



# HIGH ALUMINA MATRIX SHEETS

## TYPES RS-D AND RS-99

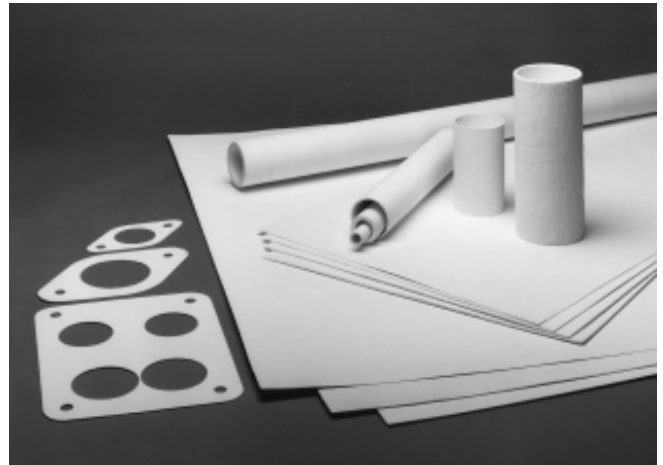
ZIRCAR Refractory Composites, Inc. produces a comprehensive range of advanced high performance ceramic-ceramic composites and related products. Our materials are used around the world in demanding thermal, structural and electrical insulating applications at temperatures from 600°C(1112°F) to 1650°C(3002°F). 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 RS-99** is a moderately high-density fiber based ceramic material with greater than 99% Alumina purity. Refractory Sheet Type RS-99 is usable to temperatures of **1650°C (3002°F)** and is able to withstand over 500 hours of continuous submersion in molten aluminum at 750°C (1382°F) with no wetting and no degradation in properties. Type RS-99's high Alumina content is ideal for high vacuum, reducing atmospheres and other applications where silica cannot be tolerated, such as setters for P/M and MIM applications. Refractory Sheet Type RS-99 boards are available in three types:

**Type RS-99M** is a plastic highly moldable sheet ideally suited for forming custom geometries or for molding in place.

**Type RS-99W** boards can be moistened with water and molded into any desired shape. After a low temperature bake-out of 300°C (570°F) the boards are unaffected by moisture.

**Type RS-99R** boards are pre-fired and are unaffected by moisture. They remain rigid even if saturated with water.



### SUGGESTED APPLICATIONS

- High and Low Temperature Gasketing
- Transite™ and Asbestos-Cement Board Replacement
- Dead Plates, Set Out Plates, Wear Guides and Pusher Pads in Hot Glass Handling
- Induction Furnace Components Such as; Channel Melter Components, Coil Liners, Coreless Induction Components, Covers, Tops, Bases, Front and Back Plates, Coil Supports, Splash and Coil Shield
- Brazing Separators and Fixtures. The High Al<sub>2</sub>O<sub>3</sub> Content Makes it Resistant to Sticking in Many Environments Including Molten Metals
- Rapid Cycle Furnace Door Cowls and Hot Face Supports
- Insulation in High Pressure Molding Presses
- High and Low Temperature Electrical Insulator

TYPE	RS-99	RS-D
Nominal Composition, wt%		
Al <sub>2</sub> O <sub>3</sub>	99+	90
SiO <sub>2</sub>	<1	10
Organic content	<1	<1
Color	White	White
Max. Use Temp. *, °C(°F)	1650(3002)	1300(2370)
Specific Heat, J/kg°K(BTU/lb°F)		
at 600°C(1100°F)	1047(0.25)	1047(0.25)
Flammability	Nil	Nil
Thermal Expansion, RT-400°C(752°F)	7.0x10 <sup>-6</sup> /°C (5x10 <sup>-6</sup> /°F)	6.0x10 <sup>-6</sup> /°C (3.3x10 <sup>-6</sup> /°F)
Surface Area, m <sup>2</sup> 3 pt. B.E.T. RS-99R	14	na

