Refractories for Torpedo car

The chemical physical properties of the products

The tables hereinafter show the main average properties of the products. These properties, verified by internal testings, are merely indicative and should not be used as guaranteed values for tender technical specifications.

In case of special requirements, technical specifications containing the guaranteed values and those detailing the various properties may be agreed with the Customer during sales negotiations.

The individual properties are determined according to ISO Recommendations and Standards Pre Recommendations (Pre Recommendations - Revision June 1990).

In default of recommendations from the two above Bodies or should special tests be required, special rules or company methods may be adopted. Such rules and methods shall be specified and agreed upon with the Customer.

Brick dimensions (shapes)

The refractory bricks are produced in the great many shapes required for the correct lining of each plant in which they are to be installed.

SANAC is able to produce both the shapes envisaged by the main international standardization rules and the special shapes for specific uses.

The Design Service is at the Customer's disposal to provide him with the most profitable solutions.

Dimensional Tolerances

The dimensional tolerances of bricks generally conform with the PRE/R23 Recommendation (“Dimensional tolerances of dense and insulating refractory products”).

Particular tolerances, if any, should be indicated at the time of the en-quiry and be the subject of tender technical specifications.

Sorting and checkig

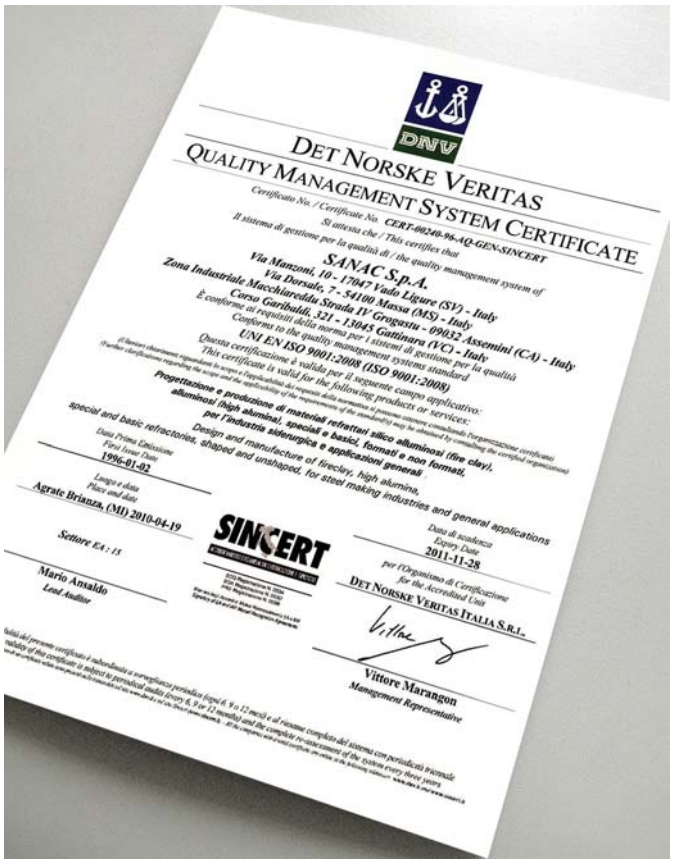
The bricks, removed from the furnaces, after heat treatment, are classified and checked (“Inspection by attributes”) with respect to their dimensional characteristics and their outward appearance (fissures, cracks, chipped edges, stains, etc.).
Furthermore, on a statistical basis, controls are carried out on the chemical-physical properties, such as mainly:

- Chemical analysis
- Refractoriness
- Bulk density
- Porosity
- Cold crushing strength
- Modulus of rupture
- Refractoriness under load (R.U.L.)
- Linear thermal expansion
- Permanent linear change
- Thermal shock
- Permeability to gases.

These tests are made on a routine basis in the Quality Control laboratory of each works.

Special test are carried out by the Central Laboratory of Research.
The production control is effected in accordance with Assurance Quality System.

Quality



The qualitative standard of a refractory material has reached such a determinant influence level as to condition the operational results.
It is therefore evident the absolute necessity to carry into effect a severe policy of quality in manufacturing.

This policy is imposed by the ever-increasing stresses to which the material is subjected during the operation as well as by the level of high specialization and differentiation reached by refractory products.

In the manufacturing process, therefore all those measures are adopted which are necessary to attain the right quality level and to keep it constant, namely:
- precise processing instructions for each phase of the production process and detailed quality manuals from the raw material control up to the finished products;
- provision of a structure able to produce according to the criteria of the “Quality Assurance”.

All our works, as well as all our laboratories, are conform to Assurance Quality System in accordance with UNI EN ISO 9001, certified by DNV as shown at side.

Services

RESEARCH AND DEVELOPMENT

Industrial progress, greatly advances in the latest years, imposes more and more severe conditions to refractory linings and demands materials of more and more sophisticated qualities in order to meet the requirements of better performances under every technical and economical aspect.

In order to take active part in this quick developing process, in addition to the individual Works Laboratories charged with the production control and testing (from raw materials to finished products), SANAC owns a Central Laboratory of Research which employs several highly-qualified specialists.

This unit is fitted with all the most modem equipments necessary to the most advanced technological requirements in the sector, it carries out its activity in applied research, in the production and development of new products, in the improvement of the existing products and relevant manufacturing processes.
The Central Laboratory of Research is in Vado Ligure.

DESIGN ENGINEERING AND TECHNICAL ASSISTANCE

The Design Engineering and Technical Assistance Service constitutes an integrated system set up in order to cover all stages from design engineering up to construction and installation. Design engineering is carried out with the C.A.D. system.
The Service is in fact a company sector whose function is to find out and solve all problems connected with refractory materials.
It operates on site in dose touch with the user and studies the most valid solutions under the technical and economical aspect, thus reaching a precise detailed design engineering of the individual components of a lining.

