

# Refractory Solutions for Aluminium

www.capital-refractories.com



# Refractory Solutions for Aluminium

Capital Refractories has been manufacturing and supplying high quality refractories and technical ceramics to metal melting and other heat process industries for over 60 years. During this time, we have extended our coverage worldwide with sales offices or distributors in over 40 countries. Capital has 270 staff at 9 sites in the UK, US, mainland Europe, China and India.

Capital supplies a comprehensive range of refractory solutions to the aluminium industry and other heat using industries. Our services include production and supply of furnace linings and consumable products, refractory engineering and installation and product development.

#### Capital's philosophy is:

 Technical support and customer service - Capital has over 50 technical and sales staff who visit our customers in every industrial country in the world to give assistance and training to maximise the performance and benefits of our products. We pride ourselves on our hands-on approach to problem solving - we get involved and stay involve.

- Product development Capital spends 20% of profits on R&D resulting that more than 20% of current sales are of new products developed in the last 4 years a higher proportion than attained in some 'high tech' industries.
- Continuous improvement we recognise that our Quality Assurance Systems are the backbone of our company, Capital was one of the first in the industry to be certified to ISO9001 and parts of the company which supply to the aerospace sector are certified to the more demanding AS9100 aerospace standard. In addition to this we use other continuous improvement methodologies, for example, Lean Manufacturing.

It is this commitment, ambition and enthusiasm to our markets, our customers and our people that makes Capital a world class company in every sense.







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# Refractory Solutions for Aluminium

Capital offers an extensive range of refractory products for the aluminium industry, including products for primary, secondary and foundry customers.

Our products have been developed in close cooperation with our customers and have undergone rigorous testing. Many of our products are approved by Pechiney (now part of Rio Tinto Alcan) and by Alcoa.

### Capital products for the aluminium industry include:

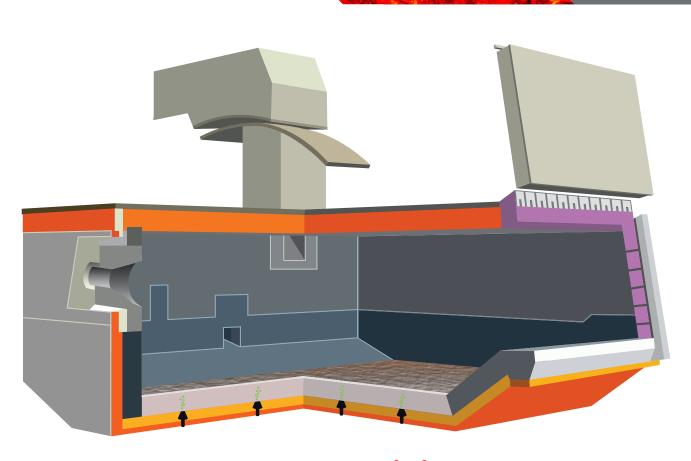
- an extensive line of castable refractories for the lining of melting and holding furnaces,
- · ladles, launders and filter boxes etc.,
- precast shapes for furnace lining and metal transfer,
- dry vibration products for induction furnace linings,
- gas diffusers for degassing and melt homogenisation,
- repair materials including rapid fire phosphate bonded castables and plastics,
- protective washcoats and ancillary items such as tap out cones, mica and thermocouple tubes.

Our team of experienced engineers and authorised installers can install and repair your furnace linings or offer on site supervision and advice as required.

Capital's product range is constantly evolving to meet new challenges. We can also supply a range of complimentary products for a complete installation package including dense and insulating firebrick, calcium silicate and microporous insulating board, mortars and ceramic or metallic anchors.

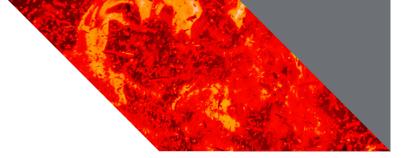
Please contact your local Capital representative for assistance in selecting the correct combination of materials for your specific application.





