

## HIGH PRESSURE DIE CASTING

High performance product range

VESUVIUS





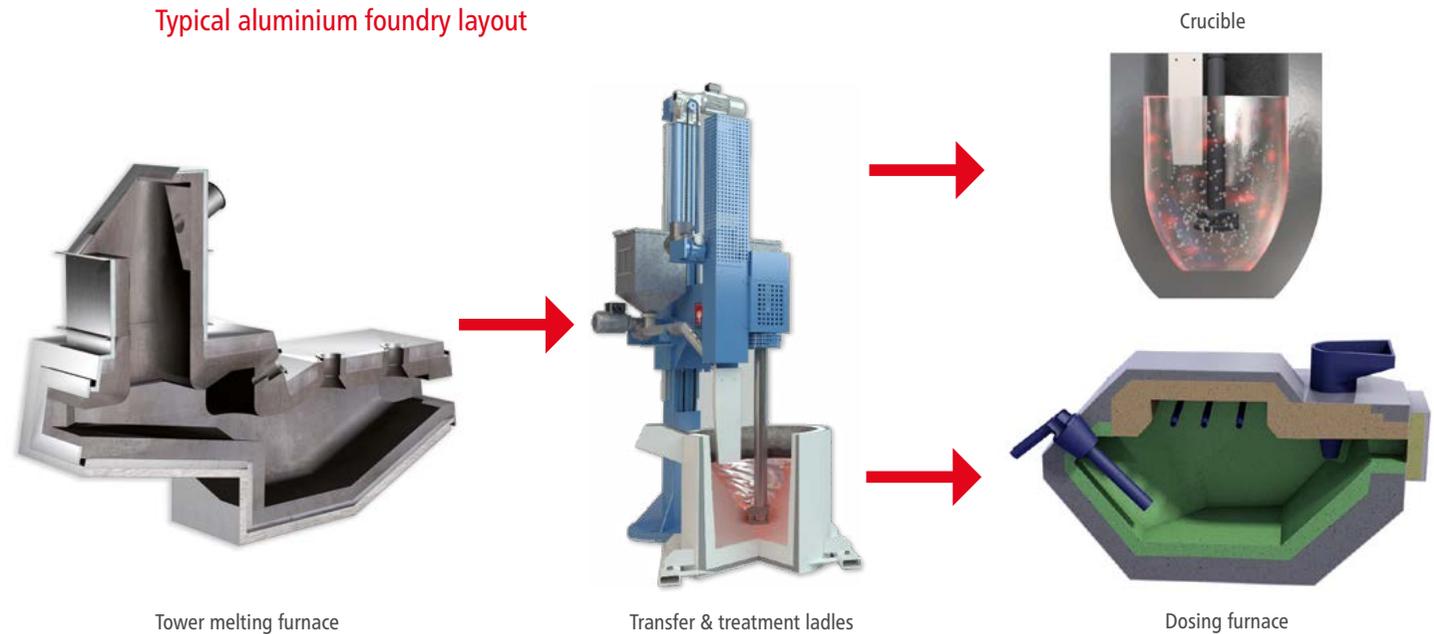
# High pressure die casting

The high pressure die casting (HPDC) process is very attractive to the casting buyer, offering fast production rates coupled to optimised production costs. Significant advances over the last 15 years in tooling, process and alloy developments have led to today's ability for HPDC to manufacture high performance components. As castings become more complex and some wall sections become heavier, so the advantage of the very rapid cooling rate is reduced and casting defects more commonly seen in gravity die casting and sand

casting are now being experienced in high pressure die castings. The current trend to heat treat and weld components places higher emphasis on the internal quality requirements and now increasing levels of inspection and measurement are applied to segregate defective parts.

A key enabler to meet these new quality demands is to begin with high quality melt cleanliness. Fosco offers a full range of products that enable HPDC foundries to exceed these increasing demands.

## Typical aluminium foundry layout



# Products for tower melting furnaces

in high pressure die casting foundries

Tower melting furnaces are commonly used in aluminium foundries consisting of a vertical melting shaft with a connecting holding bath. The solid ingot is charged into the top of the tower with pre-heating in the stack followed by melting in the melt chamber hearth.

