Investment Casting

FERESPE

+ WE CAST STRONG CONNECTIONS +

FERESPE

INVESTMENT CASTING

AT A GLANCE

Technical Parts

for High Performance Applications

Production Range

Current Casting size up to **400x400x400mm**

Current casting weight up to 7,**5 kg**

SURFACE TREATMENT

MACHINING

Materials

Super Duplex Stainless Steel

Duplex Stainless Steel

Austenitic and Super

Austenitic Stainless Steel

Martensitic Stainless Steel

Heat Resistant Steel

Wear Resistant Steel

Wear Resistant Cast Iron

Founded in 1981, FERESPE focuses on the **production of technical parts for high performance applications**, using the following alloys:

- Duplex, super-duplex and super-austenitic stainless steels
- Medium and low alloy steels
- High-alloy cast irons

Keeping the same focus on **small and medium series niche market**, to fulfill the increasing demand for **dimensional accuracy** and **better surface finish,** we can now offer this complement of range to our Customers, accomplishing short delivery times, as 7 to 8 weeks for functional prototypes.

FERESPE's **customer high satisfaction levels**, in which we would like to include your company, represent our main goal. FERESPE know-how will support your company withing metallurgical subjects, developing **solutions from scratch to cast. In full partnership**. We guarantee your company distinctive and qualified solutions. **Just try our expertise. We offer broader solutions to meet your goals.**

Investment Casting Process

Advantages

High degree of dimensional accuracy
High surface quality
Near net shape design possibility
Reduced draft angles required
Significant freedom of shape and design

How It's Made

Phase I — Wax Injection

In the investment casting process, the first step is the design and manufacturing of the mould into which wax pattern is injected. This mould is developed in-house through additive manufacturing technique—SLA Rapid Prototyping—or made by machining of aluminium block by FERESPE's reliable subcontracted partners.

As any imperfection on the wax pattern will appear on the casting, the surface quality of the mould and wax pattern has a critical importance on the quality of the casting. FERESPE uses 3D Photometric Scanning System to assure its dimensional and geometric accuracy.

After the wax injection, the resulting model will have the same shape as the final cast piece. It is then assembled onto a "tree" consisting of one or various models and the feeding and gating system.

Phase II — Ceramic Coating, Dewaxing and Melting

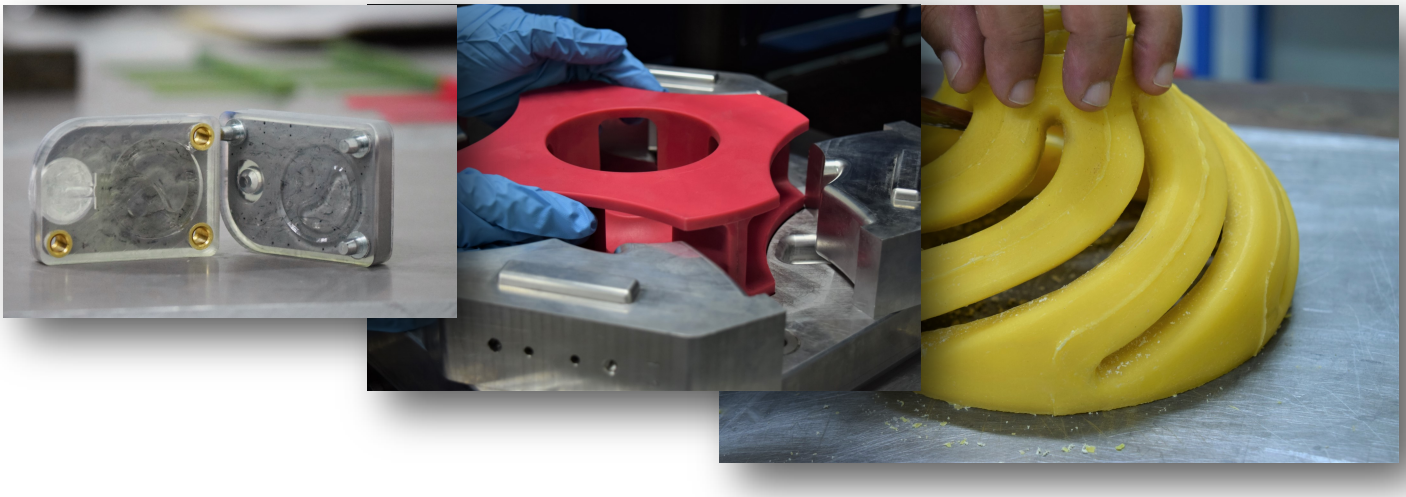
The most important step is to build the ceramic coating around the "tree" which consists of various layers of different slurries and sands. After this, the shell is then dewaxed and will be heated to temperatures up to 1100ºC. At the time, the ceramic shell is ready to be pre-heated and have metal poured.