# **Reverberatory Furnace Linings**

AREA	PRODUCT	DESCRIPTION				
Roof	Capiral 105SR	High duty high alumina castable				
	Capiral M60	High duty mullite based castable				
	Capiral 40	Chamotte based castable				
Roof Insulation	Pencrete 124GM	General purpose insulating castable				
	Pencrete 15/40GM	Low density insulating castable				
Upper Sidewall	Capiral 85	High duty bauxite Based castable				
	Capiral M60	High duty mullite castable				
	Capiral 105SR	High duty high alumina castable				
Flux Line	Capflow 1730FF	Silicon carbide enriched bauxite cas				
	Capiral 85	High duty bauxite Based castable				
	Capiral 105SR	High duty high alumina castable				





## **Reverberatory Furnace Linings**

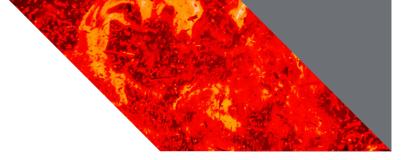
AREA	PRODUCT	DESCRIPTION					
Lower sidewall	Capiral 105SR	High duty high alumina castable					
	Capiral 85	High duty bauxite based castable					
Hearth	Capiral 85	High duty bauxite based castable					
	Capiral 105SR	High duty high alumina castable					
	Capiral 90	Very high Strength alumina based castable					
Subhearth	Capiral 35 C/G	Chamotte based non-wetting Castable					
	Capiral LWA	Lightweight non-wetting castable					
	Capiral LWB	Lightweight non-wetting castable					
Sill and Ramp	Capiral S40FF	Silicon carbide /mullite super duty castable					
	Capiral 85	High duty bauxite based castable					
	Capiral 90	Very high Strength alumina based castable					
Door	Capiral M60	High duty mullite based castable					
	Capiral 105SR	High duty high alumina castable					
	Capiral LWA	Lightweight non-wetting castable					
Taphole Block	Capiral S40 FF	Silicon carbide/mullite super duty castable					
	Capiral 85	High duty bauxite Based Castable					
	Capiral SC70	Silicon carbide based castable					
Repair Materials	PBond 85	Two component phosphate bonded repair castable					
	Capiral P12	Non-wetting plastic refractory					
Washcoat	Washcoat 222	Alumina based washcoat with non wetting properties					
	Zircon Washcoat	Zircon based washcoat					





# **Rotary Furnace Linings**

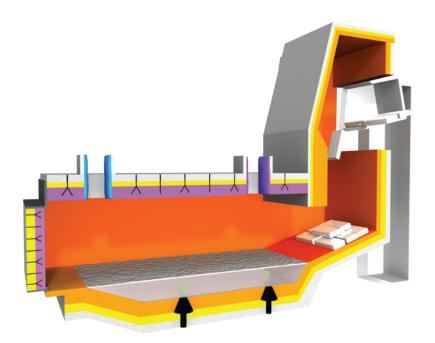
AREA	PRODUCT	DESCRIPTION
Barrel	Caprax 50HD	High stregth flint clay castable
	Caprax 1750LCF	High strength bauxite based castable
Door	Capiral M60	High duty mullite based castable
Repair Materials	PBond 85	Two component phosphate bonded repair castable
	Capiral P12	Non-wetting plastic refractory