Know-how

Sanac technology is active all over the world. In fact, SANAC puts its own experience at the disposal of other producers of refractory materials.

Many are the know-how agreements stipulated with foreign countries. The collaboration supplied by the Company mainly consists of:

- setting out of the most up-to-date production cycles;
- supervision of plant final design engineering;
- supervision of plant erection and start-up;
- supply of complete know-how;
- training of the Customer's technical personnel in order to hit the production targets.

From Company's profile it is possible to identify the principles which are at the base of its activity and which explain its constant progress in a world-wide refractory industry.

Torpedo car

In the last years, torpedo car wear lining passed through considerable changes. Operating cycle harder and harder conditions, somewhere combined with metallurgical processes such as desulphurization and desilicazation, increa¬sed wear out of traditional silica-alumina refracto¬ries and determined the need of radical innovations.

Our company, which has always been present in this area, developed a wide range of refractories that can meet such changed operating demands.

In particular, we would like to remind the series of A.G.S. system products (Al203 - SiC-C), manufactured in our Grogastu plant, which are largely used in several full cycle plants.

Sanac's works

1. 13045 GATTINARA (VC)
   Corso Garibaldi, 321
   Phone +39 0163 824711
   Fax +39 0163 89321

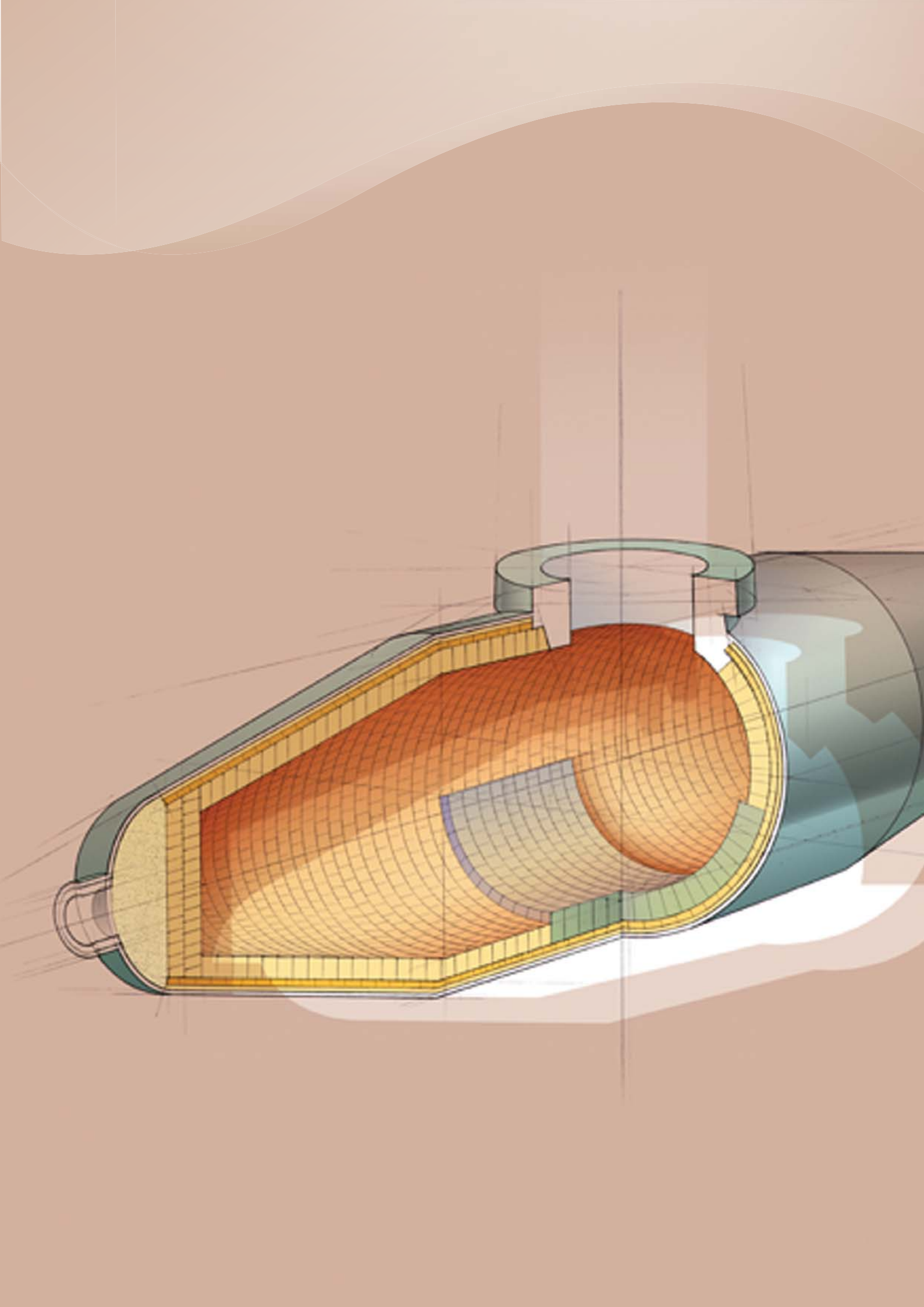
2. 17047 VADO LIGURE (SV)
   Via Manzoni, 10
   Phone +39 019 28951
   Fax +39 019 882555

3. 54100 MASSA
   Via Dorsale, 7
   Zona Industriale
   Phone +39 0585 799001
   Fax +39 0585 799031

4. 09032 ASSEMINI (CA)
   Loc. Grogastu
   Zona Ind. Macchiareddu
   Phone +39 070 24651
   Fax +39 070 247058

