



# HIGH FREQUENCY POWER TRANSFORMERS and INDUCTORS

- WELDING
- WATER CLEANING
- UPS
- GALVANIC P.S.
- BATTERY CHARGERS
- SOLAR ENERGY



**Quality, Safety, Reliability**

This brochure is a short introduction to **Sirio POWER COMPONENTS**. The new family was created after more than 30 years of experience in the development and production of high frequency electromagnetic components. In order to offer customers a complete service, Sirio has steered many efforts towards the study of the whole building process of power components, from the development stage to the supply of the final product.

## DEVELOPMENT

### CUSTOM SPECIFICATION

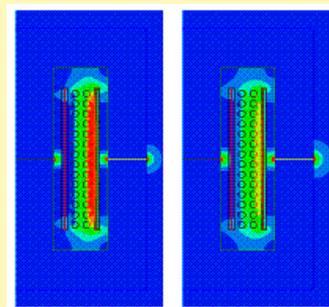
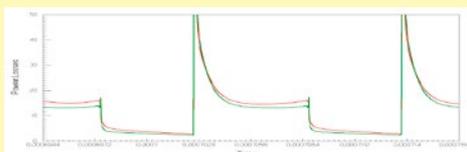
The development of a customized power transformer begins by considering the customer specification.

### SIMULATIONS

After a rough calculation, the R&D team defines few possible solutions. As one of the most important features of a power transformer is the efficiency, power losses are typically the distinguishing element at the moment of the choice of the final solution.

Thanks to a dedicated software for electromagnetic simulation using the finite element method, it is possible to study the behaviour of the transformer while running on the application circuit, in order to know:

- power losses
- dynamic fields distribution
- dynamic currents distribution



### OPTIMIZATION

The highest Quality/Price ratio can be easily reached when the best technical solution and Sirio production's facilities and technologies are properly combined.

### PROTOTYPING

Prototypes can be built in Sirio Laboratory. They are electrically measured and tested, even in customer's application too. By considering standard raw materials, the lead time for prototypes is extremely short.



## HOMOLOGATION

The customer receives samples for testing and approval.

## PRODUCTION

### AUTOMATIC WINDING PROCESS

The automatic winding machine is unique to Sirio, as it was developed according to our specifications. A second machine was added in 2012 and today we're installing the third one.



### AUTOMATIC MECHANICAL OPERATIONS

Besides the cores assembling, power transformers construction requires some finishing operations. As always, Sirio's approach has been oriented to automation, investing in tools and machines, in order to offer customers some standard, steady-quality and cheap solutions.



### VACUUM CASTING TECHNOLOGY

The vacuum casting process allows to reach high level of isolation in very thin layers of isolation. That is the typical situation in high frequency industrial applications, where high reliability, isolation and safety are required and, on the other hand, very short distances are needed to improve the coupling. More than 40 years of experience in vacuum casting has made this technology one of Sirio's strong points. The whole casting process is controlled by a dedicated computer.

### AUTOMATIC FINAL INSPECTION

All Sirio products are automatically tested and the production process is continuously checked: from the raw materials incoming to the machines' setting, from the winding process to the core assembling phase, from the casting process to the final inspection stage.

# FEATURES

The Power Components family follows the **MILESTONES** of all Sirio components:

## HIGH RELIABILITY

industrial applications need long life components: every part is important for the good functioning of the whole machine

## ISOLATION AND SAFETY

transformers are designed to guarantee the galvanic separation between the mains and the worker

## AUTOMATIC PRODUCTION

automation allows stable construction and reduces the production costs

## STANDARD RAW MATERIALS

standardization is useful to reap economies of scale and to reduce the lead time

## CUSTOMIZATION

the transformer's construction has to be flexible to customer needs.

