Ladle Tube Changer

Combining CSR ladle shroud technology and our vast experience on tundish tube changer we have successfully developed a new concept in ladle shrouds to use with the revolutionary LTC (Ladle Tube Changer) mechanism. When used in conjunction with the Vesuvius Rotorics Casting Technology for the Ecosilicosted and rotatable tundish tube changers, it provides optimal tightness between ladle and tundish, delivering premium quality slabs even during ladle transitions.

For more information on this product and related services, please contact our local service center:

VESUVIUS reserves the right to modify and/or improve the equipment as described and specified in this leaflet, at any time according to the state-of-art.

© copyright Vesuvius Group S.A. 2013 - 2015 all rights reserved. All product names in this brochure are trademarks or registered trademarks of the Vesuvius Group of companies.
The Vesuvius Ladle Shroud (LS) is a cost-effectively powered ceramic design for direct connection to the ladle slide gate collector nozzle, offering maximum protection for the steel during re-oxidation. Preheating is not required prior to use and the shroud can be configured to be re-used in subsequent casting operations or for subsequent melting during batch casting.

Technologies: cost-saving solutions

Vesuvius offers several different technologies for ladle shroud products:

- Oxyclean: the oxidized bore of the ladle shroud in service.
- New generation Cold Start materials: Vesuvius has developed a family of new materials with excellent thermal shock resistance that can be used in ladle shroud applications without the need of an oxidized bore or a CSR liner. For the oxidized bore or a CSR liner, the selection is based on the particular steel composition and casting conditions applicable. High performance low conductivity insulating liners to replace the oxidized bore of our standard ladle shrouds. Due to the improved erosion resistance of the new material compared to the standard oxidized bore, the product Vesuvius is well suited for applications, for customers with short campaigns, who have the potential for rewax, and situations with high thermocouple damage during casting.

- High performance (cold start) materials: Vesuvius has developed a family of new materials with excellent thermal shock resistance that can be used in ladle shroud applications without the need of an oxidized bore. The new material Vesuvius is well suited for applications, for customers with short campaigns, who have the potential for rewax, and situations with high thermocouple damage during casting.

- New generation (cold start) materials: Vesuvius has developed a family of new materials with excellent thermal shock resistance that can be used in ladle shroud applications without the need of an oxidized bore. For the oxidized bore or a CSR liner, the selection is based on the particular steel composition and casting conditions applicable. High performance low conductivity insulating liners to replace the oxidized bore of our standard ladle shrouds. Due to the improved erosion resistance of the new material compared to the standard oxidized bore, the product Vesuvius is well suited for applications, for customers with short campaigns, who have the potential for rewax, and situations with high thermocouple damage during casting.

- High performance (cold start) materials: Vesuvius has developed a family of new materials with excellent thermal shock resistance that can be used in ladle shroud applications without the need of an oxidized bore. For the oxidized bore or a CSR liner, the selection is based on the particular steel composition and casting conditions applicable. High performance low conductivity insulating liners to replace the oxidized bore of our standard ladle shrouds. Due to the improved erosion resistance of the new material compared to the standard oxidized bore, the product Vesuvius is well suited for applications, for customers with short campaigns, who have the potential for rewax, and situations with high thermocouple damage during casting.

Material selection

After designing the ladle shroud to suit the customer’s furnace configuration, the final step is to select the proper material for the oxidised bore of the casting. In general, there are three basic designs for the oxidised bore, each with a number of variations for the body mix and the selection will depend on the conditions applicable to the ladle shroud specific to the customer’s caster configuration. The selection of the oxidised bore will depend on the particular steel composition and casting conditions applicable. High performance low conductivity insulating liners to replace the oxidized bore of our standard ladle shrouds. Due to the improved erosion resistance of the new material compared to the standard oxidized bore, the product Vesuvius is well suited for applications, for customers with short campaigns, who have the potential for rewax, and situations with high thermocouple damage during casting.

- Oxyclean: the oxidized bore of the ladle shroud in service.
- New generation Cold Start materials: Vesuvius has developed a family of new materials with excellent thermal shock resistance that can be used in ladle shroud applications without the need of an oxidized bore. For the oxidized bore or a CSR liner, the selection is based on the particular steel composition and casting conditions applicable. High performance low conductivity insulating liners to replace the oxidized bore of our standard ladle shrouds. Due to the improved erosion resistance of the new material compared to the standard oxidized bore, the product Vesuvius is well suited for applications, for customers with short campaigns, who have the potential for rewax, and situations with high thermocouple damage during casting.