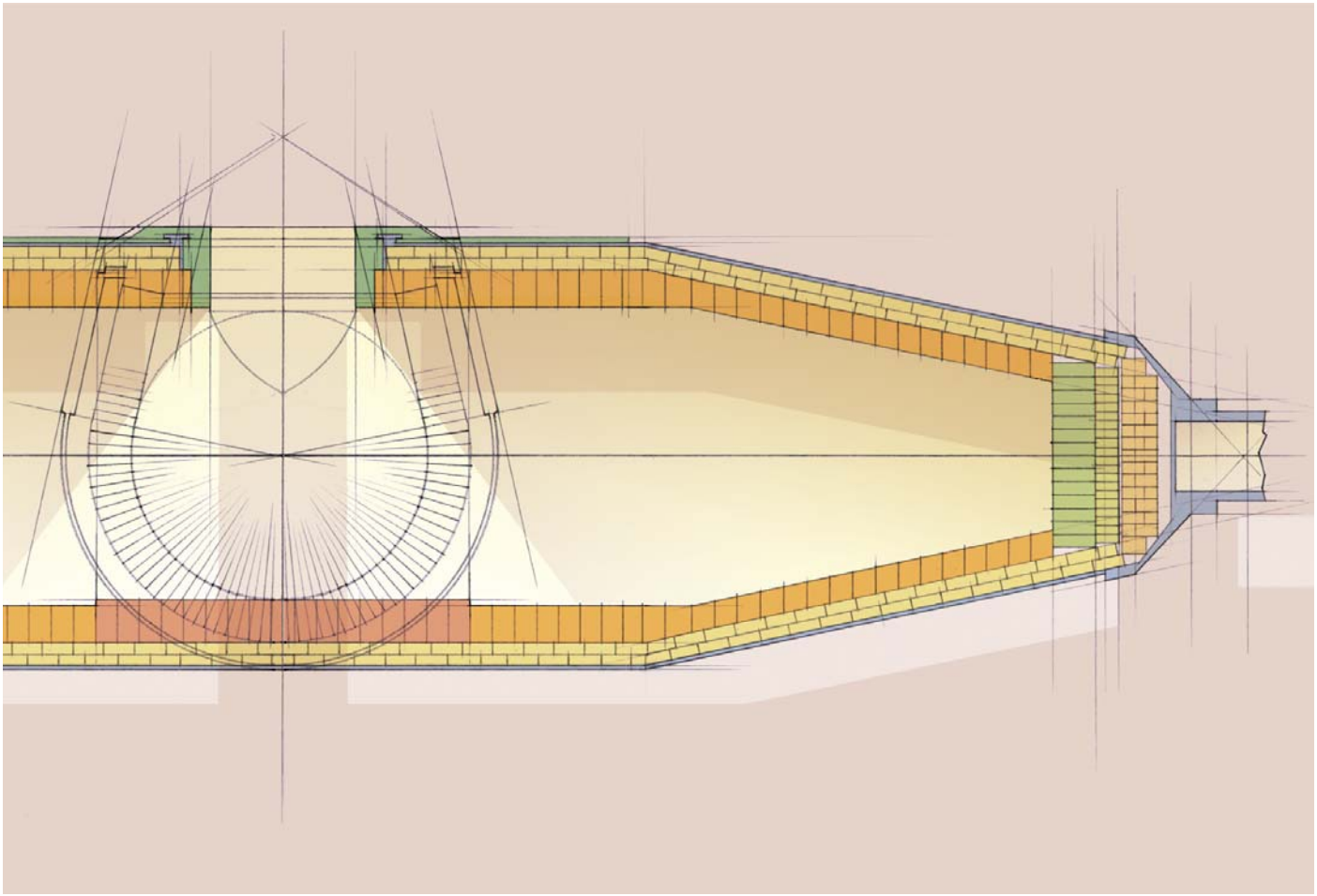
Products

Refractories for Torpedo car



Safety lining shapes

TOREDO CAR SAFETY LINING SHAPES			
Code	**Description**	**Dimensions (mm)**	**Volume (dm^3)**
T32	Split	230 x 115 x 32	0,85
R65	Straight	230 x 115 x 65	1,72
R/76	Straight	230 x 115 x 76	2,01
C4	Side arch	230 x 115 x 67/63	1,72
C8	Side arch	230 x 115 x 69/61	1,72
C16	Side arch	230 x 115 x 73/75	1,72
C24	Side arch	230 x 115 x 77/53	1,72
V4	Wedge/End arch	230 x 67/63 x 115	1,72
V12	Wedge/End arch	230 x 70/58 x 115	1,72
V24	Wedge/End arch	230 x 77/53 x 115	1,72
V4/76	Wedge/End arch	230 x 78/74 x 115	2,01
V24/76	Wedge/End arch	230 x 88/64 x 115	2,01



