



FOR THE EFFICIENT, ECONOMIC PRODUCTION OF SOUND CASTINGS

## FEEDING SYSTEMS

HIGH PERFORMANCE INSULATING AND EXOTHERMIC FEEDING TECHNOLOGY

Improved yield

Consistent feed performance

Lower fettling costs

Improved pattern plate utilisation



**“Collaborating with my customers to find innovative solutions to their feeding problems is both challenging and rewarding.”**

## High performance

insulating and exothermic feeding technology

During solidification and cooling, liquid metals and alloys contract as they pass from the liquid state into solid. If this contraction, or shrinkage, is not compensated for, the result is a defect in the form of a cavity in the cast shape that could render the component unsuitable for use.

The supply of compensating liquid metal to a casting during cooling and solidification is known as feeding. Feeding occurs by having a “reservoir” of liquid metal available that fills the cavities that would otherwise form during solidification.

Foseco’s feeding system products are a range of insulating, exothermic-insulating or exothermic sleeves designed to extend the solidification times of feeder heads. They may be open or closed and are available in a wide range of design and sizes. They can be supplied with or without breaker cores.

By using Foseco feeding systems, the following parameters may be reduced:

- The volume of the feeder required to produce a sound casting
- The height of the feeder
- The diameter of the feeder
- The volume of residual feed metal

As a consequence, the benefits of optimised feeding are numerous, including:

- More castings produced per kilo of metal melted
- Lower energy costs
- Increased maximum casting weight achievable
- Reduced sand and binder consumption
- Lower cleaning and fettling costs
- Reduced melting losses of expensive alloying materials

### Thermal properties

Three generic types of feeder materials are available: insulating, exothermic-insulating and highly exothermic. The choice of material will depend on the particular application.

Insulating products extend solidification time, promoting directional solidification and improve yield.

For more demanding applications, exothermic insulating and highly exothermic sleeves may be used. The exothermic reaction is initiated when molten metal meets the feeder, heating the metal and extending solidification time still further. Feeder volumes are minimised and significant yield improvements can be achieved.

### Consistency

Foseco feeding solutions enable foundry engineers to optimise running and gating systems because they perform more consistently than both sand risers and competitive sleeve products.

### Application expertise

The correct application of Foseco feeding solutions avoids shrinkage defects and improves casting yields, reducing the amount of non-productive metal poured. Significant savings can also be made in fettling and cleaning operations.

Foseco has over 75 years of experience, working closely with foundries to review and redesign pattern layouts to reduce costs and improve end-to-end profitability.

Our technical experts work in close co-operation with the foundry to create novel and efficient methods in running and feeding system designs tailored to suit the constraints of individual moulding practices.

Our technical experts have many years of experience in the foundry industry and are on hand to assist you with:

- Selection of the most appropriate feeding products
- Application of suitable breaker cores to optimise fettling and cleaning
- Casting layout and design

### Simulation

Solidification simulation is an essential tool for the modern methods engineer. All our experts have access to the latest simulation technology through our alliance with MAGMA GmbH - the world leader in Solidification and Flow Simulation technology for the foundry industry.

Feeding product range



FEEDEX K sleeves leave minimal feeder stubs



MAGMA simulation



Application advice





# High strength, precision sleeves

for greensand moulding lines

## High pressure greensand moulding

High-strength, high-pressure, automatic moulding lines place extra demands on feeder sleeve products. These products must be able to withstand high moulding pressures, be simple to apply and provide consistent feed performance.

## FEEDER\*

A range of low-fluoride, highly exothermic, high-strength feeder sleeves for iron castings. Fast-igniting, they are especially suited to high-pressure automatic moulding lines where the feeder sleeves have to be positioned for ram-up application on the pattern plate.

FEEDER HD V feeders are thick walled highly exothermic sleeves. The small feeder volume and small riser-to-casting contact area make them especially suitable for use on casting sections with a limited sleeve application area.

FEEDER HD VS sleeves are a range of self-centering feeders, which can be applied quickly and safely to automatic moulding lines. They can be used with specially designed spring pins and locating cores, to enable spot feeding of even the smallest contact area.

FEEDER K feeder sleeves use a compressing core mechanism to minimise the residual feeder stub after knock-off. Fettling and cleaning is virtually eliminated. Using a fixed pin system, patterns are easier to maintain, and the steel breaker core ensures that no exothermic material comes into contact with the casting surface. FEEDER K sleeves can be applied on the smallest possible casting surfaces.