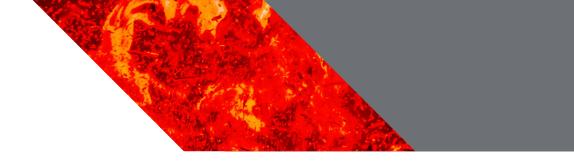
## **Tower (Stack) Melter Linings**

AREA	PRODUCT	DESCRIPTION					
Tower (Stack)	Caprax 1750LCF	High duty bauxite based castable					
	Capiral 85XS	Abrasion resistant bauxite castable					
	Capiral 85	High duty high alumina castable					
Melt Zone	Capflow 1730AL	Silicon carbide enriched bauxite castable					
	Capiral 85XS	Abrasion resistant bauxite castable					
	Capiral 85	High duty bauxite based castable					
Holding area roof and upper	Capiral 105SR	High duty high alumina castable					
sidewall	Capiral M60	High duty mullite based castable					
Roof Insulation	Pencrete 124GM	General purpose insulating castable					
	Pencrete 15/40	Low density insulating castable					
Lower Sidewall	Capiral 85	High duty bauxite based castable					
	Capiral 105SR	High duty high alumina castable					
Subhearth	Capiral 35C/G	Chamotte based castable					
	Capiral LWA	Lightweight non-wetting castable					
	Capiral LWB	Lightweight non-wetting castable					
Repair Materials	PBond 85	Two component phosphate bonded repair castable					
	Capiral P12	Non-wetting plastic refractory					





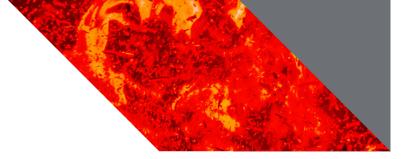
A tower melter lined with Capiral 85XS showing minimal deterioration after 12 months service.



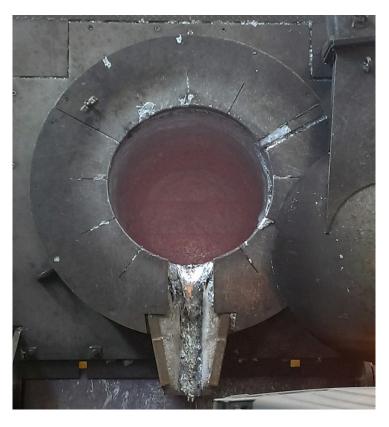


# **Bail Out and Dosing Furnace Linings**

AREA	PRODUCT	DESCRIPTION				
Roof	Capiral 105SR	High duty high alumina castable				
	Capiral M60	High duty mullite based castable				
	Capiral 40	Chamotte based castable				
Sidewall and base	Capiral 85	High duty bauxite based castable				
	Capiral 105SR	High duty high alumina castable				
	Capiral M60	High duty mullite based castable				
	Capiral 40	Chamotte based castable				
Repairs	PBond 85	Two component phosphate bonded repair castable				
	Capiral P12	Non-wetting plastic refractory				
Washcoats	Washcoat 222	Alumina based washcoat with non wetting properties				
	Zircon Washcoat	Zircon based washcoat				









# **Induction Furnace Linings**

AREA	PRODUCT	DESCRIPTION				
Main Lining	Corvibe 90	Fused alumina based for long life				
	Corvibe 90 FRX	Steel fibre reinforced lining for long life				
	CRL 65	Mullite forming, excellent chemical, thermal and impact resistance.				
	CRL75	Mullite forming, for mixed melting				
	C65 RFL	Mullite forming for removable former practice				
	C65 LS	Mullite forming with aluminium non-wetting additives.				
	CRLMAR	Mullite based lining for aluminium alloys				
	CRLMASR	Mullite based lining for aluminium and copper alloys				
Repairs	Capiral P12	Non-wetting plastic refractory				
Washcoats	Washcoat 222	Alumina based washcoat with non wetting properties				
	Zircon Washcoat	Zircon based washcoat				

# Gas Diffusers for Aluminium

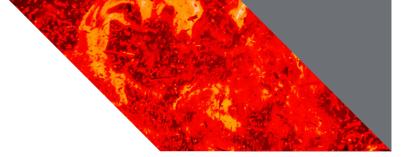
Capital have over 15 years experience in the production of gas diffusers for aluminium treatment. Our extensive range of products has been successfully used in melting and holding furnaces, ladles and degassing units.

Capital gas diffusers have been shown to consistently improve metal quality prior to casting and are considered to have low installation costs. Melt homogenisation is improved with respect to both temperature and chemistry.

The normal gases used are argon or nitrogen; however chlorine can be used through specially designed diffusers for removing light metals such as magnesium and calcium.