Due to their complexity and criticality to the entire production line, most customers look for a full supply and installation package, whilst the selection of the best material and service is paramount to the future line efficiency.



## ALUGARD

ALUGARD aluminium resistant castables are used to line these types of furnace and there are a variety of grades available that are specifically developed for the different applications or operating conditions expected during melting. ALUGARD materials are non-wetting and inert in contact with liquid Aluminium, resulting in a clean furnace lining which optimises the refractory service lifetime.

ALUGARD CE-S high alumina low-cement castable which offers excellent aluminium resistance. This is the perfect general purpose product, with good strength and all round performance.

ALUGARD HS85 high alumina, super tough aluminium resistant castable has been specially developed to combat aggressive erosion and mechanical damage around charge areas.

QUICK FIX ALUGARD EXP two-part phosphate bonded system with excellent adherence properties. Ideal for patch repairing of furnaces.

## TRIAD\*

TRIAD AL high alumina cement-free castable offers exceptional resistance to aluminium wetting and penetration and suitable for use in all sections of the furnace with the following key performance advantages:

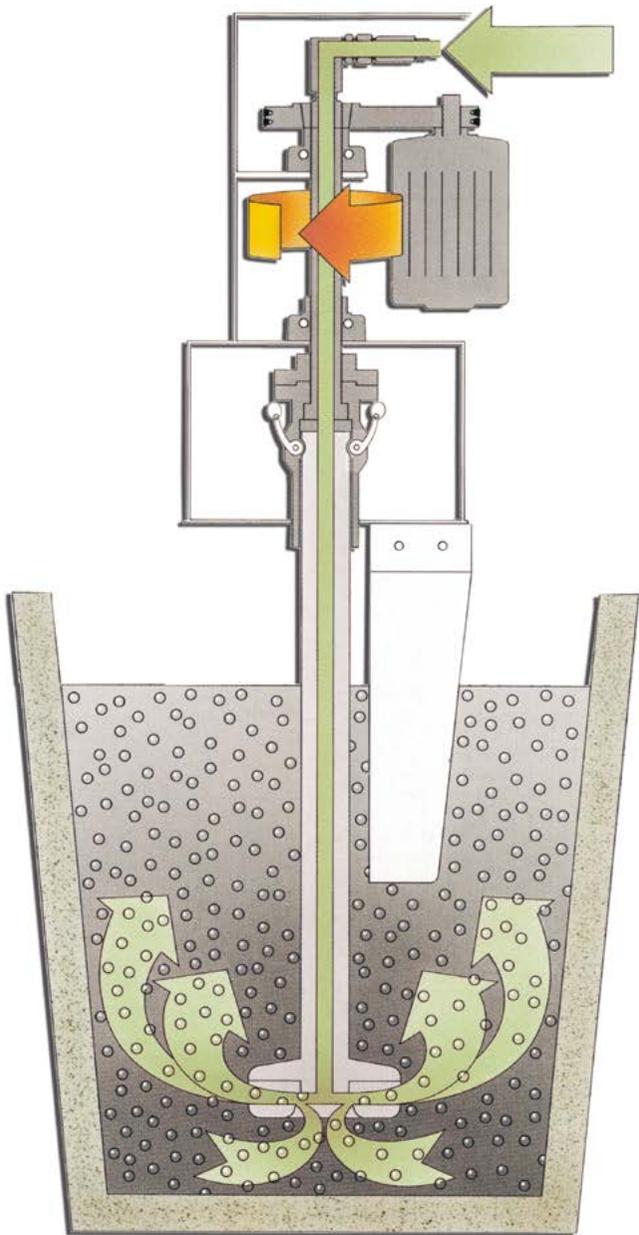
- + Easy to mix
- + Easy to install
- + Reduced bake-out time

The product is suitable for all metal contact areas; including bath, lower sidewall, ramp and sill.

