




## **IMPREGNATION TECHNOLOGY**



**STRONGER ELECTRICAL MOTOR  
WITH THE RIGHT PROTECTION**



## **“THERE IS NOTHING DEEPER THAN WHAT APPEARS ON THE SURFACE.”**

The product surface gives the first impression, strikes the observer and influences his judgment from the beginning. The external perfection becomes the mirror of the overall quality of the product.

Since more than sixty years, we have worked with passion and competence to obtain the best harmony between lines, shapes, colors in every surface, and engineering and manufacturing innovative plants and complete lines, installed all over the world.

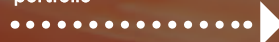
Washing, coating, impregnation: industrial treatments integrated in the productive process, often invisible to the final user but of primary importance for functionality and aesthetic quality.

Automation and technology development allow us to offer modular solutions with a full portfolio of options that satisfies any need.

Our Customers appreciate above all our capability to develop tailor made, and often co-designed, surface treatment plants that are innovative, reliable, advanced, ready to satisfy all the new requirements of the market.

### 2000

The beginning of impregnation: Tecnofirma introduces the impregnation technologies in its production portfolio



### 2009

Tecnofirma introduces induction heating as alternative source for preheating, gelification and polimerization







## TECNOFIRMA HQ



For more than sixty years Tecnofirma S.p.A. has been a pioneer on the international market thanks to our innovative and up-to-date solutions for the treatment of plastic and metal surfaces.

Over these years, we have specialized in impregnation treatments, with solutions that have changed the rules in this industrial field.

Not just for standard solutions, but also special solutions, customized on the specific needs, with activities based on an important co-design, with our most important customers.

Our "reference list", built over the years, is composed of companies of all size and manufacturers of various types of products, including the most famous automotive manufacturers in the world.

Tecnofirma has always pursued customer satisfaction from the first contact to the final testing of its products.

Our passion for technology and our devotion to our customer needs drive all of our employees to work for the best results.

## DIAMOND BEIJING



The district of Shun Yi in Beijing is home to Diamond (Beijing) Machinery Equipment Co. Ltd, the TT Group company that provides the immense Asian continent with technology "Made in Italy".

It is located just 20 km from the airport. The all-indoor 3000 square meter company headquarter has 300 square meters of office space with room for future manufacturing expansion.

Thanks to the Tecnofirma know-how, the Beijing team is able to meet Chinese companies' demands in surface treatments and also the demands of all the multinational companies delocalised in Asia, with both sales and after sales services for our products.

Diamond (Beijing) Machinery Equipment Co., Ltd  
Building 14, No.50 MapoDuan, Nanchen Road, MapoTown, Shunyi, District, Beijing, 101399, PRC

### 2011

Tecnofirma develops the Joule Heating technology for preheating, resin gelification and polymerization

### 2013

Tecnofirma develops a new solution expressly designed for Hairpin stator impregnation (patented technology)