Main benefits of using FEEDER sleeves:

- Very high yields
- Highly exothermic
- High strength
- Suitable for spot application
- Low fettling costs

## KALMINEX\* SD

KALMINEX SD feeders are a range of exothermic-insulating insert sleeves. 1.5 to 1 times stronger than standard KALMINEX 2000 sleeves, they are particularly suited to high pressure moulding ram-up applications.

## Lower pressure greensand moulding

### KALMINEX 2000

KALMINEX 2000 sleeves are accurately formed, highly exothermic and insulating shapes suitable for feeding all grades of cast iron and steel. They are available as open or blind sleeves in the diameter range of 35-120 mm and can be used in both side feeder and top feeder applications.

Developed for ease of application to high-speed, automated greensand moulding systems using the "insert" technique, the sleeves are applied to a cavity, pre-formed in the cope mould by a specially designed pattern. This allows an accurate fit of the sleeve into the cavity. KALMINEX 2000 sleeves can also be easily used for ram-up applications.

The benefits of KALMINEX 2000 sleeves include:

- The exothermic reaction and high insulation factor ensure that feeder volumes are minimised, substantially improving yield
- Fettling costs are substantially reduced, especially where breaker cores are used
- Isolated sections can be adequately fed, reducing the need for expensive padding

### Floating sleeves

The "floating sleeve" technique was developed by Foseco to facilitate the application of KALMINEX 2000 sleeves to moulding systems that do not allow access to the cope. The sleeve is positioned on the drag mould and the cope mould is closed over the sleeve. Once the metal enters the cavity the low-density sleeve floats into the upper cavity.

### Drag mould application

One method of applying feeder sleeves to moulding lines that offer access to the drag moulds only, is to locate the feeder sleeve into a suitable core.

In addition, very small neck contact areas can be achieved, minimising machining requirements.



Robotic application of FEDEX sleeves



Application of KALMINEX insert sleeves



Elevator housing with FEDEX K sleeves



Simulation of elevator housing



# Feeding solutions

for jobbing and shell moulding applications

## Jobbing applications

Jobbing applications imply low volume short runs and in many cases individual one-off castings.

Foseco has developed an extensive range of feeding products to cover a wide variety of applications. Selection of the most appropriate solution is dependent on the type and size of the casting or section to be fed and the alloy to be cast.

## KALMINEX

KALMINEX sleeves are an exothermic-insulating range of feeder sleeves, supplied as preformed cylinders, ovals and neck-downs in a range of diameters up to 850 mm for modulus ranges between 2.4 and 22 cm. They are ideally suited for steel and jobbing iron applications.

KALMINEX sleeves can also be applied with breaker cores, delivering a significant reduction in fettling and grinding operations, and in some cases allowing complete knock-off of the residual feed metal.

Optimum feeding performance may require the application of a suitable anti-piping compound or the use of a KAPEX\* insulating or exothermic preformed cover.

## KALMINEX 2000

Although primarily designed for use on repetition castings, KALMINEX 2000 feeders are also used extensively for jobbing foundry applications. The sleeve material has a density of 0.6 g/cm<sup>3</sup> and therefore has good insulating properties. In addition, the liquid metal is heated by an exothermic reaction. They are positioned on the pattern and rammed-up in situ. Suitable vents to facilitate mould gas removal on casting can be drilled through to atmosphere.

KALMINEX 2000 sleeves are frequently applied in combination with breaker cores. A wide variety of breaker core shapes, apertures and materials have been developed to suit the needs of individual foundry applications.

### KALMIN\* S

KALMIN low density feeder sleeves are suitable for general purpose application to iron and steel castings.

KALMIN S sleeves are a range of accurately formed, higher strength open and closed insulating feeders with a density of 0.45g/cm<sup>3</sup>. They are particularly suited to automated moulding lines and can be used in iron and smaller steel castings. They are also ideal for "floating sleeve" application.

Compared to sand feeders, KALMIN S sleeves show a 2 to 2.2 times extension in solidification time. Good insulating properties and the neutral behaviour of the sleeve material with both molten metal and moulding sand means that KALMIN S sleeves are suitable for a wide range of alloys.

### KALBORD\*

KALBORD flexible insulating boards are ideal for use as insulating feeders for very large iron and steel castings, especially for feeders with diameters in excess of 500mm.

KALBORD flexible insulating boards prevent an early skin formation in the feeder and the metal surface in the feeder shows a uniform flat sinking.

Supplied in mat form for on-site assembly, KALBORD feeders overcome the problems of stock control and storage of very large sleeves.

### Shell moulding

The use of highly accurate, fully formed insert sleeves can be readily applied to both vertically parted and horizontally parted shell moulding processes.

