



Flow Control and Nozzle Systems

Manufacture, Supply and Installation

www.capital-refractories.com

 **CAPITAL**
REFRACTORIES

Welcome to Capital Refractories

A warm welcome to Capital Refractories, I trust this brochure will provide you with a clear insight into our many products and services.

These are exciting times for Capital, I am very proud of what we have achieved over the last 30 years. During this time, we have grown from a single site supplier of refractory linings for the steel foundry industry to a large, global supplier of both refractory and ceramic materials for most molten metal applications.

We have a growing portfolio of technical ceramics which includes:

- Ceramic cores for the aerospace and IGT industry
- One shot and multi-use crucibles for investment casting
- Flow control nozzles for the steel, foundry and atomizing industries

Our operations have grown on a global scale with 300 staff at 9 sites and with customer support directly or indirectly in over 40 countries.

Capital has a strong reputation for developing new products and services. We invest over 10 per cent of profits back into R&D resulting in over 30% of current sales being products developed in just the last four years.

Our latest innovations include:

- Engineered tortuosity molten metal filters
- Rotary slide gate (no stopper) for multiple openings with ladles ranging from a few kg to 25t+ capacity
- SpeedLine precast blocks for quick turnaround in aluminium rotary furnaces



I am particularly proud of our staff who I strongly believe are our best asset. They are experts in their fields and provide a vast amount of experience. Based around the globe, they are always on hand to find the very best solutions for our customers.

We focus on building long-term customer relations, much of our product development is in collaboration with our customers and we strive to provide a personal approach.

After looking through the brochure, if you need further assistance in understanding Capital's products and services, please do contact one of our team of experts. We have a wide range of brochures for specific application areas, please ask for more information.

I hope you find this an interesting read!

James Newsome
Managing Director

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Here to Fulfill your Casting Requirements

We have a comprehensive range of castable and gunning products for aluminium primary and secondary melting, cement, steelmaking, power generation and other heat process industries.

At Capital we are able to supply systems that can improve the bottom pouring of ladles, while helping to reduce costs and provide a quicker turn-around on ladles.

Our unique Unibore system of replaceable nozzles allows for specific nozzles for specific castings. In the following pages you can find out how the system can integrate easily into your existing works.

Please speak to one of our experts at Capital for further advice.

Bottom Pour

Capital Refractories is able to supply systems that can improve the bottom pouring of ladles, allowing customers to reduce their consumable costs, labour costs and provide a quicker turn-around of ladles.

This document will give an overview of the unique Unibore system and how it can integrate into your existing works. For further information; experts at Capital are on hand to advise you about the system's applications.

Unibore is a system of replaceable nozzles that allows for optimum selection of the correct nozzle for a specific casting.



The Unibore System

Capital Refractories patented Unibore nozzle system brings a range of advantages to customer, while also reducing costs and providing greater flexibility.

How it Works

Unibore is a unique two-component system consisting of a re-usable outer nozzle and a second inner nozzle, which is available with a range of bore diameters. A fibre gasket makes the seal between the two pieces. This offers a new way of changing the diameter of the nozzles after each casting by replacing the inner part of the nozzle only.

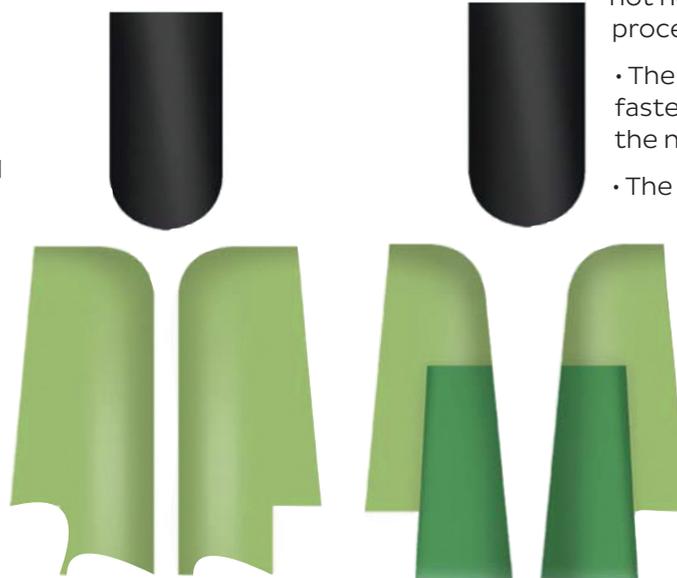
Advantages

- The Unibore system minimizes downtime and reduces consumable costs as well as labour costs
- The inner nozzle is tapered in design which ensures that the nozzle is not affected by metal erosion and retains the same bore size
- There is a much larger opening of the outer section of the nozzle compared to a standard nozzle

Unibore Developments

Capital's Unibore system, already proven in bottom-pour ladles, has been further developed for use with Autopour systems. Benefits of the Unibore system are complimented by the Multicast – our reusable stopper system. Unibore with Autopour has been specifically designed to accommodate a shallow nozzle which caters for the small gap between the Autopour tundish.

