

FOUNDRY AND
INVESTMENT CASTING
PRODUCTS

Morgan Advanced Materials

Morgan Advanced Materials is a global materials engineering company which designs and manufactures a wide range of high specification products with extraordinary properties, across multiple sectors and geographies.

From an extensive range of advanced materials we produce components, assemblies and systems that deliver significantly enhanced performance for our customers' products and processes. Our engineered solutions are produced to very high tolerances and many are designed for use in extreme environments.

The Company thrives on breakthrough innovation. Our materials scientists and applications engineers work in close collaboration with customers to create outstanding, highly differentiated products that perform more efficiently, more reliably and for longer.

Morgan Advanced Materials has a global presence with more than 9,000 employees across 50 countries serving specialist markets in the energy, transport, healthcare, electronics, security and defence, petrochemical and industrial sectors. It is listed on the London Stock Exchange in the engineering sector (ticker MGAM).

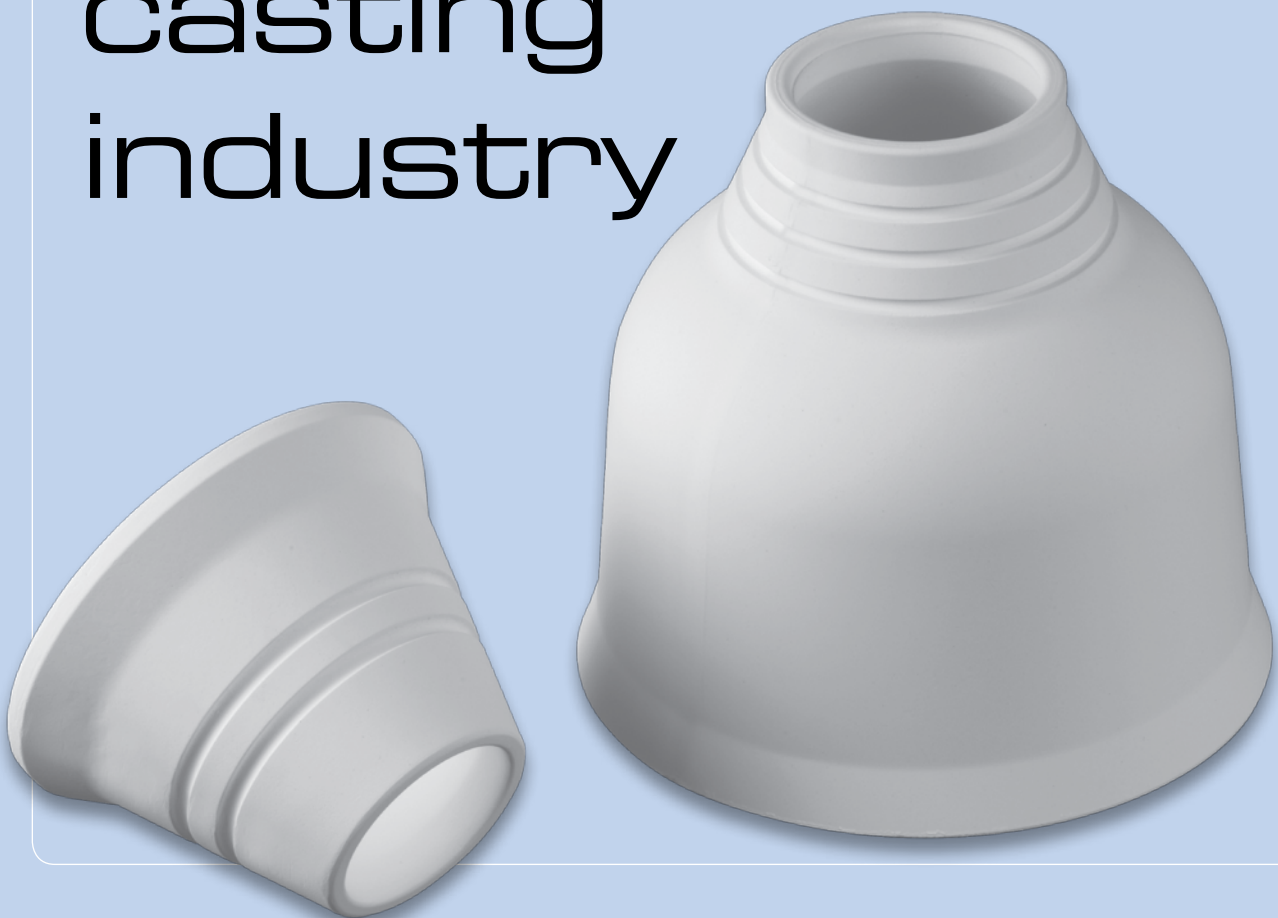
About our Certech business

Through the Certech business Morgan Advanced Materials manufactures ceramic cores predominantly for aerospace and industrial turbine applications. Our cores allow the creation of internal cavities during the investment casting process that are complex or too small to be shelled. Morgan also manufactures wax injection moulded cores, porous ceramics and a wide range of foundry supplies to meet custom requirements.

Why choose Morgan Advanced Materials

- MARKET LEADING R&D RESOURCES
- COMPREHENSIVE INSPECTION SERVICES
- LARGE CAPACITY FOR FULL OUTSOURCING AND ASSEMBLY
- MINIMAL SCRAP AND ASSOCIATED MACHINE RUNNING COSTS
- IMPROVED CASTING YIELDS USING OUR CERAMIC CORE AND WAX PRODUCTS
- MANUFACTURING OF HIGH QUALITY CUSTOM EQUIPMENT FOR INDUSTRIAL APPLICATIONS
- A WIDE RANGE OF MATERIALS WHICH REMAIN ROBUST AND STABLE AT EXTREME TEMPERATURES
- THE ABILITY TO EXPAND OUR RANGE OF PRODUCTS TO SUIT OUR CUSTOMERS' REQUIREMENTS

Over 150 years
dedicated to
innovation and
performance in
the investment
casting
industry