## Refractory Maintenance Products

- + PROTECTAL ECO 2534 – for regular cleaning
- + PROTECTAL 88 – weekly application to prevent corundum build-up
- + PROTECTAL OR 1 – intensive cleaning powder for application as necessary to reduce corundum build-up





# Melt treatment

in high pressure die casting foundries

Historically melt quality has not been a priority for many HPDC products. With the trend towards increased complexity and high performance parts there is an increasing need to improve metal quality.

In order to counter the tendency towards hydrogen absorption and oxidation of the melt, Foseco offers best-in-class solutions for melt treatment.

- + Standard rotary degassing units (FDU)
- + Melt Treatment Stations (MTS 1500)
- + Full range of shaft and rotor designs
- + Selection of shaft and rotor material grades.
- + Fluxes specifically developed for HPDC

## FDU and MTS machines

Our equipment designs can be adapted to suit specific furnace designs or ladle types and can all include our Industry 4.0 process control solution "SMARTT".

Three of the most popular FDU designs are illustrated below and our technical team will be happy to discuss with you the best solution for your needs.

**HOW MELT TREATMENT WORKS**

**FDU MINIDEGASSER**



**FDU MARK 10**



**FDU ROTOSTATIV**



# Degassing consumables

in high pressure die casting foundries

## Rotors

Graphite rotors are used in connection with the corresponding graphite shafts. A wide range of rotor designs and diameters can be combined with shafts in different lengths and types giving maximum flexibility for all manufacturing solution.

The rotor design is the key for optimal cleaning and degassing of the melt by optimising the following performance functions:

- + size of purge gas bubbles
- + complete homogeneous bubble distribution
- + excellent mixing behaviour
- + minimised agitation of the melt surface

## FDU XSR graphite rotor

The XSR rotor design can be combined with all graphite shafts. Different diameters from 140 to 250 mm fit almost all geometries and sizes of treatment vessels. The design of the upper section of the rotor minimises the size of the inert gas bubbles thus maximising the effective surface area of the gas.

## MTS FDR high-performance rotor

The MTS FDR high efficiency rotor is a next generation design development of the previous SPR and XSR rotors. This innovative design is the key for its advanced functionality for good degassing performance and optimal melt homogenisation during MTS 1500 application.

## Graphite shafts

Graphite shafts are available with two different couplings to the degassing unit: Quick-lock or clamp coupling for BKF type shafts and screw coupling for DSK type shafts.

- + Graphite shafts
  - Ø 75 mm, up to 1200 mm long
  - Ø 95 mm, up to 2300 mm long

## INSURAL\* baffle plates

A baffle plate is placed near to the graphite shaft and guarantees a smooth melt surface during treatment and is available in different shapes and lengths and has excellent non-wetting properties.

FDU BKF types of shaft



FDU XSR rotor



MTS FDR rotor



# MTS 1500 automated flux dosing

Melt treatment station

MTS 1500 melt treatment stations are designed for the fast and effective degassing and cleaning of aluminium alloys. The units use the impeller principle with patented rotor designs which mixes fine inert gas (usually Nitrogen or Argon) with the melt. The gas bubbles are distributed throughout the entire melt resulting in short treatment times, effective degassing and melt cleaning.

## Fluxes:

The automatically controlled introduction of an optimum amount of flux at the perfect time in the sequence of melt treatment is proven to give excellent returns on quality and cost.

A selection of fluxes specifically designed for HPDC are available from our COVERAL range:

- + COVERAL ECO 2531
- + COVERAL ECO 2532
- + COVERAL ECO 7510
- + COVERAL 2220

**A PERFECT VORTEX WITH  
MTS 1500**



## Metallurgical benefits

This highly efficient process of introduction of the melt treatment products gives many metallurgical benefits for the finished casting:

- + Excellent melt cleanliness
- + Consistent mechanical and physical properties
- + Homogeneous microstructure and composition
- + Controlled gas porosity

## Economic benefits

Reduced process costs is of major importance to aluminium foundries and the MTS 1500 is able to achieve this via:

- + reduced inert gas consumption
- + reduced flux consumption
- + minimised aluminium loss in the dross
- + reduced labour costs
- + improving performance
- + fast melt turn around
- + reproducible melt quality
- + increased reliability
- + decreased maintenance