#### **BENEFITS OF GAS DIFFUSERS INCLUDE:**

- Reduced hydrogen content in the melt resulting in fewer casting defects.
- Reduction of oxide inclusions.
- Improved melt homogeneity.
- Improved separation of dross and metal resulting in lower metal loss.
- Elimination of manual stirring.
- Improved melt rate and efficiency in melting furnaces giving energy savings.
- Environmentally friendly compared with other gas systems.
- · Reduction of light metal contamination.
- · Cost-effective over time compared with Rotary Systems.
- Low maintenance.

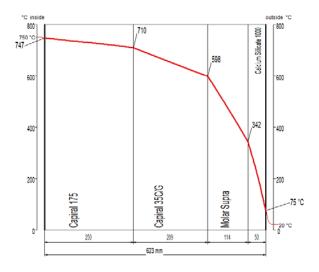


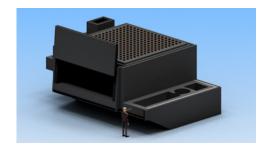
### **Refractory Engineering and Installation**

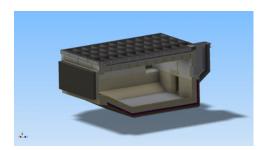
Capital can offer a fully engineered refractory solution for your furnace linings. We use advanced software for 3D design and thermal modelling.

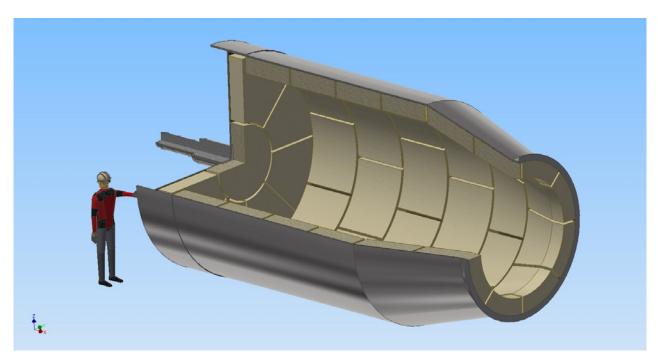
Our engineering and installation team have over 30 years experience in the design and installation of refractory linings for aluminium customers which helps us give the optimum solution for new builds, relines and repairs. Our solutions include monolithic, big block, brick or hybrid designs tailored to the customers' needs.

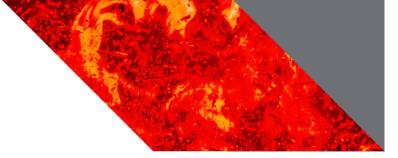
Our installation team can offer a full turnkey service or offer training and supervision to local installation teams or the customers own maintenance team.























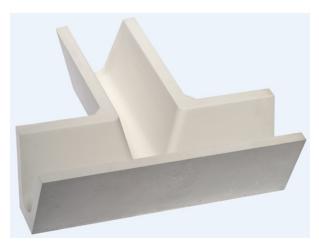


### **Metal Transfer**

Capital offer high quality fired launders and ladle liners or a wide range of castable or rammed products that can be installed in-situ or used for repairs.



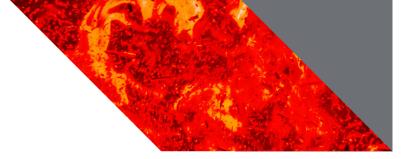
Cast in-situ launder feeding a precast filter box