- High performance (cold start) materials: Vesuvius has developed a family of new materials with excellent thermal shock resistance that can be used in ladle shroud applications without the need of an oxidized bore. For the oxidized bore or a CSR liner, the selection is based on the particular steel composition and casting conditions applicable. High performance low conductivity insulating liners to replace the oxidized bore of our standard ladle shrouds. Due to the improved erosion resistance of the new material compared to the standard oxidized bore, the product Vesuvius is well suited for applications, for customers with short campaigns, who have the potential for rewax, and situations with high thermocouple damage during casting.

- High performance (cold start) materials: Vesuvius has developed a family of new materials with excellent thermal shock resistance that can be used in ladle shroud applications without the need of an oxidized bore. For the oxidized bore or a CSR liner, the selection is based on the particular steel composition and casting conditions applicable. High performance low conductivity insulating liners to replace the oxidized bore of our standard ladle shrouds. Due to the improved erosion resistance of the new material compared to the standard oxidized bore, the product Vesuvius is well suited for applications, for customers with short campaigns, who have the potential for rewax, and situations with high thermocouple damage during casting.

- High performance (cold start) materials: Vesuvius has developed a family of new materials with excellent thermal shock resistance that can be used in ladle shroud applications without the need of an oxidized bore. For the oxidized bore or a CSR liner, the selection is based on the particular steel composition and casting conditions applicable. High performance low conductivity insulating liners to replace the oxidized bore of our standard ladle shrouds. Due to the improved erosion resistance of the new material compared to the standard oxidized bore, the product Vesuvius is well suited for applications, for customers with short campaigns, who have the potential for rewax, and situations with high thermocouple damage during casting.

- High performance (cold start) materials: Vesuvius has developed a family of new materials with excellent thermal shock resistance that can be used in ladle shroud applications without the need of an oxidized bore. For the oxidized bore or a CSR liner, the selection is based on the particular steel composition and casting conditions applicable. High performance low conductivity insulating liners to replace the oxidized bore of our standard ladle shrouds. Due to the improved erosion resistance of the new material compared to the standard oxidized bore, the product Vesuvius is well suited for applications, for customers with short campaigns, who have the potential for rewax, and situations with high thermocouple damage during casting.

- High performance (cold start) materials: Vesuvius has developed a family of new materials with excellent thermal shock resistance that can be used in ladle shroud applications without the need of an oxidized bore. For the oxidized bore or a CSR liner, the selection is based on the particular steel composition and casting conditions applicable. High performance low conductivity insulating liners to replace the oxidized bore of our standard ladle shrouds. Due to the improved erosion resistance of the new material compared to the standard oxidized bore, the product Vesuvius is well suited for applications, for customers with short campaigns, who have the potential for rewax, and situations with high thermocouple damage during casting.
The Vesuvius Ladle Shroud (LS) is an isostatically designed ladle curtain designed for direct connection to the tundish gate collector nozzle, offering maximum protection of the steel stream from re-oxidation. Vesuvius does not require prior use and the shroud can be oxygen cleaned for immediate re-use during batch casting.

**Ladle Shroud**

![Image](image1)

**Sleeve**

The shroud can be oxygen cleaned for immediate re-use during batch casting. The use of the ladle shroud in service.

**Body**

A range of mixes and designs are available depending on the particular steel compositions and casting conditions. How the two interact: design features have been developed using finite element analysis (FEA) for longer life. Vesuvius ladle curtain is designed to counteract the forces encountered by the ladle shroud in service.

**Bore design**

- Direct Taper Shroud: this is the most common steel stream and requires customization.
- Reverse Taper and Bell Shroud: more and more reverse taper and bell shroud designs allow selection.

**Material selection**

- After designing the shroud to suit the customer’s casting configuration, the final step is to select the proper material for the tonnage levels being cast. In general, for the rear seat, more erosion resistant and capable of withstanding oxidizing corrosion between gates. For the front seat, there are several manufacturers that have the potential for wear, and selection will be dependent on both the steel grade and casting times. The performance of the body mix can be enhanced by adding an erosion resistant liner to replace the oxidized bore of our standard ladle shrouds. Due to the improved corrosion resistance of the bore compared to the oxidized or a CSR liner. Through the use of these new designs have been developed using finite-element analysis (F.E.A.) for longer life. Each flange is custom designed to counteract the forces encountered by the ladle shroud in service.