## Health and Safety benefits

The MTS 1500 positively contributes to the foundry Health & Safety improvements via reduced particulate and gaseous emissions compared to conventional treatments:

- + vortex submersion of the flux into the melt
- + minimised flux quantity needed
- + no post-treatment ongoing reaction of the flux
- + more automation reduces operator safety hazards
- + low fume and smoke emissions

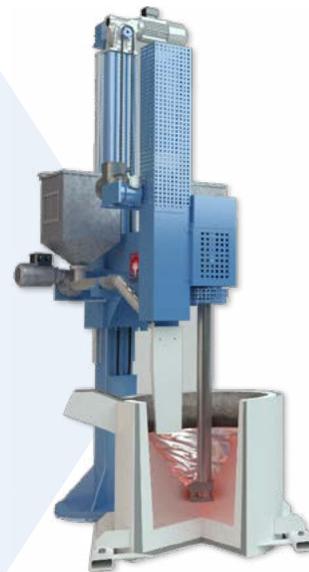
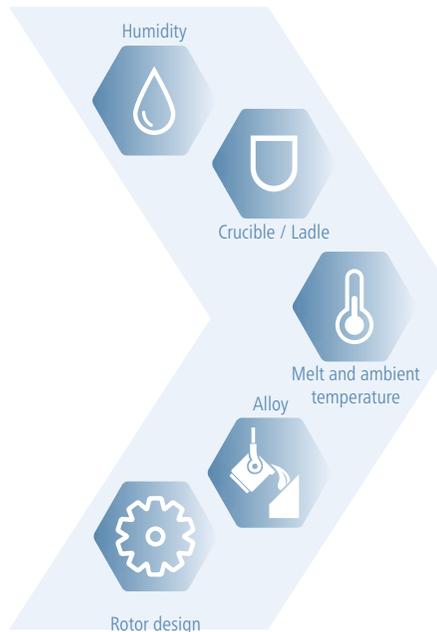
# SMARTT

An innovative process control

SMARTT is a process control tool for the rotary degassing process of aluminium alloys. It analyses all external variables and calculates the treatment parameters for degassing and upgassing processes before each treatment. The prime objective is to achieve a consistent melt quality after each treatment.

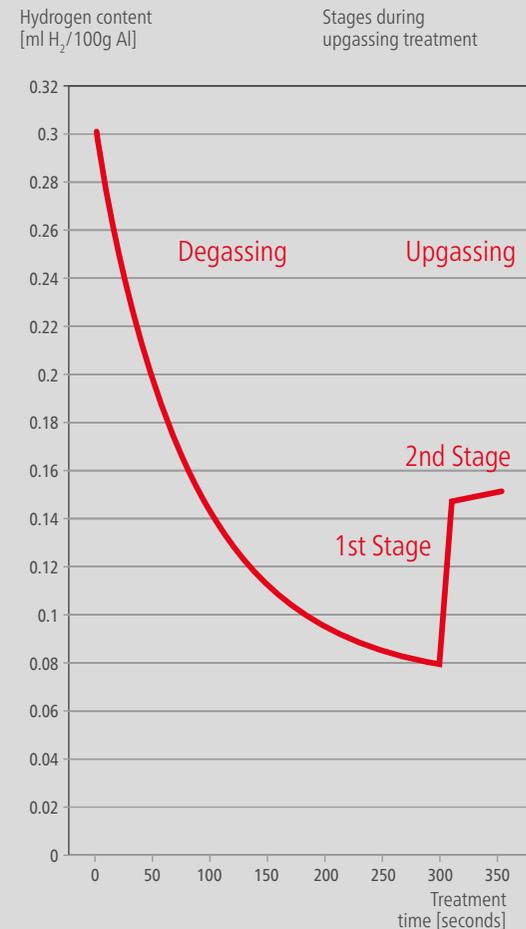
The SMARTT software is installed on a Windows PC and data exchange is carried out on a comfortable touch screen panel. The SMARTT PC is LAN connected to the Siemens PLC that controls the degassing unit. SMARTT continuously measures humidity and air temperature while data for the Foseco rotor designs

are stored in a database. The hydrogen content at the end of the treatment is always the target for the optimisation. Ingot quality, melt temperature or casting requirements influence the performance of a treatment process. SMARTT determines rotor speed, inert gas flow rate and treatment time and transfers this data to the degassing unit before treatment begins. Four different pre-determined treatment schemes (high-speed, low gas consumption, low rotor speed or standard degassing) offer opportunities for the foundry manager to optimise the process according to their specific priorities.