- Nozzles are quickly and easily changed providing greater flexibility
- The one-piece stopper remains in place and does not need resetting during the process



- The flow rate is consistent and faster than a standard design as the nozzle is wider at the top
- The flow is also more stable and provides reduced drag
- Unibore reduces inclusions and defects in the metal meaning less rework and scrap

Trial Successes

Unibore has been trialled and adopted by many foundries in the UK and overseas, with great success.

Benefits included:

- Reduced defects
- Improvement on scrap rate
- Increased efficiency
- Cost reductions
- Optimising ladle operatives' time
- More flexibility

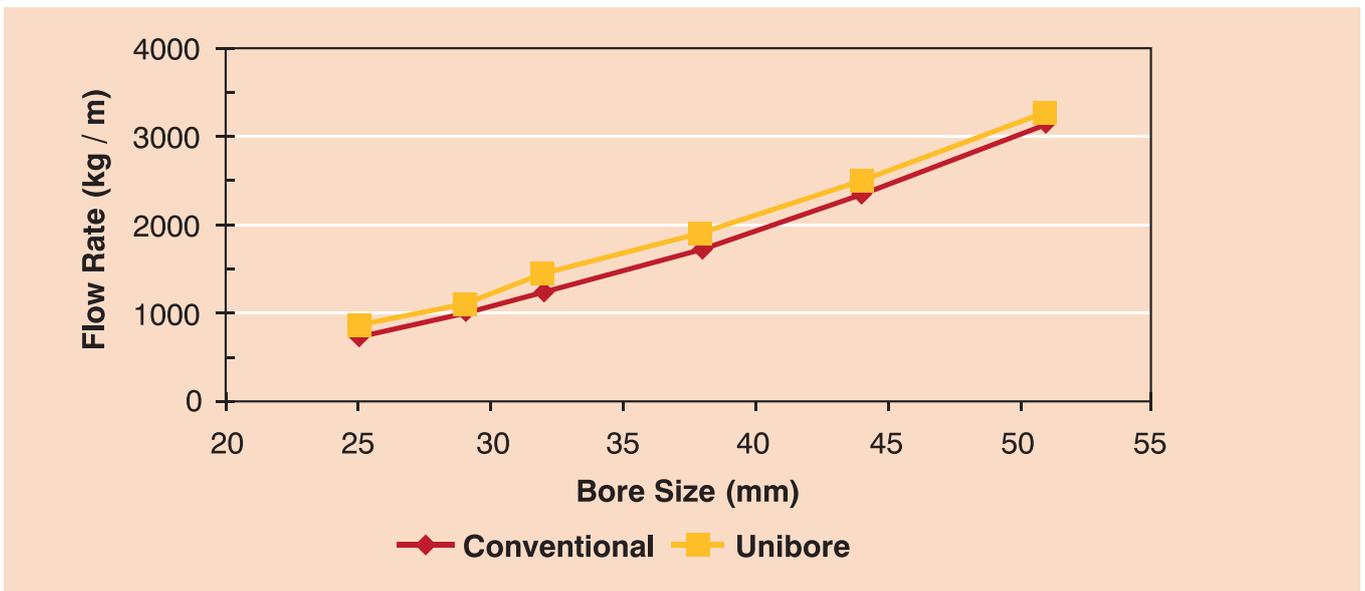
Advantages of Unibore with Autopour:

- Downtime is reduced
- Labour is reduced
- The amount of metal poured can be accurately controlled
- A higher casting quality
- Reduction in waste – greater control reduces spillage
- Unibore with Autopour helps to keep pace with high speed mould machines
- The system allows for consistent pouring