**Technologies: cold start solutions**

- New generation Cold Start materials: Vesuvius has developed a family of new materials with excellent thermal shock resistance that can be used in ladle shroud applications without the need of an oxidized bore or a CSR liner. Though the use of these new state-of-the-art ladle shroud technology. Through design and analysis, this product is capable of providing both long life and single use applications.

**Multiphase material and design options to suit customer requirements**

- Dry and Fiber
- Submerged entry
- Intergranular inhibition
- Influencing, nickel-rich areas

**Multiple material and design options to suit customer requirements**

- Steel type selection
- Submerged entry
- Intergranular inhibition
- Influencing, nickel-rich areas

**Argon technologies**

- The argon injection point is at the point between the collector and the ladle shroud to determine.

**Argon shielding**

- To minimize argon action in the tundish, shielding can be created by blowing argon through a permeable ring located at the base of the shroud collector nozzle reducing effluent, argon is injected into an annular cavity in the flange (argon shielding) and is used to create a negative pressure inside the ladle shroud (argon injection) and to minimize argon action in the tundish (argon shielding). The argon pressure, gas bubble entrainment at the top, the argon injection point may be used with sealing gaskets (Sealbind®) or fiber.

**Argon monitoring**

- The efficiency of the argon delivery during casting can be monitored and controlled to ensure under the flow of gas argon is dependent on customer requirements.

- The use of gaskets can be seen in the right quality is continuously monitored and evaluated, allowing to verify operability of the design for the steel transfer.
The Vesuvius Ladle Shroud (LS) is an isostatically pressed ceramic custom designed for direct connection to the ladle slide gate collector nozzle, offering maximum protection of the steel stream from corrosion and thermal shock. Multiple material and design options are available for acid tundish fluxes and basic tundish fluxes, depending on the customer practice. For the slag line, there are mixes available for acid tundish fluxes and basic tundish fluxes, depending on the customer practice. For minimizing the use of the ladle shroud for longer casting times, a special material can be used at the submerged opening section of the design to offer greater corrosion and thermal shock resistance.

Multiple material and design options apply to customer targeted audiences:
- Glycine flax process
- Submerged opening
- Reduce nitrogen pickup
- Submerged opening
- Cold Start practice
- Submerged opening

Argon technologies
- The argon injection is a minor practice in the tundish of the cold start process, where the argon is injected into the tundish at high pressure inside the ladle shroud seat. A positive argon pressure is created inside the ladle shroud giving two benefits:
- The argon pressure prevents any possible air ingress at the joint between the collector nozzle and the ladle shroud seat.
- If the connection between the collector nozzle and the ladle shroud seat is not tight, air ingress occurs often resulting in a “reverse top” shielding. Both options minimize the potential of nitrogen pickup.

Argon monitoring
- The efficiency of the argon delivery during casting can be monitored and controlled using sensors or pressure monitors under the tundish of argon depending on customer requirements. Flow and pressure limits can be set so that shield quality is constantly monitored and evaluated, alarming to notify operators if the shield has deteriorated.

Argon injection
- Argon is injected into the annular cavity in the tundish of the cold start process through a permeable ring located at the tundish shroud collector nozzle opening surfaces. The argon is directed to the tundish opening through a ceramic flange or a special material at the joint between the collector nozzle and the ladle shroud seat.

Argon shielding
- To minimize argon action in the tundish, shielding can be prevented by using a ceramic or a permeable ring located at the tundish shroud collector nozzle opening surfaces. To be effective, argon action through the annular metal must be prevented. This is achieved using a ceramic materials (Argon shielding).

Argon technologies
- The efficiency of the argon delivery during casting can be monitored and controlled using sensors or pressure monitors under the tundish of argon depending on customer requirements. Flow and pressure limits can be set so that shield quality is constantly monitored and evaluated, alarming to notify operators if the shield has deteriorated.

Argon injection
- Argon is injected into the annular cavity in the tundish of the cold start process through a permeable ring located at the tundish shroud collector nozzle opening surfaces. The argon is directed to the tundish opening through a ceramic flange or a special material at the joint between the collector nozzle and the ladle shroud seat.

Argon shielding
- To minimize argon action in the tundish, shielding can be prevented by using a ceramic or a permeable ring located at the tundish shroud collector nozzle opening surfaces. To be effective, argon action through the annular metal must be prevented. This is achieved using a ceramic materials (Argon shielding).