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

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ZIRCAR Refractory Sheet Type RS-D is a group of medium density reinforced matrix composite products produced in a thin sheet form. Type RS-D is comprised of a high purity alumina matrix reinforced with high temperature ceramic fibers. Type RS-D has a maximum use temperature of 1200°C (2192°F) and is available in four forms, making it a versatile product useful in many applications. Type RS-D is also resistant to corrosion in numerous environments. Refractory Sheet Type RS-D are available in four Types:

- **Refractory Sheet Type RS-DR**

RS-DR is a rigid pre-fired sheet which has been heat-treated to remove all organic binder rendering it stable to moisture attack. RS-DR can be readily machined to exacting dimensional tolerances with conventional tooling. It possesses high compressive and flexural strength and is therefore useful as a structural insulation material. Its high dielectric strength makes it suitable for use as a high temperature electrical insulation.

- **Refractory Sheet Type RS-DD**

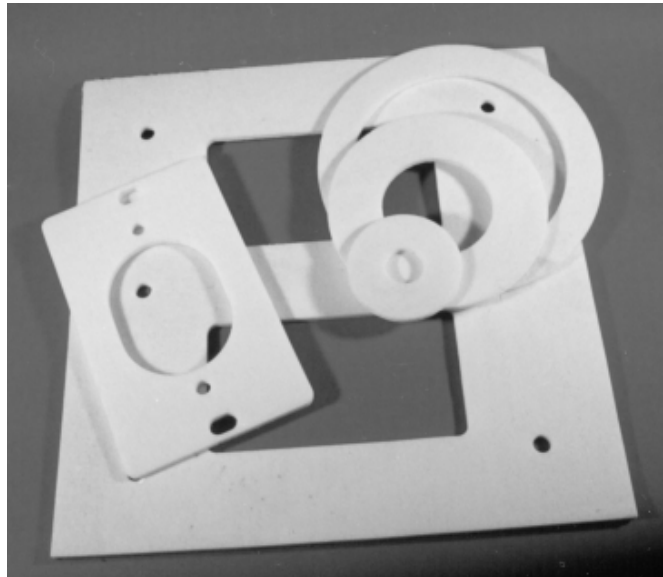
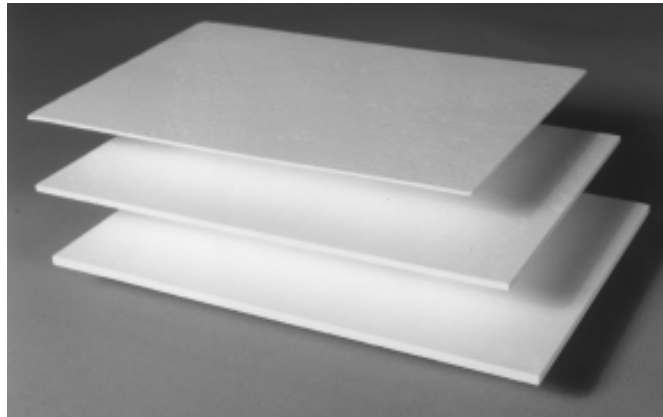
RS-DD is a dried, rigid sheet which can be moistened with water to impart moldability. RS-DD can be molded into shape and dried. When exposed to a temperature of 300°C (570°F), it will become permanently rigid. At this point RS-DD will exhibit properties and characteristics similar to Type DR.

- **Refractory Sheet Type RS-DM**

RS-DM is a pre-moistened moldable Type D product. RS-DM is easily formed into complex shapes and can be dried and fired to impart high strength. RS-DM is ideally suited for use as a mold for slumping and fusing of glass.

- **Refractory Sheet Type RS-DA**

RS-DA is a moldable Type D product which exhibits lower density than RS-DM, making it highly moldable. Drying with subsequent heat treatment to 300°C will result in a permanently rigid structure.



