

# GREEN.THE high efficiency transformers

CONFORMING TO **IEC 60076-11**  
AND **EU REGULATION 548/2014**



**ZUCCHINI**

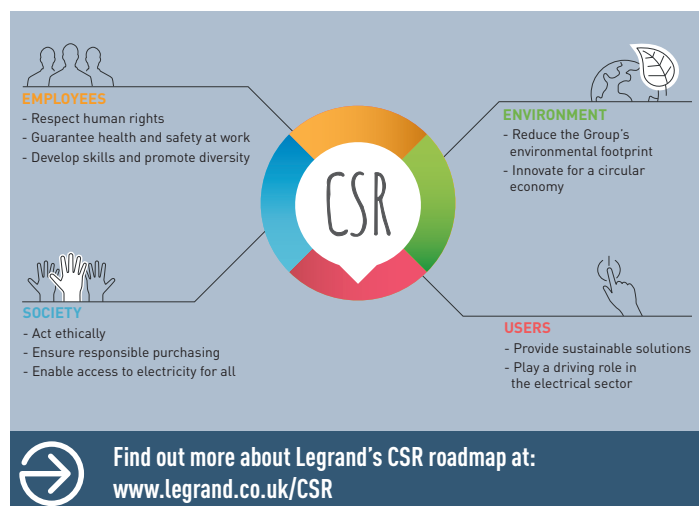


# Global strength built on local knowledge

Legrand is the global specialist in electrical and digital building infrastructures. Innovation is the driving force behind its development. With an increasing investment in research and development (circa 5% of sales) and more than 4,000 active patents, the Legrand Group is focused on maintaining a high rate of new product launches that present innovative solutions to the market.

## CORPORATE SOCIAL RESPONSIBILITY

Legrand's 2014-2018 CSR roadmap is a natural extension to the governance and sustainable development approach in which the company has been engaged for many years. The CSR roadmap firmly asserts Legrand's continued commitment to sustainable development.



**BUILDING SERVICES**



**INFRASTRUCTURE**



**PROCESSING INDUSTRIES**



**HEAVY INDUSTRIES**



# MEETING THE ECODESIGN DIRECTIVE

The latest amendment to the European Commission's Ecodesign Directive is fully implemented from 1st July 2015.

The new legislation outlines the parameters transformers must adhere to in order to meet efficiency requirements, detailing the maximum load and no-load losses a transformer can record.

The European Commission estimates that as much as 2.5 per cent of all energy consumed by the EU is wasted through transformer losses.

The new directive will help to reduce wasted energy on future projects and consequently improve global carbon emissions and lower energy bills for the end user.



## PRODUCT SELECTION

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## Green T.HE MV/LV cast resin transformers

### 12 kV insulation class



Technical information p. 6-16

Compliance with standard : IEC 60076-11 / EU regulation 548/2014

Frequency (Hz) : 50

Adjustment, MV side :  $\pm 2 \times 2.5\%$

Vectorial group : Dyn11

Thermal class of the insulating system : 155 °C (F) / 155 °C (F)

Temperature rise : 100/100 K

Class of use : E2-C2-F1 Certified CESI A9032391 IEC 60076-11

Tolerances : Po and Pk have zero tolerances in line with the EU regulation 548/2014

BIL : 75 kV

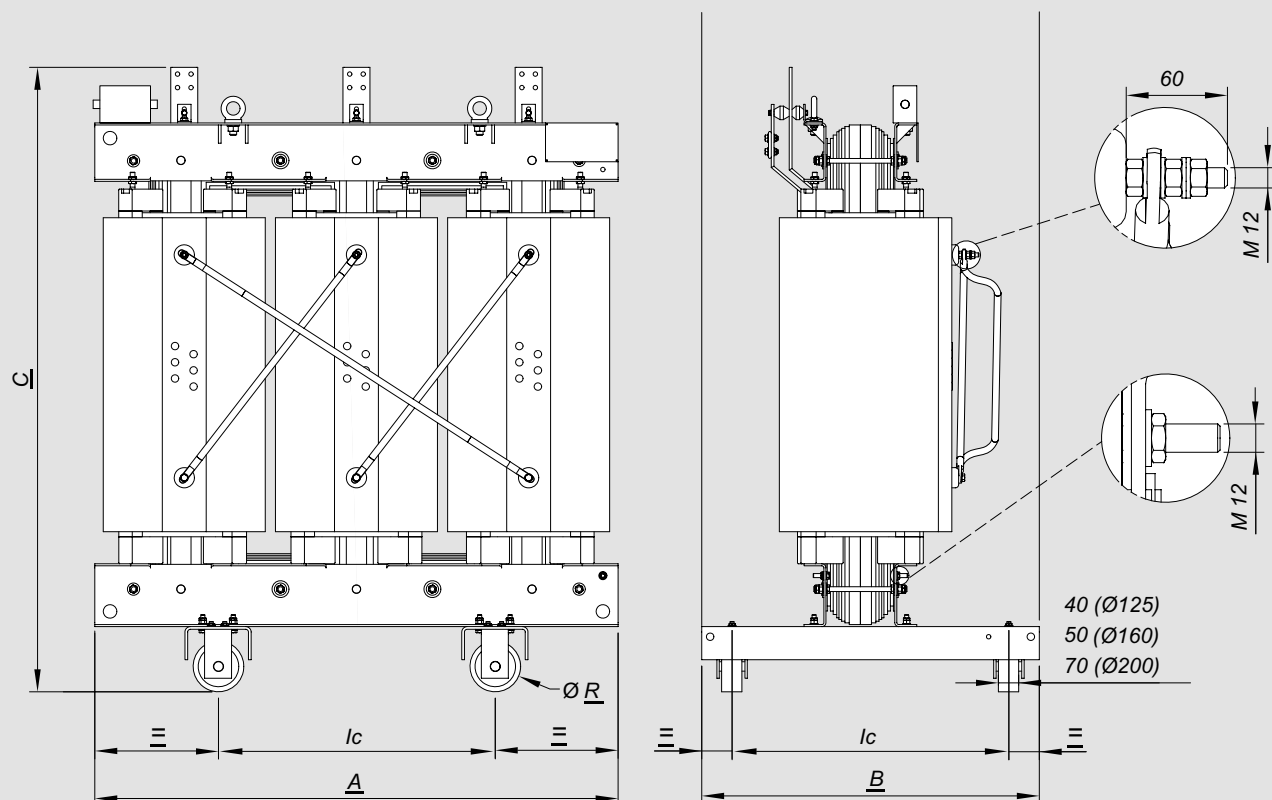
S <sub>R</sub> [kVA]	Series	U <sub>k</sub> [%]	Primary voltage [kV]	Secondary voltage [V] Insulation class 1-1 kV	P <sub>0</sub> [W]	P <sub>k</sub> [W] at 120°C	I <sub>0</sub> [%]	LwA- Acoustic power [dB (A)]	Length (A) [mm]	Width (B) [mm]	Height (C) [mm]	Ic - wheel centre line [mm]	R - wheel diameter [mm]	Weight [kg]	BOX type
100	AoAk	6	11	400 / 417 / 433	280	1800	1.8	51	1250	600	1250	520	125	850	2
	AoBk	6	11	400 / 417 / 433	280	2050	1.8	51	1250	600	1250	520	125	850	2
160	AoAk	6	11	400 / 417 / 433	400	2600	1.6	54	1300	600	1300	520	125	1050	2
	AoBk	6	11	400 / 417 / 433	400	2900	1.6	54	1300	600	1300	520	125	1050	2
200	AoAk	6	11	400 / 417 / 433	450	2955	1.4	55	1350	600	1350	520	125	1150	3
	AoBk	6	11	400 / 417 / 433	450	3300	1.4	55	1350	600	1350	520	125	1150	3
250	AoAk	6	11	400 / 417 / 433	520	3400	1.2	57	1350	600	1350	520	125	1250	3
	AoBk	6	11	400 / 417 / 433	520	3800	1.2	57	1350	600	1350	520	125	1250	3
315	AoAk	6	11	400 / 417 / 433	615	3875	1.1	58	1350	750	1450	670	125	1350	3
	AoBk	6	11	400 / 417 / 433	615	4535	1.1	58	1350	750	1450	670	125	1350	3
400	AoAk	6	11	400 / 417 / 433	750	4500	1	60	1450	750	1500	670	125	1600	4
	AoBk	6	11	400 / 417 / 433	750	5500	1	60	1450	750	1500	670	125	1600	4
500	AoAk	6	11	400 / 417 / 433	900	5630	0.9	60	1450	750	1600	670	125	1700	4
	AoBk	6	11	400 / 417 / 433	900	6410	0.9	60	1450	750	1600	670	125	1700	4
630	AoAk	6	11	400 / 417 / 433	1100	7100	0.9	62	1450	850	1700	670	160	2050	5
	AoBk	6	11	400 / 417 / 433	1100	7600	0.9	62	1450	850	1700	670	160	2050	5
800	AoAk	6	11	400 / 417 / 433	1300	8000	0.8	64	1550	850	1800	670	160	2450	5
1000	AoAk	6	11	400 / 417 / 433	1550	9000	0.7	65	1650	1000	1950	820	160	3050	6
1250	AoAk	6	11	400 / 417 / 433	1800	11000	0.7	67	1750	1000	2050	820	160	3500	6
1600	AoAk	6	11	400 / 417 / 433	2200	13000	0.5	68	1850	1000	2100	820	160	4350	7
2000	AoAk	6	11	400 / 417 / 433	2600	16000	0.5	70	1950	1310	2200	1070	200	5250	7
2500	AoAk	6	11	400 / 417 / 433	3100	19000	0.4	71	2050	1400	2300	1070	200	5950	8
3150	AoAk	6	11	400 / 417 / 433	3800	22000	0.4	74	2300	1400	2500	1070	200	8000	8