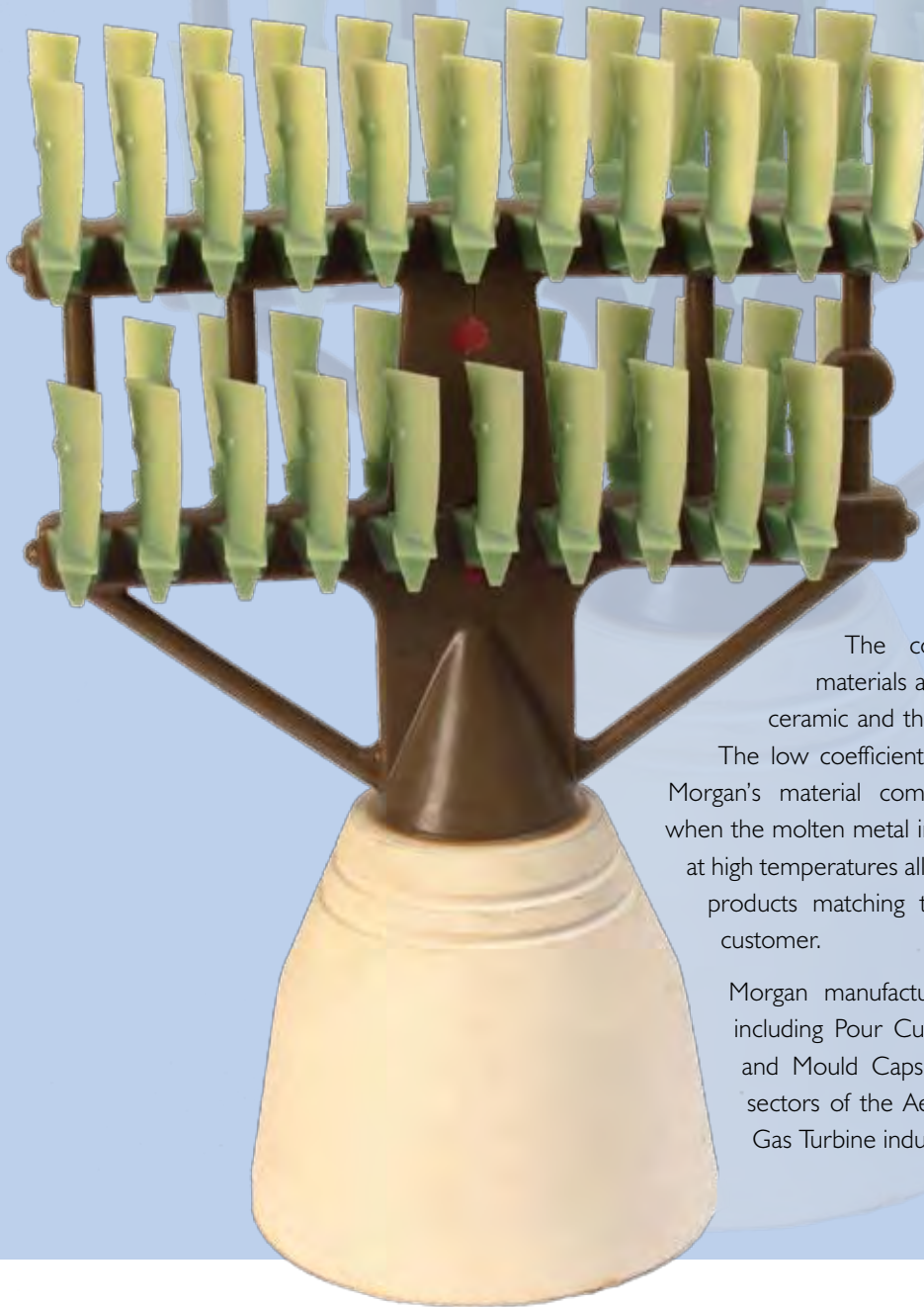


Hardware and Foundry supplies

Morgan Advanced Materials designs and manufactures a wide range of foundry products using our proprietary injection moulded refractory materials. These products have excellent thermal shock resistance and can be customised to suit your specific requirements.

Produced from the same materials utilised for our ceramic cores, our foundry products have a typical composition of 70% silica and around 30% zircon. This material provides excellent thermal stability at high temperatures and is highly leachable.

Consideration of the size, complexity and type of alloy being cast is crucial in material selection. The relationship between alloy and ceramic must provide the correct benefits for each custom application. Morgan provides a wide range of ceramic grades, suitable for use with alloys including; nickel and cobalt based alloys, steels, aluminium and titanium.



The composition of Morgan's ceramic materials allow for no interaction between the ceramic and the metal used in the casting process.

The low coefficient of thermal expansion ensures that Morgan's material components stay dimensionally stable when the molten metal interacts. The stability of the material at high temperatures allows Morgan to manufacture durable products matching the tolerances and needs of each customer.

Morgan manufactures a range of foundry products including Pour Cups, Filters, Crucible Liners, Chokes and Mould Caps for use in the Investment casting sectors of the Aerospace, Automotive and Industrial Gas Turbine industries.

Pour Cups

Morgan's pour cups can be customised to accommodate individual feed system requirements. The pour cup becomes a part of the assembly reinforcing the overall stability whilst providing a safe zone for the molten metal to impact on.