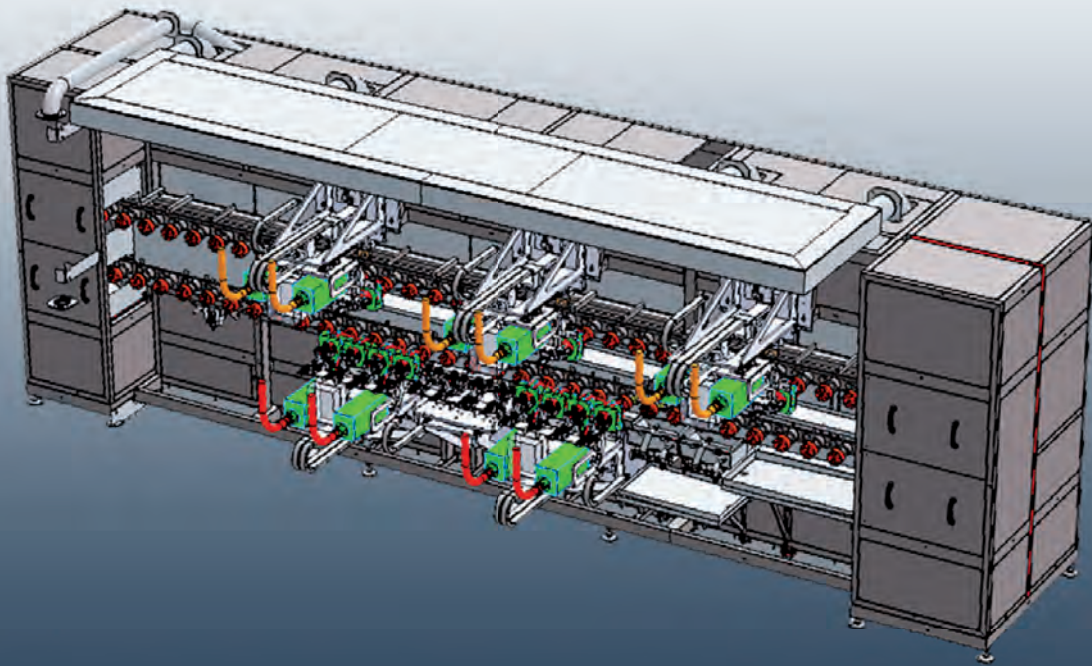
### 2017

Tecnofirma patents a system to check parts' temperature in joule dipping impregnation process.

### 2018

Tecnofirma develops fluid bed powder painting for Hairpin welding insulation.





# RING



TRICKLING



ROLL DIP

## Parts treated :

Round wire Stators, Hair Pin stators , Rotors

## Available processes :

Preheating / Impregnation / Gelification  
Polymerization

## Optional processes :

Joule effect / Induction / Microwave

The Ring machine is designed to handle high production rates and high quality levels.

The parts are positioned and fixed horizontally on special rotating chucks. The parts are kept rotating during all stages of the process.

The machine is composed of a preheating area, the resin application (trickling or roll dip), gelification area and final polymerization.

In addition, it can be equipped with external tunnel to complete the whole process.

The heating of the stators can be done using hot recirculated air, induction heating, joule effect heating, or by the combination of these heating sources. The ring machine is suitable for single process (as resin application) when it is not necessary the stators tilting during the application.

The Ring Trickling can be customized according to the customer needs.

The number of stators chucks in the different process areas and the right design of the impregnation stations are studied case by case according to the stator needs.

The machine can be fully automatic and totally integrated in a stator production line without any operator.