## SMARTT Properties

- + 20 programs on the operator screen
- + For MTS 1500 units with 1 or 2 dosing systems
- + Degassing to a hydrogen target
- + Upgassing with N<sub>2</sub>-H<sub>2</sub> mixed gas
- + Data logging of all treatment parameters



Complete treatment cycle including upgassing

NEW PRODUCT

# Crucibles and ladles

for melt transport in high pressure die casting foundries



ENERTEK ATL crucible with highly insulating coating



INSURAL ATL precast ladle linings

Foseco offers a wide range of isostatically pressed crucibles, available in both clay graphite and silicon carbide qualities. Crucibles design can be matched to the quantity of metal to be melted, held or transported.

## DIAMANT UNIVERSAL

Crucibles suitable for a wide range of temperature applications, including copper alloys and zinc.

## DIAMANT SPECIAL

Specifically developed for lower temperature holding applications, where service life is critical.

## ENERTEK

ENERTEK crucibles offer long life performance, while reducing energy consumption in both melting and holding applications.

## ENERTEK ATL

Our latest technological innovation helps reduce the heat loss during transport, compared with conventional crucibles. This technology can be with all available qualities.

## DURATEK Supermelt

The DURATEK family of crucibles are designed to provide extended life in different crucible applications. DURATEK Supermelt has been developed specifically to provide aluminium melting departments with the possibility to maximize melting and holding capacity and reduce furnace downtime.

The optimized chemistry of DURATEK Supermelt crucibles delivers superior critical mechanical properties - with increased fracture toughness and strength at high operating temperatures, and excellent resistance to oxidation.

## INSURAL ATL ladle linings

Precast linings which are supplied fully fired and ready for use. The non-wetting properties ensure that aluminium skull formation is reduced and is simple to remove, preventing cross contamination between melts.

Due to the excellent insulating characteristics of INSURAL, melt superheat can be reduced, which in turn further reduces oxidation and hydrogen pick-up within the melt.

The use of CERAMOL\*258G or TERRACOTE 7667 refractory coatings can further improve the ladle lining cleanliness.

 **ENERTEK ATL COMPARED TO CONVENTIONAL CRUCIBLES**

 **BROCHURE AND CATALOGUE**

# INSURAL\* furnace lining system

Insulating shaped refractories for aluminium applications

## Dosing furnaces

Traditional furnace lining systems involving the application of wet refractory mixes typically require time-consuming dry-out and sintering operations prior to metal charging. In addition to significant furnace downtime, such lining systems can lead to hydrogen pick-up in the aluminium melt during the initial period following furnace installation.

INSURAL Furnace Lining systems combine highly insulating and durable components, preformed and ready to use – avoiding completely the need for dry-out and sintering.

The benefits:

- + No sintering required
- + Significant energy savings
- + Low corundum growth
- + Improved melt quality
- + Reduced hydrogen pick-up
- + Able to install on or off-site
- + Minimised downtime
- + Easy to clean

 [VIEW VIDEO CASE STUDY](#)