Precast fused silica launder



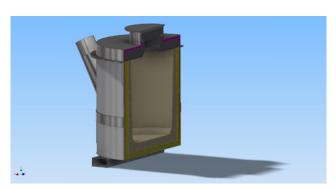
Cast in-situ transfer launder





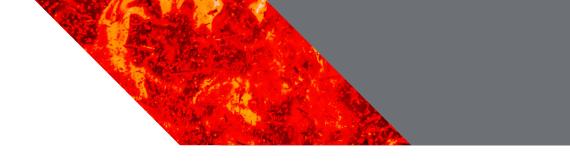


Cast in-situ transfer ladle



Road transfer ladle design

PRODUCT	DESCRIPTION
Calight 1.4	Calcium silicate insulating shapes
Fused Silica FS65C	Fused silica shapes
Fused Silica FS55C	Silicon carbide reinforced fused silica shapes
Fused Silica FS45C	Silicon carbide reinforced fused silica shapes
Tuffmax ML60	High fracture toughness composite with mullite
Tuffmax SC40	High fracture toughness composite with silicon carbide
Capiral FSA	Fused silica castable
Capiral FSC	Fused silica/silicon carbide castable
Capiral 105SR	High alumina non-wetting castable
Capiral 85	High alumina non-wetting castable
Capiral S15	Silicon carbide reinforced mullite castable
Capiral S40FF	Silicon carbide reinforced mullite castable
Capiral SC70	Silicon carbide castable



### **Precast Shapes**

Capital produce a wide variety of precast shapes for aluminium ranging from less than one kilogram to several tonnes in weight.

These can be made from any of our castable range or from a range of more specialised precast materials summarised below. These are typically fully fired to remove both free and chemically combined water and to form a true ceramic bond.

Typical applications include -

- Big block construction for reverbatory and rotary furnaces
- Launders, filter boxes and degassing units for metal distribution and treatment
- Ladle liners and impact pads
- Crucibles
- Hot tops, control pins and downspouts for metal casting
- Feed cones and riser tubes for dosing furnaces and low die pressure casting furnaces
- Flue covers, exhaust ports, burner and flue caps for carbon anode baking

We can also precast complete linings into your steelwork and carry out full preheat before delivery to your site.

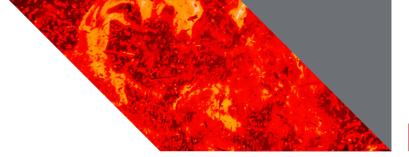
Typical applications include

- · Launder systems
- · Degassing and filter units
- Dosing furnaces
- · Low pressure die casting furnaces
- · Foundry melting and holding furnaces
- · Chip melting units



### **Product Data**

PRODUCT NAME	DESCRIPTION	PHYSICAL PROPERTIES			
		BULK DENSITY ( gcm <sup>-3</sup> )	APPARENT POROSITY (%)		
F5 45C	Silicon carbide reinforced fused silica	2.27	13.2		
F5 55C	Finer fused silica material with silicon carbide	2.26	16.1		
F5 65C	Dense fused silica material	2.22	12.1		
Capiral MLA	Mullite based non-wetting material	2.51	17.7		
Calight 1.4	Calcium silicate insulating material	1.38	52.6		
Armourcast AL1 <sup>†</sup>	Fibre matrix alumina material	3.08	22.1		
Tuffmax AL1 <sup>†</sup>	High fracture toughness alumina material	3.17	17.0		
Tuffmax ML60 <sup>†</sup>	High fracture toughness mullite material	2.81	15.1		
Tuffmax SC40 †	High fracture toughness silicon carbide	3.02	13.3		







Precast liner for ALPUR degassing unit



Precast launder assembly in fused silica material



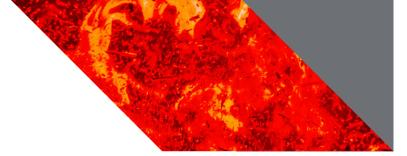
Composite skim dam/stirring tools

PHYSICAL F	PROPERTIES	CHEMICAL ANALYSIS (%)							
COLD CRUSHING STRENGTH (MPa)	MODULUS OF RUPTURE (MPa)	SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	CaO	SiC	Others			
63.3	8.4	49.3	16.1	2.58	26.2	5.79			
80.5	12.8	55	26.4	2.8	9.7	5.9			
73.4	12.1	64.8	26.4	2.82	-	5.73			
48.7	8.5	31.2	58.3	1.5	-	9			
8.8	3.0	37.0	23.0	31.0	-	8.9			
189	61.0	0.1	95.6	4.0	-	-			
206	58.2	2.46	95.0	2.0	-	-			
124	46.2	24.5	63.9	2.91	-	-			
173	59.7	2.8	51.0	2.0	2.8	4.8			