Other insulation classes, such as 17.5, 24 and 36 kV, available on request along with other primary voltages, such as 6.6 kV, please contact us on +44 (0) 370 608 9020



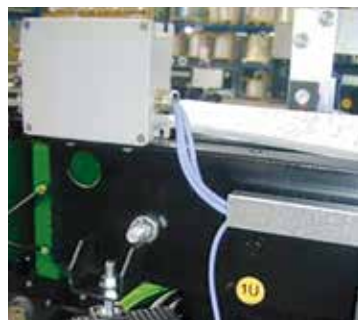
# Technical dimensions



Values are for reference only  
 Construction drawings must be used for design  
 Data provided may be modified without warning for reasons of technical production  
 or product improvement

# Green T.HE MV/LV cast resin transformers

## installation accessories



IP 65 junction box



Pt100 temperature measurement sensor

Selection charts **p. 2-3**  
Technical information and dimensions **p. 6-16**

Pack	Cat. Nos.	Temperature measurement sensors				
		Temperature measurement sensors are supplied mounted on to the transformer and wired to aluminium IP 65 junction box				
		Type	Range (kVA)	No.	Δt (°C)	Installation
3	200073	Pt100	≤2000	3	—	on the LV (3) windings
3	200074	Pt100	>2500	3	—	on the LV (3) windings
4	200137	Pt100	≤2000	3 + 1	—	on the LV (3) windings + on the core (1) on the LV (3) windings
4	200138	Pt100	>2500	3 + 1	—	on the LV (3) windings + on the core (1) on the LV (3) windings
6	CB00120	PTC	—	3 x 2	130-140	windings for alarm and release
6	CB02400	PTC	—	3 x 2	110-120	on the LV (3 pairs) windings for alarm and release

Pack	Cat. Nos.	Temperature control devices	
		Central units are supplied unassembled	
		Type	Description
1	220035	VRT200	Fan control
1	220002	T154	Temperature control for 4 Pt100 probes
1	220023	MT200L	Temperature control for 4 Pt100 probes
1	220010	T119 DIN	Temperature control for 6 PTC probes, preset for DIN rail mounting
1	220004	T119	Temperature control for 6 PTC probes

Pack	Cat. Nos.	Non-magnetic thermometer
		Both thermometer and support bracket must be ordered
1	250662	Thermometer (supplied without supporting bracket)
1	250005	Thermometer support bracket (must be ordered alongside thermometer)

Pack	Cat. Nos.	Surge arrester kit
		Supplied mounted on the transformer
		Fitting of surge arresters increases warranty to 24 months
		Voltage Vn (kV)
1	130054D	11
1	130055D	15
1	130056D	20
		Rubber supports (anti-vibration)
		4 anti-vibration pads for mounting under transformer casters
		Range kVA
1	170019	100-1600
1	170020	2000-3150

For details of corresponding connection interfaces for the SCP busbar range see p. 15



## Green T.HE MV/LV cast resin transformers

### installation accessories (continued) and enclosures



Ventilation bars

Selection charts **p. 2-3**Technical information and dimensions **p. 6-16**

Pack	Cat. Nos.	Ventilation bars		
		Ventilation bars allow a temporary increase of the rated power (at rated operation conditions) :		
		1. When ordering an AN/AF transformer, the ventilation bars will be supplied fitted to the transformer		
		2. When ordering a transformer, and the AN to AN/AF conversion (within the limits indicated in the table below) is completed after delivery, the purchaser will have to return the original data plate to the manufacturer, who shall then supply a new data plate and the corresponding assembly instructions		
		Range (kVA)	ΔPower (%)	Notes
1	CB02443	100-250	+30	A temporary increase in rated conditions
1	CB02453	315-800	+30	
1	CB02463	1 000-1 250	+30	
1	CB01413	1 600-2 500	+30	
1	CB01411	3 150	+30	
1	CB02444	100-250	+40	
1	CB02454	315-800	+40	
1	CB02464	1 000-1 250	+40	
1	CB01414	1 600-2 500	+40	
1	CB01412	3 150	+40	