## Preheating

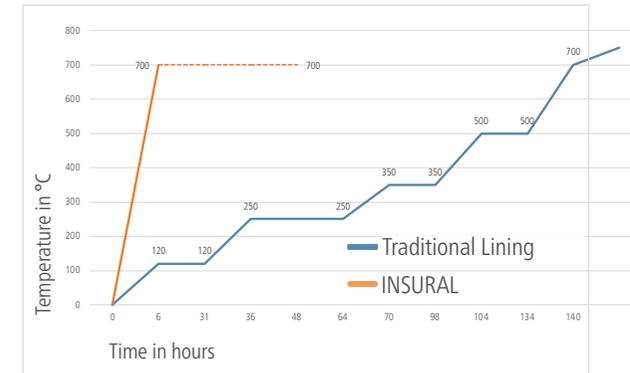
The table shows a typical preheating curve for a traditional 650 kg capacity furnace lining compared with an INSURAL lining. Traditional refractory linings have to be brought up to temperature gradually for up to 7 days, whereas an INSURAL lining can be heated to working temperature immediately. Once up to temperature we recommend 48 hours holding time.

## Density index

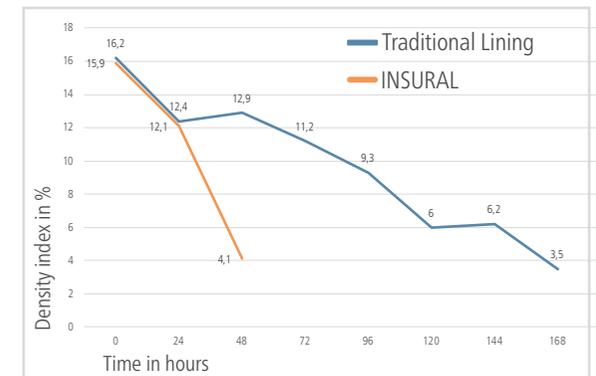
With an INSURAL installation, the desired density index of the melt can be achieved much sooner. The advantage is a faster integration of the furnace into the production process. High quality castings can be produced much sooner than with conventional linings. In many cases, restrictions on production capacity are avoided or significantly reduced.

## Energy consumption

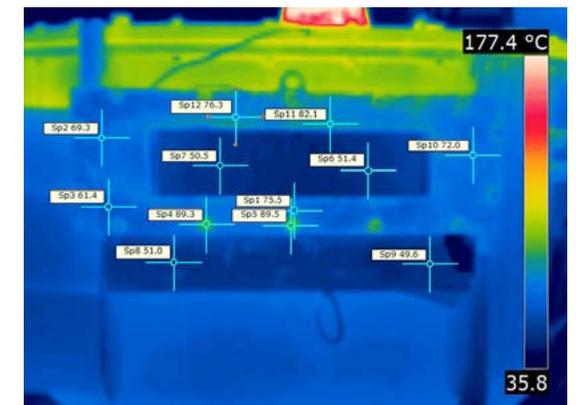
INSURAL linings are highly insulating and combined in application with an insulating backing layer. Consequently heat losses are kept to a minimum, saving energy and reducing costs. Compared to a conventional monolithic lining system, energy savings of up to 17% can be achieved.



Preheating cycle reduction by up to -65%



Density index of the melt post commissioning (reduction by up to 70%)



Shell temperature with INSURAL lining



INSURAL  
Launders



INSURAL Shot  
Launders

## Auxillary products

INSURAL insulating refractory preformed shapes and pouring accessories

The highly insulating and refractory properties of INSURAL make it an ideal material for many foundry applications. It is a highly versatile material, ideal for many challenging applications.

A wide range of auxiliary products for dosing furnace applications is now available; such as lower filling cones, shot liners, launders and thermocouple protection tubes.

Advantages:

- + No melt contamination
- + Good corrosion resistance
- + Easy installation
- + High thermal insulation
- + Extended service life



DOSING TUBE VIDEO

INSURAL All-in-one  
dosing tube



Lower filling cones



# Repair and maintenance

for furnaces and ladles in aluminium foundries

Foseco offers a wide range of repair mixes and mortars.

## QUICK FIX\* ALUGARD EXP

A phosphate bonded castable with 85% alumina providing:

- + excellent non-wetting characteristics
- + good mechanical resistance
- + rapid installation and dry-out
- + excellent adhesion
- + long shelf life (12 months)

## X-9 PLASTER

Thermally stable, putty consistency refractory, suited for all non ferrous applications providing:

- + Excellent refractoriness
- + Durable performance
- + Non-wetting characteristics
- + Resistance to slag and molten metal
- + Easy cleaning

X-9 PLASTER is designed for hand patching and repairing applications.

