

Cast resin transformers
HARMONY™

ALSTOM

HARMONY™ the optimum solution

for higher performance

At a time when we are all seeking to preserve our way of life, the production of equipment whilst ensuring safety and protecting the environment is our prime objective. HARMONY™ series, with its 60° oblique winding and its exclusive casting system, provides a real answer to the problems set with regard to safety and protection of personnel, equipment and the environment.

- Excellent classification according to standard HD 464 S1 (tests performed at CESI laboratory in Italy).
 - **F1** Fire behaviour. Harmony is non-flammable and self-extinguishing
 - **C2** Insensitive to thermal shocks. Harmony withstands to loads and overloads changes. Dielectric tests and measurement of partial discharges ≤ 10 pC.
 - **E2** Insensitive to corrosive environments. Harmony resists to polluted environments and humidity.
- Well adaptation to disturbed electrical environments.
- Recycle of components.
- No release of toxic or corrosive products and opaque smokes in the event of pyrolysis. The Harmony exclusive casting system has obtained an excellent classification according to standard NF F 16-101 (tests performed at National Test Laboratory in Trappes) confirming the non-toxicity of decomposition products as well as the low



quantities of opaque smoke produced in case of fire.

General specifications

Three-phase transformers 50 Hz, class F dry type cast resin, cooled naturally by air AN, for continuous indoor service (insulation outdoors, cooling AF, available on request).

- LV winding generally consists of aluminium foils pre-impregnated with hot polymerised resin. If necessary, ventilation ducts can be added, consisting of a pre-formed stainless steel or aluminium element.
- HV winding generally consists of an aluminium circular section enamelled wire, wound using an ALSTOM patented method. **This 60° oblique**

winding, named "pyramidal", is then cast under vacuum into an exclusive casting system developed in our laboratories. This system comprises 3 components none of which include any halogens (epoxy resin, anhydride hardener, mineral fillers), endowing it with a compact and homogeneous structure.

Standards

The HARMONY™ transformers are in accordance with standards :

- IEC 726 et IEC 76-1 to 76-5
- HD 464.S1 + A2 and HD 538.1 S1
- NF C 52-726 and NF C 52-115

Electrical characteristics – Dimensions and weights

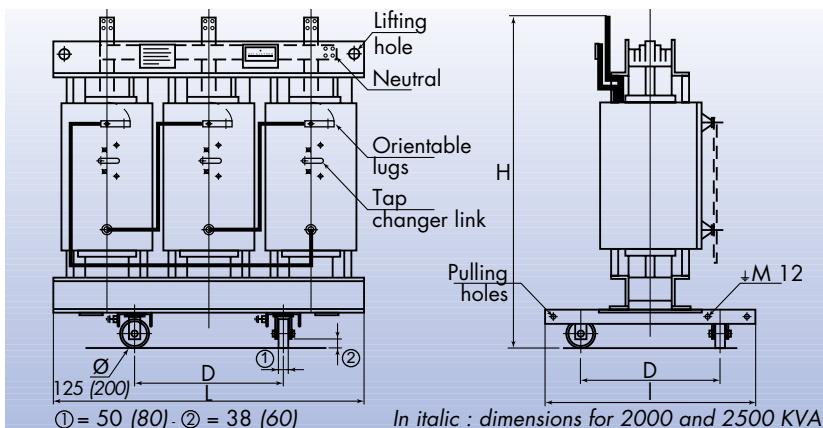
Rated power (1) (*)	kVA	160	250	400	630	800	1000	1250	1600	2000	2500	
HV rated voltage (1)	kV	5,5 – 10 – 15 – 20 and dual 10/20 – 15/20										
Rated insulation level (1)	kV	7,2 for 5,5 – 12 for 10 – 17,5 for 15 – 24 for 20 kV										
Off-load secondary voltage (1)	V	410 between phase, 237 between phase and neutral										
Adjustment (1)	%	± 2,5										
Vector group (1)		Dyn11 (delta, star neutral brought out)										
Losses (W)	no-load	650	880	1200	1650	2000	2300	2800	3100	4000	5000	
	on-load (à 75°C)	2360	3320	4800	6800	8200	9600	11450	14000	17500	20000	
	on-load (à 120°C)	2700	3800	5500	7800	9400	11000	13100	16000	20000	23000	
Impedance voltage	UCC %	6										
No-load current	Io %	2,5	2,1	1,7	1,4	1,3	1,3	1,3	1,3	1,2	1,1	
Voltage drop at full load	cos φ 1 %	1,85	1,69	1,55	1,41	1,35	1,27	1,22	1,18	1,18	1,10	
	cos φ 0,8 %	4,87	4,77	4,68	4,59	4,55	4,50	4,47	4,44	4,44	4,38	
Efficiencies	Charge 100%	cos φ 1 %	97,95	98,16	98,35	98,52	98,60	98,69	98,74	98,82	98,81	98,89
		cos φ 0,8 %	97,45	97,71	97,95	98,16	98,25	98,36	98,43	98,53	98,52	98,62
	Charge 75%	cos φ 1 %	98,22	98,42	98,59	98,74	98,80	98,88	98,93	99,00	98,99	99,05
		cos φ 0,8 %	97,79	98,03	98,24	98,43	98,50	98,61	98,66	98,76	98,75	98,82
Noise level dB(A)	Acoustic power	LWA	62	65	68	70	72	73	75	76	78	81
	Acoustic pressure at 1m.	LPA	50	53	55	57	58	59	61	62	63	66
Dimensions and weights IP 00 (2)												
H	mm	1165	1295	1375	1585	1625	1670	1735	1795	2218	2325	
L	mm	1275	1280	1425	1460	1550	1670	1845	1850	2030	2205	
l	mm	810	810	885	885	955	955	990	990	1100	1160	
D	mm	520	520	670	670	670	670	820	820	820	820	
Weight	kg	809	993	1335	1715	2055	2512	3120	3895	5065	6395	
Dimensions and weights IP 31 (2)												
H	mm	1620	1620	1830	1830	2040	2040	2240	2240	2400	2530	
L	mm	1620	1620	1830	1830	2040	2040	2240	2240	2250	2550	
P	mm	850	850	925	925	995	995	1030	1030	1140	1200	
Weight	kg	195	195	215	215	255	255	300	300	445	495	