RS-DA is an ideal source for die-cut high temperature gaskets in a moldable form

## SUGGESTED APPLICATIONS

- Asbestos cement board replacement
- Oven construction
- Induction heating lining and coil fixtures
- High temperature gasketing
- Molded shapes, tubes, trays, boats, etc. for sintering and heat-treating
- Art glass slumping and fusing molds
- Heating element support
- Fireproof structural insulation
- Non-ferrous metal handling, spouts, troughs, casting tips
- Brazing separators and fixtures
- Hot furnace repairs
- Induction hot press insulation



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TYPE	RS-99M	RS-99W	RS99R
Form	Moldable Sheet <sup>1,3</sup>	Rigid Sheet <sup>2,3</sup>	Rigid Sheet
Density, as supplied, gm/cc(pcf)	2.1(130) <sup>^</sup>	2.1(130)	2.1(130)
Porosity, %	56	48	48
Loss on Ignition, %	4 - 5	4 - 5	0 - 1
Modulus of Rupture**, MPa(psi) as received	18(2600) <sup>^</sup>	18(2600)	21.8(3150)
Compressive Strength**, MPa (psi) at 10% compression	25.6(3700) <sup>^</sup>	25.6(3700)	30.1(4350)
Thermal Conductivity, W/m°K(BTU/hr. ft² °F/in)	0.64(4.5) <sup>^</sup>	0.64(4.5)	0.64(4.5)
Linear Shrinkage, % Length/Thickness			
after 4 hrs. at 1200°C(2192°F)	0.4 / 1	0.3 / 1	0.3 / 0.4
after 4 hrs. at 1400°C(2552°F)	4 / 5	3 / 5	3 / 5
after 4 hrs. at 1600°C(2912°F)	8 / 10	8 / 10	8 / 10
Hardness, Durometer "D"	-	80	86

TYPE	RS-DM	RS-DD	RSDR	RS-DA
Form	Moldable Sheet <sup>1,3</sup>	Rigid Sheet <sup>2,3</sup>	Rigid Sheet	Moldable Sheet <sup>1,3</sup>
Density, as supplied, gm/cc(pcf)	2.1(130) <sup>^</sup>	2.1(130)	2.1(130)	1.6(100) <sup>^</sup>
Porosity, %	56	48	48	-
Modulus of Rupture**, MPa(psi) as received	21(3000) <sup>^</sup>	21(3000)	21(3000)	3.4(490)
Compressive Strength**, MPa (psi) at 3% compression	-	41.4(6000)	62(9000)	12(2134)
Thermal Conductivity, W/m°K(BTU/hr. ft² °F/in)	0.64(4.5) <sup>^</sup>	0.64(4.5)	0.64(4.5)	0.53(3.8)
Linear Shrinkage, % Length/Thickness				
after 4 hrs. at 1000°C(1832°F)	-	0.3 / 1	0.3 / 1	-
after 4 hrs. at 1200°C(2192°F)	-	1 / 4	1 / 4	-
after 4 hrs. at 1400°C(2552°F)	-	8 / 10	8 / 10	-
Hardness, Durometer "D"	-	80	85	-
Electrical Properties				
Volume Resistivity, ohm-cm	-	5 x 10 <sup>7</sup>	5 x 10 <sup>7</sup>	-
Dielectric Strength, Volts/mil		530	530	
Arc resistance, sec.		360	360	

<sup>1</sup> Becomes rigid upon drying.

<sup>2</sup> Can be made moldable with addition of 10-20 wt% H<sub>2</sub>O.

<sup>3</sup> Can be made permanently rigid by heating to 300°C(570°F).

<sup>4</sup> Depending on humidity.

\*\* Properties expressed parallel to thickness.

<sup>^</sup> Dried at 300°C(570°F).