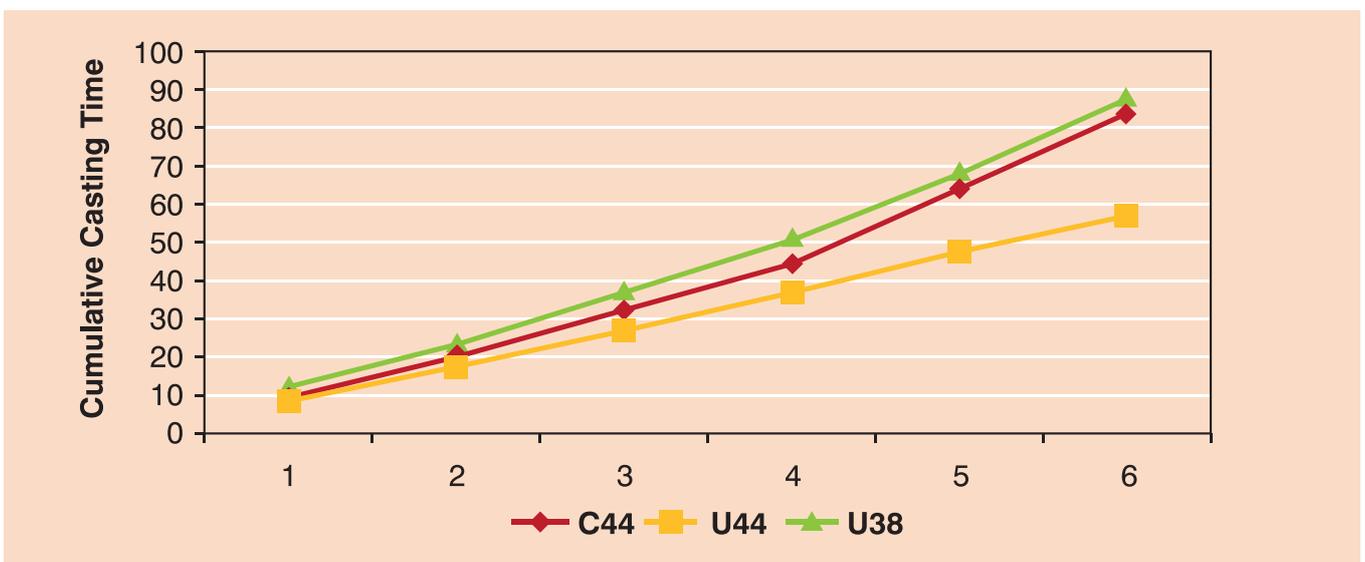
The Unibore System

Unibore offers a number of characteristics and advantages over conventional bottom-pour nozzle systems.

The graph below shows that a similarly sized bore in Unibore passes metal at a slightly faster rate than with a conventional nozzle. Continued on the next page.



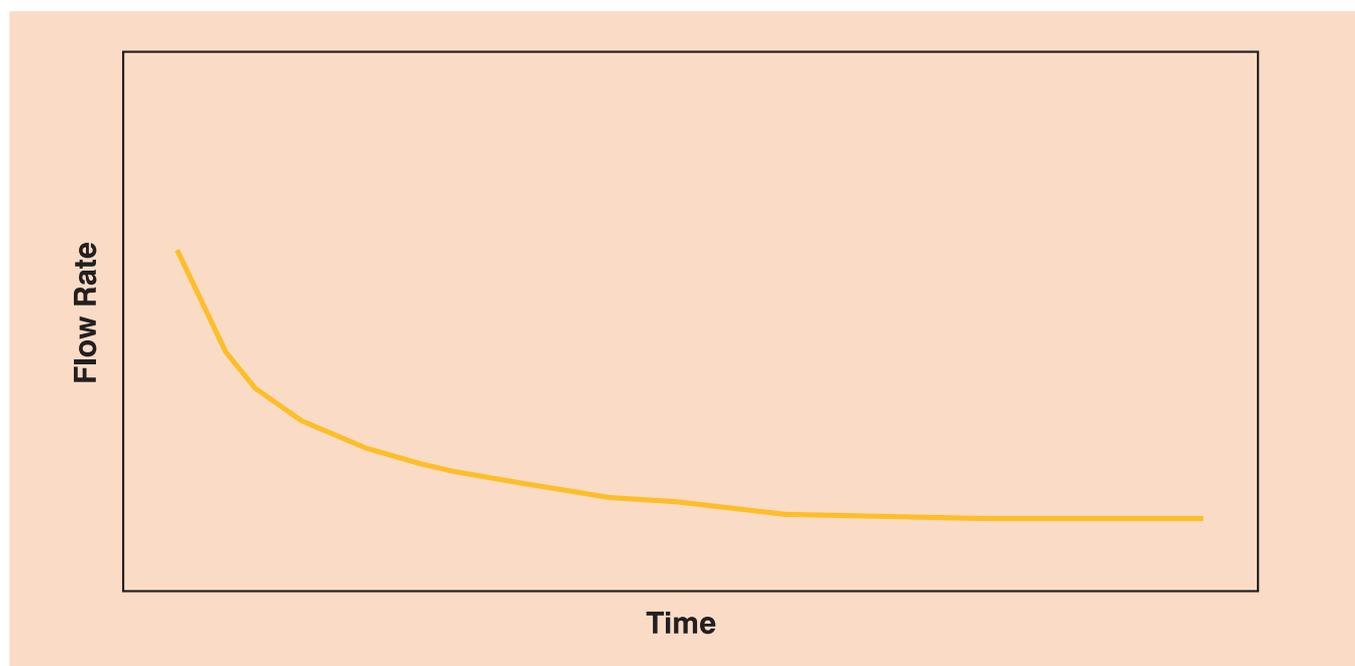
The graph below shows that by utilising a slightly smaller nozzle (in this case a 38 mm bore rather than 44 mm) comparable mould fill rates are achievable.



