



## SILICA COMPOSITES

### Types RSLE-57 Boards, RSLE-501 Cylinders and RSLE-56 Moldable

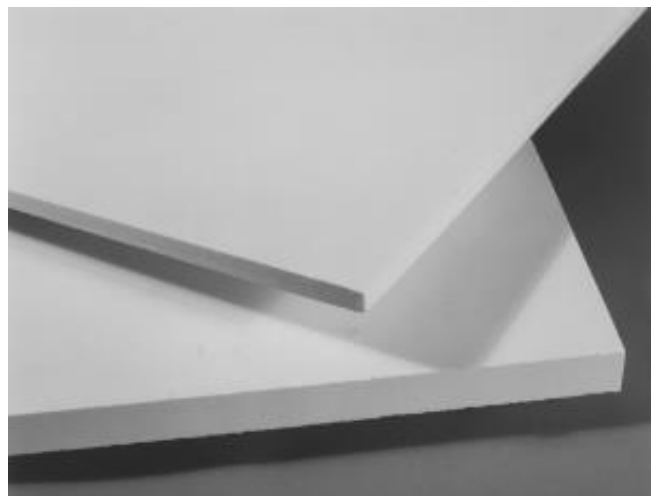
ZIRCAR Refractory Composites, Inc. produces a comprehensive range of advanced high-performance ceramic-ceramic composites and related products. Our materials are used around the world in demanding thermal, structural and electrical insulating applications at temperatures from 600°C (1112°F) to 1650°C (3002°F). For over twenty-five years we have been a problem solver working with many industries to resolve their thermal management problems. We have developed materials that have become industry standards for induction melting, forging and heat-treating applications, investment casting, glass processing, hot pressing, as well as many high temperature electrical applications.

**ZIRCAR Refractory Sheet Type RSLE-57** is a low expansion, high strength reinforced silica matrix composite. Designed for use as a high strength insulator in induction hot press applications, it is ideal for any application which require a material with superior hot strength at temperatures as high as **1200°C (2192°F)**. Beyond 1200°C (2192°F) it begins to transform into a crystalline structure. RSLE-57 maintains its properties up to 1650°C (3002°F) providing that there is no significant fall in temperature. At these elevated temperatures, this material will exhibit surface glazing, but will retain its strength and integrity.

**RSLE-57's exhibits a very low thermal coefficient of expansion ( $0.3 \times 10^{-6} \text{ }^\circ\text{C}$ )** which provides remarkable resistance to the thermal shock up to 1200°C (2192°F) in an oxidizing atmosphere and permits its use with rapid variation in temperature in that zone.

RSLE-57's very low thermal expansion coefficient and high density combine to give it thermal shock resistance not found in other structural ceramic composite materials. These properties give it much greater life in most hot pressing and induction heating applications.

RSLE-57 also exhibits exceptional non-wetting properties when used in contact with molten aluminum, zinc, lead, tin and other non-ferrous metals, making it useful in numerous casting,



*RSLE-57 is an integral part of the production of hot pressed diamond segments. RSLE-57 is used as a separator to electrically and thermally insulate a metal ram from a graphite pack. It will see in excess of 1000°C (1832°F) with several thousand pounds per square inch compression without any surface deformation.*

conveying, containing and forming applications. RSLE-57 is the ideal material for use as Dams, Spouts, Floats, Launderers, Head Boxes, Baffles, Headers, Tips, Rings, Distribution Boxes, Stoppers, Basins, Snouts, Transition & Orifice Plates and Hot Top & Ingot Mold Liners.

**RSLE-57 is 100% organic free and contains no refractory ceramic fibers, (RCF's).**

## APPLICATION INFORMATION

### MACHINING GUIDELINES

ZIRCAR Refractory Sheet Type RSLE materials exhibit a uniformly bound fine-pore structure. They can be machined to precision dimensional tolerances with conventional carbide tooling following the guidelines outlined below:

Cutting Tool	Rotation Speed	Feed Rate
Circular Saw Blade, Carbide tipped, 10" diam. 24 teeth	3450	15-20 ft/min
4 Fluted Carbide End Mill	1000-2000	15-20 ft/min

### ZIRCAR Refractory Composites, Inc.

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### Technical Data

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# SILICA COMPOSITE MATERIALS

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**ZIRCAR Refractory Sheet Type RSLE-501** is a low expansion high strength reinforced silica matrix composite in a cylindrical form. This remarkable material was designed for use as a high strength, durable insulator in induction heat treating applications. Type RSLE-501's very low thermal expansion coefficient and high hot strength combine to give it thermal shock resistance not found in other structural ceramic materials.

