



# HARMONY™

## Dry Type Cast Resin Transformers

**Around the world, customers are demanding eco-friendly solutions for their transmission networks that are not only safe for their personnel but that are also safe for the environment.**

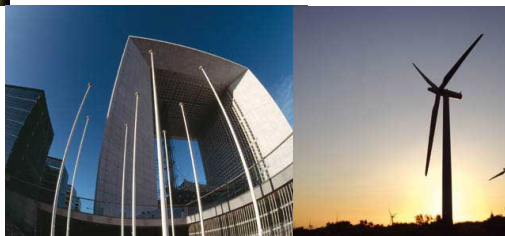
With today's focus on improving environmental impact and preserving the earth's natural resources, AREVA T&D's contribution is to manufacture safe and environmentally friendly equipment. High quality and reliability make HARMONY™ cast resin transformers the perfect solution for infrastructure projects such as transmission and distribution substations, public buildings and high-rise developments.

As HARMONY™ is non-flammable and self-extinguishing, it provides an effective solution for use in industrial installations susceptible to fire hazards. In addition, it meets the needs of special applications such as wind farms and it is the perfect replacement for PCB transformers.

### HARMONY™ THE SAFE ECO-FRIENDLY SOLUTION

Our HARMONY™ range of dry type cast resin transformers complies with all your distribution transformer requirements.

HARMONY™ is available as single and three-phase units. With ratings up to 20 MVA and 36 kV, 50/60 Hz, it offers AN cooling for continuous indoor service (with AF and outdoor options), and normal or reduced losses.



HARMONY™ meets the following standards:

- > IEC 60076-11
- > HD 464.S1+A2 + A3 and HD 538.1 S1
- > EN 60726
- > NF C 52-726 and NF C 52-115
- > VDE 0532 part 6
- > DIN 42523
- > ANSI C57.12.01

### Customer Benefits

- Non-flammable and self-extinguishing
- Designed for wet or highly polluted environments and areas with high electrical disturbance
- Excellent load and short circuit performance
- Low noise level
- Space optimization



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### SAFETY & RELIABILITY FIRST

To ensure total compliance with the most relevant national and international standards, HARMONY™ transformers have been put through the most stringent series of tests. HARMONY™ is one of few transformers having successfully passed these tests and is characterized by the following features:

- > C2 Insensitive to thermal shocks.  
Withstands overloads and frequent changes in loading. Dielectric tests of standard.
- > Very resistant to polluted environments and humidity. E2; Immune to corrosive environments.
- > Reduced flammability and self-extinguishing  
Excellent classification according to HD 464 S1 standard: F1 Fire behaviour.

HARMONY™ is your best solution for public safety. Whether for industrial plants susceptible to fire hazards or use in public buildings and high rise developments that are occupied or visited by thousands of people per day.

### ECO-FRIENDLY

Because preserving the environment is one of the most important issues today, we have designed our products to help you meet the latest environmental protection guidelines and regulations introduced by national and international governments and institutions.

HARMONY™ dry-type cast resin transformers are not only non-flammable and self-extinguishing, they are also free of any risk of leakage of flammable or contaminating substances. Using non-toxic high quality materials, HARMONY™ components are designed to enable the maximum amount to be recycled. HARMONY™ is the best solution to replace existing PCB transformers.

### HARMONY™ FOR A MODERN WORLD

Minimizing space requirements and associated civil work costs is a major factor in most building projects today. Whether it is for a new city center office block, an expansion in the capacity of an industrial process or a wind farm project, the compact design of HARMONY™ provides a cost-effective solution.

The exclusive casting system and advanced technology used in its HV windings give HARMONY™ transformers the reliability and operating characteristics needed in the high-technology applications which demand maximum availability and maximum quality of electrical supplies.

### QUALITY ASSURANCE

All our transformer production sites are certified ISO 9001 or ISO 14000.





## MAGNETIC CORE

The magnetic core consists of oblique cut, grain-oriented steel sheets insulated by carlite, made for low losses. It is protected on the surface with a flash-proof varnish (non-static insulation) in order to prevent the sheet from corroding and to improve the noise level.

## LV WINDING

The LV winding generally consists of aluminium foils isolated between layers by a pre-impregnated insulating material with hot polymerized resin. If necessary, ventilation ducts can be added. A choice of copper coils and casting is also available depending on the specific application requirement.

