



# MOLTEN METAL TRANSFER

Ladle lining and metal transfer solutions for iron and steel foundries

VESUVIUS





# The importance of molten metal transfer technology

## Ladle technology impacts on the complete casting process

In most ferrous foundries, all the molten metal used to produce castings passes through a ladle or molten metal transfer system.

The type of ladle lining and flow control systems used can have a significant impact on the quality of the castings produced and many of the key operations and concerns within the foundry.

The metal transfer system affects:

### Casting quality

- + Casting cleanliness
- + Casting pouring temperature

### Process control

- + Metal temperature control
- + Mould fill rate
- + Control of oxides

### Energy efficiency

- + Furnace tapping temperature
- + Ladle pre-heat energy

### Health and safety

- + Effects of lining removal (vibration white finger)
- + Temperature of metal containing systems

### Environmental

- + CO<sub>2</sub> emissions
- + Oxygen lancing

### Productivity

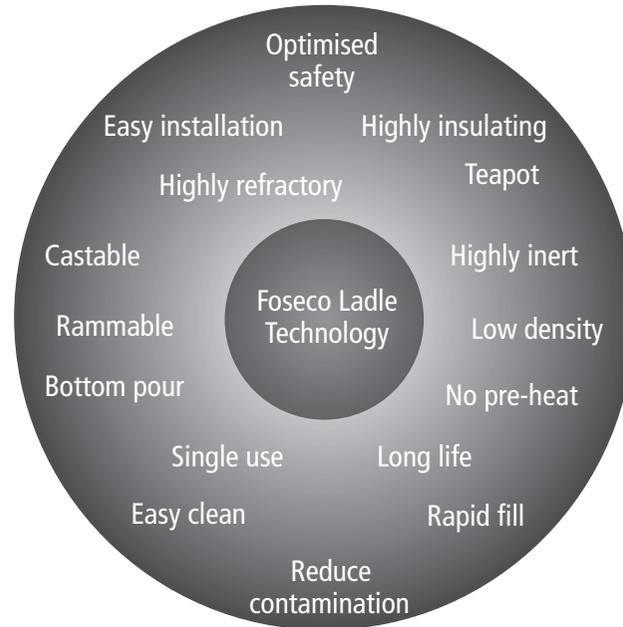
- + Ability to pour many moulds per ladle

The performance required from a ladle and mould transfer system depends on many considerations from within the foundry.

These include:

- + Casting type
- + Alloy
- + Ladle type and size
- + Mould shape and size
- + Casting quality specification
- + Pouring line
- + Casting preparation requirements
- + Health and safety
- + CO<sub>2</sub> and environmental legislation
- + CO<sub>2</sub> and environmental strategy
- + Casting fill time
- + Production requirements

Foseco has a wide range of ladle lining and flow control solutions available to provide the properties your foundry requires. We can assist you in selecting and implementing the system that best suits your foundry.





# Refractory lining systems

Foseco supplies a comprehensive range of high technology lining systems to provide the properties you require from your ladle and molten metal transfer devices.

## **KALTEK\***

Low density ladle lining systems that require almost no drying and pre-heat.

### KALTEK boards – preformed ladle lining

Predominantly, this system is applied to steel foundry ladles up to 25 tonnes in capacity. Foseco provides 2 KALTEK board systems. A single life and a multi-life system (used for up to 5 heats).

### KALTEK ISO – powder refractory

Used in iron and steel applications for ladles up to 15 tonnes. KALTEK ISO is cast using a former as a dry powder and hardened using heat.

Foseco has recently developed a new generation of NO CEMENT castable TRIAD Z for iron and steel applications. See separate brochure.

### Benefits of KALTEK

- + Increased insulation
- + Improved temperature control
- + Easy installation and removal
- + Better energy efficiency
- + Clean ladle system

## **CRITERION\* and DURAFLO\***

A range of low cement and high strength refractories, suitable for iron and steel application. CRITERION is applied by mixing with the optimum amount of water and vibrocasting behind a former.

DURAFLO is applied in a similar way, but due to the self-flowing properties, no vibration is required.

### Benefits of CRITERION and DURAFLO

- + Long life
- + Clean ladle system
- + Easy slag removal
- + Simple to repair
- + Thermal shock resistance
- + High hot strength
- + Minimal hot load deformation

### TRIAD\*

A range of cement-free, high strength refractories, ideally suited for iron foundry lining applications. TRIAD is applied by mixing with water and casting into place behind a former with vibration.

Benefits of TRIAD

- + Easy to install
- + Short and simple drying schedule
- + Long shelf life

### Refractory bricks

Dimensionally accurate refractory shapes are available in a variety of sizes and materials which offer properties including low heat conductivity, high strength and high temperature resistance.

SILLMAX\* bricks are a range of fired, high alumina dense shapes ranging from 42% to 85% alumina content.