**Type RSLE- 501 exhibits a very low coefficient of expansion ( $0.3 \times 10^{-6} \text{ }^{\circ}\text{C}$ )** which provides remarkable resistance to the thermal shock up to **1200°C (2192°F)** in an oxidizing atmosphere and permits its use with rapid variation in temperature in that zone. Beyond 1200°C (2192°F) it begins to transform into a crystalline structure. RSLE-57 maintains its properties up to 1650°C (3002°F) providing that there is no significant fall in temperature. At these elevated temperatures, this material will exhibit surface glazing, but will retain its strength and integrity.

**ZIRCAR Refractory Sheet Type RSLE-56 Moldable** is a high silica fiber reinforced ceramic composite material that is easily cut and formed into a wide variety of shapes. When dried, RSLE-56 Moldable becomes a hard-rigid structure. Further heat treatment or exposure to process temperatures significantly increases the physical strength of this material.

**Type RSLE-56 exhibits a very low thermal coefficient of expansion ( $0.5 \times 10^{-6} \text{ }^{\circ}\text{C}$ )** which provides remarkable resistance to the thermal shock up to **1200°C (2192°F)** in an oxidizing atmosphere and permits its use with rapid variation in temperature in that zone. Beyond 1200°C (2192°F) it begins to transform into a crystalline structure. RSLE-57 maintains its properties up to 1650°C (3002°F) providing that there is no significant fall in temperature. At these elevated temperatures, this material will exhibit surface glazing, but will retain its strength and integrity.

Engineered and produced with low thermal expansion raw materials, Type RSLE-56 exhibits greater thermal shock resistance than alumina matrix composites. Its binder is locked in place and will not separate from its supporting fiber reinforcement resulting in a homogeneous structure throughout the material. Type RSLE-56 is 100% inorganic, and once dried, undergoes little or no outgassing.

Types RSLE-56 and RSLE-501 exhibits exceptional non-wetting properties when used in contact with molten non-ferrous alloys making it useful in numerous molten metal contact applications.



*RSLE-501 Cylinders can be made as small as 1/2" ID up to 72" long and as large as 48" OD*

## SUGGESTED APPLICATIONS

- Induction coil liners
- Glass furnace repairs
- Hot flue linings
- Hot press insulation
- Hot face insulation where gas velocity is of concern
- Casting table and trough liners



*RSLE-56 Moldable makes relining troughs and casting tables easy. It can be backed up with low mass blanket, fiber board or calcium silicate to reduce the overall thickness and increase insulation value*

**Type RSLE-56 and RSLE-501 are 100% organic free and contain no refractory ceramic fiber.** It is readily machined to precision tolerances with conventional tooling.



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TYPE	RSLE-57	RSLE-56	RSLE-501
Nominal Composition, wt%			
SiO <sub>2</sub>	99	99	99
Other Metal Oxides	<1	<1	<1
Organic content	0	0	0
Thermal Expansion,			
RT-800°C(1472°F)	0.3 x10 <sup>-6</sup> /°C	0.5 x10 <sup>-6</sup> /°C	0.3 x10 <sup>-6</sup> /°C
Density, gm/cc(pcf)	1.4(90)	1.36(84)	
Porosity, %	31	36	31
Color	White	White	White
Flammability	Nil	Nil	Nil
Hardness, Durometer "D"			
Dry, at room temp.	87	80	80
Charpy Impact Strength, ft-lb	0.8		
Compressive Strength**, MPa (psi), 2% consolidation as received	48(7000)	9(1260)	20(2900)
Modulus of Rupture**, MPa(psi) as received	30(4300)	8(1100) dry	21(3167)
8 hrs. at 370°C(698°F)		11(2300)	
8 hrs. at 1000°C(1832°F)		18(3800)	
Linear Shrinkage‡, %			
after 24 hrs. at 800°C(1472°F)	0.1	2	0.1
after 24 hrs. at 1000°C(1832°F)	1	1	1
Drying Shrinkage, %			
Length / Width	na	2 / 3	na
Thickness	na	3	na
Thermal Conductivity,			
W/m°K(BTU/hr. ft <sup>2</sup> °F/in)			
200°C(392°F)	0.54(3.8)	0.54(3.8)	0.54(3.8)
400°C(752°F)	0.64(4.4)	0.64(4.4)	0.64(4.4)
600°C(1112°F)	0.61(4.2)	0.61(4.2)	0.61(4.2)
800°C(1472°F)	0.67(4.6)	0.67(4.6)	0.67(4.6)
1000°C(1832°F)	0.75(5.2)	0.75(5.2)	0.75(5.2)
Volume Resistivity, ohm-cm ASTM D-257-93	7.5 x10 <sup>9</sup>		
Dielectric Strength, Volts/mil, ASTM D-149-95	43		

\* Maximum use temperature is dependent on variables such as stresses, both thermal and mechanical, and the chemical environment that the material experiences.

\*\* Properties expressed parallel to thickness.