The 'G' family material, generally used for a wide range of Equiax castings with an intermediate particle size distribution, comprises 70% Silica and 30% Zircon. Offering excellent thermal stability at high temperatures, low shrinkage rates and minimal absorption. The material itself offers 100% leachability although this is not a vital requirement for pour cups.

Morgan aim to manufacture custom designs matching the needs of our customers, as well as continuing to manufacture our current products with a wide range of outlet sizes.

Please refer to the standard sizes page (page 10) for more information on our product range.



Crucible Liners

Morgan's crucible liners, which are available in a wide range of sizes from 9-25kgs (20lb to 55lb) shot capacity, have been extremely successful in reducing non-metallic inclusions that develop during the vacuum melting process.

Our crucible liners offer a coarse particle distribution, excellent stability at high temperatures and very low absorption rates. The excellent thermal shock properties of this material reduce failures that may occur in the casting processes due to thermal cycling or general failure due to high temperatures.

Filters

The ever changing competitive market of investment casting requires the production of high quality castings. This means the eradication of any impurities before the metal sets, a result which can be successfully achieved through Morgan's ceramic filters.

Our ceramic filters are available in a variety of different particle sizes, to enable customers to cast high quality products to individual specifications. Morgan provides ceramic filters in a range of slot sizes, each providing excellent thermal shock properties and efficient removal of impurities such as floating slag, in stream slag, inclusions and any dross to provide our customers with clean metal castings.



Please refer to the standard sizes page (page 10) for more information on our product range.

