

RATH

emhart glass
SYSTEM

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REFRACTORY PARTS

for the glassmaking industry



METALS



CERAMICS



GLASS



SPECIAL
FURNACES



FUELS
CHEMICALS
ENERGY

top technology
creates confidence

RATH



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Refractories for glassmaking

RATH refractories are formulated from high purity, special oxide raw materials and manufactured with the properties necessary for the success of each specific glass making operation. In our laboratory, manufacturing, and quality operations, we bring together people, processes, and products to meet your needs. Our refractory craftsmen - most with at least a decade of experience - are the heart of our operation. They are supported by engineering and R&D professionals who emphasize innovative product development and individual customer solutions.

Time-honored craftsmanship, world-class innovation

RATH supplies precision-crafted refractory products designed for a wide range of applications:

- Glass containers
- Flat glass
- Television/monitor glass
- Fiberglass
- Art glass
- Hand glass
- Tableware
- Pressware

Quality driven Since 1891, RATH has been developing and manufacturing high quality refractories for the glass container industry. The Owensville plant is specialised in the production of glass pot refractories.

We understand that the basis of superior glass conditioning for all areas of the glass making industry is high quality refractories. Their use in forehearth and feeder mechanisms play crucial roles in the formation and conditioning of the glass prior to being formed into finished products. All RATH refractories are formulated from the highest quality raw materials and designed to achieve predictable density and resistance to erosion and corrosion. Precise PC monitoring of batching and kiln firing ensure the highest quality performance and service life.

Customer focus Our customer service team responds rapidly to provide knowledgeable assistance to help our customers eliminate downtime and maximize production efficiency. RATH continues to grow by serving the glass making industry with time-honored craftsmanship, world-class innovation, and service to customers.



Quality engineered feeder and refractory expendables RATH has earned a reputation for unsurpassed quality in refractories. As a flexible, well-staffed fabricator of premium refractory compositions, our goal is to service the individual requirements of each customer, no matter what type of glass they manufacture. What's more, we can provide a level of customized service normally unavailable from other refractories manufacturers.

RATH provides refractories and expendables for the Emhart Glass System, the global leading industry standard in glass manufacturing. For example, the patented 555 Feeder Mechanism includes a self-centering tube holder and orifice ring pans with engineered refractory rings for consistent quality and efficient production. Bucher Emhart Glass offers a full range of standard refractory shapes, and also manufactures unusual, complex, and small quantity shapes to the same exacting tolerances.

The industry's widest range of glass refractory expendable composition RATH continues to advance the state of the art in gob forming technology. One way we do this is by providing the industry's widest range of glass refractory expendable compositions. Our bonded compositions include alumina silicates, AZS, zircon, and fused silica. We offer the full range of shapes in industry standard compositions including 301, 315, 333, 311, 338, 345, and 357. For applications demanding customized compositions, our unrivaled research and development capabilities enable us to devise formulations to achieve specific customer objectives.



Forehearth and feeder products High quality refractories are crucial to proper conditioning of molten glass. RATH forehearth refractory components are designed for long life with predictable heat loss characteristics and resistance to thermal shock, erosion, and corrosion. The range of forehearth components includes both substructure and superstructure. We manufacture distributor shapes, alcovs, doglegs, and colorant sections, and a full range of feeder refractories, including spouts, tubes, plungers, and orifice rings. Feeder refractories are available in a variety of materials to address each customer's individual needs.

Exclusive refractory products for the hand glass industry

The ability to match our proprietary mixes to our customers' melt and firing needs has enabled RATH Owensville to serve a wide spectrum of glass industries. Today, RATH is a leading manufacturer and supplier of glass house crucibles, used exclusively in hand glass shops throughout the world. This highly specialized product line demands meticulous craftsmanship. We manufacture a wide variety of shapes and sizes, ranging from one pound glass capacity open crucibles to closed pots with 500 pound glass capacity. RATH also offers a complete line of refractory accessories designed specifically for the hand glass industry.



Removal of a refractory furnace liner from the mold.



Filling orifice ring molds.



Finish work on green burner blocks prior to entering the drying room.



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Orifice rings and gaskets



Excellent thermal shock resistance, accurate shapes

The complex and precise shape of orifice rings places special demands on the refractory material. In service, orifice rings must be able to deliver good thermal shock resistance and corrosion resistance to preserve their accurate shape.