‡ Properties expressed perpendicular to thickness.



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Refractory Sheet Type RSLE-56 Moldable is a wet blanket shipped rolled up on a plastic tube, separated and wrapped in plastic. Type RSLE-56 Moldable can be shaped and molded prior to drying and firing, permitting the fabrication of complex shapes as well as flat sheets.

**To make a flat board:** Open plastic covering and unroll the desired amount of RSLE-56 Moldable. Cut to size with a knife. Dry on a rigid glass, wood or metal plate separated by a layer of plastic, cloth or paper. Dry at 140°F until dry. A 1/2" thick sheet of RSLE-56 Moldable will dry completely in 16 to 24 hours. Prevent warping by either restraining or flipping over to allow drying from both sides. RSLE-56 Moldable can be dried at much higher temperatures without adverse impact upon the product.

**To make a cylinder:** Select a smooth mandrel of the desired size and shape. Wrap mandrel with plastic sheet. Cut enough RSLE-56 Moldable off roll to make the desired shape. Cut a bevel on the leading edge of the RSLE-56 Moldable with a knife. Wrap the RSLE-56 Moldable around the mandrel to achieve the desired wall thickness. Work joints together with a tool such as a knife, spatula or screwdriver to achieve as much fiber to fiber interlocking as possible. Wrap wet cylinder with porous cloth to hold the moldable in place while drying. Dry at 140°F until dry.

**To make complex shapes:** Make a mold, (plaster will work), with sufficient draft to allow the removal of the formed RSLE-56 Moldable. Form the sheet into or onto the mold, or form by hand by working the material to achieve both complete contact with the mold and the desired surface texture. Dry at 140°F until dry. Large complex shapes can be made by joining sheets of RSLE-56 Moldable together achieving as much fiber to fiber interlocking as possible. RSLE-56 Moldable adheres to itself well during drying.

**Other Information:** Once dried, RSLE-56 Moldable becomes permanently rigid. Reseal packaging around unused material. Do not allow RSLE-56 Moldable to freeze. Freezing will cause the silica matrix to separate from its fiber reinforcement. RSLE-56 Moldable exhibits a shelf life of approximately 120 days. After 120 days RSLE-56 Moldable will become stiff and will break upon flexing. Firing RSLE-56 Moldable will increase its physical strength. Dried and fired RSLE-56 Moldable can be sanded, drilled and cut with conventional tools.

## AVAILABILITY

### Item # Description

HS01 RSLE-57 Board, 24" X 36" X 1/4"  
HS02 RSLE-57 Board, 24" X 36" X 3/8"  
HS03 RSLE-57 Board, 24" X 36" X 1/2"  
HS04 RSLE-57 Board, 24" X 36" X 5/8"  
HS05 RSLE-57 Board, 24" X 36" X 3/4"  
HS06 RSLE-57 Board, 24" X 36" X 1"  
HS07 RSLE-57 Board, 24" X 36" X 1 1/2"  
HS08 RSLE-57 Board, 24" X 36" X 2"  
HS12 RSLE-57 Board, 24" X 36" X 1/8"

### Item # Description

IS01 RSLE-501 Cylinder, 2" ID X 2 1/2" OD X 30" L  
IS02 RSLE-501 Cylinder, 3" ID X 3 1/2" OD X 30" L  
IS03 RSLE-501 Cylinder, 4" ID X 5" OD X 30" L  
IS04 RSLE-501 Cylinder, 5" ID X 6" OD X 30" L  
IS05 RSLE-501 Cylinder, 6" ID X 7" OD X 30" L  
IS06 RSLE-501 Cylinder, 7" ID X 8" OD X 30" L

Custom boards, shapes and preparations are available on request. Our forming processes, large inventory of custom tooling and state of the art machining techniques allow a wide variety of sizes and shapes to be made. Special geometries such as disks, rings and custom-machined shapes and others can be fabricated. Tight tolerance machining, compositional variations and the application of surface rigidizers and hardening agents are available. Please contact us with your special requirements.

### Item # Description

HS30 RSLE-56 Moldable Sheet, 24" X 36" X 1/8"  
HS31 RSLE-56 Moldable Sheet, 24" X 36" X 1/4"  
HS32 RSLE-56 Moldable Sheet, 24" X 36" X 1/2"  
HD33 RSLE-56 Moldable Sheet, 24" X 36" X 3/4"  
HS34 RSLE-56 Moldable Sheet, 24" X 36" X 1"

Our forming process allows a wide range of cylinders to be made, RS-501 cylinders can be made from inside diameter of 3/4" with lengths to 72", to inside diameter of 36" with lengths to 36". RS-201 and RS-202 cylinders can be made from inside diameter of 1/2" with lengths to 72", to inside diameter of 36" with lengths to 36".



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