IP00				Sizes (mm) / Mass (kg) - Including Cabinet IP				Trail (mm)
	Po	Pcc		Depth	Width	Height	Mass	Depth	Width	Height	Mass	
250 *	880	3.300	6	1350	690	1.300	900	1.750	1.100	1.700	1.150	600
315 *	1.000	4.000	6	1.350	690	1.350	1.050	1.750	1.100	1.700	1.300	600
400 *	1.200	4.800	6	1.400	1.000	1.450	1.200	1.950	1.200	2.050	1.480	800
500 *	1.400	5.900	6	1.400	1.000	1.550	1.400	1.950	1.200	2.050	1.680	800
630 *	1.650	6.800	6	1.500	1.000	1.600	1.700	1.950	1.200	2.050	1.980	800
800 *	2.000	8.000	6	1.550	1.000	1.750	2.000	1.950	1.200	2.050	2.280	800
1.000 *	2.300	9.400	6	1.650	1.000	1.850	2.550	2.250	1.350	2.550	2.930	800
1.250 *	2.800	11.500	6	1.750	1.240	1.900	2.900	2.250	1.350	2.550	3.280	1.000
1.600 *	3.300	13.500	6	1.800	1.240	2.150	3.700	2.250	1.350	2.550	4.080	1.000
2.000 *	4.200	16.000	6	1.950	1.240	2.250	4.500	2.600	1.450	2.750	4.950	1.000
2.500 *	5.000	18.000	6	2.050	1.240	2.300	5.350	2.600	1.450	2.750	5.800	1.000
3.150	5.500	19.500	8	2.300	1.240	2.375	6.800	2.600	1.450	2.750	7.300	1.000

(*) IEC 60726 and IEC 60076

CLASS "F" 36 kV TRANSFORMERS - Ratio: 33,000 (± 2 x 25%) / 400-231 V/V												
Power (kVA)	Losses (W)		Vcc (%)	Sizes (mm) / Mass (kg) - IP00				Sizes (mm) / Mass (kg) - Including Cabinet IP				Trail (mm)
	Po	Pcc		Depth	Width	Height	Mass	Depth	Width	Height	Mass	
315 *	1.300	4.000	6	2.000	1.000	1.800	2.700	2.700	1.700	2.400	3.100	800
400 *	1.700	4.300	6	2.100	1.000	1.800	3.000	2.700	1.700	2.400	3.400	800
500 *	1.900	4.800	6	2.100	1.000	1.900	3.300	2.700	1.700	2.400	3.700	800
630 *	2.200	6.700	6	2.150	1.000	2.000	3.700	2.700	1.700	2.400	4.100	800
800 *	2.700	8.000	6	2.200	1.000	2.100	4.300	3.000	1.900	2.950	4.800	1.000
1.000 *	3.350	9.400	7	2.300	1.200	2.300	4.600	3.000	1.900	2.950	5.100	1.000
1.250 *	3.800	12.700	8	2.400	1.200	2.300	5.000	3.000	1.900	2.950	5.500	1.000
1.600 *	4.000	13.500	8	2.400	1.200	2.500	5.900	3.000	1.900	2.950	6.400	1.000
2.000 *	4.700	17.400	8	2.500	1.200	2.700	7.000	3.500	2.100	3.450	7.600	1.000
2.500 *	5.500	21.000	8	2.600	1.200	2.850	8.000	3.500	2.100	3.450	8.600	1.000
3.150	7.500	23.000	8	2.900	1.300	3.000	10.000	3.500	2.100	3.450	10.600	1.000

(*) IEC 60726 and IEC 60076

- * For thermal classes other than F, please contact us.
- * For other ratios and specifications, please contact us.
- * Cabinet are only provided on request.
- * Other Trail sizes, upon request.



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