RATH's 311 and 345 materials contain 91% and 83% Al_2O_3 , respectively. Both are high purity materials, specifically designed for the fabrication of complex shapes.

They are designed with a close grained structure that provides the necessary corrosion resistance to complement their thermal shock resistance. They have proven an excellent choice for shops with frequent job changes. In applications where extended orifice ring life is desired, RATH's 314 and 315, bonded AZS materials containing 20% ZrO_2 , provide excellent performance.



Orifice rings

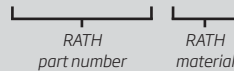
Material data		
	311	314
ZrO ₂	-	20
Al ₂ O ₃	91	69
SiO ₂	9	11
Density (g/cc)	2.6	3.0
Porosity (%)	23	24
MOR (MPa)	16.5	15.9
Type	Pressed	Pressed

Additional materials available upon request. Please contact your nearest RATH representative for assistance.

All data is subject to reasonable deviations and not to be used for specification purposes.

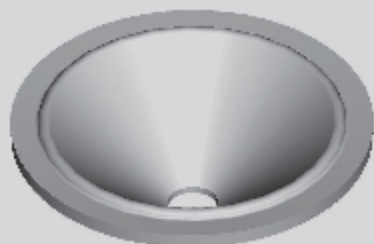
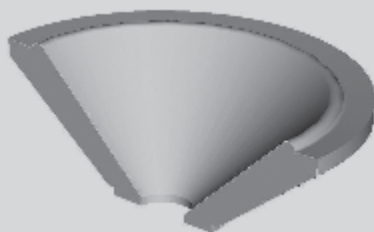
Refractory part numbers

123-4567 - 3XX



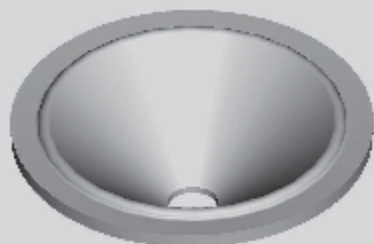
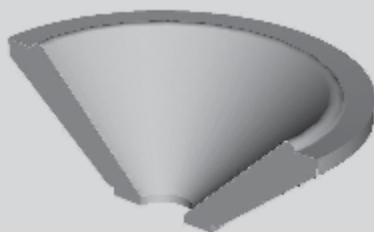
For special applications, alternative refractory materials are available. Please contact your nearest RATH representative.

5" Spout Single Gob Orifice Rings



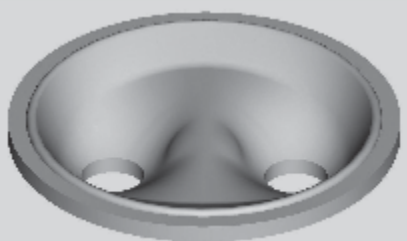
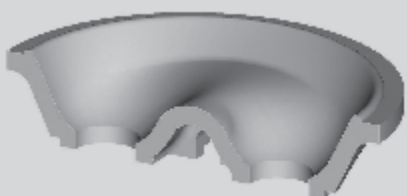
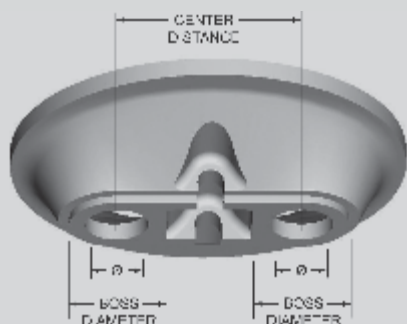
Orifice Diameter Ø		Part #	Ring Holder Part #	Boss Diameter
in.	mm			
5/16	8	144-15340-3XX		
11/32	9	144-15341-3XX		
3/8	10	144-15342-3XX		
13/32	10.3	144-15343-3XX		
7/16	11	144-15344-3XX		
15/32	12	144-15345-3XX		
1/2	13	144-15346-3XX		
17/32	13.5	144-15347-3XX		
9/16	14	144-15348-3XX	Carbon Steel	2"
19/32	15	144-15349-3XX	144-1333	(51 mm)
5/8	16	144-15350-3XX		
21/32	16.7	144-15351-3XX	Stainless Steel	
11/16	17	144-15352-3XX	144-14363	
23/32	18	144-15353-3XX		
3/4	19	144-15354-3XX		
25/32	20	144-15355-3XX		
13/16	21	144-15356-3XX		
27/32	21.4	144-15357-3XX		
7/8	22	144-15358-3XX		
29/32	23	144-15359-3XX		
15/16	24	144-15360-3XX		
31/32	24.6	144-15361-3XX		KS-144-15565
1	25	144-15362-3XX		
1 1/16	27	144-15363-3XX		
1 1/8	29	144-15364-3XX		
1 3/16	30	144-15365-3XX		
1 1/4	32	144-15366-3XX		
1 5/16	33	144-15367-3XX		
1 3/8	35	144-15368-3XX	Carbon Steel	3"
1 7/16	37	144-15369-3XX	144-1337	(76 mm)
1 1/2	38	144-15370-3XX		
1 9/16	40	144-15371-3XX	Stainless Steel	
1 5/8	41	144-15372-3XX	144-14365	
1 11/16	43	144-15373-3XX		
1 3/4	44	144-15374-3XX		
1 13/16	46	144-15375-3XX		
1 7/8	48	144-15376-3XX		
1 15/16	49	144-15377-3XX		KS-144-15566