## HV WINDING

The HV winding is an insulated aluminium (or copper) conductor cast under vacuum in moulds. Strong fiber glass reinforcement dramatically improves and enhances the mechanical stability and shock withstandability during thermal overload.

## HV/LV COLUMN ASSEMBLY

The columns are assembled concentrically. The LV winding is secured directly to the core. The HV winding is blocked between two frames by wedges of rubber cushions that also serve as expansion absorbers. This arrangement ensure minimal movement during handling.

## EXCLUSIVE CASTING SYSTEM

In the face of increasingly strict regulations with regard to the risk of fire and pollution, AREVA T&D practices a policy of permanent research on the fire behavior of insulating materials. This has led to the exclusive class F casting system (temperature of insulation system: 155°C) developed in our laboratories.

This system comprises 2 main components:

- > Epoxy resin
- > A hydrid hardener

When polymerized, the epoxy resins associated with the hardener forms a stable three-dimensional network. These systems have better properties than most of plastics. Their use in transformers is justified owing to their:

- > Excellent resistance to thermal aging.
- > Remarkable adherence to almost all known materials.

Exceptional performance renders the windings resistant to many chemicals. Mechanical strength and high-thermal conductivity are achieved by incorporating selected mineral fillers, thus enabling heat to be evacuated during use, improved fire resistance and a dramatically reduced quantity of combustible materials.

The solid insulation is obtained by vacuum casting in pre-heated moulds, followed by a hardening period under controlled temperature.

After hardening by polymerization, this casting system becomes permanent. It offers excellent fire behavior and immediate self-extinction well beyond rated conditions of use. HARMONY™ transformers can hence be qualified as truly "non-flammable".



**HARMONY™**  
in wind farm installation

## ELECTRICAL AND ROUTINE TESTS

- > Winding resistance
- > Voltage ratio and coupling
- > No-load loss and no-load current
- > Short circuit impedance
- > Load loss
- > Dielectric tests
- > Partial discharge testing  
(acceptable level: 10 pC at 1.30 Ur)

## TYPE TESTS

In addition to the routine tests, the following type tests can be performed on request in AREVA laboratories:

- > Impulse voltage test
- > Temperature rise test

## SPECIFIC TESTS

- > Noise level test  
This test can be performed on request in our laboratories.
- > Short circuit withstand test  
Test certificate:  
HM21/20-7102/1 (630 kVA)  
HM21/20-7103/1 (1000 kVA)



## TESTS IN ACCORDANCE WITH HD 464 S1 AND EN 60726

The tests to prove compliance with class C2 - E2 - F1 shall be performed on the same unit in the same testing laboratory.

### E2 Class: suitability in moist & corrosive environment

Certificate n° AT-97/ 004568.  
In accordance with CENELEC HD 464 S1: 1988/A2 and 1991 annex ZA.2.2a  
> Condensation test  
> Moisture penetration test

### C2 Class: Thermal behavior

#### Thermal shock test

Certificate n° AT-97/ 004568.  
This test is carried out according to standard HD 464 S1/A2 and section ZB3.2a covers the evaluation of the transformer's performance when energized at low ambient temperature CENELEC HD 464 S1/A2.

### F1 Class: fire behavior

Certificate n° BC-97/ 006490.  
Measurement of the oxygen index and the gross calorific value.

The HARMONY™ casting system and insulation used have obtained excellent F1 classification, thus confirming the non-toxicity of decomposition gases as well as the low quantities of opaque smoke produced in case of fire.h

### Oxygen index

Certificate n° 4060765 DMAT/1 according to French standard NF T 51-071. This index makes it possible to appreciate the reliability of a material. It corresponds to the minimum percentage of oxygen necessary for a fire to continue burning. Substances having an oxygen index superior to 21 (ambient air) do not feed combustion, they are self-extinguishing.

### Smoke classification

Certificate n°4060765 DMAT/3 during a fire, the smoke alone can have considerable impact on people, property and the environment. The effect of smoke may include:

- > Opacity: no orientation.
- > Emission of corrosive gases which produces damage far from the fire zone and increases repair costs and downtime.
- > Emission of noxious gases which present a health and safety hazard.