## APPLICATION FIELDS

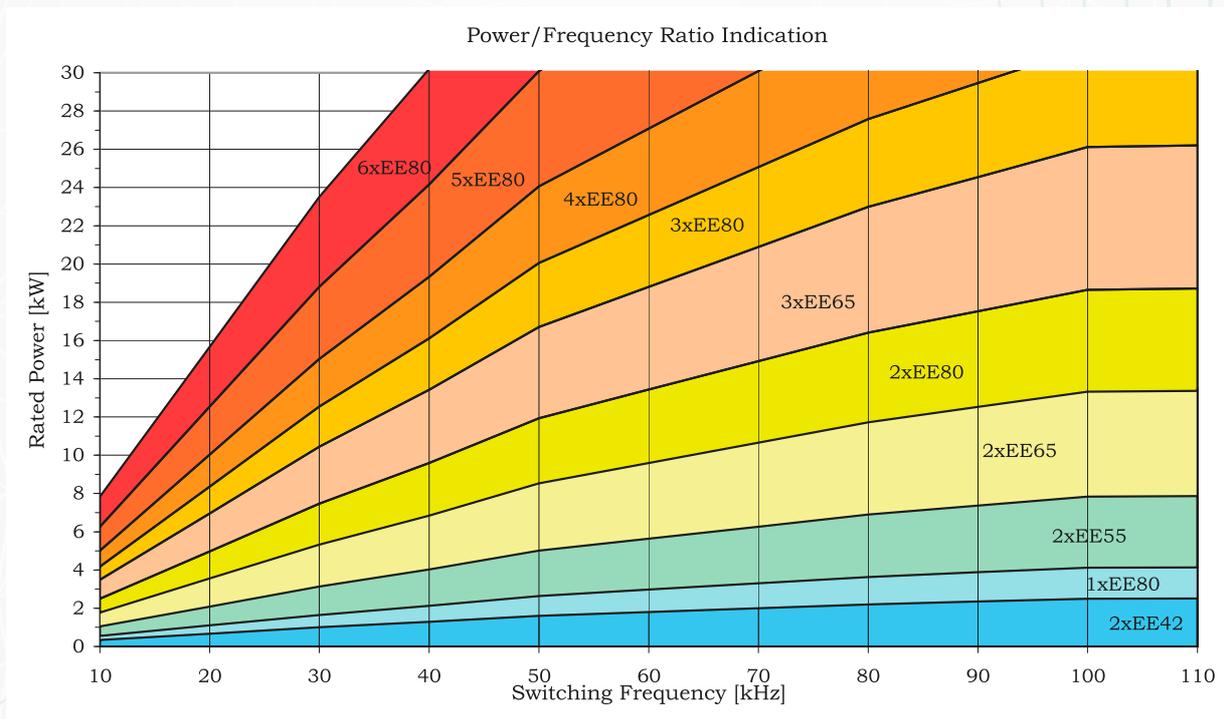
After few years from its launch, the Sirio Power Transformer family has become very successful in several **APPLICATION FIELDS**, e.g. :

- U.P.S.
- WELDING
- GALVANIC TREATMENTS
- BATTERY CHARGERS
- SOLAR ENERGY
- POWER SUPPLIES
- INDUCTION HEATING
- WATER CLEANING

From theoretical point of view, **TRANSFORMER DIMENSIONS** are related mainly to two parameters: the switching frequency and the rated power. An easy formula says that the transformer volume is approximately proportional to the Power/Frequency ratio,

$$\text{Transformer Volume} \propto \frac{\text{Rated Power}}{\text{Switching Frequency}}$$

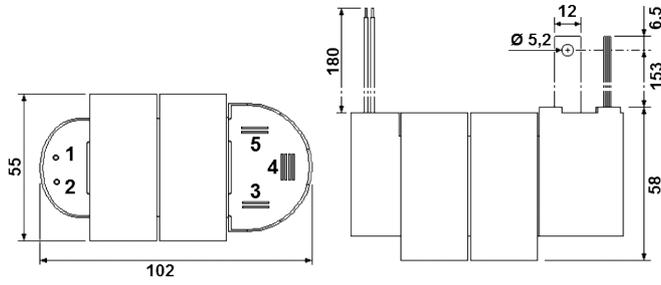
but that is just a quick way to make a first choice and to understand the approximate dimensions. By looking at the whole project, other factors are obviously involved in the final design definition, like topology, working voltage and isolation voltage, currents through the windings, expected power losses and overtemperature, cooling system, duty cycle and so on. Sirio offers a standard range of bobbins and boxes for Power Components, developed by Sirio in order to evenly cover the power range from 1 kW to 20 kW. The following chart is an overview about the Power/Frequency ratio. It was extrapolated from our running projects and, as already said, it can be considered just for reference, as each converter needs an optimized transformer.