Ring Trickling machine  
for Powertrain Stators

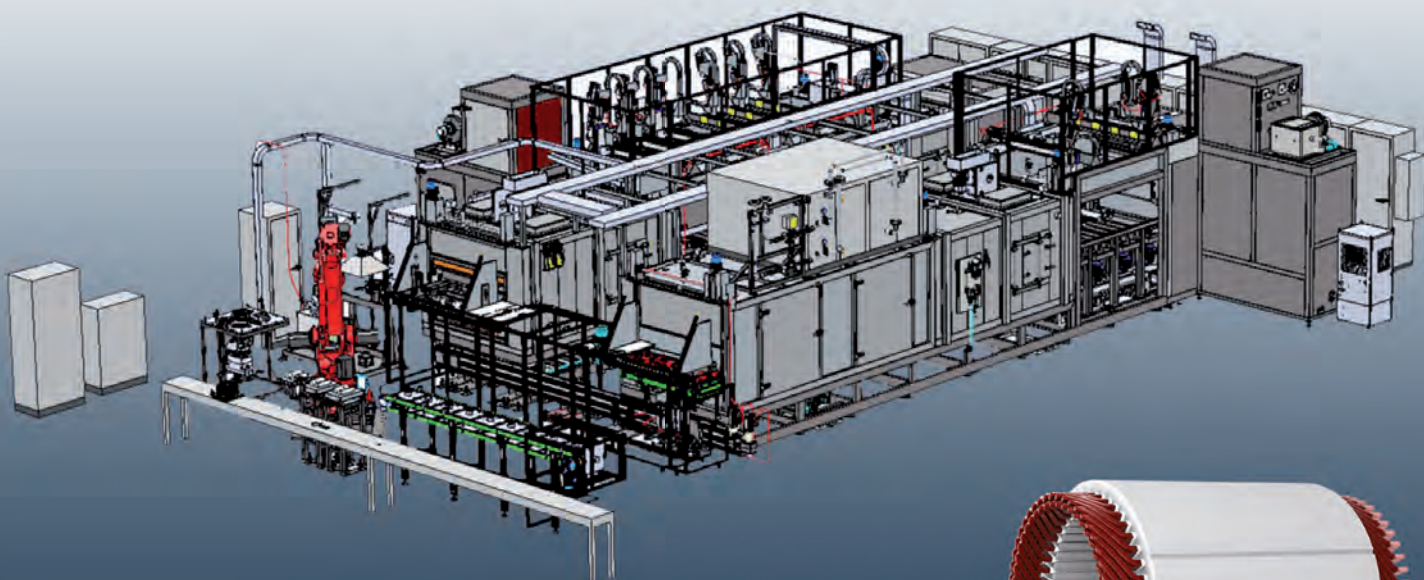


Ring Roll Dip machine  
for Rotors



Ring Trickling machine  
for Rotors





## U LINE



TRICKLING



ROLL DIP

**Parts treated :**  
Hair Pin Stators

**Available processes :**  
Preheating / Impregnation / Gelification  
Polymerization

**Optional processes :**  
Gel coating / Induction



POWDER COATING

**Parts treated :**  
Hair Pin Stators

**Available processes :**  
Preheating / Gelification / Curing  
Cooling

**Optional processes :**  
Plasma cleaning

The U line machine (patented) is the evolution of the traditional impregnation machine designed to handle high production rates , high quality levels with maximum level of flexibility. The parts are placed horizontally on special pallets / chucks to allow processing of medium and large size pieces and are constantly rotated during all stages of the process.

It is expressly dedicated to Hair Pin motor design, and it has possibility to tilt the stators during the trickling application process, ensuring fast and long penetration of the resin into the slots. All process parameters are adjustable as rotation speed, rotation direction, tilting angle, flow rate of drippers, and others for each single impregnation station. The machine can be run in random mode with different stator types without any change over time.

The U-line machine offers the possibility to combine the standard resin application with the application of the product for the welding joints protection (gel coat). The machine is designed in a modular concept, so it can be customized according the customer needs in term of production rate, easily integrated in a stator manufacture line, with all standard requirements in term of traceability and automation. All these features made the U-line the most suitable solution for the automotive companies.

The powder coating process is a possible alternative process to protect the welding joints on hairpins motors.

The epoxy product is applied by vertical stator dipping in a fluidizing bed tank. The control of some parameters permits to have a right powder thickness and right protection level necessary to achieve the electrical insulation needs.

This process can be combined and supplied together with or without U-line trickling technology.