ALRO\* bricks are a range of un-fired high alumina, dense shapes ranging from 42% to 85% alumina content.

### Mouldable refractories

Foseco's range of mouldable or rammed refractories include DURACRETE\*, BLU-RAM\* and X9 PLASTER\*.

These products can be applied by hand or pneumatic tools according to the application and consistency of the product.

Foseco's mouldable products are ideal for application to launders, ladles, spouts and general refractory repairs.

These materials are generally easy and quick to apply whilst offering excellent refractoriness, durable performance, resistance to slag and metal, and ladle cleanliness.

- + Ready to use
- + Hand forming
- + Easy to dry (chemical bonding)
- + Good thermal shock resistance
- + High performance
- + Easy to repair

Former placement



Refractory application



Removing of the former





## Flow control

Flow control products are available in two main formulations - VAPEX\* and VISO\*.

### VISO

VISO stoppers and nozzles are a range of isostatically pressed shapes based on carbon bonded alumina graphite. The products offer excellent thermal shock and oxidation resistance, making them particularly suited for application with molten steel.

### VAPEX

VAPEX stoppers and nozzles are a range of dimensionally accurate extruded shapes based on a refractory combination of graphite and alumina. VAPEX offers excellent erosion and oxidation resistance and maintains high mechanical strength over a long operational time period. VAPEX is therefore ideally suited for use in automated pouring iron foundries.

VAPEX and VISO are available in a wide range of shapes and sizes, most typically as stoppers and nozzles in foundry applications.

In steel foundry ladle applications, the VISO stoppers are normally removed from the ladle and cleaned before being reused. In automated iron pouring applications, VAPEX stoppers are positioned in the pouring box and then continuously used for multiple shifts or days depending on the application.

### ROTOLOK

A single use stopper rod may be preferred for large bottom pour steel ladles. This gives the benefit of a new stopper and nozzle for each heat. The ideal solution is ROTOLOK\* which is applied in conjunction with a steel stopper bar and holloware tubes.

The selection of the correct material and shapes for the flow control system in a ladle or pouring box has a significant impact on the pouring of the castings.

Inadequate flow control devices can result in many problems. A worn or blocked nozzle will give inconsistent flow rates and mould fill times. Incorrect shape of the stopper and nozzle will result in poor metal flow quality. If metal is allowed to flow from the nozzle in a turbulent fashion this can result in casting defects from oxidation, air entrapment and erosion of the pouring cup by the metal stream.

The use of VAPEX cross bore nozzles improves the integrity and consistency of the metal flow into the mould.

### Gas diffusers

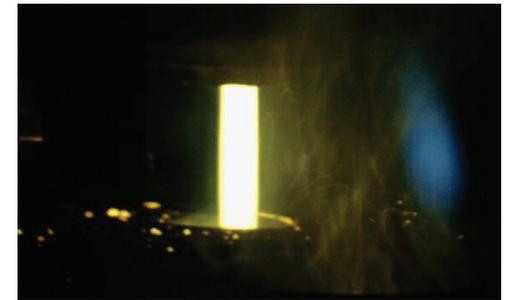
The technology associated with purging of molten iron and steel with inert gases is becoming increasingly important as the demands on casting integrity continue to rise. The purging process is typically undertaken in the induction furnace or the treatment and pouring ladles and generates many benefits including:

- + Reduction in scrap rate
- + Improved quality of castings
- + Reduction in pin holing
- + Removal of inclusions
- + Reduction in gas content
- + Temperature homogenisation
- + Improved distribution of alloying agents and deoxidants

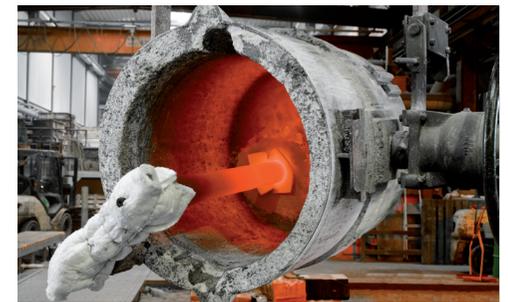
To facilitate the optimum purging process, gas diffusers are available in a range of materials and shapes designed to provide the optimum benefit for the application.



VAPEX cross bore nozzles



Metal stream from a cross bore nozzle



Bottom pour ladle ready for use



Gas diffusers available in a range of shapes

# Quality, consistency and flexibility

## Research and development

As the quality demands from end-users of castings increases, it is essential that foundry technology keep pace. Foseco continually invests resources in the research and development of innovative solutions, to the problems of today and tomorrow. Development laboratories work closely with in-house casting facilities to ensure new product developments fully meet the customer's needs.

## Consistency

Controlled and automated manufacturing processes ensure that products are supplied to a highly consistent specification, minimising batch to batch product variations.

## Quality assurance

Accredited quality assurance systems ensure optimal testing of finished products, and provides a framework for continual improvement and further process optimisation.



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