5" Spout Single Gob Orifice Rings



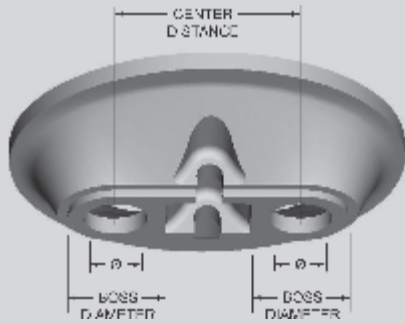
Orifice Diameter Ø		Part #	Ring Holder Part #	Boss Diameter
in.	mm			
2	52	144-15378-3XX		
2 ¹ / ₁₆	52	144-15379-3XX		
2 ¹ / ₈	54	144-15380-3XX		
2 ³ / ₁₆	56	144-15381-3XX		
2 ¹ / ₄	57	144-15382-3XX		
2 ⁵ / ₁₆	59	144-15383-3XX		
2 ³ / ₈	60	144-15384-3XX	Carbon Steel	4"
2 ⁷ / ₁₆	62	144-15385-3XX	144-1341	(102 mm)
2 ¹ / ₂	64	144-15386-3XX		
2 ⁹ / ₁₆	65	144-15387-3XX	Stainless Steel	
2 ⁵ / ₈	67	144-15388-3XX	144-14367	
2 ¹¹ / ₁₆	68	144-15389-3XX		
2 ³ / ₄	70	144-15390-3XX		
2 ¹³ / ₁₆	71	144-15391-3XX		
2 ⁷ / ₈	73	144-15392-3XX		
2 ¹⁵ / ₁₆	75	144-15393-3XX		KS-144-15567
3	76	144-15394-3XX		
3 ¹ / ₁₆	78	144-15395-3XX		
3 ¹ / ₈	79	144-15396-3XX		
3 ³ / ₁₆	81	144-15397-3XX		
3 ¹ / ₄	83	144-15398-3XX		
3 ⁵ / ₁₆	84	144-15399-3XX		
3 ³ / ₈	86	144-15400-3XX		
3 ⁷ / ₁₆	87	144-15401-3XX		
3 ¹ / ₂	89	144-15402-3XX		
3 ⁹ / ₁₆	90	144-15403-3XX		
3 ⁵ / ₈	92	144-15404-3XX	Carbon Steel	5 ¹ / ₂ "
3 ¹¹ / ₁₆	94	144-15405-3XX	144-10330	(140 mm)
3 ³ / ₄	95	144-15406-3XX		
3 ¹³ / ₁₆	97	144-15407-3XX	Stainless Steel	
3 ⁷ / ₈	98	144-15408-3XX	144-14370	
3 ¹⁵ / ₁₆	100	144-15409-3XX		
4	102	144-15410-3XX		
4 ¹ / ₁₆	103	144-15411-3XX		
4 ¹ / ₈	105	144-15412-3XX		
4 ³ / ₁₆	106	144-15413-3XX		
4 ¹ / ₄	108	144-15414-3XX		
4 ⁵ / ₁₆	110	144-15415-3XX		
4 ³ / ₈	111	144-15416-3XX		
4 ⁷ / ₁₆	113	144-15417-3XX		
4 ¹ / ₂	114	144-15418-3XX		KS-144-15568