Wear lining shapes

BARREL STANDARD WEDGE SHAPES

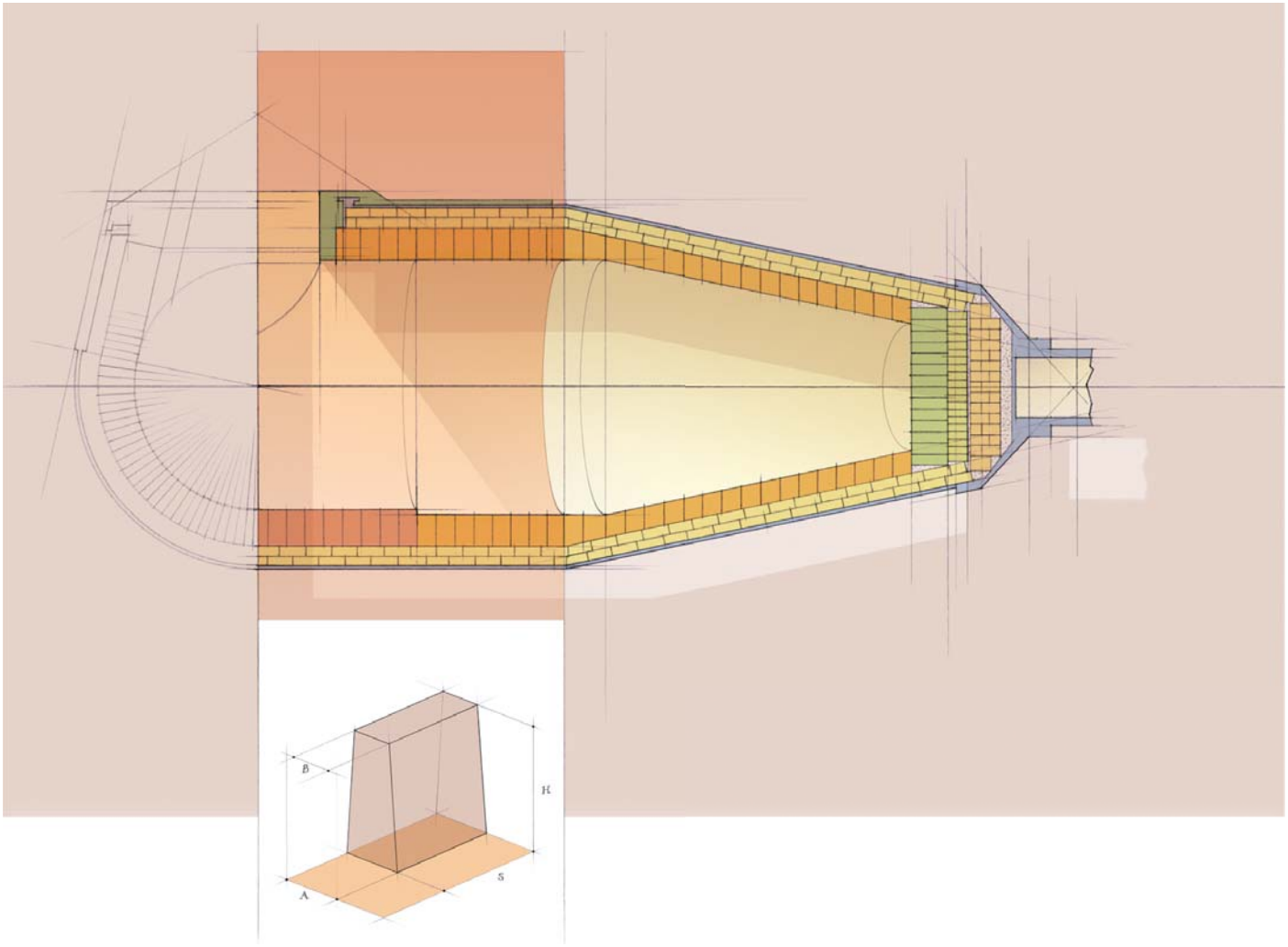
Code	A (mm)	B (mm)	H (mm)	S (mm)	Volume (dm^3)
V8/100	104	96	230	115	2,65
V24/100	112	88	230	115	2,65
V8K/100	104	96	230	172	3,96
V24K/100	112	88	230	172	3,96
KLV12/100	104	92	345	172	5,82
KLV36/100	112	76	345	172	5,58
V4/76	78	74	230	115	2,01
V24/76	88	64	230	115	2,01
V4K/76	78	74	230	172	3,00
V24K/76	88	64	345	172	3,00
VL15	85	70	345	115	3,07
VL25	85	60	345	115	2,88
LV6/76	78	72	345	115	2,98
L36/76	88	52	345	115	2,78
KLV6/76	78	72	345	172	4,45
KLV36/76	88	52	345	172	4,15
LV6D/76	78	72	345	230	5,95
LV36D/76	88	52	345	230	5,55
NV12/100	104	93	300	115	3,40
NV36/100	112	80	300	115	3,31
KNV12/100	104	93	300	172	5,08
KNV36/100	112	80	300	172	4,95

CONE RAMP SHAPES

Code	Dimensions (mm)	Volume (dm^3)
XT/98	172 x 152 / 140 x 98	2,46
AX5/98	230 x 152 / 136 x 98	3,24
A/98	230 x 152 x 98	3,42
PX18/98	265 x 152 / 134 x 98	3,71
PA/98	265 x 152 x 98	3,95
BX23/98	300 x 150 / 127 x 98	4,07
3/98	300 x 150 x 98	4,41
EX3/98	345 x 152 / 127 x 98	4,72
ER/98	345 x 152 x 98	5,14

BARREL SPECIAL WEDGE SHAPES

Code	A (mm)	B (mm)	H (mm)	S (mm)	Volume (dm^3)
SD-2G4	66	62,0	250	124	1,98
SD-2G16	72	56,0	250	124	1,98
SD-2G24	76	52,0	250	124	1,98
SD-2GG24	66	62,0	250	250	4,00
SD-2GG16	72	56,0	250	250	4,00
KVL22/DK	106	84,5	345	172	5,65
KVL19/DK	106	87,0	300	172	4,98
1/F	105	86,0	250	238	5,69
1A/F	105	83,0	300	238	6,70
1,5F	105	83,0	300	357	10,04