Casting Inserts

Casting inserts allow the formation of cavities within the shell. The inserts are manufactured using a wide range of materials which offer excellent stability at high temperatures and low shrinkage/expansion.

Manufactured to the customer's requirements, casting inserts can be easily leached out of the system, leaving behind the desired intricate cavity.

Our special H-7 material inserts can also be physically blown out of Aluminium casting assemblies with pressurised water. This is a cost, time and environmentally effective solution to using chemicals.

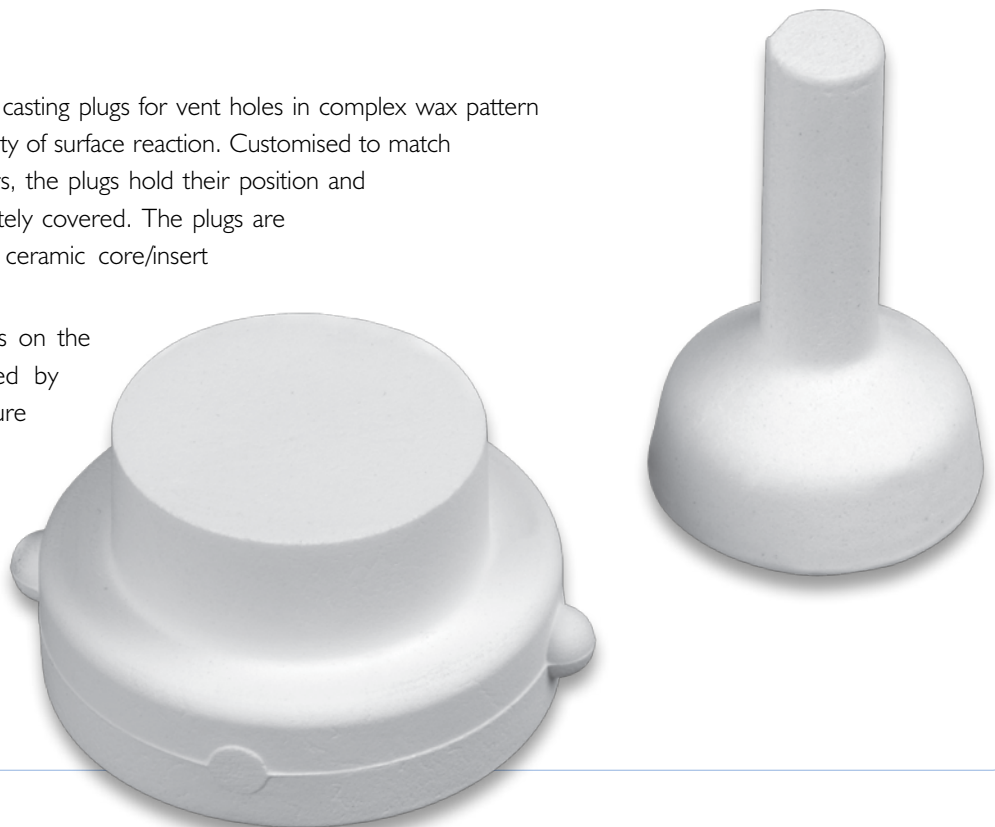
For more information on H-7 and its applications please get in touch with Morgan today or visit our Silica data sheets on www.morgantechnicalceramics.com.



Casting Plugs

Morgan designs and manufactures casting plugs for vent holes in complex wax pattern assemblies, preventing any possibility of surface reaction. Customised to match the requirements of our customers, the plugs hold their position and ensure the vent holes are completely covered. The plugs are also utilised as hold offs for any ceramic core/insert within the assembly.

The selection of material depends on the strength and removability required by the customer. Morgan manufacture plugs with a wide range of materials including our B family which offers very high strength and resistance to leaching.



Counter-Gravity Low Pressure (CLA) Snouts

The CLA (counter gravity casting of air melted alloys) process relies on the permeable wax/ceramic assembly being kept upside down in a vacuum box with a snout extending outwards from the cavity. The snout is submerged in molten metal, and a vacuum is applied, drawing the molten metal into the cavity.

Morgan manufactures snouts suitable for the CLA process which can help improve your casting yields, as well as the removal of any dross or slag. Utilising snouts within your process can also help to cast products with thicknesses of around 0.5mm and offer the ability to control the grain boundaries.