5" Spout Double Gob Orifice Rings - 3" center distance



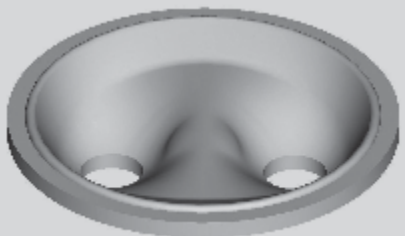
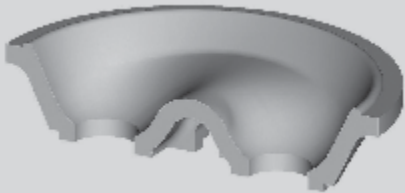
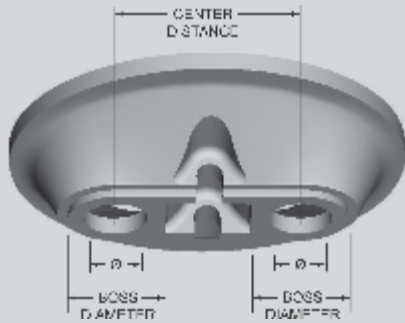
Orifice Diameter Ø		Part #	Ring Holder Part #	Boss Diameter
in.	mm			
3/8	10	81-3848-3XX		
7/16	11	81-3849-3XX		
15/32	12	81-3850-3XX		
1/2	13	81-3851-3XX	Carbon Steel	1 1/4"
17/32	13.5	81-3852-3XX	81-309-1	(32 mm)
9/16	14	81-3853-3XX		
19/32	15	81-3854-3XX	Stainless Steel	
5/8	16	81-3855-3XX	81-297-1	
21/32	16.7	81-3856-3XX		
11/16	17	81-3857-3XX		KS-81-4463
23/32	18	81-3858-3XX		
3/4	19	81-3859-3XX		
25/32	20	81-3860-3XX		
13/16	21	81-3861-3XX	Carbon Steel	
27/32	21.4	81-3862-3XX	81-309-2	1 1/2"
7/8	22	81-3863-3XX		(38 mm)
29/32	23	81-3864-3XX	Stainless Steel	
15/16	24	81-3865-3XX	81-297-2	
31/32	24.6	81-3866-3XX		
1	25	81-3867-3XX		KS-81-4464
1 1/16	27	81-3868-3XX	Carbon Steel	
1 1/8	29	81-3869-3XX	81-309-3	1 3/4"
1 3/16	30	81-3870-3XX	Stainless Steel	(44 mm)
1 1/4	32	81-3871-3XX	81-297-3	KS-81-4465
15/16	33	81-3872-3XX	Carbon Steel	
1 3/8	35	81-3873-3XX	81-309-4	
17/16	37	81-3874-3XX		2"
1 1/2	38	81-3875-3XX	Stainless Steel	(51 mm)
19/16	40	81-3876-3XX	81-297-4	
1 5/8	41	81-3877-3XX		KS-81-4466
1 11/16	43	81-3878-3XX	Carbon Steel	
1 3/4	44	81-3879-3XX	81-309-5	2 3/16"
1 13/16	46	81-3880-3XX	Stainless Steel	(56 mm)
			81-297-5	KS-81-4467
17/8	48	81-3881-3XX	Carbon Steel	
1 15/16	49	81-3882-3XX	81-309-6	2 3/8"
2	51	81-3883-3XX	Stainless Steel	(60 mm)
2 1/16	52	81-3884-3XX	81-297-6	KS-81-4468