Transformer enclosure colour RAL 7035

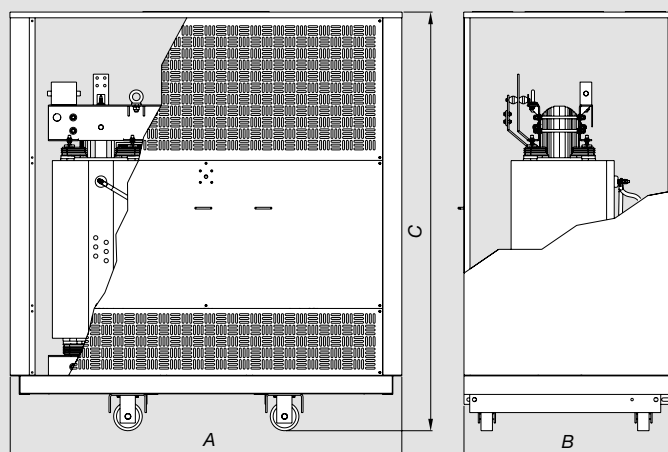
AREL door lock on the enclosure, Cat. No. 230076

Pack	Cat. Nos.	Enclosures					
		Insulation Class 12 / 17-5 / 24 kV					
		Degree of protection : IP 21 / IP 23 / IP 31					
		Colour RAL 7035					
		Boxes can be supplied or assembled on the transformer					
		For a pre-assembled box add the 'M' suffix to the Cat. No. (e.g. Cat. No. 231043M)					
		Box type	IP degree	Dimensions (mm)			Weight (kg)
				Length (A)	Width (B)	Height (C)	
1	230316	1	IP21	1600	900	1470	120
1	230288	1	IP31	1600	900	1470	130
1	230353	1	IP23	1600	900	1470	120
1	230211	2	IP21	1700	950	1580	140
1	230273	2	IP31	1700	950	1580	140
1	230263	2	IP23	1700	950	1580	140
1	230212	3	IP21	1800	1000	1680	160
1	230215	3	IP31	1800	1000	1680	170
1	230234	3	IP23	1800	1000	1680	160
1	230204	4	IP21	1900	1050	1950	180
1	230277	4	IP31	1900	1050	1950	200
1	230222	4	IP23	1900	1050	1950	180
1	230213	5	IP21	2050	1100	2200	210
1	230221	5	IP31	2050	1100	2200	230
1	230223	5	IP23	2050	1100	2200	210
1	230214	6	IP21	2300	1310	2500	280
1	230267	6	IP31	2300	1310	2500	340
1	230249	6	IP23	2300	1310	2500	280
1	230287	7	IP21	2500	1310	2700	300
1	230309	7	IP31	2500	1310	2700	360
1	230371	7	IP23	2500	1310	2700	300
1	231042	8	IP21	2700	1400	2800	320
1	231043	8	IP31	2700	1400	2800	380
1	231044	8	IP23	2700	1400	2800	320



Other enclosures including freestanding options are available on request, please contact us on +44 (0) 370 608 9020

#### Technical dimensions



For 36 kV enclosures' dimensions and weights, please contact us on +44 (0) 370 608 9020

## Green T.HE MV/LV cast resin transformers

### constructional characteristics

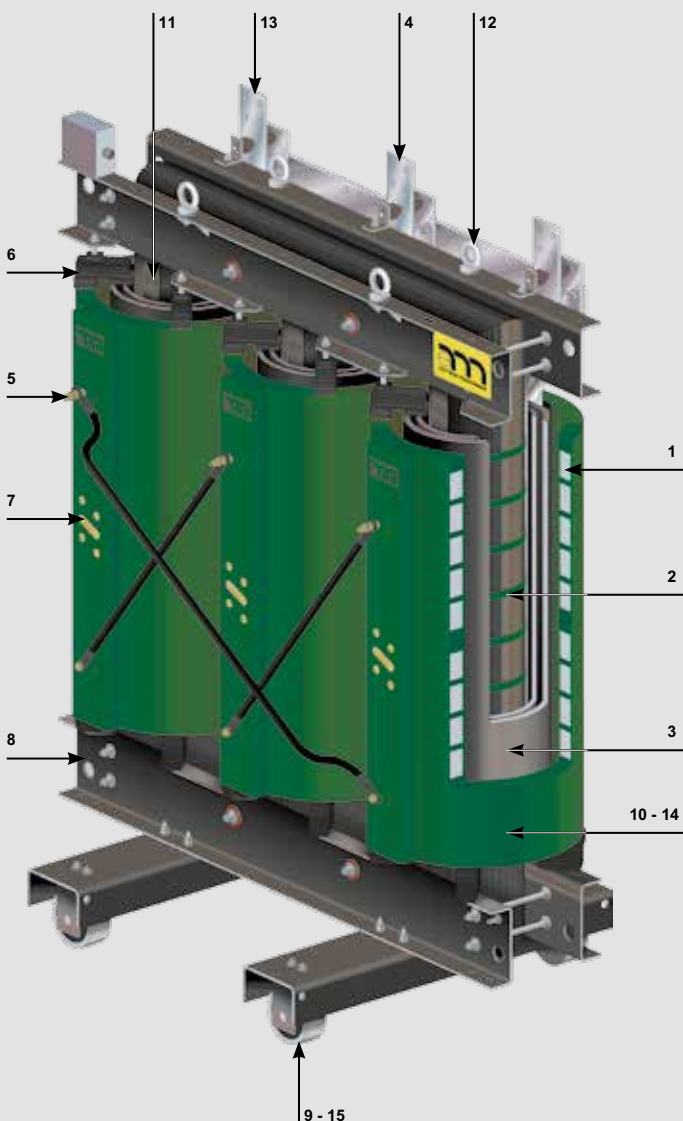
#### ■ Installing a Zucchini cast resin transformer

Zucchini cast resin transformers are distinguished by their high quality production. Using state-of-the-art constructional techniques and equipment, quality is assessed throughout the production process and via a rigorous checking process in the final phase, resulting in a high quality, reliable product.

Zucchini cast resin transformers can be installed quickly and easily.

With no additional construction or building activities necessary, safe installation is ensured by following a few simple steps :

- Standard execution – indoor installation, in dry / clean environments, protected from direct sunlight, with no possibility of water ingress
- Altitude no higher than 1000 m above sea level (for higher installations, contact us on +44 (0) 370 608 9020)
- Room temperature with transformer in operation (for higher values, contact us on +44 (0) 370 608 9020) :
  - T minimum – 25°C
  - T maximum + 40°C
- With a standard execution, transformers are designed in accordance with IEC Standard 60076-11 for the following room air temperatures :
  - 40°C at peak times
  - 30°C as a monthly average in the warmest month
  - 20°C as a yearly average
- To protect the transformers from external environment impacts and/or people from the risk of having direct contact, a set of standard enclosures is available with different degrees of protection : IP 21 / IP 31 / IP 23