The Unibore System

Continued from the previous page.

The graph below is a typical measured flow rate that shows a consistent flow rate after the initial surge.



ADVANTAGES OF CAPITAL REFRACTORIES PATENTED UNIBORE SYSTEM INCLUDE

- Changing the bore size is quicker and easier. The inner nozzle can be removed and replaced in situ and whilst the ladle is hot.
- The design of Unibore ensures the same bore size can be maintained throughout casting.
- Flow rate is consistent and faster (with equivalent bore sizes) than a standard design as the nozzle is wider at the top.
- The flow is also more stable and provides reduced drag.
- Unibore reduces inclusions and defects in the metal meaning less rework and scrap.
- Consumable costs are reduced.
- Labour costs are reduced as far less time is spent setting new nozzles.
- Unibore provides greater flexibility – bore sizes can be changed with ease for every job required.

Unibore with Autopour

Capital Refractories' licensed and patented Unibore system, already proven in bottom-pour ladles, has been further developed for use with Autopour systems.

The Unibore system enables a more stable and controllable metal flow and allows for a quicker turn-around of the pouring system. It is complemented by Multicast – our re-usable stopper system. A slightly faster rate than with a conventional nozzle.

Unibore with Autopour has been specifically designed to accommodate a shallow nozzle which caters for the small gap between the Autopour tundish.



THE ADVANTAGES OF USING UNIBORE WITH AUTOPOUR INCLUDE

- Downtime is reduced. The Unibore inner nozzle can be removed and changed allowing casting to be re-started quickly.
- Labour is reduced due to the reduced changeover time.
- The amount of metal poured can be accurately controlled.
- A higher casting quality.
- Reduction in waste – greater control reduces spillage.
- Unibore with Autopour helps to keep pace with high speed mould machines.
- The system allows for consistent pouring.

Consumables

Standard Available with bore sizes of 25mm, 29mm, 32mm,
 RT Nozzles – 38mm, 44mm, 51mm, 57mm, 64mm, 76mm – Boxes of 8

Stopper Rods

120 mm x 1250 mm
 105 mm x 1015 mm
 90 mm x 810 mm

Base Plates

Standard
 Large (100 mm range)
 French (3 holes instead of 2)

Multicast Plate

(for Standard RT Nozzles)

Roto Rods

Arms – MCA 75/650

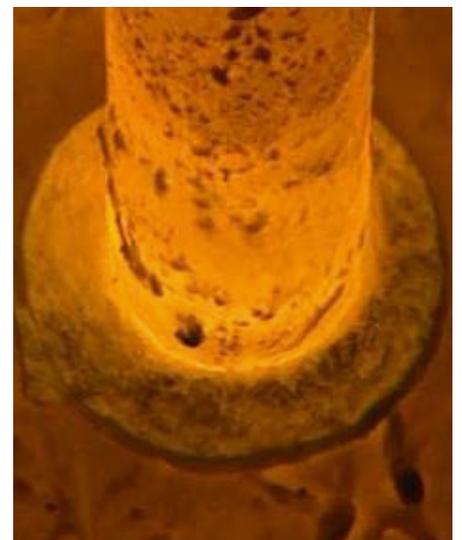
Blocks (in pairs)

Applicators – 4 inch, 5 inch

Gaskets

160 mm x 3 mm
 160 mm x 6 mm
 200 mm x 3 mm
 200 mm x 6 mm
 200 mm – 2 piece

Unibore 40mm Series;
 Unibore 45mm Series;
 Unibore 65mm Series;
 Unibore 100mm Series



Foundry Nozzles

Foundry Nozzles are available in a range of Alumina grade material qualities to suit casting requirements. Our nozzles are made from high purity raw virgin materials with no added Grog.

