



## Slide Gate Refractories

Improving Steel Flow through Materials



## Vesuvius Slide Gate Refractory

Vesuvius has been supporting the worldwide steel-making industry for nearly 100 years and has grown to become a global market and performance leader in ladle and tundish slide gate refractory materials.

Vesuvius' consistent, high performance materials and engineered assembly designs provide solutions and value added benefits for our customers:

- Increased reliability and added safety
- Steel plant operational efficiency
- Improved downstream steel quality
- Reduced refractory costs per tonne of steel produced

Our supply strategy is to offer consistent, high performance materials, utilising innovative designs and to provide first-rate service and support. This approach assists our customers in achieving their safety, operational, productivity and commercial goals.



## High Performance Materials



Vesuvius offers a wide range of high performance plate and nozzle materials. Depending on metallurgical and customer operation practices and to maximise performance, materials are generally selected from one of our several high performance product groups as listed below.

### Alumina-Zirconia-Carbon

Using novel additives and processing methods, these materials are leading the way in performance in many applications.

### Zirconia

Excellent base materials, proprietary processing, along with innovative design and assembly techniques, have enabled Vesuvius to become the worldwide market leader in zirconia inserted slide gate plate technology.

### Magnesia-Carbon

Using our advances in carbon-bond technology, combined with high corrosion resistant magnesia base materials, these products can maximise plate and nozzle performance in the most aggressive applications.

### Alumina-Spinel

These products are generally used in high performance nozzle or well block applications. They provide exceptional corrosion resistance in most steel-making applications. Combining favorable Al-Spinel formulations with our Optimax™ technology further increases product performance potential.

### Permeable Refractory

These specialty, high-fired magnesia, zirconia or alumina based materials are used primarily as nozzles or plate inserts in tundish gas-purging assemblies. This gas flow feature minimises air aspiration into the system and reduces clogging. Due to these features, tundish slide gate assemblies using this material are performance leaders in slab caster applications.

Vesuvius has a rigorous supplier audit process to ensure all raw materials strictly meet our quality and property requirements. Combining this strategy with tightly controlled manufacturing processes, Vesuvius is able to offer products that will perform consistently and reliably over a wide range of applications.

## Ladle Slide Gate Materials

Utilising Vesuvius' high performance materials and engineered design solutions, our products can reduce ladle turn-around time and enable more efficient ladle management, which will reduce overall ladle refractory, labour and energy costs.

### Plates

Vesuvius produces a wide range of plate materials, including plates capable of reaching performance levels up to 12-15 heats, as well as lower duty materials if more moderate performance targets are desired.

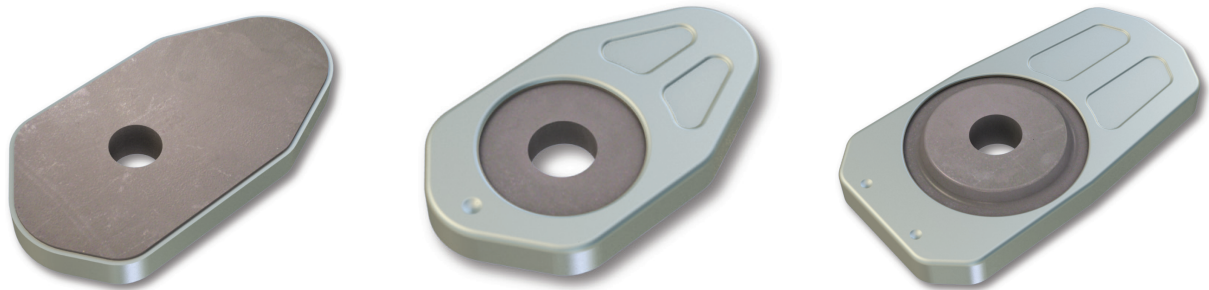
### Nozzles

Vesuvius supplies various inner nozzle and collector nozzle material options, ranging from Al-Zr-C pressed products to cast alumina-spinel materials.



### Well Blocks

Vesuvius offers many different block materials, including our most recent material advancements, Optimax™ and Numax™. These technologies have resulted in significant increases in block performance versus traditional block materials. This enables our customers to increase their ladle lining life, thus reduce operating costs significantly.