Phase III — Finishing Process

FERESPE performs the finishing processes, such as surface treatments (grinding and shotblasting) heat treatment and final inspections. Other activities, such as machining, coatings, surface chemical treatments, among others can be subcontracted by FERESPE's experienced partners.

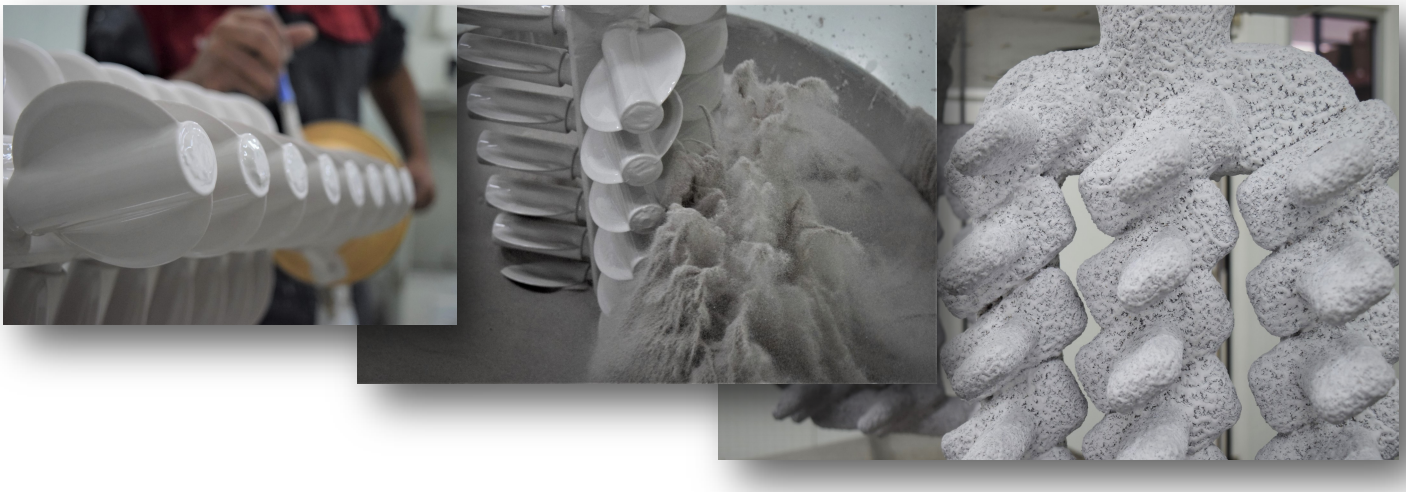
Pattern-Making and Wax Room

- **SLA Rapid Prototyping** for prototype patterns
- Automated wax injection system — **400 x 400 x 250 mm max. mould dimensions**
- Manual wax injection system for **water-soluble cores**



Shell Room

- Current phase: Ceramic tree **shell up to Ø600 x 500 mm**
- Temperature and humidity **controled rooms**



Melting

FERESPE Investment Casting has **3 furnaces** in its facilities

- **2 induction** furnaces of 50 kg
- 1 induction furnace of **150 kg**

Size Limits and Surface Finish

Casting **size** up to	Casting **weight** up to	Surface **Finish**
400x400x400 mm	**7,5 kg** current phase	**Ra ~6.3µm**

Dimensional Tolerances

Nominal dimensions related to the		DCTG 6
—	≤ 10	0,52
> 10	≤ 16	0,54
> 16	≤ 25	0,58
< 25	≤ 40	0,64
> 40	≤ 63	0,7
> 63	≤ 100	0,78
> 100	≤ 160	0,88
> 160	≤ 250	1
> 250	≤ 400	1,1
Source: ISO 8062-3:2007 (E) Table 2—Linear Dimensional casting Tolerances (DTC)		

ALWAYS AHEAD

Product Engineering and Quality Control

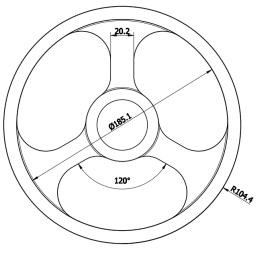
To achieve FERESPE Quality, **FERESPE** combines the Human Experience with Technology

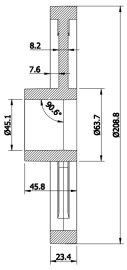
- **SLA Rapid Prototyping Technology** — reduce the delivery time in the prototypes' phase, thus allowing for functional prototypes in a short leadtime.