In vertically parted processes, KALMINEX 2000 and KALMIN S sleeves are placed in a specially designed cavity and can be used for top riser or side riser application.

For horizontally parted shell moulds a suitable cavity is formed in the invested shell mould. Conventional breaker cores can also be used for top riser applications to improve knock-off.

KALMINEX sleeves on a pattern plate



Wide ranging methoding expertise



KALPUR\*, FEEDEX and KALMINEX application on a 100 kg sg iron casting



KALBORD flexible insulating boards





# Direct pour technology

for maximum casting yield

## KALPUR

The KALPUR direct pouring process is the combined use of a feeder sleeve and ceramic foam filter.

The KALPUR unit replaces one of the conventional feeders and the conventional gating system. Liquid metal is poured directly into the unit which connects directly with the casting cavity.

The KALPUR process can be used for steel and iron, by choosing the appropriate feeder and filter types. It is suitable for hand-moulded castings, and horizontal and vertical automatic moulding lines.

The KALPUR process entirely eliminates the need for a conventional running system. In addition, by allowing the foundryman to pour directly into the casting, directional solidification is improved.

## Hand moulding

For hand moulding and basic moulding machines, open pouring cup shaped KALPUR units are available. They can be moulded in position on the pattern plate or inserted into a cope mould cavity formed by using an appropriate dummy pattern or dolly.

## Insert applications

KALPUR insert sleeve technology facilitates the application of KALPUR units in high volume repetition iron and steel foundries. Units are available with the filter in position and can be supplied with or without breaker cores.

KALPUR units can also be successfully implemented in moulding plants using top runners with multiple downsprues.

## Vertically parted moulding lines

In this case, KALPUR units are located in the core print either by hand or using an automatic core setter.

### KALPUR for iron

KALPUR units for iron castings consist of a specially designed KALMIN insulating feeder sleeve or a KALMINEX exothermic/insulating feeder sleeve and a SEDEX\* or STELEX\* PrO ceramic foam filter. This allows castings to be successfully poured directly through the feeder.

### KALPUR for steel

KALPUR units for steel castings consist of specially designed KALMIN or KALMINEX feeder sleeves and STELEX PrO or STELEX ZR ceramic foam filters. The choice of filter will depend on alloy, casting temperature and filter capacity considerations.

### Benefits

The use of KALPUR direct pour technology provides the foundryman with the quality advantages of metal filtration, whilst at the same time offering significant cost and productivity improvements including:

- Higher yield from the elimination of running systems and hence a reduced metal requirement
- More room on the pattern plate for further castings or reduction in mould box size
- Enhanced directional solidification
- Less scrap, in-house and at the customer
- Reduced fettling and cleaning
- Reduced welding and repair
- Improved surface finish
- Better machinability