Morgan's CLA snouts are stable at high temperatures, have low shrinkage rates and minimal absorption and contamination caused by metallic erosion.



Mould Caps

Our range of foundry supplies also includes Mould Caps or Ceramic Cover Plates. During the preheat process, the ceramic plates are used to cover the investment casting mold to avoid any contamination. The plates are thermally stable, meaning that they can withstand thermal shock at extreme temperatures.

Morgan supplies standardized sizes of ceramic mould caps to fit our wide range of standard pour cups.



Please refer to the standard sizes page (page 10) for more information of our product range.

Chokes

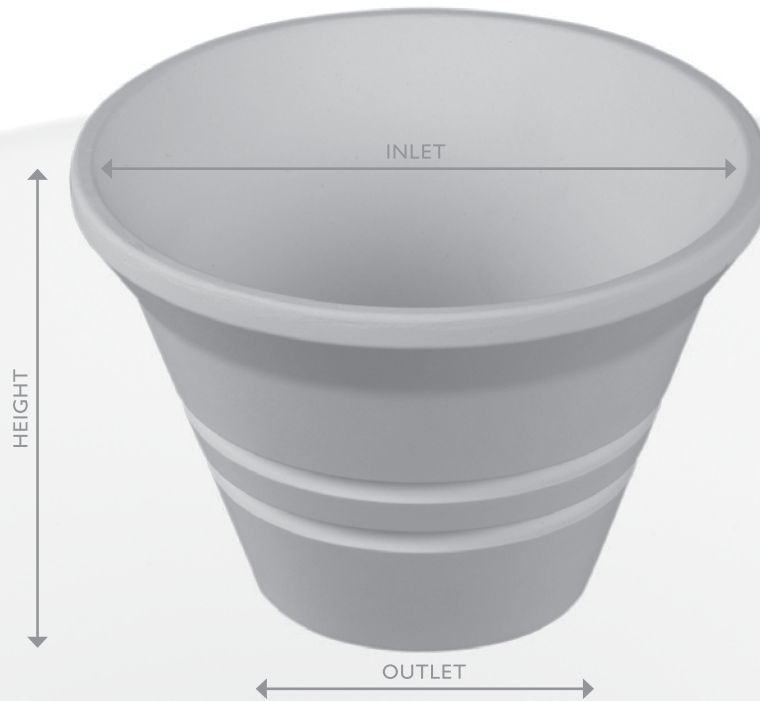
Some materials used within the casting process can cause turbulence within the flow which leads to a poor finish, and erosion on the surfaces of the casting. Morgan's custom manufactured chokes are used to reduce these instances, by slowing down and smoothing out the flow as it enters the shell. The choke provides a much better overall finish and excellent control over the flow.



Support Rods / Tubes

Morgan manufactures custom extruded ceramic rods for casters, to support the structure of their assemblies. The rods add strength to parts of the structure that require additional support. These rods are made at a range of different standard sizes but can be customized easily to match your needs.

Please refer to the standard sizes page (page 10) for more information on our product range.



Pour Cups

Height (mm)	Inlet Diameter (mm)	Outlet Diameter (mm)
73	115	42
80	120	60
80	135	63
85	120	54
105	170	60
105	141	60.5
200	203	75

Ceramic Filters

Morgan offers four standard ceramic filters for our customer's casting requirements:

- 0.52mm slots tapered at 9 degrees (with or without a flange depending on the customer's requirements)
- 1.02 mm slots tapered at 5 degrees (with or without flange)

Mould Caps

Morgan offers two standard sizes in our Mould Caps range:

- Small size mould cap with a diameter of approximately 210 mm
- Large size mould cap with a diameter of approximately 260 mm

Snouts As well as offering custom designs for customer's specific requirements, Morgan offers:

Standard Snouts	Height (mm)	Inlet Diameter (mm)	Outlet diameter (mm)
Snout 1	133.3	25.5	60.3
Snout 2	160	30	60