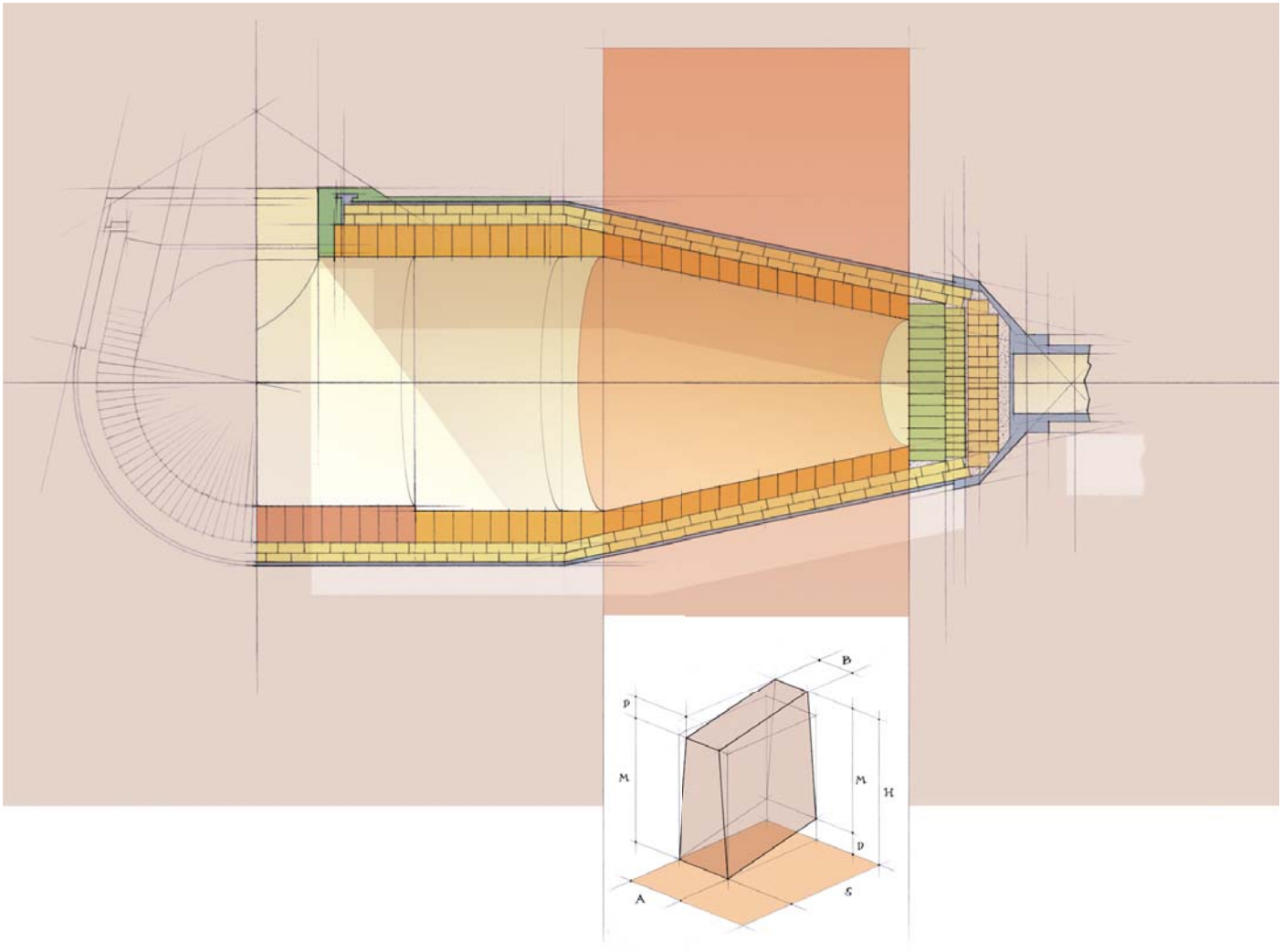


CONE RAMP SHAPES

Code	A (mm)	B (mm)	H (mm)	M (mm)	D (mm)	S (mm)	Angle (°)	Volume (dm^3)
1/62081	104	96	230	230	36,0	172	12	3,96
2/62081	112	88	230	230	36,0	172	12	3,96
1/62925	104	96	230	230	49,5	177	16	4,07
2/62925	112	88	230	230	49,5	177	16	4,07
3/62925	104	92	345	230	49,5	177	16	2,77
93M409/1	112	76	345	300	42,0	150	16	4,02
93M401/2	78	74	230	300	42,0	150	16	4,07
1/62840	88	64	230	230	65,0	172	20	3,01
2/62840	78	74	230	230	65,0	172	20	3,01
92M147/1	88	64	345	230	82,5	177	25	3,09
92M147/2	85	70	345	230	82,5	177	25	2,77
1/63960	85	60	345	250	97,4	186	30	4,30
2/63960	78	72	345	250	97,4	186	30	4,00