- 1 MV windings in aluminium strip coils, cast in resin under vacuum
- 2 Core in three columns in magnetic lamination with high-permeability oriented crystals, also available with low losses
- 3 LV windings in aluminium plate/sheet and vacuum-cast impregnated insulation material
- 4 LV connections upwards (standard) or downwards version (on request)
- 5 MV connections upwards (standard) or downwards version (on request)
- 6 Rubber inserts attenuate the transmission of vibrations between core and windings, and reduce operating noise generated by the transformer to a minimum, as well as absorbing the thermal expansion of the components
- 7 Off load links on the MV side to adapt the primary voltage to the mains, which can be set with transformer switched OFF
- 8 Structure, armatures and carriage, manufactured from strong painted sheet steel
- 9 Carriage with bi-directional castors
- 10 The epoxy resin insulation makes the transformer low maintenance
- 11 The operating temperature is checked by Pt100 sensor or PTC in the LV windings
- 12 Lifting eyebolts conform to the DIN-580 UNI-2947 standards with safety hooking at 4 points
- 13 Optional pre-equipment for connection of the LV connection to Zucchini busbar trunking system
- 14 Class F insulating material, at 155°C, allowing for a temperature rise of 100°K. (100°C)
- 15 The carriage allows safe movement and is pre-equipped for mounting IP reinforced boxes



## Green T.HE MV/LV cast resin transformers

### technical information

#### ■ Medium voltage (MV) winding

The medium voltage winding, made by highly automated winding machines, is constructed with the continuous disk technique and made in aluminium strip, interleaved with double insulation

This type of working produces uniformity of the internal and external thickness of the resin and guarantees uniform resistance to the dielectric stresses to which the transformer will be subjected in the inspection phase or during its operation at the place of installation

The primary winding has off load links to adjust the primary voltage equal to the value  $\pm 2 \times 2.5\%$ , made with brass bushes protruding from the resin, and brass nuts and bolts with indelible numbering (not with adhesive labels)

The thermal class of the insulating materials used corresponds to class F, with the temperature rises allowed by standard IEC 60076-11



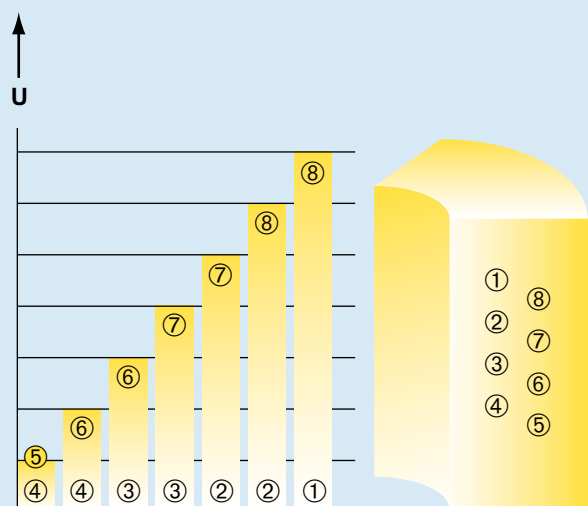
Modern electronically controlled winding machines



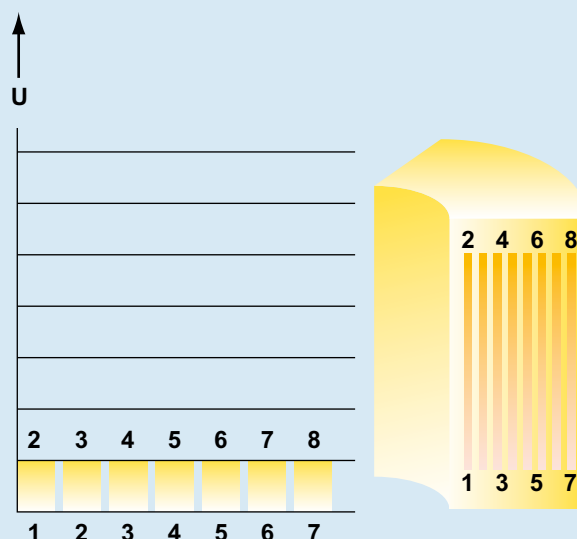
The pouring system under high vacuum

The technology used in making the MV windings in strips, rather than in wire, puts less stress on the insulation between the turns. In traditional windings, made with a circular-section conductor, each layer of the winding is made up of a number of turns side by side. In windings made with strip conductors, each layer is made up of just one turn. If the voltage of a single turn of a winding is denoted by  $u_s$ , in strip windings the voltage between turns belonging to two adjacent layers is always  $u_s$ , while in traditional windings this voltage assumes the maximum value of  $(2n - 1) u_s$ , as shown in the diagram below

#### Division of the voltage between the turns of the medium voltage winding



Winding made with wire conductors :  
the voltage increases with the number of turns



Winding made with strip conductors :  
the voltage is divided uniformly

Transformers with strip windings thus have a greater capacity of resistance to impulse voltages and at industrial frequencies, as well as a lower probability of occurrence of localised partial discharges. Strip winding also has the advantage of drastically reducing the axial forces due to short-circuit currents

## Green T.HE MV/LV cast resin transformers

### technical information (continued)

#### ■ Low voltage (LV) winding

The low voltage winding is made up of a single aluminium strip, of the same mechanical height as the MV electrical winding, with an interleaved sheet of insulating material which can be Class F or Class H. Making the winding in this way guarantees a compactness which forms a single cylinder that resists any axial and radial forces that may arise from a short-circuit

All the welds of the conductor strip with the output bars are made by butt welding in an inert atmosphere and under electronic control, so as to avoid any excess of material which could, by repeated stress, affect or damage the insulation interposed between output terminal and the following turn

This winding is then impregnated with epoxy resin, under vacuum, to confer the necessary compactness and homogeneity, as well as avoiding the absorption of humidity during the transformer's lifetime, wherever it may operate

This treatment means the system meets classification at level F1 according to standards IEC 60726 and IEC 60076-11



LV winding system



TIG welding in controlled atmosphere for LV connections

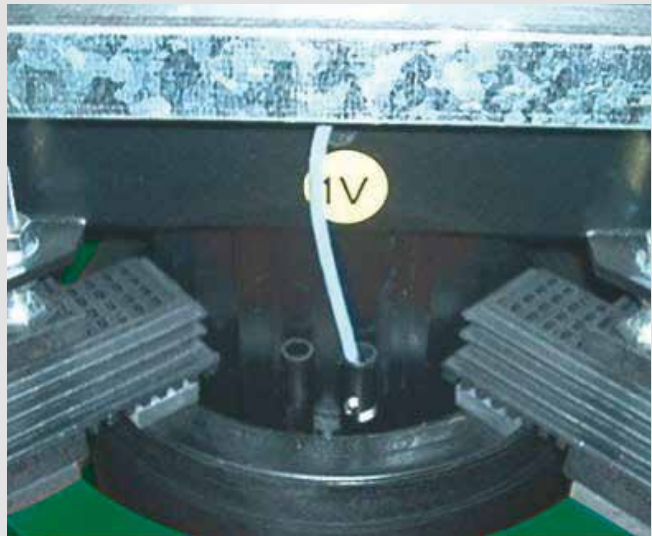


## ■ Protection against temperature rise

During its normal operation a transformer has no-load losses and load losses which fundamentally translate into dispersed thermal energy. This energy depends on the construction of the transformer itself, its power and the installation conditions. It should be remembered that the energy dispersed thermally is proportional to the transformer temperature minus the room temperature. At a given room temperature, the transformer temperature depends mainly on the load losses. As the load increases consequently the losses and the room temperature increase favouring a more rapid degradation of the insulations and thus a greater probability of failure of the dielectric. This situation could also occur when, with equal losses due to load, the room temperature and consequently the transformer temperature, increase. The IEC 60085 standard defines insulation classes which indicate the maximum temperatures that can be reached by the transformers in their normal operation and which must not be exceeded