 $<sup>^\</sup>dagger$  Material contains high percentage of refractory steel fibres



PRODUCT NAME	PRINCIPAL RAW MATERIALS	MAX. SERVICE TEMP	MAX. GRAIN SIZE	CHEMICAL ANALYSIS (%)					
		°C	(mm)	Al <sub>2</sub> O <sub>3</sub>	SiO <sub>2</sub>	Fe <sub>2</sub> O <sub>3</sub>	CaO	MgO	SiC
Pencrete 15/40 GM <sup>†</sup>	Vermiculite	1000	3	27	21	11	21	10	-
Pencrete 124 GM <sup>†</sup>	Expanded Clay	1100	5	29	38	8	13	-	-
Capiral LWA	Insulating Chamotte	1300	10	42	40	1.5	7.1	-	-
Capiral LWB	Insulating Chamotte	1300	10	48	34	0.7	8.1	-	-
Pencrete LWGM <sup>†</sup>	Expanded Clay	1200	5	30	45	7.6	13	-	-
Capiral 40	Chamotte	1400*	5	47	43	0.6	1.7	-	-
Caprax 50HD <sup>†</sup>	Flint Clay	1650	5	50	46	0.7	1.4	-	-
Capiral 105SR	Chamotte/Bauxite	1400*	10	61	31	8.0	2.1	-	-
Capiral M60	Mullite	1400*	8	60	34	1.1	1.7	-	-
Capiral 85	Bauxite	1400*	5	81	11	8.0	1.9	-	-
Capiral 85XS	Bauxite	1400*	5	82	9.5	0.9	2.2	-	-
Capiral 90	Fused Aluminate	1400*	10	88.8	3.0	0.3	1.8		-
Capiral 155	Chamotte	1400*	5	48	43	1.3	2.2	-	-
Capiral 165	Chamotte /Bauxite	1400*	5	58	33	1.1	1.5		-
Capiral 175	Bauxite	1400*	5	82	11	1.5	2.0	-	-
Capiral 175WR	Bauxite	1400*	5	81	9.0	1.1	2.1		-
Silcast 65 <sup>†</sup>	Mullite	1700	8	65	29	1.0	2.9	-	-
Capiral 42C	Chamotte/Silicon Carbide	1350	10	38.2	42.4	0.7	1.5		15.0
Capiral S15	Mullite/Silicon Carbide	1450	8	55.7	23.6	0.7	1.4	-	14.4
Capflow 1730AL	Bauxite/Silicon Carbide	1500	10	73.7	6.8	0.7	1.5		14.4
Capiral S40FF	Silicon Carbide/Mullite	1500	8	39.9	16.1	0.4	1.4	-	38.4
Capiral SC70	Silicon Carbide	1400	5	19.3	5.5		1.4		67.0
Capiral FSA	Fused Silica	950	5	26.4	64.8	0.1	2.8	-	-
Capiral FSC	Fused Silica/Silicon Carbide	1000	5	16	49	0.1	2.6		26.0
PBond 85	Bauxite	1300	5	87.5	3.1	0.6	-	-	-
Caprax 1750LCF <sup>†</sup>	Bauxite	1750	10	82.4	12.3	0.9	1.5	-	-