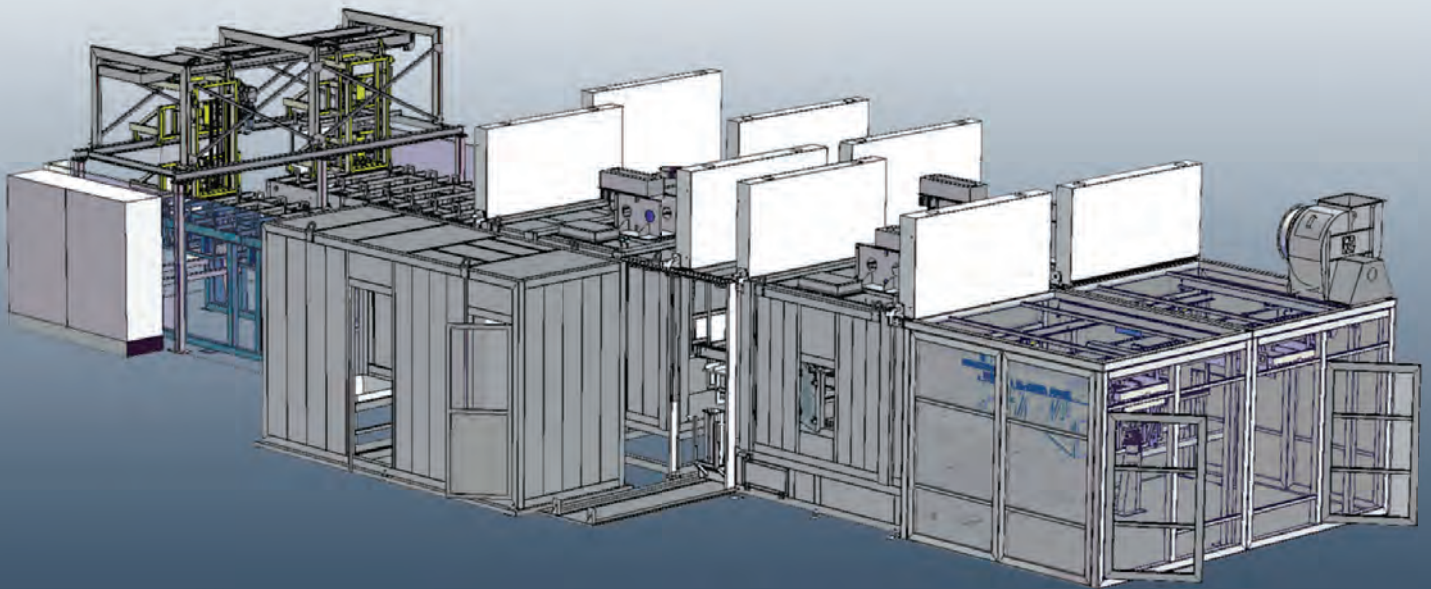
U Line Trickling machine  
for Hairpin Stators



U Line Roll Dip machine  
for Winding Stators



U Line Trickling machine  
for Hairpin Stators



## CAMELOT LINE



### COLD DIPPING



### HOT DIPPING

#### Parts treated :

Round wire Stators, electrical windings, transformers, coils, bobbins

#### Available processes :

Preheating / Impregnation / Gelification  
Polymerization / Cooling



### JOULE DIPPING

#### Parts treated :

Round wire Stators for Powertrain  
HairPin Stators for Power train

#### Available processes :

Preheating / Impregnation / Blowing for cleaning / Gelification Polymerization

The TF Camelot line has been developed to combine user friendly, flexibility, economy and environmental sustainability.

The machine is able to treat a wide range of products and meet the different production capacity requirements.

The plant's cycle requires the pieces to be loaded off line into a special basket or hanged by special hooks.

The modular nature of the units, that forms the system, makes it possible to build it up rapidly and facilitates any adjustment to specific customer needs.

The Camelot line can be designed in two versions:

#### Cold dipping

#### Hot dipping

The immersion phase in cold dipping is carried out, as the name suggests, at room temperature. The immersion phase in hot dipping on the other hand requires a preheating of the parts before the immersion phase. Thanks to this additional step in the process, it is possible to use resins with a higher viscosity and achieve higher slot saturation level comparing the cold process.

New Process expressly dedicated to Power train motor:

#### Current Dipping

The whole thermal process is made by electrical current supplied on the motors (DC or AC current).

The temperature profile is managed by a special system (Tecnofirma patent). The possibility to keep the stators warm during the dipping process and have a fast gelification permits to have a very high saturation level with low resin contamination on the lamination stack.