5" Spout Double Gob Orifice Rings - 3" center distance



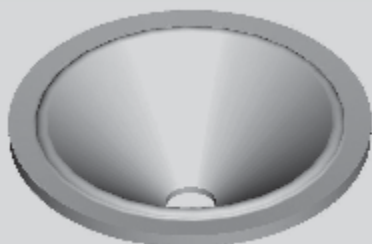
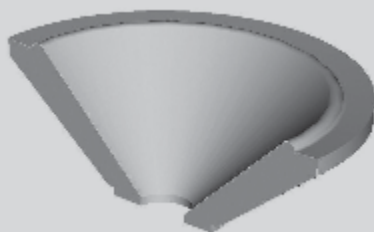
Orifice Diameter Ø		Part #	Ring Holder	Boss
in.	mm		Part #	Diameter
2 1/8	54	81-3885-3XX	Carbon Steel	2 7/16"
2 3/16	56	81-3886-3XX	Stainless Steel	(62 mm)
			81-297-7	KS-81-4469

5" Spout Double Gob Orifice Rings - Cooling slots - 2 7/8" center distance



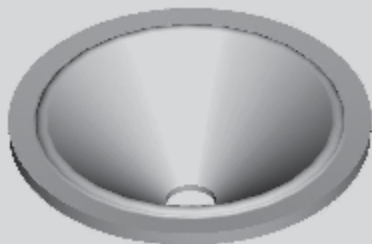
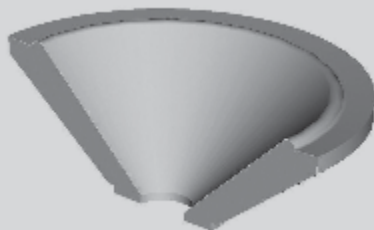
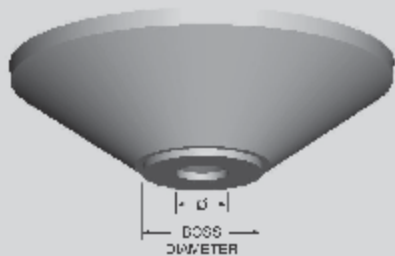
Orifice Diameter Ø		Part #	Boss	
in.	mm		Diameter	
23/32	18	81-3044-3XX	1 1/2" (38 mm)	
3/4	19	81-3045-3XX		
25/32	20	81-3084-3XX		
13/16	21	81-3046-3XX		
27/32	21,4	81-3085-3XX		
7/8	22	81-3047-3XX		
29/32	23	81-3086-3XX		
15/16	24	81-3048-3XX		
31/32	24,6	81-3087-3XX		
1	25	81-3049-3XX		
1 1/8	29	501-9223-3XX	KS501-9697	
1 1/16	27	501-9272-3XX	2" (51 mm)	
1 1/8	29	501-9138-3XX		
1 5/16	33	81-2919-3XX		
1 3/8	35	81-2845-3XX		
1 7/16	37	81-2846-3XX		
1 1/2	38	81-2622-3XX		
1 9/16	40	81-2847-3XX		
1 5/8	41	81-2848-3XX		
1 3/4	44	81-2850-3XX		KS501-9679
1 1/16	27	81-3050-3XX		1 3/4" (44 mm)
1 1/8	29	81-3051-3XX		
1 3/16	30	81-2921-3XX		
1 1/4	32	81-2920-3XX	KS501-9701	