## INSURAL 700 and INSURAL 800

INSURAL insulating pastes are hardened by heat and are designed particularly for aluminium and zinc applications. They are self-adhesive, ready-to-use and free from classified refractory fibres.

INSURAL 700 and 800 pastes are used for the assembly of INSURAL shapes, joining of INSURAL insulating bricks, repairing cracks and lining of ladles.

## KALSEAL\* 1

A sealing compound that is used for INSURAL lining assemblies, but can also be used as a general purpose mortar for repairs of brickwork refractories, etc. The mortar will dry and harden by air-setting in 30-40 minutes, depending on ambient temperatures.

## BLU-RAM HS

A phosphate bonded mouldable refractory, based on mullite and can be used as a repair material.



QUICK FIX ALUGARD EXP  
repair



X-9 PLASTER and  
BLU-RAM HS repair  
material



INSURAL ATL  
precast ladle linings



# WASCO\*

Water soluble binder and coating system

## Introduction

HPDC offers a range of advantages, such as higher production rates and good surface finish; as a result, is the process of choice for many of the new lightweight casting parts. One significant limitation of the process is the ability to produce complex internal cavity shapes. To overcome that obstacle, it is necessary to use disposable cores. They must be able to tolerate the high pressures, temperatures and speeds involved in the HPDC and Rheocasting process.

A new type of sand core, developed by Foseco provides a solution to these challenges.

These cores are made with an innovative water-soluble Binder WASCO and coating using standard sand core production equipment.

They therefore offer a more cost-effective and sustainable option for HPDC of complex, hollow shapes at high volume and are equally suitable for use in liquid HPDC or also in semi-solid (Rheocasting) process.



Water-soluble core with applied coating

## Product Description

For the new HPDC suitable cores, the sand mixture is prepared using binder WASCO HPB and additive WASCO HPA. After the core is cured a coating WASCO HPC will be applied. The coating protects the core against the intensification pressure on the end of the HPDC cycle.

- + Sand core shooting on a core shooter with hot air curing
- + High fluidity of the mixed sand
- + Bending strength > 1000 N/cm<sup>2</sup> achievable
- + Spraying or dipping of the coating

## Benefits

HPDC is the most cost-effective forming process for Al castings. With the opportunity to use sand cores more complex parts, named structural castings can be produced. The competitiveness of the products can be increased by weight savings. More large components can be manufactured with a reduced number of single parts.

WASCO bonded cores can be manufactured on existing core making facilities. For decorating the castings are simply washed out with flushing water.

During the casting process no VOC will be released.

The used water and the sand can be separated and reused.

# Service, training and development

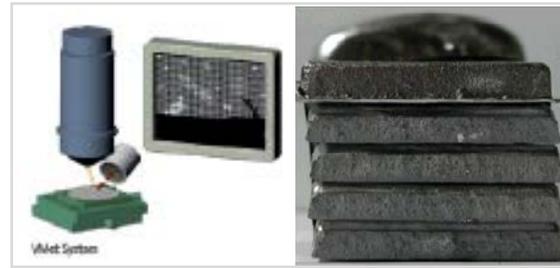
## Research & Development

Our Global R&D facility is equipped with state of the art analytical equipment, chemical laboratories, and a test foundry for continuous improvement of products and processes.



## Vmet Analysis

Our Vmet Analysis System is designed to provide our customers with a detailed analysis and understanding of their melt cleanliness. The system provides a quantified measure of inclusions and gives details of their chemistry.



## Service Team

Vesuvius is continually developing new and improved products and services to boost product efficiency and effectiveness. Our service team would be pleased to answer any further questions you may have.



## Potential for savings

The benefits of effective metal treatment can be clearly demonstrated through an analysis of the metal content of the dross produced in the foundry.



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VMET ANALYSIS VIDEO



**FOSECO. THINK BEYOND. SHAPE THE FUTURE.**

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