Camelot Cold Dipping machine  
for Stators Linear model

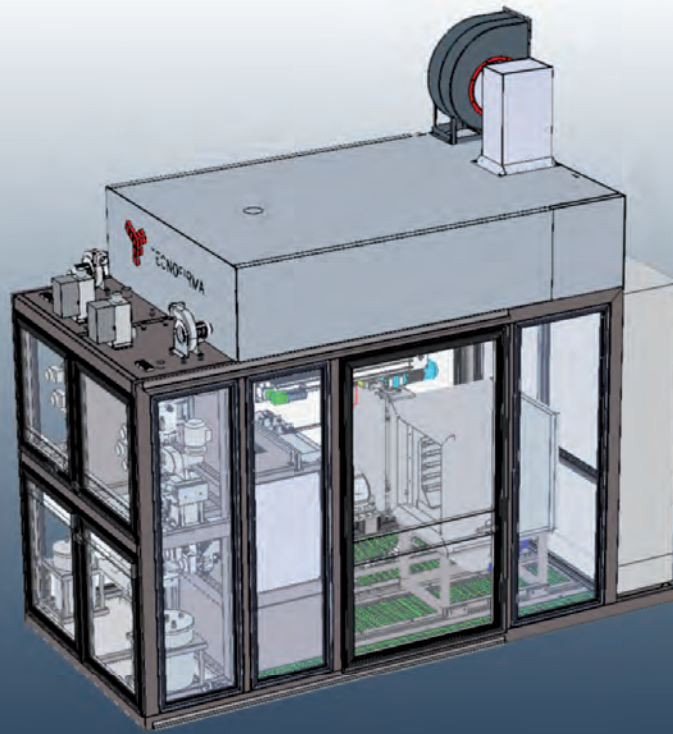


Camelot Hot Dipping machine  
for Stators U Shape model



Camelot Hot Dipping machine  
for Stators Linear model





# PILOT



TRICKLING



ROLL DIP



JOULE DIPPING



POWDER COATING

## Parts treated :

Round wire Stators, HairPin Stators, Rotors, armatures, electrical windings

## Available processes :

Preheating / Impregnation / Gelification Polymerization

## Optional processes :

Gel coating / Joule effect / Induction Microwave

The Pilot machine has been developed to be easily fitted with a wide range of devices that makes it possible to properly set up the machine for the main methods of impregnation.

Besides the opportunity of testing processes and products, the pilot machines can be equipped with multi spindle devices that make the solution excellent for small productions, with different potential level of automatism.

The main processes installable on Tecnofirma Pilot machines are Trickling, Roll Dipping, Current Heating & Powder Coating.

Tecnofirma Pilot machines are designed and realized in order to use traditional polyester, No-Solvent Polyester, Epoxy and Epoxy-Phenolic Resins, and all other medium-high performance products suitable for the selected impregnation method.

The operator can easily change process data in order to comply with the product manufacturer's instructions in the maximum safety and environmental respected condition.

In the last years, Tecnofirma has developed the Hairpin Pilot machine that offer the possibility to combine two processes and do them in right sequence: resin application for slot saturation & epoxy product application on stator welding joints.



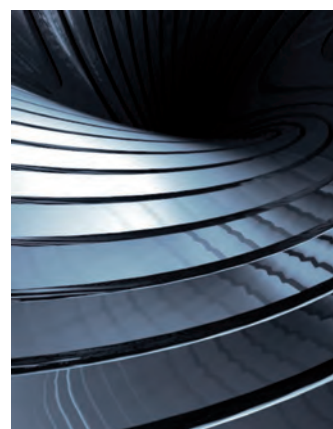
Pilot Trickling machine for Stators multispindle model



Pilot Trickling machine for Stators monospindle model



Pilot Joule Dipping machine for Hairpin Stators



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