(1) Other characteristics available on request.

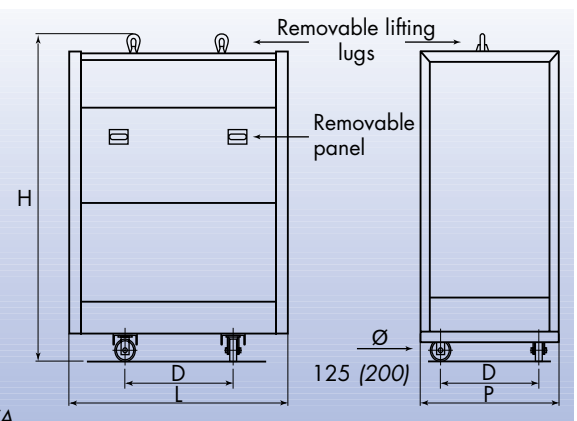
(*) The rated power is defined for continuous service with natural air cooling (AN). For special constraints, it can be increased by 40% by adding forced ventilation (AF). Details available on request.

(2) These values are indicated for single HV 7,2 ≤ 24 kV and LV 410 V voltages. As an example, they can be used for 15/20 or 10/20 kV HV dual voltage transformers, except for 1600 kVA with protective enclosure (use dimensions of 2000 kVA enclosure). For all other characteristics, these dimensions are not valid: details available on request.

Transformer without enclosure - IP00



Protective enclosure - IP31



Layout and connection guide

Off-circuit tap changer links mounted on the front face are mandatory.
Check that the ventilation system of the premises fully dissipates all losses.

Transformer without enclosure (IP00)

Since unprotected transformer (IP00) is installed inside premises, the following provisions must be taken :

- Make sure that, when the transformer is energised, no person can touch it, even when it is equipped with plug-in bushings.
- Eliminate all risk that drops of water can fall onto the transformer (in particular condensation on piping).
- Comply with the minimum clearances to the walls of the room appropriate for the insulation voltages.

Choice of HV and LV connections

6 possibilities are proposed.

Details on all other configurations available on request.

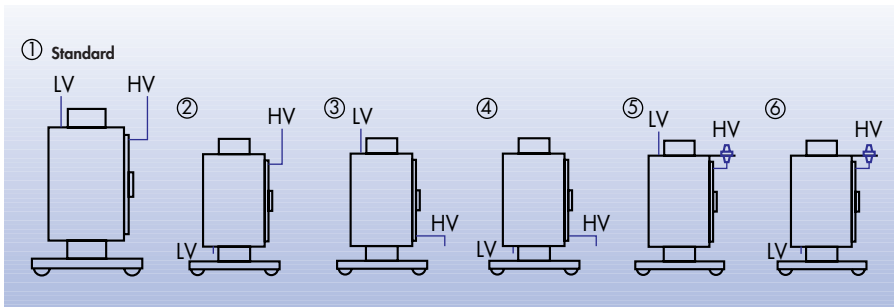


Fig. 5 and 6 : HV connection by plug-in terminals.