# MODELS

## Multiple EE55 series

2xEE55 - Mechanical Drawing

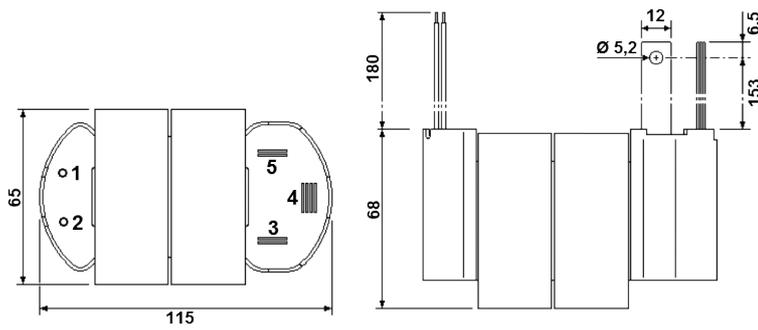


Example

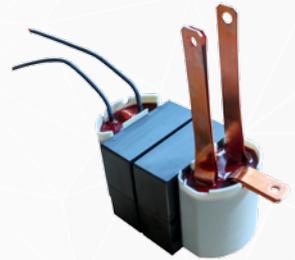


## Multiple EE65 series

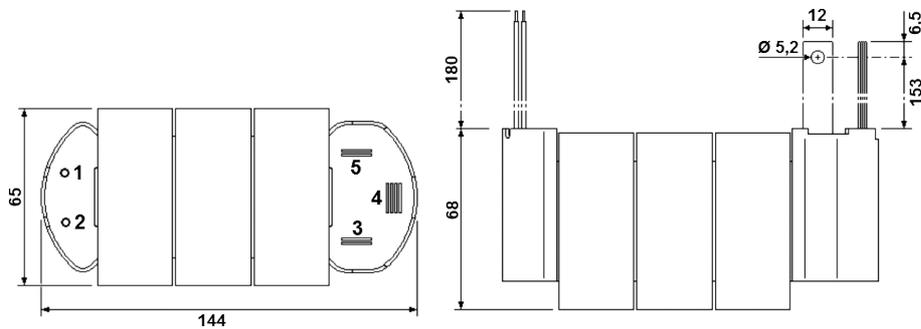
2xEE65 - Mechanical Drawing



Example



3xEE65 - Mechanical Drawing

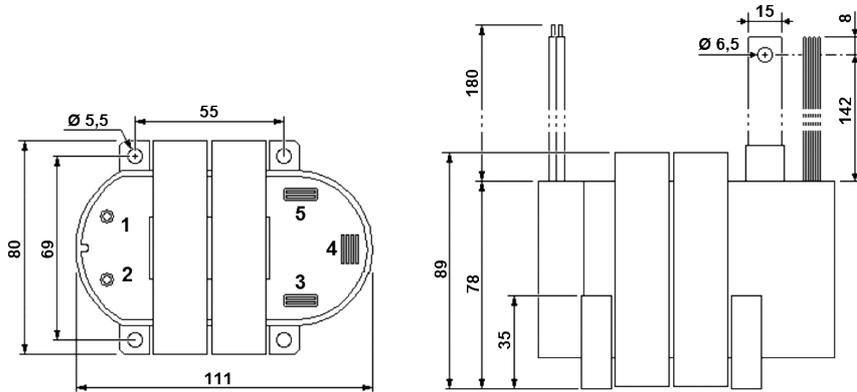


Example



## Multiple E80 series

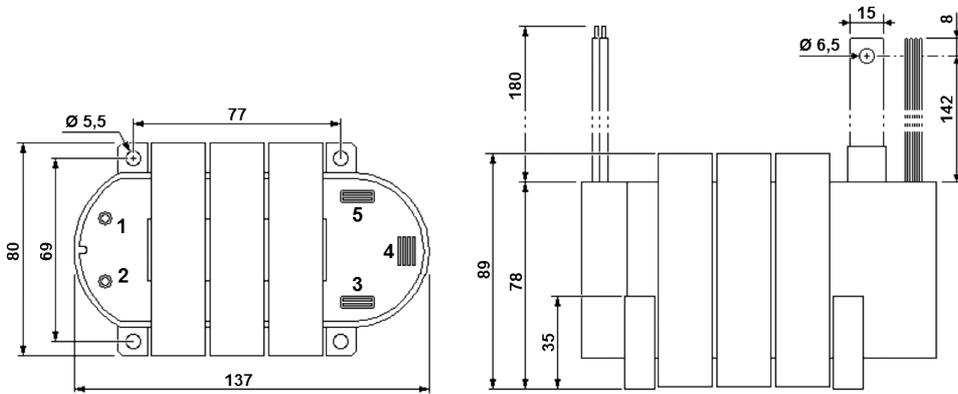
2xEE80 - Mechanical Drawing



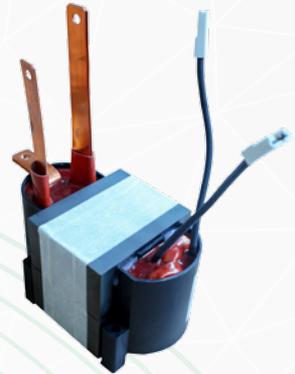
Example



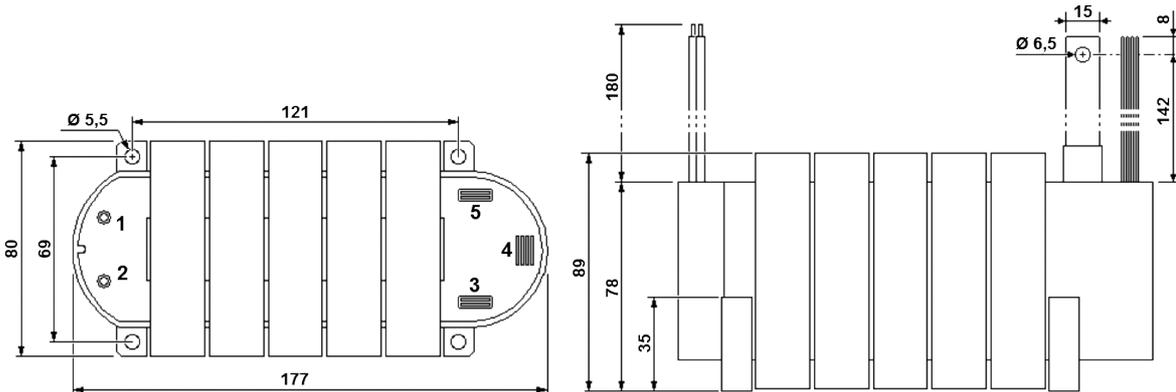
3xEE80 - Mechanical Drawing



Example



5xEE80 - Mechanical Drawing

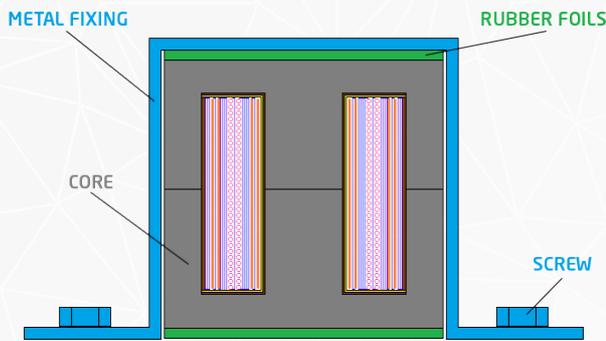


Example



## OTHER MODELS

Beside our standard models, optimized for automatic manufacturing process, we can also produce transformers of several other sizes and shapes, customized for your specific applications.



Power transformers are relatively heavy components, therefore we always recommend our customers to design the most suitable mechanical fixing.

Several materials are available on the market, such as thermo-conductive rubber foils which help to avoid mechanical stresses on the cores and to improve, at the same time, the core losses dissipation.

The figure shows one of the most typical solutions, based on a metal bracket and two rubber foils on upper and bottom surface.

## INDUCTORS

Optimization of an inductor could be challenging too, in order to keep low losses and compact dimensions while raising the current and frequency ratings.

In power electronics, inductors are usually employed as DC output stage chokes, but also applications like Power Factor Correction filters and resonance tanks for Soft Switching converters are today more and more common: all different applications requiring different design approaches. Hence, we have to put the same care used for power transformers.

The technology involved in producing inductors is the same as well. Again, automatic operations and standard raw materials make possible a just-in-time production of a custom component at the same cost of a catalogue product.