7" Spout Single Gob Orifice Rings



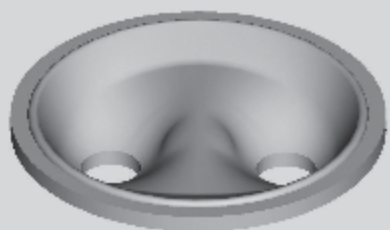
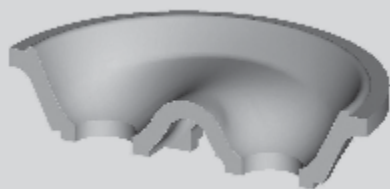
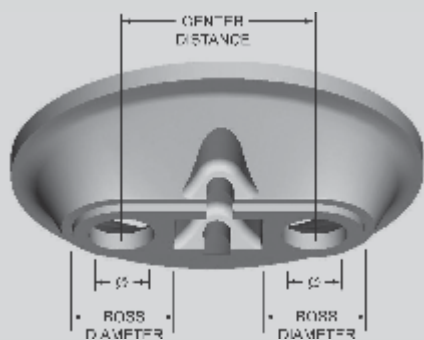
Orifice Diameter Ø			Ring Holder Part #	Boss Diameter
in.	mm	Part #		
1/2	13	58-3012-3XX	194-87-1	2 13/16" (71 mm)
9/16	14	58-3013-3XX		
5/8	16	58-3014-3XX		
11/16	17	58-3015-3XX		
3/4	19	58-3016-3XX		
13/16	21	58-3017-3XX		KS-58-3177
7/8	22	58-3018-3XX	194-87-2	3" (76 mm)
15/16	24	58-3019-3XX		
1	25	58-3020-3XX		
1 1/16	27	58-3021-3XX		
1 1/8	29	58-3022-3XX		
1 3/16	30	58-3023-3XX		KS-58-3178
1 1/4	32	58-2662-3XX	194-87-3	3 1/4" (83 mm)
1 5/16	33	58-3041-3XX		
1 3/8	35	58-2663-3XX		
1 7/16	37	58-2949-3XX		
1 1/2	38	58-2664-3XX		
1 9/16	40	58-2950-3XX		KS-58-3179
1 5/8	41	58-2665-3XX	194-87-4	3 1/2" (89 mm)
1 11/16	43	58-2951-3XX		
1 3/4	44	58-2666-3XX		
1 13/16	46	58-2952-3XX		
1 7/8	48	58-2667-3XX		
1 15/16	49	58-2953-3XX		KS-58-3180
2	51	58-2525-3XX	194-87-5	4" (102 mm)
2 1/16	52	58-2954-3XX		
2 1/8	54	58-2526-3XX		
2 3/16	56	58-2955-3XX		
2 1/4	57	58-2527-3XX		
2 5/16	59	58-2956-3XX		KS-58-3181
2 3/8	60	58-2528-3XX		
2 7/16	62	58-3158-3XX		
2 1/2	63	58-2529-3XX	194-87-6	4 3/8" (111 mm)
2 9/16	65	58-3159-3XX		
2 5/8	67	58-2530-3XX		
2 11/16	68	58-3160-3XX		
2 3/4	70	58-2531-3XX		
2 13/16	71	58-3161-3XX		KS-58-3182
2 7/8	73	58-2532-3XX		
2 15/16	75	58-3162-3XX		

7" Spout Single Gob Orifice Rings



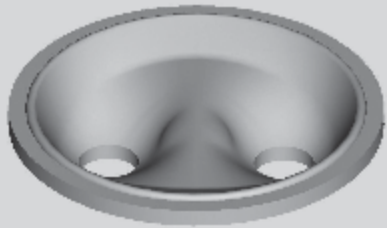
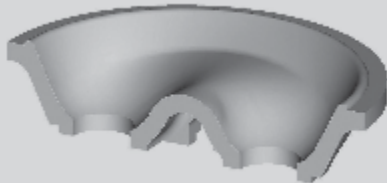
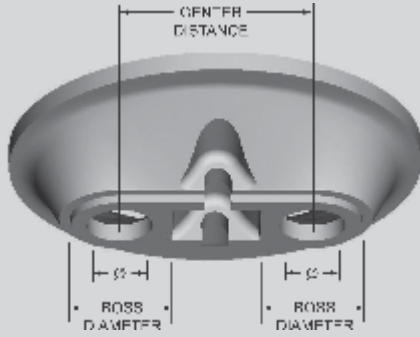
Orifice Diameter Ø		Part #	Ring Holder Part #	Boss Diameter
in.	mm			
3	76	58-2533-3XX	194-87-7	4¾" (121 mm) KS-58-3183
3¼	78	58-3163-3XX		
3½	79	58-2534-3XX		
3¾	81	58-3164-3XX		
3⅞	83	58-2535-3XX		
4	86	58-2536-3XX		
4½	89	58-2537-3XX	194-87-8	5⅛" (130 mm) KS-58-3184
4⅝	92	58-2538-3XX		
4¾	95	58-2539-3XX		
4⅞	98	58-2540-3XX		
4	102	58-2541-3XX	194-87-9	5⅝" (143 mm) KS-58-3185
4⅛	105	58-2542-3XX		
4¼	108	58-2543-3XX		
4⅜	111	58-2544-3XX		
4½	114	58-2545-3XX	194-87-10	6¼" (154 mm) KS-58-3186
4⅝	117	58-2546-3XX		
4¾	121	58-2547-3XX		
4⅞	124	58-2548-3XX		
5	127	58-2549-3XX	194-87-11	6½" (165 mm) KS-58-3187
5⅛	130	58-2550-3XX		
5¼	133	58-2551-3XX		
5⅜	137	58-2552-3XX		
5½	140	58-2553-3XX	194-87-12	6⅝" (176 mm) KS-58-3188
5⅝	143	58-2554-3XX		
5¾	146	58-2555-3XX		
5⅞	149	58-2556-3XX		
6	152	58-2557-3XX	194-87-13	7⅜" (187 mm) KS-58-3189
6⅛	156	58-2558-3XX		
6¼	159	58-2559-3XX		
6⅜	162	58-2560-3XX		
6½	165	58-2561-3XX		