A combination of excellent cosmetic appearance and dimensional accuracy promotes stable casting conditions. All our nozzles are available in a wide variety of bore sizes and are widely used in bottom pour ladle applications, where flow control is of paramount importance. Our efficient manufacturing techniques enable short reliable lead times.

- Dimensionally accurate
- Large material catalogue to suit all requirements (please ask for details on alternative materials)
- Lean manufacturing provide provides our customers with short and reliable lead times

Foundry Nozzle Product Range:

Pm600

- High thermal shock resistant
- Economic material, to suit most low tempcast

Pm700

- Providing extra erosion resistance while still remaining economically priced



Pm850

- Superior erosion resistance.

FOUNDRY NOZZLE MATERIAL SELECTION			
	Pm600	Pm700	Pm850
General Properties			
Apparent Porosity (%)	23.0	22.0	18.0
Bulk Density (g/ml) (lb/ft)	2.26	2.50	2.84
Thermal Conductivity (w/mK)			
Mean Temperature 500°C	1.8	2.3	3.3
Mean Temperature 900°C	2.0	2.4	3.0
Mean Temperature 1300°C	2.1	3.3	2.6
Chemical Analysis (%)			
SiO ₂	36.0	26.0	10.0
TiO ₂	2.65	2.65	3.3
Fe ₂ O ₃	1.3	1.3	1.5
Al ₂ O ₃	56.5	67.0	81.5
P ₂ O ₅	2.5	2.5	2.5

AtomiZIR, Zirconia and Zircon Atomising Nozzles for Powder Metallurgy

Capital produce a wide range of atomising nozzles in a range of Zirconia and Zircon materials. These are suitable for use with a wide range of alloys including aluminium, lead, iron, steel and super alloys. Our nozzles comprise high dimensional accuracy, erosion resistance and controlled porosity. Additions of calcium, magnesium and rare earth oxides are used in zirconia compositions as stabilising agents to enhance thermal shock resistance.

Composite nozzles are also available which combine a erosion resistant insert, with a chemically bonded high alumina or zircon outer.

Advantages of the AtomiZIR Nozzle

- Stable flow characteristics achieved through close dimensional control and erosion resistance
- Suitable for both water and gas atomisation of ferrous and non-ferrous metals.
- Excellent erosion resistance combined with reduction of cracking from thermal shock.
- Can be used in a variety of casting environments.
- Available in a wide range of shapes and sizes to suit all atomising requirements.



SOLID NOZZLES			COMPOSITE NOZZLES			
ATOMIZIR		ZIRCON	ZIRCONIA INSERTS		ALUMINA OUTERS	
CRL SUPERZCS	CRL SUPER ZY		CRL SUPER ZM	CRL SUPER ZDM	CRLPM850	

General Properties	CRL SUPERZCS	CRL SUPER ZY	ZIRCON	CRL SUPER ZM	CRL SUPER ZDM	CRLPM850
Apparent Porosity (%)	18	18.5	19	18.5	17	19
Bulk Density (g/ml) (lb/ft ³)	4.6	4.5	3.70	4.50	4.65	2.84
Linear Change (%) 2h at 1600°C (2912°F)	Nil	Nil	-0.5	Nil	Nil	1.0
Chemical Analysis (%)						
SiO ₂	1.2	1.7	3.2	1.7	1.7	1.0
TiO ₂	0.2	0.5	0.3	0.5	0.3	3.3
Fe ₂ O ₃	0.2	0.1	0.2	0.05	0.1	1.5
Al ₂ O ₃	0.9	0.6	2.9	0.6	0.6	82
CaO	1.9	0.2	0.1	0.05	0.1	0.2
MgO	0.1	0.1	0.2	2.4	2.5	0.2
K ₂ O	-	-	-	-	-	0.4
Na ₂ O	-	-	-	-	0.01	0.1
CeO ₂	-	-	-	-	-	-
ZrO ₂ + HfO ₂	96.5	92.5	64	92.5	94	-
Y ₂ O ₃	-	3.8	-	-	-	-
P ₂ O ₅	-	-	-	-	-	2.5

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For supply and additional information about Capital Refractories, or if your country is not listed, please contact Capital's UK Head Office, see back of brochure for details.

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