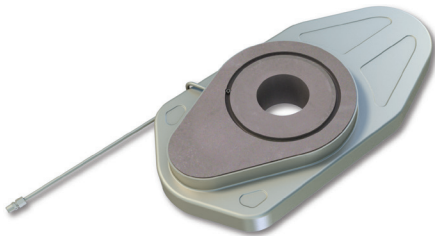
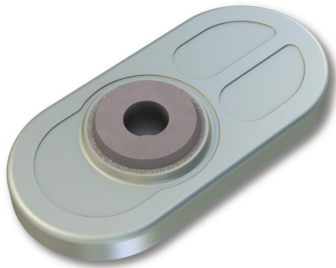
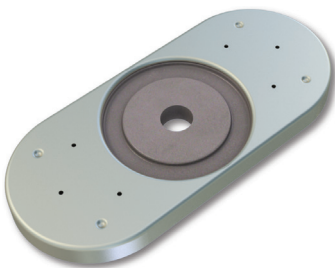






	Flat Product			Long Product		Specialty
Plate Material*	Low-to-High C Al Killed Steel	Al Killed Steel Ca Treated	Thin Slab	Rebar, etc.	Structural, Wire, Rail	Stainless
Alumina-Zirconia- Carbon / Fired	✓	✓	✓		✓	✓
Alumina-Zirconia- Carbon / Resin Bonded	✓			✓	✓	✓
Magnesia-Spinel- Carbon	✓	✓	✓	✓		
Zirconia Inserts	✓	✓	✓			

\* The material recommendations listed above are for general consideration. Please consult Vesuvius personnel for assistance in selecting the specific material solution to match your performance requirements.



## Tundish Slide Gate Materials

Vesuvius provides tundish refractory materials that have enabled our customers to achieve world record-breaking tundish performance results.

We supply high performance tundish refractory materials for all applications ranging from slab, bloom and billet casters, to thin slab, beam blank and strip casting.

Our product offering includes plates, nozzles and tubes for the following systems:

- Tube changers – stopper/rod systems
- Tundish plate systems (e.g. 3-plate systems)
- Nozzle changers for billet casters
- Metering nozzles
- Custom/specialty processes (e.g. strip casting)





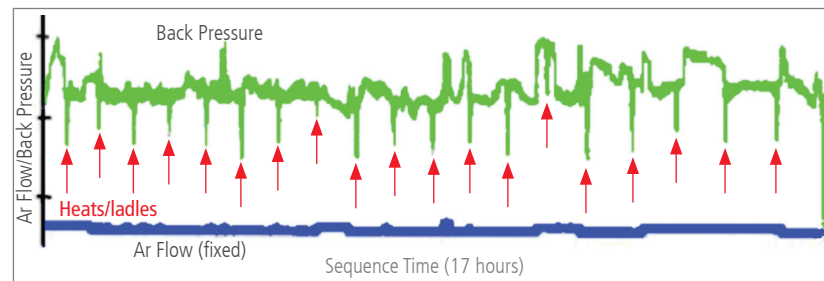
Unique assembly techniques and processes allow Vesuvius to offer state-of-the-art tundish refractory design features, such as the following:

- Argon / gas purging and shielding
- Mono-assemblies: 1-piece nozzle-plate designs to reduce joints and minimize air ingress
- Inserted plates utilising high performance, long-life zirconia
- Permeable materials for targeted, reliable gas delivery

These features provide value added benefits to our customers, such as reduced refractory and energy costs, improved steel quality and significantly increased sequence lengths.

Customers using our tundish flow control products are able to achieve record performances in tundish sequence lengths, as listed below:

- Slab Caster: approaching 30 hours on one tundish casting high quality steel (e.g. IF grades)
- Billet Caster: achieving tundish sequences over 100 hours



Actual argon flow chart for a Vesuvius tundish well nozzle recorded while running a high quality slab grade. As illustrated, the nozzle maintains consistent back pressure throughout the entire tundish sequence.

## First-Rate Service and Support

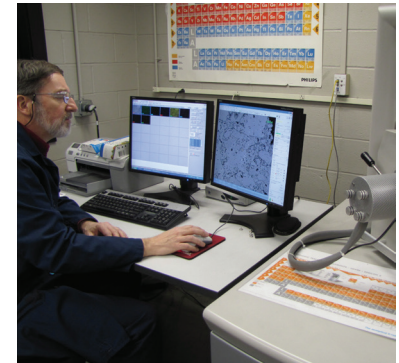


Service and support are key components to the Vesuvius supply approach.

Vesuvius provides a wide variety of professional support options:

- Dedicated on-site account management personnel
- On and off-site training for all level of operators
- Knowledgeable local, regional and global technical personnel
- Operational and refractory problem solving teams
- Refractory related metallurgical analysis and support

This support approach ensures the mutual success of our customers and our products.





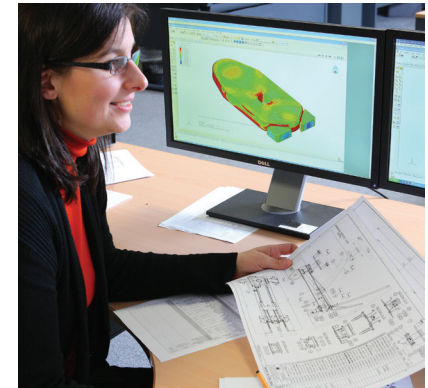


Vesuvius offers many different on-site support packages that provide dedicated on-site personnel to work with your team ensuring optimum performance and operational efficiency.