	LINEAR	ANENT CHANGE %)		D CRUSH TRENGT (MPa)		BU	LK DENS (kg m <sup>-3</sup> )	SITY	THERMAL CONDUCTIVITY, MEAN	APPROX WATER ADDITION
	FIRED 800°C	FIRED 1000°C	DRIED 110°C	FIRED 800°C	FIRED 1000°C	DRIED 110°C	FIRED 800°C	FIRED 1000°C	700°C (Wm-1 K-1)	%
_	-1.1	-1.4	0.7	0.5	0.5	620	600	600	0.17	13.5
	-1.0	-1.2	3.2	2.1	2.2	1050	1040	1040	0.28	40.0
	-0.1	-0.1	18	10	8	1050	1030	990	0.5	55.0
	-0.2	-0.1	27	21	17	1540	1450	1370	0.6	18.0
_	-0.2	-0.2	11	9	6.1	1280	1270	1270	0.25	23.0
	-0.1	-0.1	115	109	100	2370	2340	2370	1.8	6.5
	-0.1	-0.3	96	118	120	2400	2380	2380	1.5	6.0
	-0.2	-0.3	99	90	109	2520	2560	2560	1.8	6.5
	-0.1	-0.3	101	86	80	2560	2550	2540	1.5	5.5
	-0.3	-0.3	110	120	112	2930	2880	2880	1.2	5.5
	-0.3	-0.3	140	154	129	2930	2890	2830	1.4	4.5
	+0.1	0.0	100	156	257	2320	3290	3300		4.0
	-0.3	-0.3	66	89	128	2380	2290	2350	-	5.5
	-0.3	-0.3	73	130	154	2580	2570	2560	1.8	5.5
	-0.3	-0.2	54	94	140	2900	2940	2960	2.6	5.0
	-0.3	-0.3	159	164	171	2990	3000	2970	2.2	5.0
		-0.4	+1.1	109	102	92	2530	2480	2440	1.7 1.75
	+0.0	+0.5	85	110	90	2450	2400	2400	1.3	1.65
_	-0.3	-0.3	122	147	226	2700	2680	2650	2.0	1.12
	-0.5	-0.3	131	156	94	2870	2840	2870	2.3	1.06
	-0.3	+1.6	151	187	86	2760	2750	2650	-	2.18
	+0.1	0.0	51.1	80.9	138	2640	2620	2600	8.7	6.0
	-0.1	-0.2	70	72	69	2220	2200	2210	-	1.06
	-0.1	+0.2	62	63	90	2300	2270	2240		4.5
	-0.3	-0.4	104	40	471	2720	2690	2730	-	N/A
	-0.2	+1.4	107	150	92	2860	2870	2780	2.3	5.5

<sup>&</sup>lt;sup>†</sup> Material does not contain non-wetting agents \* Not aluminium contact temperature Properties are the mean of valves determined during routine quality control and therefore do not constitute a specification

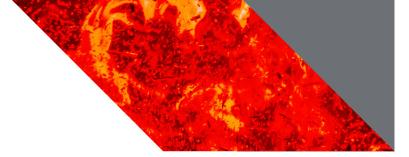
Testing and classification according to BS EN993 and BS EN 150 10081

### **Dry Vibration Linings**

PRODUCT NAME	PRINCIPAL RAW MATERIALS	BONDING	CHEMICAL ANALYSIS (%)							
			Al <sub>2</sub> O <sub>3</sub>	SiO <sub>2</sub>	MgO	CaO	Fe <sub>2</sub> O <sub>3</sub>	OTHER		
Corvibe 90	Fused Alumina	Chemical	91	3	-	-	0.4	-		
Corvibe 90 FRX <sup>†</sup>	Fused Alumina	Chemical	91	3	-	-	0.4	-		
CRL 65	Andalusite	Ceramic	68	29	<0.5	<0.5	1.0	-		
CRL75	Andalusite	Ceramic	74	23	<0.5	<0.5	0.6	-		
C65 RFL	Andalusite	Chemical	68	29	<0.5	<0.5	0.8	-		
C65 LS	Andalusite	Chemical	59	36	<0.5	<0.5	0.8	-		
CRL MAR	Mullite	Ceramic	56	33	-	<0.5	1.0	-		
CRLMASR	Mullite	Ceramic	51	29	-	<0.5	0.9 SiC	10		