- **3D Modeling, Simulate and Scanning**

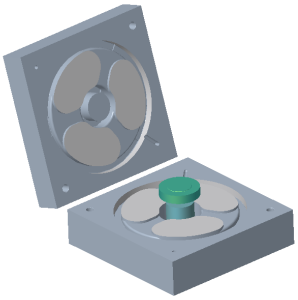
  PTC CREO allows us to model the piece, the mould and to predict the wax pattern shape
  PTC CREO SIMULATE is an elementary tool to simulate mechanical stresses
  3D Scanning for reverse engineering and a wide range of measurements

- **Finite Solutions** — Casting Simulation Software to predict the appearance of any defects during filling and solidification, as well as to validate the casting project.

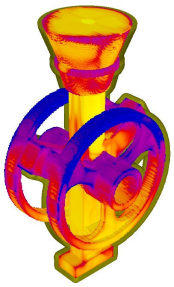




2D MODELING



3D MODELING

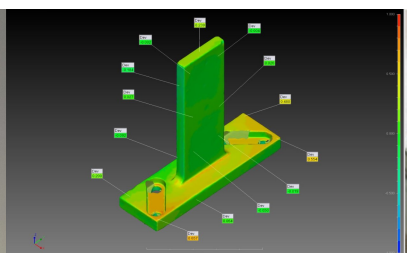


FLUID SIMULATION

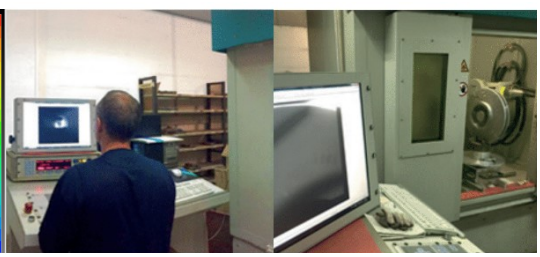
To fulfill **QUALITY** requirements, FERESPE is constantly seeking improvements of material properties and manufacturing procedures. To support this pro-active attitude, FERESPE has built solid relationships with Universities and Technological Centres.

FERESPE continuously invests in state-of-the-art equipment ensuring at every stage of the production process a cutting-edge positioning.

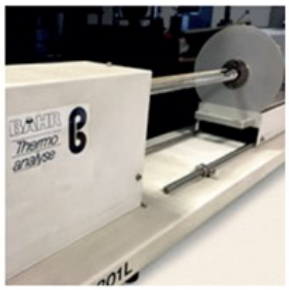
PHOTOMETRIC 3D SCANNING



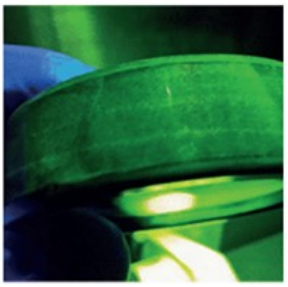
DIMENSIONAL CONTROL AND REVERSE ENGINEERING



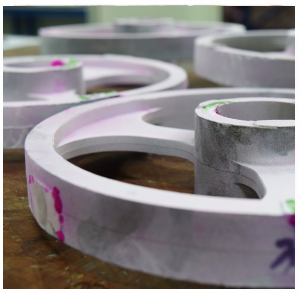
DIGITAL X-RAY INSPECTION



DILATOMETRY



MAGNETIC PARTICLE INSPECTION



LIQUID PENETRANT INSPECTION

CHEMICAL ANALYSIS

FERESPE is able to perform **Non-destructive Testing** (PT, MT, UT and Radioscopy) **in-house**, with **qualified inspectors** according SNT-TC-1A, and subcontract activities for PT, MT, UT and RT also with qualified inspectors, in this case according EN ISO 9712:2012.

The **Destructive Testing** we are able to perform in-house are tensile test, impact test, hardness test and micrographic examination. If required, the destructive tests can be subcontracted to **Accredited Laboratories** according EN ISO/IEC 17025:2005, with whom we have a long relationship.

Our experience is supported by statistical data for the key parameters e.g. tensile strengths, impact toughness, corrosion resistance (e.g. ASTM G48 Method A; ASTM A923 Method C; A262 Practice E) and micrographic examination (e.g. ASTM E562/ ASTM E1245, ASTM E112).

For the **repairs by welding operations** FERESPE has qualified welders according EN ISO 9606-1 and ASME IX and also qualified welding procedures for the relevant materials according EN11970, EN ISO 15614-A and ASME IX.

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FERESPE — Fundição de Ferro e Aço, Lda.
Rua Brasiela, 60
4760-485 | V. N. Famalicão
Tel. +351 252 490 470 | Fax +351 252 490 479

For more information, please contact:

Pedro Lacerda - pedrolacerda@ferespe.pt

Joaquim Santos - joaquimsantos@ferespe.pt

Francisca Casais - franciscacasais@ferespe.pt