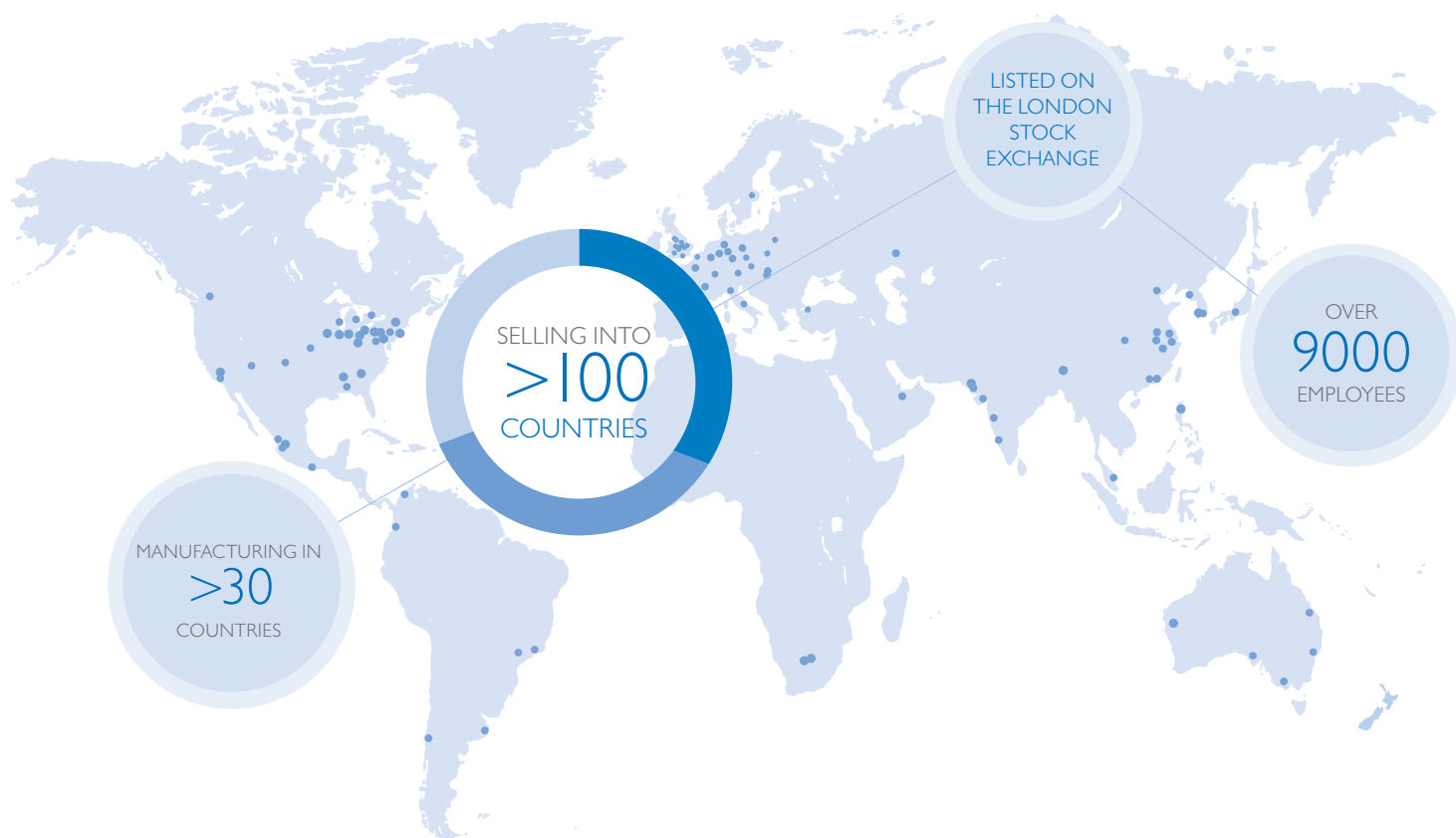
Support Rods

Our support rods come in a range of varying sizes, however we do offer standard sizes to help support and add strength to our customer's assemblies.

Support Rod Range	Diameter (in increments of 2 inches/51mm)	Length (in increments of 0.001 inches/0.25mm)
Small	0.095" – 0.250"/2.42mm – 6.4mm	2"-10"/51mm-254mm
Medium	0.251"-0.600"/6.425mm-15.24mm	2"-10"/51mm-254mm
Large	0.601"-0.860"/15.25mm-21.8mm	2"-10"/51mm-254mm

Contact us today to see how we can help support your casting needs

MORGAN ADVANCED MATERIALS



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