Argon technologies
- The efficiency of the argon delivery during casting can be monitored and controlled using sensors or pressure monitors under the tundish of argon depending on customer requirements. Flow and pressure limits can be set so that shield quality is constantly monitored and evaluated, alarming to notify operators if the shield has deteriorated.

Argon injection
- Argon is injected into the annular cavity in the tundish of the cold start process through a permeable ring located at the tundish shroud collector nozzle opening surfaces. The argon is directed to the tundish opening through a ceramic flange or a special material at the joint between the collector nozzle and the ladle shroud seat.

Argon shielding
- To minimize argon action in the tundish, shielding can be prevented by using a ceramic or a permeable ring located at the tundish shroud collector nozzle opening surfaces. To be effective, argon action through the annular metal must be prevented. This is achieved using a ceramic materials (Argon shielding).

Argon technologies
- The efficiency of the argon delivery during casting can be monitored and controlled using sensors or pressure monitors under the tundish of argon depending on customer requirements. Flow and pressure limits can be set so that shield quality is constantly monitored and evaluated, alarming to notify operators if the shield has deteriorated.

Argon injection
- Argon is injected into the annular cavity in the tundish of the cold start process through a permeable ring located at the tundish shroud collector nozzle opening surfaces. The argon is directed to the tundish opening through a ceramic flange or a special material at the joint between the collector nozzle and the ladle shroud seat.

Argon shielding
- To minimize argon action in the tundish, shielding can be prevented by using a ceramic or a permeable ring located at the tundish shroud collector nozzle opening surfaces. To be effective, argon action through the annular metal must be prevented. This is achieved using a ceramic materials (Argon shielding).

Argon technologies
- The efficiency of the argon delivery during casting can be monitored and controlled using sensors or pressure monitors under the tundish of argon depending on customer requirements. Flow and pressure limits can be set so that shield quality is constantly monitored and evaluated, alarming to notify operators if the shield has deteriorated.

Argon injection
- Argon is injected into the annular cavity in the tundish of the cold start process through a permeable ring located at the tundish shroud collector nozzle opening surfaces. The argon is directed to the tundish opening through a ceramic flange or a special material at the joint between the collector nozzle and the ladle shroud seat.

Argon shielding
- To minimize argon action in the tundish, shielding can be prevented by using a ceramic or a permeable ring located at the tundish shroud collector nozzle opening surfaces. To be effective, argon action through the annular metal must be prevented. This is achieved using a ceramic materials (Argon shielding).

Argon technologies
- The efficiency of the argon delivery during casting can be monitored and controlled using sensors or pressure monitors under the tundish of argon depending on customer requirements. Flow and pressure limits can be set so that shield quality is constantly monitored and evaluated, alarming to notify operators if the shield has deteriorated.

Argon injection
- Argon is injected into the annular cavity in the tundish of the cold start process through a permeable ring located at the tundish shroud collector nozzle opening surfaces. The argon is directed to the tundish opening through a ceramic flange or a special material at the joint between the collector nozzle and the ladle shroud seat.

Argon shielding
- To minimize argon action in the tundish, shielding can be prevented by using a ceramic or a permeable ring located at the tundish shroud collector nozzle opening surfaces. To be effective, argon action through the annular metal must be prevented. This is achieved using a ceramic materials (Argon shielding).

Argon technologies
- The efficiency of the argon delivery during casting can be monitored and controlled using sensors or pressure monitors under the tundish of argon depending on customer requirements. Flow and pressure limits can be set so that shield quality is constantly monitored and evaluated, alarming to notify operators if the shield has deteriorated.

Argon injection
- Argon is injected into the annular cavity in the tundish of the cold start process through a permeable ring located at the tundish shroud collector nozzle opening surfaces. The argon is directed to the tundish opening through a ceramic flange or a special material at the joint between the collector nozzle and the ladle shroud seat.

Argon shielding
- To minimize argon action in the tundish, shielding can be prevented by using a ceramic or a permeable ring located at the tundish shroud collector nozzle opening surfaces. To be effective, argon action through the annular metal must be prevented. This is achieved using a ceramic materials (Argon shielding).

Argon technologies
- The efficiency of the argon delivery during casting can be monitored and controlled using sensors or pressure monitors under the tundish of argon depending on customer requirements. Flow and pressure limits can be set so that shield quality is constantly monitored and evaluated, alarming to notify operators if the shield has deteriorated.

Argon injection
- Argon is injected into the annular cavity in the tundish of the cold start process through a permeable ring located at the tundish shroud collector nozzle opening surfaces. The argon is directed to the tundish opening through a ceramic flange or a special material at the joint between the collector nozzle and the ladle shroud seat.