### Insulation classes

Class	Transformers	Average temperature rise limits, at rated current
Class F (155°C)	resin	100° K



Pt100 sensor to check the temperature

Temperature rises depend not only on the load and the overcurrents that may be detected by the protection devices, but also on environmental factors (inefficiency of the cooling system, fault on the forced ventilation and increase of the room temperature) which influence the dispersal of heat produced by the transformer's specific losses. For this reason electronic temperature measuring devices are normally provided. These are necessary to trigger the alarm or transformer protection. The following temperature sensors are available for Zucchini transformers: Pt100 thermosensors and PTC thermistors :

- **Pt100**: supplies a signal proportional to the temperature measured
- **PTC**: supplies an ON/OFF signal depending on whether the temperature measured is less or more than the sensor's threshold

The sensors are positioned in the hot point of the winding

Both the Pt100 and PTC signals must be processed by the temperature control unit, which does not form part of the standard equipment

On request other accessories are available to check the temperature :

- a separate temperature display, to be installed on the control panel
- an output relay for alarm and release and control of the fans

### Maximum transformer alarm and release temperature values

Transformer type	Room (°C)	Alarm (°C)	Release (°C)
Resin	40	130	140

### Temperature rise limits for cast resin transformers

Part	Insulating system temperature (°C)	Maximum temperature rises (K)
Windings : temperature rise measured with the heating element variation method	155 (F)	100
Core, metal parts and adjacent materials	—	In no case must the temperature reach values which would damage the core itself, other parts or adjacent materials

When combined with control sensors, the following can also be supplied, if required :

- T154 Unit or MT200 Unit : equipment used for controlling the Pt100 thermistors with temperature display, output relay for alarm, optional trip and control of the ventilation bars supplied as a detached part to be installed on the electric panel
- T119 Unit : equipment used for controlling the PTC thermistors with output relay for alarm, optional trip and control of the ventilation bars supplied for being installed on the electric panel

Ventilation accessories :

- Zucchini cast resin transformers can be equipped at the factory with special ventilation bars  
These special tangential fans are designed to allow temporary and limited increase of the power delivered by the transformer, up to + 40% of the rated power

- VRT200 Unit : equipment for automatic activation and control of the fans

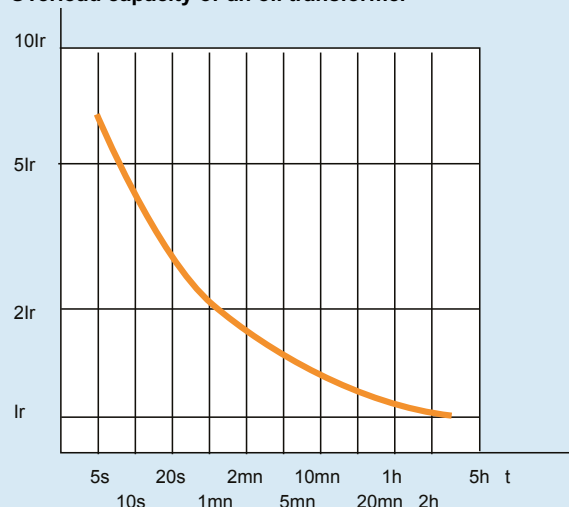
# Green T.HE MV/LV cast resin transformers

## technical information (continued)

### Protection against overloads

Overload is the phenomenon which occurs when the value of current absorbed by the system is higher than the rated value. The persistence of an overload inevitably leads to exceeding the acceptable temperature rise limits specified for the transformer, with the consequent risk of deterioration of the insulating materials. Exceptionally, in certain abnormal service conditions, it may be acceptable to exceed the overload and temperature rise thresholds, to the detriment of the transformer's expected lifetime. This situation is sometimes preferable to an interruption of service (due to a temporary power peak) which could cause considerable material and economic damage. In most cases the overloads are transient and thus generally do not affect the thermal equilibrium. The 'acceptable' overload level is a function of the user's need for service continuity and the type of system itself. For insulating-liquid transformers the circulation of the cooling oil and the shape of the radiator containment tanks allow the rapid restoration of the insulation and the reduction of partial discharges, as well as allowing the transformer to reach its operating temperature quickly

Overload capacity of an oil transformer



For cast resin transformers, the cooling component is air, and thus it takes longer to reach the operating temperature. In these conditions cast resin transformers may be more overloaded and thus may be used in systems with loads where there are frequent breakaway starting currents. This is true as long as the temperature rises on the windings do not remain above the allowable values for too long. A partial solution of the problem may be the use of radial fans affixed to the cast resin transformers, allowing a temporary transformer overload up to 150% of the rated power. It should, however, be remembered that as the power increases the losses due to load increase. As they depend on the square of the current they can reach up to 2.25 times the rated value. Radial fans should only be used in special and temporary cases to cool the windings or to have a sort of power reserve which may be used in emergency situations



### Overload in public distribution

In public distribution, in the short term priority is given to continuity of service. For this reason overloads do not generally lead to switching the transformer "OFF". Again for the same reason generally low voltage circuits are always oversized and consequently an overload of the transformer never corresponds to an overload of the conductors. However, attention should be paid when the overloads repeat too frequently. In this situation the distributing organisation should replace the transformer with a model with greater power



### Overload in industrial distribution

In an industrial installation, the overload can last for a short or long time. In these installations the main distribution board equipped with protective circuit breakers against overload and short-circuit is always immediately downstream of the transformers. Management of the overload is in fact delegated to the circuit breakers on the low voltage side which will detach the loads in an automatic or controlled way



### Overload in service distribution

In service installations, such as offices and shopping centres, continuity of service is fundamental. In these types of application conditions of regular load, which have starting regimes or similar behaviour, rarely occur

To guarantee maximum continuity of service, even when there are overloads, it is essential that the loads considered non-priority are managed and disconnected when needed by the transformer on the low voltage side



## ■ Protection against overloads by means of measuring the temperature

As previously stated, overload is fundamentally associated to a temperature rise, which is the real component to be kept under control, because its effects could lead to the rapid deterioration of the insulation materials and to the failure of the transformer's dielectric properties. Verifying the temperature is a determining factor in protection of the transformer itself. To check the temperature therefore, cast resin transformers are generally equipped with thermoresistors, in turn connected to electronic control units, which signal or directly release the transformer when the defined thresholds are exceeded. Zucchini cast resin transformers have these thermoresistors installed near the parts which are most critical from the thermal point of view



Example of installation of a Pt100 temperature control unit



Fan control unit



Temperature control unit



# Green T.HE MV/LV cast resin transformers

## technical information (continued)

### ■ Environmental and climatic features, and fire resistance

Standard IEC 60076-11 (2004) uses an alphanumeric code to identify the environmental, climatic and fire behaviour classes of dry-type transformers

- environmental class (E0 – E1 – E2)
- climatic class (C1 – C2)
- fire behaviour class (F0 – F1)