7" Spout Double Gob Orifice Rings - 3" center distance



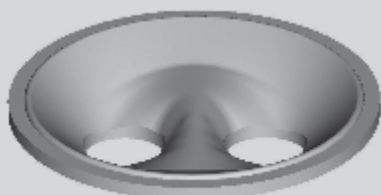
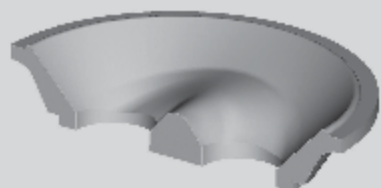
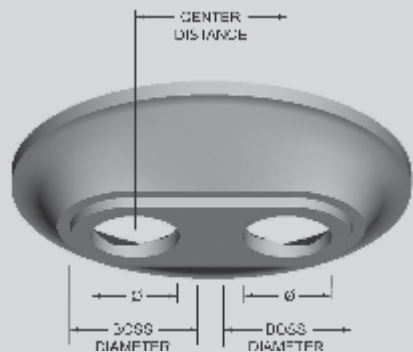
Orifice Diameter Ø		Part #	Ring Holder Part #	Boss Diameter
in.	mm			
3/8	10	81-3815-3XX	194-141-1	1 1/4" (32 mm)
7/16	11	81-3816-3XX		
1/2	13	81-3817-3XX		
9/16	14	81-3818-3XX		
5/8	16	81-3819-3XX		
11/16	17	81-3820-3XX		KS-81-3814
3/4	19	81-3821-3XX	194-74-2	1 1/2" (38 mm)
13/16	21	81-3822-3XX		
7/8	22	81-3823-3XX		
15/16	24	81-3824-3XX		
1	25	81-3825-3XX		KS-81-3814
1 1/16	27	81-3826-3XX	194-74-3	1 3/4" (44 mm)
1 1/8	29	81-3827-3XX		
1 3/16	30	81-3828-3XX		
1 1/4	32	81-3829-3XX		KS-81-3814
1 5/16	33	81-3830-3XX	194-74-4	2" (51 mm)
1 3/8	35	81-3831-3XX		
1 7/16	37	81-3832-3XX		
1 1/2	38	81-3833-3XX		
1 9/16	40	81-3834-3XX		
1 5/8	41	81-3835-3XX		
1 11/16	43	81-3836-3XX		KS-81-3814
1 3/4	44	81-3837-3XX	194-74-5	2 3/16" (56 mm)
1 13/16	46	81-3838-3XX		
1 7/8	48	81-3839-3XX		KS-81-3814
1 15/16	49	81-3840-3XX	194-74-6	2 1/4" (57 mm)
2	51	81-3841-3XX		
2 1/16	52	81-3842-3XX		
2 1/8	54	81-3843-3XX		
				KS-81-3814