Argon shielding
- To minimize argon action in the tundish, shielding can be prevented by using a ceramic or a permeable ring located at the tundish shroud collector nozzle opening surfaces. To be effective, argon action through the annular metal must be prevented. This is achieved using a ceramic materials (Argon shielding).

Argon technologies
- The efficiency of the argon delivery during casting can be monitored and controlled using sensors or pressure monitors under the tundish of argon depending on customer requirements. Flow and pressure limits can be set so that shield quality is constantly monitored and evaluated, alarming to notify operators if the shield has deteriorated.

Argon injection
- Argon is injected into the annular cavity in the tundish of the cold start process through a permeable ring located at the tundish shroud collector nozzle opening surfaces. The argon is directed to the tundish opening through a ceramic flange or a special material at the joint between the collector nozzle and the ladle shroud seat.

Argon shielding
- To minimize argon action in the tundish, shielding can be prevented by using a ceramic or a permeable ring located at the tundish shroud collector nozzle opening surfaces. To be effective, argon action through the annular metal must be prevented. This is achieved using a ceramic materials (Argon shielding).

Argon technologies
- The efficiency of the argon delivery during casting can be monitored and controlled using sensors or pressure monitors under the tundish of argon depending on customer requirements. Flow and pressure limits can be set so that shield quality is constantly monitored and evaluated, alarming to notify operators if the shield has deteriorated.

Argon injection
- Argon is injected into the annular cavity in the tundish of the cold start process through a permeable ring located at the tundish shroud collector nozzle opening surfaces. The argon is directed to the tundish opening through a ceramic flange or a special material at the joint between the collector nozzle and the ladle shroud seat.

Argon shielding
- To minimize argon action in the tundish, shielding can be prevented by using a ceramic or a permeable ring located at the tundish shroud collector nozzle opening surfaces. To be effective, argon action through the annular metal must be prevented. This is achieved using a ceramic materials (Argon shielding).

Argon technologies
- The efficiency of the argon delivery during casting can be monitored and controlled using sensors or pressure monitors under the tundish of argon depending on customer requirements. Flow and pressure limits can be set so that shield quality is constantly monitored and evaluated, alarming to notify operators if the shield has deteriorated.

Argon injection
- Argon is injected into the annular cavity in the tundish of the cold start process through a permeable ring located at the tundish shroud collector nozzle opening surfaces. The argon is directed to the tundish opening through a ceramic flange or a special material at the joint between the collector nozzle and the ladle shroud seat.

Argon shielding
- To minimize argon action in the tundish, shielding can be prevented by using a ceramic or a permeable ring located at the tundish shroud collector nozzle opening surfaces. To be effective, argon action through the annular metal must be prevented. This is achieved using a ceramic materials (Argon shielding).

Argon technologies
- The efficiency of the argon delivery during casting can be monitored and controlled using sensors or pressure monitors under the tundish of argon depending on customer requirements. Flow and pressure limits can be set so that shield quality is constantly monitored and evaluated, alarming to notify operators if the shield has deteriorated.

Argon injection
- Argon is injected into the annular cavity in the tundish of the cold start process through a permeable ring located at the tundish shroud collector nozzle opening surfaces. The argon is directed to the tundish opening through a ceramic flange or a special material at the joint between the collector nozzle and the ladle shroud seat.
Ladle Tube Changer

Combining CSR ladle changer technology and our vast experience on tundish tube changer refractories, we have successfully developed a new concept in ladle shrouds as we see it, the revolutionary LTC (Ladle Tube Changer) mechanism. When used in conjunction with the Vesuvius Robotics’ technology for ladle preheaters, deliverables with a safe and reliable submerged ladle opening and optimized air tightness between ladle and tundish, delivering premium quality slabs even during ladle transitions.

Refer to FLOW CONTROL SYSTEMS brochure for further details and information.
Ladle Tube Changer

Combining CSR ladle shroud technology and our vast experience on tundish tube changer we have successfully developed a new concept in ladle shroud to use with the revolutionary LTC (Ladle Tube Changer) mechanism. When used in conjunction with the Vesuvius Robot2 casting technology for tundish cooldowns, the new and mobile submerged shroud opening and positioner air tightness between ladle and tundish, delivering premium quality slabs even during ladle transitions.

Refer to FLOW CONTROL SYSTEMS brochure for further detail and information.