For high frequency applications, the most common core materials are:

- Soft Ferrite
- Amorphous and Nanocrystalline Laminations
- Powder (so-called distributed airgap materials)

Here below some examples of power inductors are shown.



# CUSTOMER SPECIFICATION SHEETS

The **R&D Department** is available to receive customer's specification and to offer the development service, in order to propose the most suitable solution.

Customer specification sheet for SMPS POWER TRANSFORMERS		
Field of application		
SMPS circuit topology (forward, half bridge, full bridge...)		
Secondary rectifier circuit (center tapped, Graetz bridge,...)		
Input voltage [V]	Min:	Max:
Output voltage [V]		
Output current [A]		
Switching frequency [kHz]		
Output current ripple [A]		
Turns ratio Np/Ns		
Switching time [µs]	Min:	Max:
No load secondary voltage [V]		
Output filter inductance [µH]		
Output filter capacitance [µF]		
Rated output power [kW]		
Primary current [Arms]		
Max primary over current [A]		
Primary inductance [mH]		
Primary leakage inductance [µH]		
Secondary current [Arms]		
Working voltage between primary and secondary [Vrms]		
Test voltages between primary and secondary [Vrms]		
Test voltages windings and core [Vrms]		
Operating temperature [°C]		
Cooling system		
Air flow [m³/s]		
Size limitations LxWxH [mm]		
Standards to comply with		
Quantity		
Target price		

Customer Specification Sheet for INDUCTORS	
Inductor purpose (output choke, PFC filter, resonance inductor, etc.)	
Inductance value at nominal rated current [µH]	
Tolerance on inductance [%]	
Rated current [Arms]	
Current ripple peak-to-peak [A]	
Working voltage [Vrms]	
Working frequency [kHz]	
Rated power [VA]	
Operating temperature [°C]	
Open construction or box version	
Size limitations [mm]	
Standards to comply with	
Quantity	
Target price	

Schematic:



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