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## AVAILABILITY

### ITEM # DESCRIPTION

DS01 RS99M, 24" X 24" X 1/32"  
DS02 RS99M, 24" X 24" X 1/16"  
DS03 RS99M, 24" X 24" X 1/8"  
DS04 RS99M, 24" X 24" X 3/16"  
DS05 RS99M, 24" X 24" X 1/4"  
DS06 RS99M, 24" X 24" X 1/2"  
DS10 RS99M, 24" X 48" X 1/32"  
DS11 RS99M, 24" X 48" X 1/16"  
DS12 RS99M, 24" X 48" X 1/8"  
DS13 RS99M, 24" X 48" X 3/16"  
DS14 RS99M, 24" X 48" X 1/4"  
DS15 RS99M, 24" X 48" X 1/2"  
DS20 RS99W, 24" X 24" X 1/32"  
DS21 RS99W, 24" X 24" X 1/16"  
DS22 RS99W, 24" X 24" X 1/8"  
DS23 RS99W, 24" X 24" X 3/16"  
DS24 RS99W, 24" X 24" X 1/4"  
DS25 RS99W, 24" X 24" X 1/2"  
DS30 RS99W, 24" X 48" X 1/32"  
DS31 RS99W, 24" X 48" X 1/16"  
DS32 RS99W, 24" X 48" X 1/8"  
DS33 RS99W, 24" X 48" X 3/16"  
DS34 RS99W, 24" X 48" X 1/4"  
DS35 RS99W, 24" X 48" X 1/2"  
DS40 RS99R, 24" X 24" X 1/32"  
DS41 RS99R, 24" X 24" X 1/16"  
DS42 RS99R, 24" X 24" X 1/8"  
DS43 RS99R, 24" X 24" X 3/16"  
DS44 RS99R, 24" X 24" X 1/4"  
DS45 RS99R, 24" X 24" X 1/2"  
DS50 RS99R, 24" X 48" X 1/32"  
DS51 RS99R, 24" X 48" X 1/16"  
DS52 RS99R, 24" X 48" X 1/8"  
DS53 RS99R, 24" X 48" X 3/16"  
DS54 RS99R, 24" X 48" X 1/4"  
DS55 RS99R, 24" X 48" X 1/2"

### ITEM # DESCRIPTION

JS01 RS-DA, 18" X 24" X .020"  
JS02 RS-DA, 18" X 24" X .040"  
JS03 RS-DA, 18" X 24" X .080"  
JS04 RS-DA, 18" X 24" X .120"  
JS05 RS-DA, 36" X 48" X .020"  
JS06 RS-DA, 36" X 48" X .040"  
JS07 RS-DA, 36" X 48" X .080"  
JS08 RS-DA, 36" X 48" X .120"  
JS20 RS-DM, 18" X 24" X .020"  
JS21 RS-DM, 18" X 24" X .040"  
JS22 RS-DM, 18" X 24" X .080"  
JS23 RS-DM, 18" X 24" X .120"  
JS24 RS-DM, 36" X 48" X .020"  
JS25 RS-DM, 36" X 48" X .040"  
JS26 RS-DM, 36" X 48" X .080"  
JS27 RS-DM, 36" X 48" X .120"

### ITEM # DESCRIPTION

JS50 RS-DD, 18" X 24" X .020"  
JS51 RS-DD, 18" X 24" X .040"  
JS52 RS-DD, 18" X 24" X .080"  
JS53 RS-DD, 18" X 24" X .120"  
JS54 RS-DD, 36" X 48" X .020"  
JS55 RS-DD, 36" X 48" X .040"  
JS56 RS-DD, 36" X 48" X .080"  
JS57 RS-DD, 36" X 48" X .120"  
JS70 RS-DR, 18" X 24" X .020"  
JS71 RS-DR, 18" X 24" X .040"  
JS72 RS-DR, 18" X 24" X .080"  
JS73 RS-DR, 18" X 24" X .120"  
JS74 RS-DR, 36" X 48" X .020"  
JS75 RS-DR, 36" X 48" X .040"  
JS76 RS-DR, 36" X 48" X .080"  
JS77 RS-DR, 36" X 48" X .120"

## CYLINDERS/CUSTOM SHAPES:

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, gaskets and custom-machined shapes 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.

## FABRICATION GUIDELINES

RS-99M, RS-DA and RS-DM can be readily cut with a knife or scissors. Joints can be made by wetting both surfaces with water, (with a sponge or brush), and promptly pressing the two surfaces together. Thicker sheets can be made by laminating two or more sheets together in this manner.

RS-99W and RS-DD are suitable for die cutting or stamping of gaskets. They can be re-wet, made moldable, and handled like RS-99M or RS-DD. RS-99R and RS-DR cuts and handles similar to RS-99W and RS-DD except they are slightly less compressible and more rigid. They can be machined to precision tolerances with conventional tooling.



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