Thanks to the use of a high-quality epoxy resin, all Zucchini transformers reduce environmental impact to a minimum and conform to the following classes :

- environmental class E2
- climatic class C2
- fire behaviour class F1

### ENVIRONMENTAL TESTS

- E0**  
No condensation on the transformer, negligible pollution, installation in a clean and dry room
- E1**  
Occasional condensation and little pollution
- E2**  
The transformer is subject to consistent condensation, to intense pollution, or to both phenomena

### CLIMATIC TESTS

- C1**  
The transformer will not operate at temperatures lower than -5°C, but may be exposed to -25°C during transport and storage
- C2**  
The transformer can operate and be transported and stored at temperatures down to -25°C

### FIRE RESISTANCE

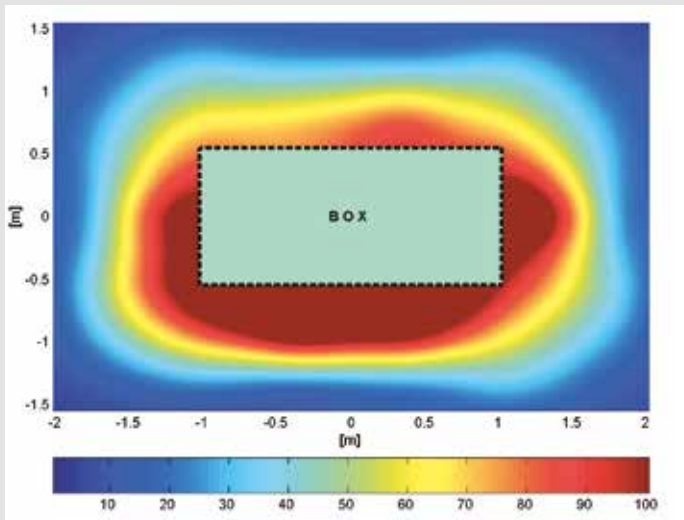
- F0**  
The risk of fire is not expected and no measures are taken to limit inflammability
- F1**  
The transformer is subject to the risk of fire and reduced inflammability is required. Fire on the transformer must be extinguished within laid-down limits

The thermal class of the insulating materials used corresponds to class F and the temperature rises are those given in the specific standards for the transformer product

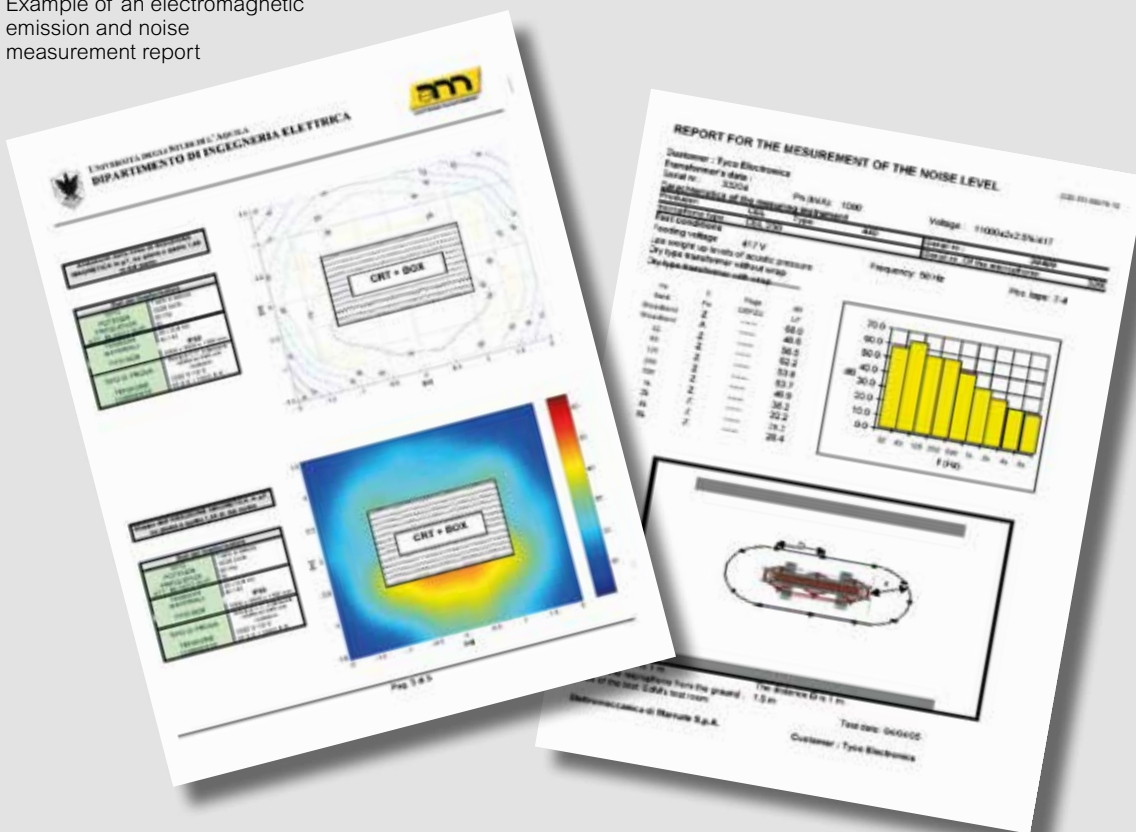
### ■ CLE range (certified low electromagnetic emission)

CLE transformers (certified low electromagnetic emissions) are specifically designed and built for reducing electromagnetic emissions. This is the ideal solution for places continuously attended by people or, for example, with particularly sensitive electronic equipment. As a result, the Zucchini cast resin CLE range is fully in compliance with the DPCM regulations of 8/7/2003 (electromagnetic emissions lower than 10 microTesla), and the Zucchini quality target is set to a threshold of 3 microTesla. Legrand provides each CLE cast resin transformer with a specific measurement ratio of the electromagnetic emissions.

Furthermore, by using a modern semi-anechoic chamber located inside the Legrand laboratory, the CLE transformation systems can also be supplied with a noise measurement ratio based on different emission bands.