KALPUR direct pour product range



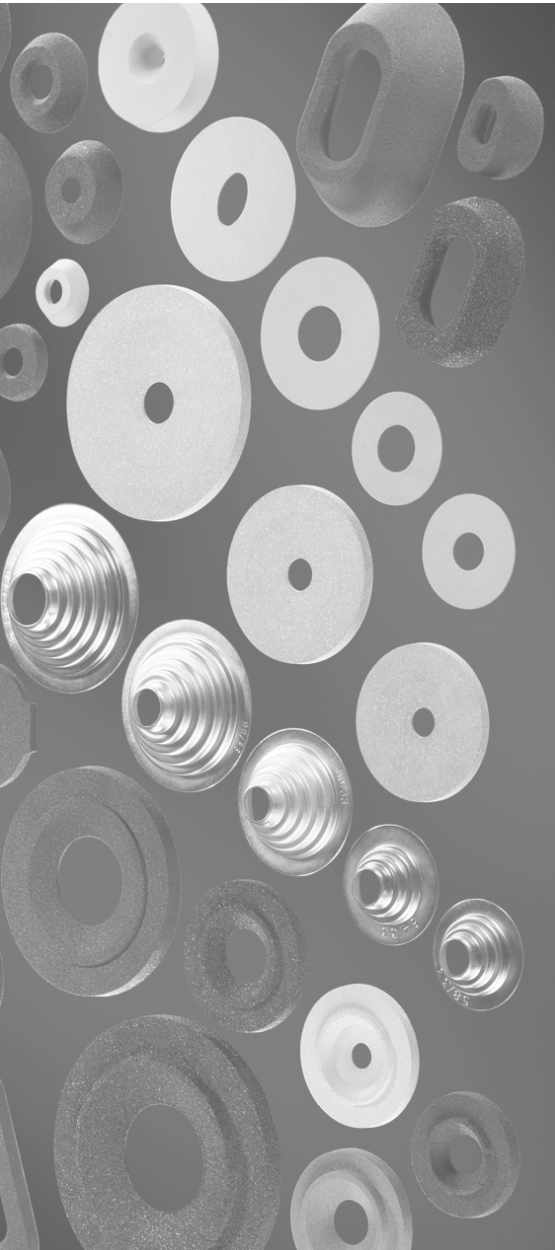
Berlin Olympic Stadium node casting



Simulation of KALPUR direct pour unit greensand application



Buffer plate KALPUR direct pour unit application



# Support products and services

for optimum feeding performance

## Simulation and design support

Foseco is the market leader in providing best-in-class simulation and methoding support tools. Our global alliance with MAGMA Giessereitechnologie GmbH is an example of our continued commitment to casting process simulation.

## Foseco PRO MODULE

Jointly developed by Magma and Foseco, the Foseco PRO MODULE has been specifically designed to simplify the process of specifying running and gating systems and thereby improve the accuracy of the simulation result.

The Foseco PRO MODULE is a parametric 3D library of Foseco sleeve and filter products, combined with a proprietary database of sleeve material thermophysical datasets and filter pressure drop data.

The main features of this software include:

- Special Foseco interfaces embedded in the MAGMASOFT® Pre-processor
- Parametric 3D libraries of standard Foseco feeding system and filtration products, by region
- “One-click” product selection and definition
- Foseco sleeve material thermo-physical database
- Foseco filter pressure drop datasets
- Database of heat transfer coefficients specific to Foseco feeding system products
- Sleeve material and filter properties are automatically assigned simplifying simulation setup

## FEEDERCALC\*

FEEDERCALC iron and steel programs allow foundry engineers to optimise casting design through the calculation of:

- Section size and modulus
- Feeding distance
- Feeder selection and sizing

### Sleeve library

A European sleeve library is also available containing models for all standard feeder sleeves and their breaker core combinations. Containing fully dimensioned 2D drawings and exact 3D models for use with simulation packages, the library is available in 10 languages.

### Application tools

A wide range of tooling is available to support the foundryman in the application of Foseco feeding products, including:

- Drawings for feeder dollies and ram-up posts for all applications
- Resin feeder dolly patterns that are available for horizontal and vertically parted greensand insert applications
- Spring loaded and rigid pins are available for FEEDEX HD V, VS and VSK feeder sleeve applications

### Anti-piping compounds

FERRUX anti-piping compounds are a range of low-fume, low-dust, free-flowing exothermic powders designed for application to the top surface of open feeders to minimise heat loss. Suitable for both iron and steel risers, FERRUX improves feeder performance and minimises skull formation.

### KAPEX lids

KAPEX lids are a range of insulating and exothermic preformed lids suitable for application to KALMIN and KALMINEX open feeders. On application, an exothermic reaction causes the KAPEX lid to expand by as much as 200%, producing a highly insulating cover layer. They ensure optimum feeding for all grades of iron and steel and have a number of advantages over traditional powdered covers:

- Dust free and very low fume
- Uniform insulation across the whole feeder surface
- Elimination of human error
- Provides protection for the mould cavity between moulding and pouring

### Breaker cores

Selection of the correct design and type of breaker core is an integral part of optimisation of feed performance and fettling and cleaning productivity.

Application of the correct breaker core to FEEDEX and KALMINEX sleeves can reduce the contact area between feeder and casting by as much as 75%, significantly reducing, or even eliminating, expensive fettling operations.

Foseco PRO MODULE



KAPEX lids



Insert feeder patterns



Application advice



# Quality and consistency

for reproducible performance, time after time

## Consistency

Foseco feeder sleeves are formulated with carefully controlled raw materials to specific thermal and dimensional criteria.

Controlled and automated manufacturing processes ensure that products are supplied to a highly consistent specification.

Consequently, batch to batch variation is minimised, facilitating consistent and reproducible performance time after time.

## Quality

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

## Research and development

A team of dedicated chemists and engineers strive to constantly improve the performance of all Foseco feeding systems products, to develop new and novel formulations and designs and to improve the application of Feeding Systems to realise ever greater process control over shrinkage.

Consideration is also given to reducing the energy consumption associated with producing defect free castings, whilst maintaining the need to be environmentally aware, and to offer the best and safest product available.

Compression strength testing of FEEDER sleeves



Testing burn properties of KALMINEX 2000 sleeves



TMAX measurement



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