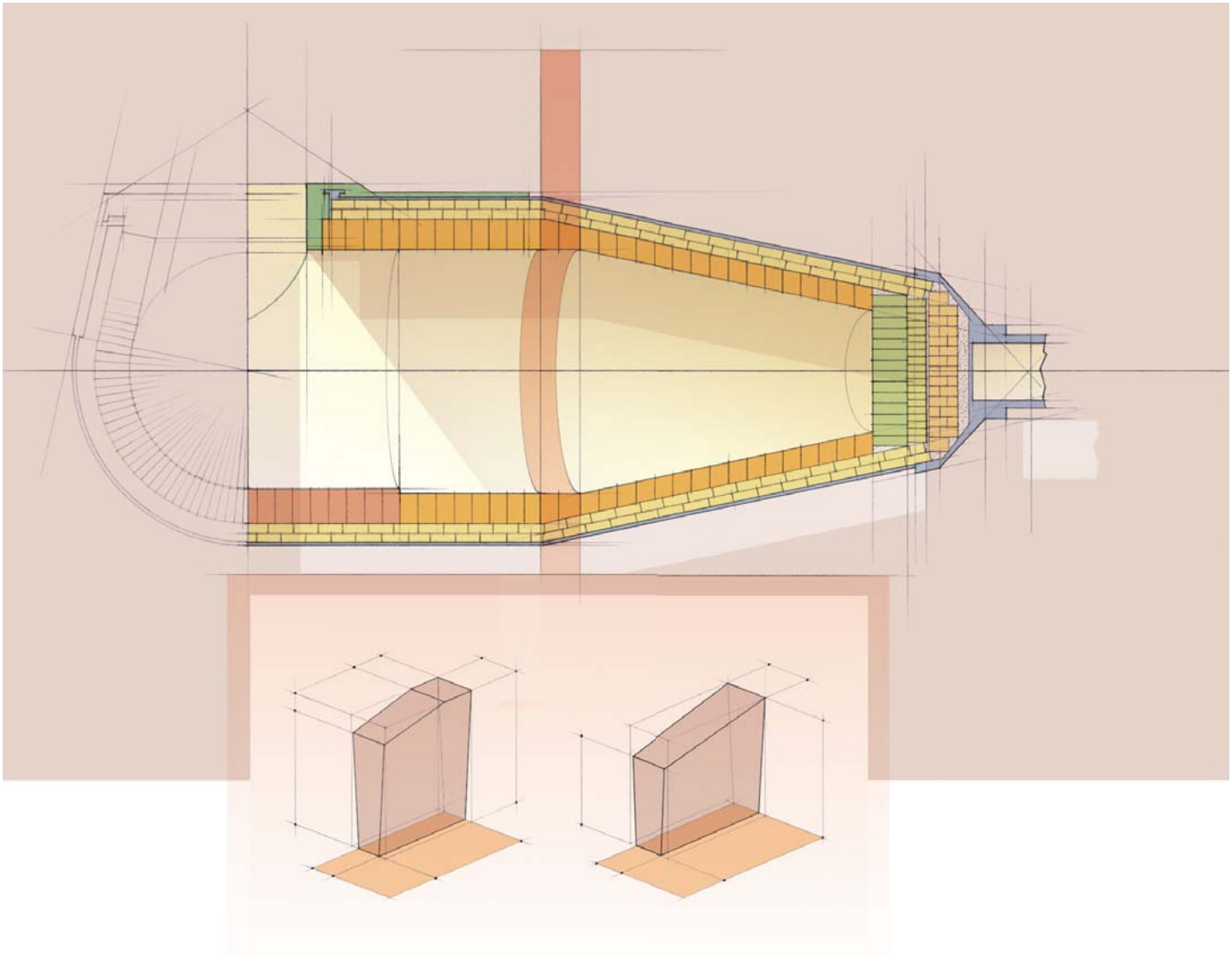
CONE-BARREL TRANSITION SPECIAL SHAPES

Code	A (mm)	B (mm)	H (mm)	S (mm)	Volume (dm^3)
93M251/1	86	66	345	254	6,35
93M251/2	84	66	304	320	6,49



MIRROR STRAIGHT SHAPES

Code	L (mm)	H (mm)	S (mm)	Volume (dm^3)
R65	230	115	65	1,98
R76	230	115	76	1,98
K76	230	172	76	1,98
K100	230	172	100	4,00
4P0	230	187	100	4,00
3/76	300	150	76	5,65
30/0	300	150	100	4,98
KL/76	345	172	76	5,69
3K100	345	172	100	6,70



Bricks for safety lining

PRODUCT		AF 23 I	AF 26	AFO 44 C	AL 50	AL 85 TCR
Main component		Chamotte		Andalusite	Andalusite Bauxite	Alumina Bauxite
CHEMICAL ANALYSIS (on raw materials oxides)						
Al_2O_3	%	45,5	46,0	47,5	49,0	88,0
SiO_2	%	50,0	50,0	47,5	47,0	5,0
Fe_2O_3	%	1,5	1,5	1,5	0,7	1,0
TiO_2	%	1,5	1,5	1,5	1,1	3,2
PHYSICAL PROPERTIES						
Refractoriness	SK	34	35	34	36	> 37
Density	Kg/dm^3	2,33	2,33	2,39	2,37	2,88
Apparent porosity	%	15,5	16,0	16,0	16,0	18,5
Cold crushing strenght	Kg/cm^2	550	500	900	600	1.000
Modulus of rupture at 1.500 °C	-	-	-	-	-	20
Refractoriness under load t 0,5	°C	1.430	1.430	1.390	1.450	1.480
Reversible expansion at a 1.000 °C	%	0,56	0,50	0,55	0,65	0,79
Thermal conductivity at 500 °C	W/mK	1,40	1,20	1,40	1,40	2,50
Thermal conductivity at 1.000 °C	W/mK	1,50	1,30	1,50	1,40	2,40

Bricks for wear lining

PRODUCT		ALCAR		
		65	90	90 S
Main component		ANDALUSITE	BAUXITE	
CHEMICAL ANALYSIS (on raw materials oxides)				
Al_2O_3	-	67,0	88,0	88,0
SiO_2	-	29,0	8,5	8,5
Fe_2O_3	%	1,3	1,1	1,0
TiO_2	-	1,8	2,4	2,2
PHYSICAL PROPERTIES				
Refractoriness	SK	> 37	> 37	> 37
Density	Kg/dm^3	2,62	2,75	2,79
Apparent porosity	%	18	19	20
Cold crushing strenght	Kg/cm^2	650	1.000	1.000
Modulus of rupture at 1.500 °C	-	15	28	32
Refractoriness under load t 0,5	°C	1.520	1.490	1.500
Reversible expansion at a 1.000 °C	%	0,76	0,77	0,78
Thermal conductivity at 500 °C	W/mK	1,2	2.9	3,0
Thermal conductivity at 1.000 °C	W/mK	1,2	2,7	2,8