Example of an electromagnetic emission and noise measurement report



# Green T.HE MV/LV cast resin transformers

## technical information (continued)

### The main vector groups of transformers

Internal windings may be connected in star, triangle or zigzag  
Depending on the connection method, the system of induced voltages on the low voltage side is out of phase with respect to the average voltage by angles which are multiples of  $30^\circ$

The winding connection method is identified by 3 letters (upper case for the primary and lower case for the secondary) :

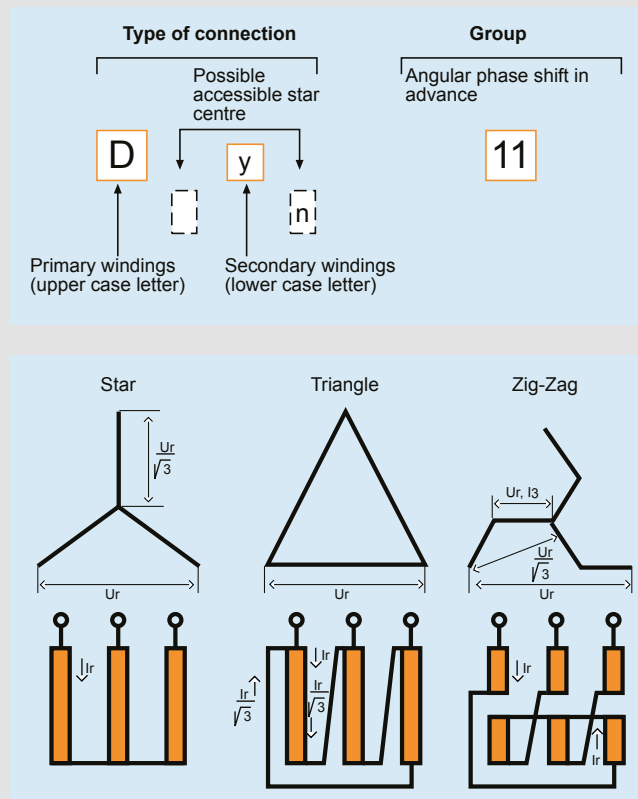
**Y** – star connection  
**D** – triangle connection  
**Z** – zigzag connection

Associated with these letters are identified numbers which represent the phase shift, dividing it into 4 groups :

Group 0 – no phase shift  
Group 11 –  $330^\circ$   
Group 6 –  $180^\circ$   
Group 5 –  $150^\circ$

The choice of the transformer switching ON unit is one of the important factors for determining the operating regime as a function of the load  
The ideal condition is when the load is balanced on all the phases, but this condition is often impossible to obtain. For this reason one must know the phase shift between primary and secondary phases

The table below shows the typical insertion diagrams



### Typical insertion diagrams

	<b>Dd0</b>		<b>Dd6</b>
	<b>Yy0</b>		<b>Yy6</b>
	<b>Dz0</b>		<b>Dz6</b>
	<b>Dy11</b>		<b>Dy5</b>
	<b>Yd11</b>		<b>Yd5</b>
	<b>Yz11</b>		<b>Yz5</b>

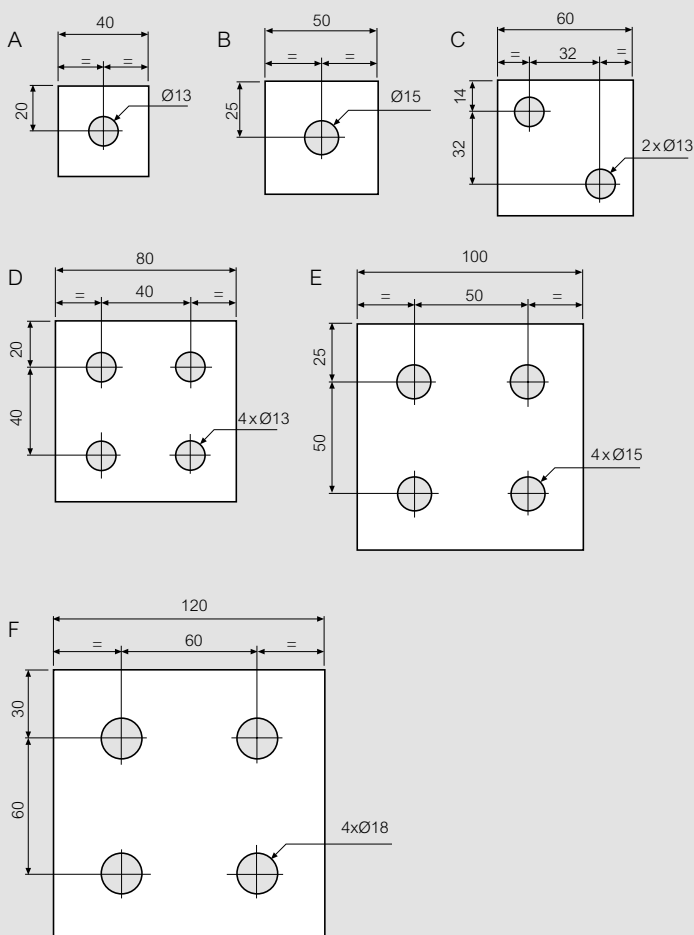


## ■ Standard drilling details

LV connection terminals are manufactured from aluminium  
Special CUPAL bimetallic plates can be supplied for the connection of copper cables

Drawing	Range kVA	Thickness [mm]	Width [mm]	No. of holes	Ø holes [mm]
<b>A</b>	100	4	40	1	13
	160	4	40	1	13
<b>B</b>	200	5	50	1	15
	400	5	50	1	15
<b>C</b>	500	6	60	2	13
	630	6	60	2	13
	800	8	60	2	13
<b>D</b>	1000	8	80	4	13
<b>E</b>	1250	8	100	4	15
<b>F</b>	1600	10	120	4	18
	2000	12	120	4	18
	2500	16	120	4	18
	3150	20	120	4	18

All the data given can be modified without warning for reasons of technical production or product improvement

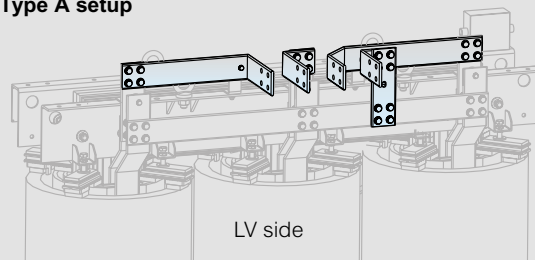


## ■ Special extended LV bar arrangements

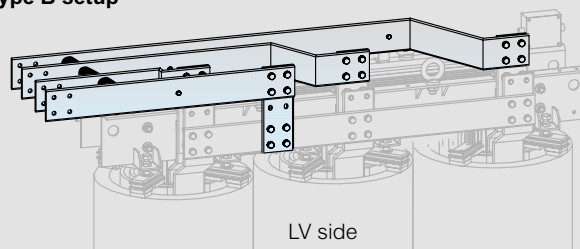
The Legrand Group offer meets the needs of any installation  
Cast resin transformers have specifically designed connections for Zucchini busbars

The versions shown represent some of the standard solutions for the outgoing busbar run from the transformer

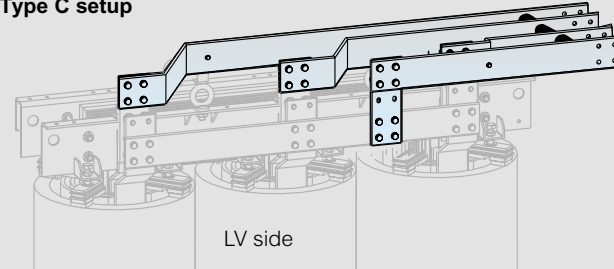
### Type A setup



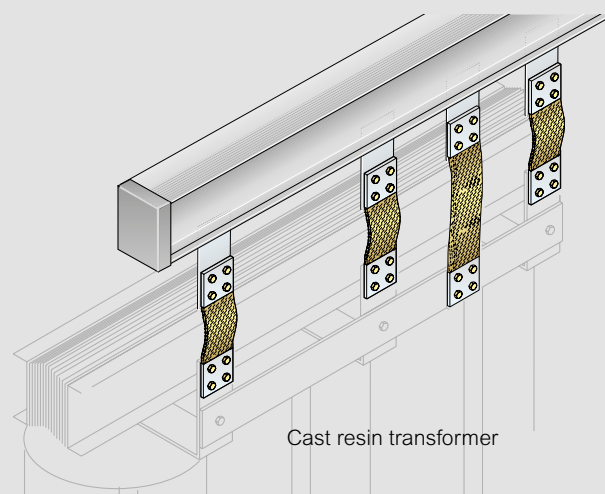
### Type B setup



### Type C setup



## ■ ATR connection interface



A technical drawing of the transformer is needed when creating an ATR connection interface

**Extended MV bars are available on request,  
contact us on +44 (0) 370 608 9020**

# Green T.HE MV/LV cast resin transformers

## technical information (continued)

### Compatibility with Zucchini SCP busbar

The Zucchini SCP busbar trunking system and cast resin transformers have been designed in perfect synergy for a direct connection. The versions shown below represent just a few of the standardised solutions.