Vesuvius also has a wide network of technical professionals, including metallurgists and material specialists, offering problem-solving services to our customers.

We utilise many unique analytical tests and tools (e.g. quantitative SEM, and our proprietary STEELVIEW software) to evaluate the impact of our products on steel quality, validate improvements and solve refractory performance issues.

Using our various analytical techniques, as well as on-site practice audits, Vesuvius can offer material and design solutions to meet and exceed our customers' needs.



## Innovative Design



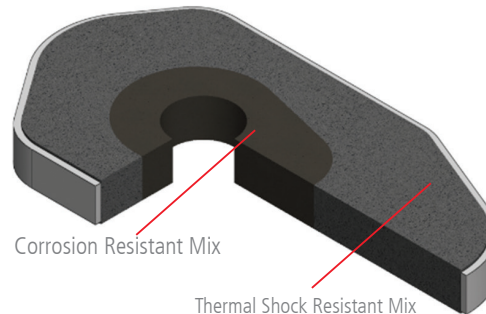
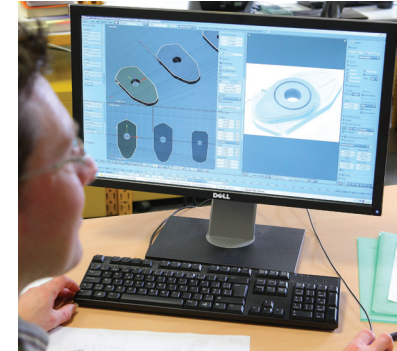
MTNP: 1-piece tundish nozzle plate assembly.

This design includes argon injection and zirconia inserted features, as well as patented Off-Set Bore™ technology.

Design is vital to the success of flow control refractory materials. Working within the footprint of our slide gate mechanical systems, as well as other systems, we can customize refractory designs to meet our customers' specific requirements.

Our designers and engineers use various tools (e.g. FEA, computer modelling, thermal imaging, etc.) to ensure our refractory designs maximise our material benefits and properties.

These design aspects have resulted in many patented and proprietary design features that provide customer focused benefits, such as reduced alumina clogging, increased ladle or tundish campaigns, and extended refractory life.



Composite Design Technology (CDT™) plate: multiple mixes pressed in one plate to provide different properties in different areas of the plate, as needed.

## Frequently asked questions

### Can Vesuvius provide slide gate refractory for the non-Vesuvius system we are currently using?

Vesuvius is tooled for many non-Vesuvius shapes and has the manufacturing capability and flexibility to offer refractory plates and nozzles into these systems. Currently, Vesuvius successfully supplies a wide range of non-Vesuvius refractory shapes. With our design capabilities, we can often offer improved assemblies in these competitor systems.

### How fast can Vesuvius supply parts for an initial trial?

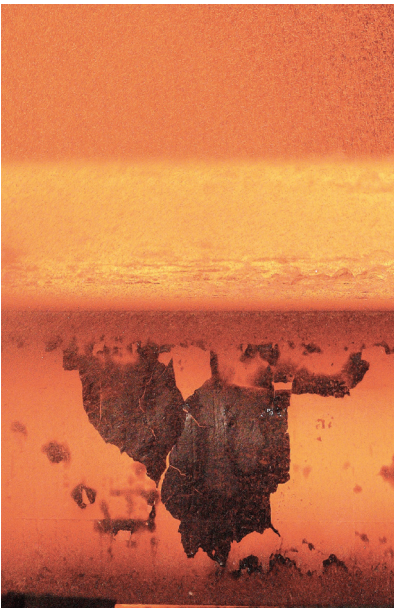
With over 15 slide gate manufacturing facilities throughout the world, we can expedite trial production and shipment to respond quickly to trial requests. For any non-typical assemblies, we maintain a dedicated pilot plant production operation that allows us to manufacture unique plate shapes or designs in a timely manner.

### What materials / products will work best for my application?

To determine a customer's specific material need, Vesuvius' sales professionals, along with regional Slide Gate Technical Specialists, will work with our customer's on-site operations, metallurgical and quality teams to review current practices and provide the optimum product recommendation.

### Does Vesuvius supply materials, such as mortar, that can be used to install flow control refractory products?

Yes, Vesuvius offers a full line of gaskets, mortars and sealants, for use with slide gate refractory part installation as well as other steel plant refractory applications. In addition, we provide the corresponding application and storage procedures to ensure optimum performance of these materials.



For more information on this product and on our complete package of solutions please contact our local service center :

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