Transformer with IP 31 enclosure

Indoor installation does not require any special precautions, except the compliance with a minimum clearance to the walls of the room. No special fire protection requirements are necessary (fire barrier...).

Choice of HV and LV connections

7 possibilities are proposed. Details on all other configurations available on request.

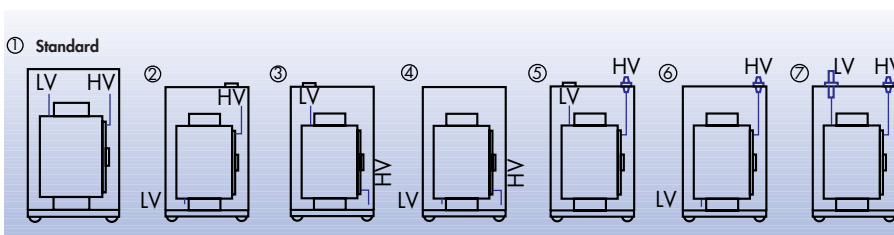


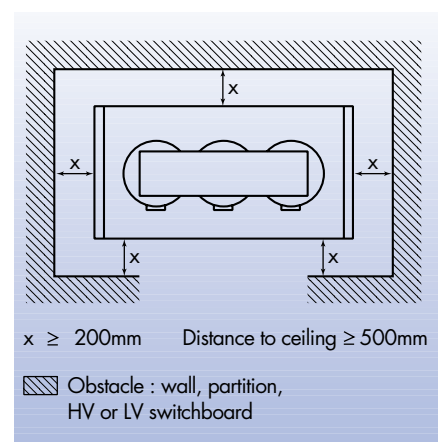
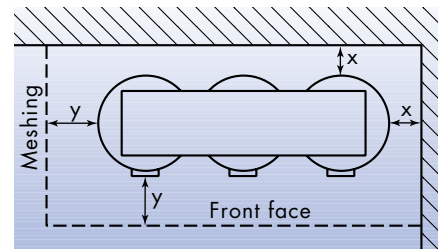
Fig. 5,6 and 7 : HV connection by plug-in terminals

Fig.7: LV connection is provided by busbars. Connection by busducts is possible on request.

Minimum distances to walls

Insulation kV	Solid walls (Rep.X) mm	Walls consisting of meshing (Rep.Y) mm
7,2	90	300
12	120	300
17,5 ou 24	220	300

In accordance with standard NF C 13.100.
Should it not be possible to comply these distances, please consult us. When the HV is brought out through the bottom, cable trenches must be provided also complying with the same distances (curvature of cable inside trench).



Equipments

Standard equipment

Transformer without enclosure (IP00)

- 3 HV connecting lugs at top of windings.
- 4 LV connecting lugs at top of windings.
- Off-circuit voltage regulation tap changer links.
- 4 swivel rollers.
- 4 lifting holes.
- 1 earthing terminal at bottom.
- 1 rating plate secured to HV side.

Transformer with IP 31 enclosure

- Transformer without enclosure (IP00)
- 1 protective enclosure IP31 (except the bottom IP21) removable :
 - anticorrosion treatment and final coat RAL 7038 grey colour.
 - 2 removable lifting lugs for handling transformer complete with its enclosure.
 - 1 earthing terminal at bottom.
 - 1 panel bolted to the front face, removable to gain access to the HV connections, equipped with 2 handles facilitating handling.
 - 1 locking system for removable panel, lock not supplied.
 - 1 removable panel earthing braid (to be connected on installation).
 - 1 rating plate secured to the removable HV panel.
 - 1 electrocution warning triangle.
 - 1 undrilled anti-magnetic plate on the ceiling enabling cables to be lead through on the HV side and another on the LV side.



Optional equipment

- HV or (and) LV connecting lugs at bottom.
- 3 plug-in bushings with 24 kV fixed parts connected to HV connecting lugs.
- 3 plug-in bushings with straight or elbow connectors (in this case, it is imperative that the characteristics of the cable be indicated).
- 1 plug-in bushing locking system, lock not provided.
- 4 busbar LV bushings (on protective enclosure only).
- 1 LV protective cover (on protective enclosure only).
- 1 thermal protection device :
 - 6 thermostatic detectors (2/phase) led back to a terminal block secured to the top part of

- the transformer. The contact can be of the open or closed type, or,
 - 6 PTC thermistors (2/phase) led back to a terminal block, associated to an electronic converter with 2 contacts (1 for alarm, 1 for tripping) separated delivery.

Note : The characteristics and options indicated are preferential and not restrictive, others adaptations available on request.