#### 400 V secondary voltage

Transformer				Busbar (aluminium)	
kVA (kVA)	Insulation class (kV)	400 V current (A)	IK 6 % (kA)	Family	Connection component
630	12, 17-5, 24, 36	910	15-20	SCP 1000 A	60281012P
800		1155	19-30	SCP 1250 A	60281014P
1000		1444	24-10	SCP 1600 A	60281016P
1250		1805	30-10	SCP 2000 A	60281017P
1600		2310	38-50	SCP 2500 A	60391014P
2000		2887	48-20	SCP 3200 A	60391016P
2500		3609	60-20	SCP 4000 A	60391017P

Transformer				Busbar (copper)	
kVA (kVA)	Insulation class (kV)	400 V current (A)	IK 6 % (kA)	Family	Connection component
630	12, 17-5, 24, 36	910	15-20	SCP 1000 A	65281011P
800		1155	19-30	SCP 1250 A	65281013P
1000		1444	24-10	SCP 1600 A	65281015P
1250		1805	30-10	SCP 2000 A	65281016P
1600		2310	38-50	SCP 2500 A	65391018P
2000		2887	48-20	SCP 3200 A	65391015P
2500		3609	60-20	SCP 4000 A	65391016P
3150		4547	75-78	SCP 5000 A	65391018P

For full details on Legrand busbar systems see [www.legrand.co.uk/zucchini](http://www.legrand.co.uk/zucchini)

#### 417 V secondary voltage

Transformer				Busbar (aluminium)	
kVA (kVA)	Insulation class (kV)	417 V current (A)	IK 6 % (kA)	Family	Connection component
630	12, 17-5, 24, 36	873	14-60	SCP 1000 A	60281012P
800		1108	18-50	SCP 1250 A	60281014P
1000		1385	23-10	SCP 1600 A	60281016P
1250		1731	28-90	SCP 2000 A	60281017P
1600		2216	37-00	SCP 2500 A	60391014P
2000		2770	46-20	SCP 3200 A	60391016P
2500		3462	57-70	SCP 4000 A	60391017P

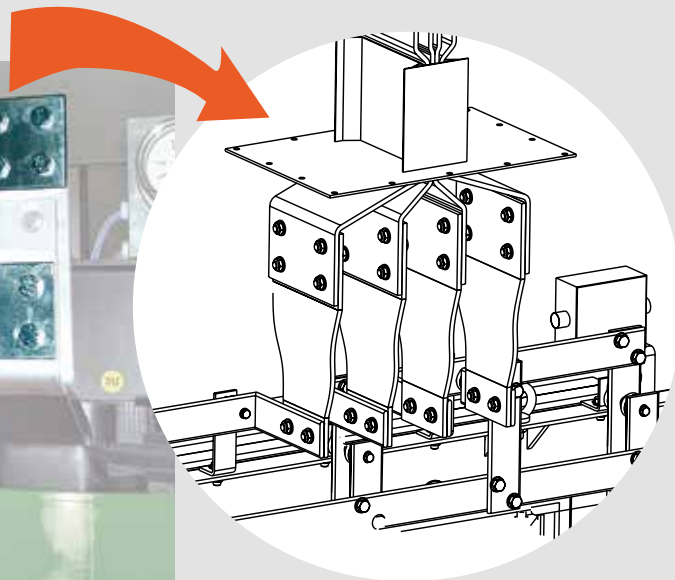
Transformer				Busbar (copper)	
kVA (kVA)	Insulation class (kV)	417 V current (A)	IK 6 % (kA)	Family	Connection component
630	12, 17-5, 24, 36	873	14-60	SCP 1000 A	65281011P
800		1108	18-50	SCP 1250 A	65281013P
1000		1385	23-10	SCP 1600 A	65281015P
1250		1731	28-90	SCP 2000 A	65281016P
1600		2216	37-00	SCP 2500 A	65391018P
2000		2770	46-20	SCP 3200 A	65391015P
2500		3462	57-70	SCP 4000 A	65391016P
3150		4362	72-70	SCP 5000 A	65391018P

#### 433 V secondary voltage

Transformer				Busbar (aluminium)	
kVA (kVA)	Insulation class (kV)	433 V current (A)	IK 6 % (kA)	Family	Connection component
630	12, 17-5, 24, 36	841	14-10	SCP 1000 A	60281012P
800		1067	17-80	SCP 1250 A	60281014P
1000		1334	22-30	SCP 1600 A	60281016P
1250		1667	27-80	SCP 2000 A	60281017P
1600		2134	35-60	SCP 2500 A	60391014P
2000		2667	44-50	SCP 3200 A	60391016P
2500		3334	55-60	SCP 4000 A	60391017P

Transformer				Busbar (copper)	
kVA (kVA)	Insulation class (kV)	433 V current (A)	IK 6 % (kA)	Family	Connection component
630	12, 17-5, 24, 36	841	14-10	SCP 1000 A	65281011P
800		1067	17-80	SCP 1250 A	65281013P
1000		1334	22-30	SCP 1600 A	65281015P
1250		1667	27-80	SCP 2000 A	65281016P
1600		2134	35-60	SCP 2500 A	65391018P
2000		2667	44-50	SCP 3200 A	65391015P
2500		3334	55-60	SCP 4000 A	65391016P
3150		4201	70-02	SCP 5000 A	65391018P

#### Transformer to busbar connection



# ZUCCHINI SCP



fast, simple  
installation saves  
time and money on site

## INSTALLATION SIMPLICITY

Designed to work perfectly in conjunction with Zucchini's cast resin transformers, the SCP busbar range offers quick, reliable assembly with a vast combination of accessories for maximum flexibility. Conductors are available in a choice of copper or aluminium.

## PLANNING SIMPLICITY

A comprehensive range of standard products is further enhanced by Legrand's technical expertise and ability to create bespoke solutions tailored to any requirements. The SCP range can be manufactured in standard, clean earth or 200% neutral versions.



TO FIND OUT MORE CALL OUR TECHNICAL SUPPORT TEAM ON  
+44 (0) 370 608 9020





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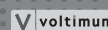
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