PRODUCT		ALSICARBON							
		BC	70	70 KR	70 KA	75 KA	EBC	EBC S	05
Main component									
CHEMICAL ANALYSIS (on raw materials oxides)									
Al_2O_3	%	96,5	96,0	92,5	88,6	91,9	88,0	88,2	88,0
SiO_2		2,6	3,1	4,5	6,9	5,0	8,0	7,8	8,1
Fe_2O_3		0,1	0,1	0,6	0,5	0,4	1,0	0,9	1,0
SiC + C		+ 13,0	+ 22,0	+ 22,0	+ 13,5	+ 13,0	+ 13,0	+ 13,0	+ 8,5
Metallic addition	-	yes	yes	yes	yes	yes	yes	yes	yes
PHYSICAL PROPERTIES									
Refractoriness	SK	> 37	> 37	> 37	> 37	> 37	> 37	> 37	> 37
Density	Kg/dm^3	2,81	2,85	2,79	2,90	3,02	2,79	2,77	2,81
Apparent porosity	%	9,0	9,0	8,0	8,0	7,5	9,0	9,0	10,0
Cold crushing strenght	Kg/cm^2	400	400	400	400	400	400	420	400
Modulus of rupture	Kg/cm^2	150	150	150	150	150	150	150	150
Modulus of rupture at 1.500 °C	°C	70	75	75	-	75	70	-	80
Reversible expansion at a 1.000 °C	%	0,45	0,40	0,74	-	0,75	0,73	0,75	0,76
Thermal conductivity at 500 °C	W/mK	5,6	9,5	9,5	5,8	6,0	5,3	5,2	4,5
Thermal conductivity at 1.000 °C		4,8	8,5	8,5	5,0	5,2	4,6	4,5	3,7

PRODUCT		ANSICARBON		ALCARBON		
		E 3	58	06 T	07	635 A
Main component		ANDALUSITE ALLUMINA		ALLUMINA	BAUXITE	ANDALUSITE
CHEMICAL ANALYSIS (on raw materials oxides)						
Al_2O_3	%	45,5	46,0	47,5	49,0	88,0
SiO_2		50,0	50,0	47,5	47,0	5,0
Fe_2O_3		1,5	1,5	1,5	0,7	1,0
SiC + C		1,5	1,5	1,5	1,1	3,2
C		-	-	6,0	7,0	5,0
Metallic addition	-	yes	yes	no	no	no
PHYSICAL PROPERTIES						
Refractoriness	SK	> 37	> 37	> 40	> 37	> 37
Density	Kg/dm^3	2,84	2,78	2,99	2,85	2,66
Apparent porosity	%	8,0	9,0	8,0	7,0	6,0
Cold crushing strenght	Kg/cm^2	400	400	> 400	800	450
Modulus of rupture	Kg/cm^2	150	150	> 100	-	100
Modulus of rupture at 1.500 °C	°C	80	80	> 30	-	-
Reversible expansion at a 1.000 °C	%	0,75	0,80	0,70	0,75	-
Thermal conductivity at 500 °C	W/mK	5,8	7,0	3,8	4,2	2,0
Thermal conductivity at 1.000 °C		5,0	6,0	3,0	3,4	2,1

Cements

PRODUCT			Wet chemical bonded		Dry chemical bonded	Dry hydraulic bonded	Dry heat setting		
			BONDLOK		SINTBOND 80	ALSIBOND	CEM		
			KB	Z			72	90	906
Main component			Corundum		Bauxite	Corundum	Mullite	Bauxite	
				Chrome oxide	Corundum				
CHEMICAL ANALYSIS (on raw materials oxides)									
Al_2O_3	%	PRE R24	79,5	78,5	70,5	97,0	73,0	77,5	73,0
SiO_2	%	PRE R24	15,5	11,5	20,0	0,45	26	17,0	21,0
P_2O_5	%	PRE R24	3,2	3,2	1,4	-	-	-	-
Cr_2O_3	%	PRE R24	-	5	-	-	-	-	-
Alkali	%	PRE R24	-	-	1,4	-	-	-	-
PHYSICAL PROPERTIES									
Grain size max.	mm	PRE R25	0,2	0,2	0,5	0,2	0,2	0,5	1,0
Fraction < 0,063 mm min.	%	UN12231/ 2232	65	65	65	65	65	60	60
Refractoriness	Cono	ISR528	> 37	> 37	37	> 37	> 37	> 37	37
Bonding strenght after heating 24 h at 450°C	kg/cm²	(")	80	40	30	30	(110 °C) 30	(110 °C) 15	(110 °C) 18
5 h at 1.000°C	kg/cm²	-	90	100	10	20	-	-	-
5h at 1.400°C	kg/cm²	-	200	220	60	340	-	-	-
Water required	%	(")	-	-	16	20	23	30	31
Retentive time	min.	(")	> 1,0	> 2,0	1,5	1,0	> 21,0	> 2,0	> 2,0
Characteristics	-	-	Heat setting		Air setting		Heat setting		