### Wet Rammables, Patching & Miscellaneous

PRODUCT	PRINCIPAL RAW MATERIALS	MAX. SERVICE TEMP °C	MAX. GRAIN SIZE (mm)	CI	HEMIC	ALANAL	BULK DENSITY (DRIED	TYPE OF		
NAME				Al <sub>2</sub> O <sub>3</sub>	SiO <sub>2</sub>	Fe <sub>2</sub> O <sub>3</sub>	ZrO <sub>2</sub>	P <sub>2</sub> O <sub>5</sub>	110°C) kg m <sup>-3</sup>	SET
Capram 70	Mullite	1700	5	68.0	25.0	0.9	-	3.3	2700	Chemical
Capram P12	Bauxite	500	3	66	12.5	1.5	-	5.0	2550	Chemical
D10	Bauxite	1700	3	77.5	12.3	1.4	-	5.0	2550	Chemical
D10f	Bauxite	1700	1.5	77.5	12.3	1.4	-	5.0	2550	Chemical
D11	WFA	1800	1	92.5	3.2	0.1	-	3.8	2750	Chemical
Washcoat 222	Alumina	1500	0.1	73.3	19.2	1.0	-	3.4	2800	Chemical
Zircon Washcoat	Zircon	1700	0.1	23	29	0.4	43	2.1	3200	Chemical
Capscreed	BFA	1700	1	91	3.1	0.3	-	-	2690	Hydraulic
Silkote 90	WFA	1700	1	92	0.3	0.1	-	-	2510	Hydraulic
PBond 85	Bauxite	1300	3	87	46	0.5	-	5.4	2640	Chemical



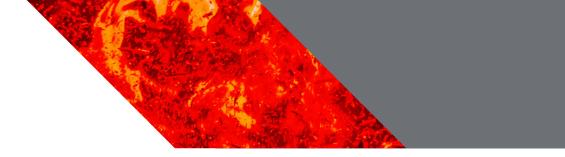


	MAX. GRAIN SIZE mm	BULK DENSITY kg m <sup>-3</sup>	MAX. SI TEM	ERVICE P°C Short term	COMMENTS
-	5	0050	4200	1400	Fundal wains based lining faulage accounting
	5	2850	1300	1400	Fused alumina based lining for long campaigns
	5	2850	1300	1400	Fibre reinforced fused alumina based lining for long campaigns
	4	2600	1650	1700	Mullite forming, excellent chemical, thermal & impact resistance
	5	2600	1650	1720	Mullite forming, for mixed melting
	5	2600	1400	1600	Mullite forming for removable former practice
	5	2600	1300	1400	Mullite forming with aluminium non-wetting additives
	5	2600	1000	1200	Mullite containing lining for aluminium alloys
	5	2600	1050	1400	Mullite containing lining for aluminium and copper alloys

Data is without fibres

### **Backing Insulation**

PRODUCT NAME	MAX. SERVICE TEMP °C	c	НЕМІС	:AL AN	ALYSIS	5 (%)	PLC (%)	BULK DENSITY	THERMAL CONDUCTIVITY Wm-1K-1	
		Al <sub>2</sub> O <sub>3</sub>	SiO <sub>2</sub>	Fe <sub>2</sub> O <sub>3</sub>	CaO	OTHER	FIRED 1000°C	kg m⁻³	400°C	800°C
Supra Brick	950	9	77	7	0.8	-	N/A	750	0.17	0.19
Calcium Silicate Board	1000	0.2	47	0.1	42	-	-	225	0.1	0.14
Microporous Board	1000	-	80	-	-	SiC 15	4.8	230	0.024	0.040
Superflex	1000	10	60	-	-	ZrO <sub>2</sub> 25	2.6	375	0.027	0.044
Pyrogel	650	-	-	-	-	-	N/A	-	0.035	-
Superwool HT paper	1300	-	70-80	-	21.5	-	-	210	0.07	0.14
Block 800	1000	13.9	61.2	-	17.1	-	1.4	320	0.06	0.12



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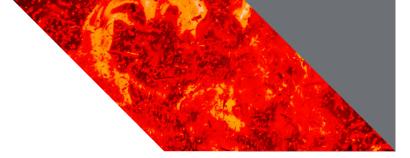
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