Regular castables

PRODUCT			ALOCAST				
			F 44 LI	CH 55	CH 66	CH 98	CH 98 S
Main component			Fireclay		Bauxite Andalusite		Tabular alumina
CHEMICAL ANALYSIS (on raw materials oxides)							
Al_2O_3	%	PRE R24	51,0	55,0	72,0	91,0	94,5
SiO_2	%	PRE R24	38,5	39,0	20,0	3,0	0,5
Fe_2O_3	%	PRE R24	1,7	0,8	0,8	0,5	0,1
CaO	%	PRE R24	7,5	4,0	4.0	4,5	4,5
PHYSICAL PROPERTIES							
Max service temperature	°C	(**)	1.500	1.600	1.600	1.800	1.800
Quantity required	t/m^3	(**)	2,17	2,29	2,47	2,56	2,72
Water required	%	PRE R26	12	10	11	11	10
PERMANENT LINEAR CHANGE AFTER HEATING							
5 h at 1.000 °C	%	PRE R28	- 0,3	- 0,2	- 0,2	0,0	0,0
5 h at max. service temperature	%	PRE R28	1,5	2,0	- 0,8	- 0,8	- 0,5
BULK DENSITY AFTER HEATING							
24 h at 110 °C	gr/cm^3	PRE R9	2,24	2,36	2,55	2,64	2,78
5 h at 1.000 °C	gr/cm^3	PRE R9	2,09	2,34	2,50	2,59	2,73
5 h at max. service temperature	gr/cm^3	PRE R9	1,89	2,09	2,75	2,75	2,76
COLD CRUSHING STRENGHT AFTER HEATING							
24 h at 110 °C	kg/cm^2	PRE R28	850	570	420	580	600
5 h at 1.000 °C	kg/cm^2	PRE R28	400	350	350	500	500
5 h at max. service temperature	kg/cm^2	PRE R28	300	450	850	850	900
MODULUS OF ROPTURE AFTER HEATING							
24 h at 110 °C	Kg/cm^2	PRE R28	60	75	60	85	90
5 h at 1.000 °C	Kg/cm^2	PRE R28	20	30	20	60	70
5 h at max. service temperature	Kg/cm^2	PRE R28	60	100	75	120	130
THERMAL CONDUCTIVITY							
at 500 °C	W/mK	PRE R32	0,71	1,00	1,30	1,30	1,20
at 1.000 °C	W/mK	PRE R32	0,78	1,10	1,40	1,40	1,50
Characteristics			-	(*)		-	-
APPLICATION METHOD							
			Casting				

(*) available with steel needles added

(**) Internal method

PRODUCT			ALOCAST			
			LX 48	LX 58	LX 85	HTC 85
Main component			CHAMOTTE MULLITE	ANDALUSITE	BAUXITE	
CHEMICAL ANALYSIS (on raw materials oxides)						
Al_2O_3	%	PRE R24	51,5	59,0	84,0	84,5
SiO_2		PRE R24	44,0	37,0	11,0	10,5
Fe_2O_3		PRE R24	0,8	0,6	1,0	0,8
CaO		PRE R24	1,4	2,4	2,4	1,0
PHYSICAL PROPERTIES						
Max service temperature	°C	(*)	1.500	1.600	1.600	1.700
Quantity required	t/m_3	(*)	2,45	2,65	2,85	2,89
Water required	%	PRE R26	5,0 - 6,0	4,5 – 5,5	5,0	5,0
PERMANENT LINEAR CHANGE AFTER HEATING						
5 h at 1.000 °C	%	PRE R28	- 0,20	0,04	- 0,20	- 0,20
5 h at max. service temperature		PRE R28	0,2	0,6	1,6	0,7
BULK DENSITY AFTER HEATING						
24 h at 110 °C	gr/cm^3	PRE R9	2,24	2,36	2,55	2,64
5 h at 1.000 °C		PRE R9	2,09	2,34	2,50	2,59
5 h at max. service temperature		PRE R9	1,89	2,09	2,75	2,75
COLD CRUSHING STRENGHT AFTER HEATING						
24 h at 110 °C	kg/cm^2	PRE R28	1.000	1.300	1.300	950
5 h at 1.000 °C		PRE R28	1.000	900	1.200	1.500
5 h at max. service temperature		PRE R28	1.330	1.300	900	1.300
MODULUS OF ROPTURE AFTER HEATING						
24 h at 110 °C	Kg/cm^2	PRE R28	120	170	190	130
5 h at 1.000 °C		PRE R28	170	70	170	230
5 h at max. service temperature		PRE R28	120	100	140	110
THERMAL CONDUCTIVITY						
a 500 °C	W/mK	PRE R32	1,54	1,70	2,40	2,00
a 1.000 °C		PRE R32	1,48	1,80	2,20	2,10
Characteristics			available with steel needles added			
APPLICATION METHOD						
			Vibrating			

(**) Internal method

Special products

PRODUCT			ALOFLOW	ALOGUN
			LX 48	BF 525
Main component			Mullitic chamotte	
CHEMICAL ANALYSIS (on raw materials oxides)				
Al_2O_3	%	PRE R24	53,0	52,5
SiO_2		PRE R24	43,0	38,0
P_2O_5		PRE R24	0,7	0,6
Cr_2O_3		PRE R24	1,5	6,5
PHYSICAL PROPERTIES				
Granulometria massima	mm	-	6	6
Max service temperature	°C	(*)	1.500	1.500
Quantity required	t/m^3	(*)	2,40	2,06
Water required	%	-	7,0 ÷ 7,5	13,0 ÷ 15,0
PERMANENT LINEAR CHANGE AFTER HEATING				
24 h at 110 °C	%	PRE R28	-	-
5 h at 1.000 °C		PRE R28	+ 0,2	- 0,2
5 h at max. service temperature		PRE R28	- 0,2	+ 0,4
BULK DENSITY AFTER HEATING				
24 h at 110 °C	gr/cm^3	PRE R9	2,45	2,09
5 h at 1.000 °C		PRE R9	2,22	-
5 h at max. service temperature		PRE R9	2,41	-
COLD CRUSHING STRENGHT AFTER HEATING				
24 h at 110 °C	kg/cm^2	PRE R28	1.250	850
5 h at 1.000 °C		PRE R28	1.000	450
5 h at max. service temperature		PRE R28	1.350	650
MODULUS OF ROPTURE AFTER HEATING				
24 h at 110 °C	Kg/cm^2	PRE R28	120	65
5 h at 1.000 °C		PRE R28	165	30
5 h at max. service temperature		PRE R28	145	90
THERMAL CONDUCTIVITY				
at 500 °C	W/mK	PRE R32	1,51	0,90
at 1.000 °C		PRE R32	1,40	0,92
APPLICATION METHOD				
			Self flowing	Gunning

(*) Internal method

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