7" Spout Double Gob Orifice Rings - 4 3/8" center distance



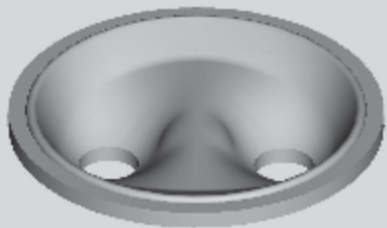
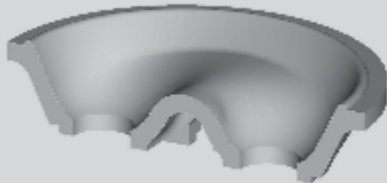
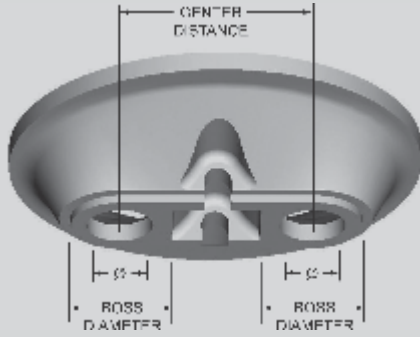
Orifice Diameter Ø			Ring Holder	Boss
in.	mm	Part #	Part #	Diameter
1/2	13	194-5588-3XX		
9/16	14	194-5589-3XX		
5/8	16	194-5590-3XX		
11/16	17	194-5591-3XX		
3/4	19	194-5592-3XX		
13/16	21	194-5593-3XX	194-141-1	1 3/4" (44 mm)
7/8	22	194-5594-3XX		
15/16	24	194-5595-3XX		
1	25	194-5596-3XX		
1 1/16	27	194-5597-3XX		
1 1/8	29	194-5598-3XX		
1 3/16	30	194-5599-3XX		KS-194-5665
1 1/4	32	194-5600-3XX		
1 5/16	33	194-5601-3XX		
1 3/8	35	194-5602-3XX		
1 7/16	37	194-5603-3XX		
1 1/2	38	194-5604-3XX		
1 9/16	40	194-5605-3XX		
1 5/8	41	194-5606-3XX		
1 11/16	43	194-5607-3XX		
1 3/4	44	194-5608-3XX		
1 13/16	46	194-5609-3XX		
1 7/8	48	194-5610-3XX	194-141-2	3" (76 mm)
1 15/16	49	194-5611-3XX		
2	51	194-5612-3XX		
2 1/16	52	194-5613-3XX		
2 1/8	54	194-5614-3XX		
2 3/16	56	194-5615-3XX		
2 1/4	57	194-5616-3XX		
2 5/16	59	194-5617-3XX		
2 3/8	60	194-5618-3XX		
2 7/16	62	194-5619-3XX		
2 1/2	64	194-5620-3XX		
2 9/16	65	194-5621-3XX		KS-194-5666
2 5/8	67	194-5622-3XX		
2 11/16	68	194-5623-3XX		3 3/8" (86 mm)
2 3/4	70	194-5624-3XX	194-141-3	
2 13/16	71	194-5625-3XX		
2 7/8	73	194-5626-3XX		KS-194-5667

7" Spout Double Gob Orifice Rings - Solid bridge - 4 3/8" center distance



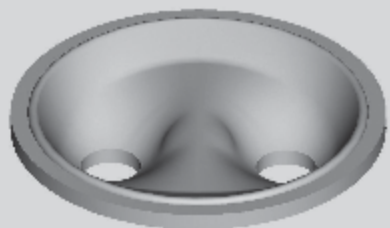
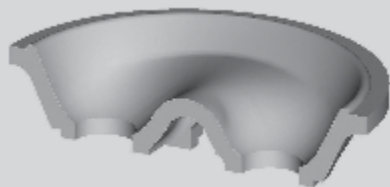
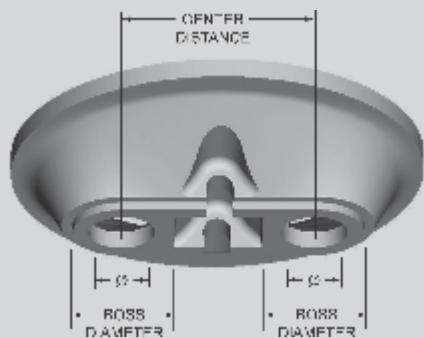
Orifice Diameter Ø			Ring Holder	Boss	
in.	mm	Part #	Part #	Diameter	
1/2	13	194-5687-3XX	194-141-1	1 3/4" (44 mm)	
9/16	14	194-5688-3XX			
5/8	16	194-5689-3XX			
11/16	17	194-5690-3XX			
3/4	19	194-5691-3XX			
13/16	21	194-5692-3XX			
7/8	22	194-5693-3XX			
15/16	24	194-5694-3XX			
1	25	194-5695-3XX			
1 1/16	27	194-5696-3XX			
1 1/8	29	194-5697-3XX			
1 3/16	30	194-5698-3XX			KS-501-6467
1 1/4	32	194-5699-3XX			194-141-2
1 5/16	33	194-5700-3XX			
1 3/8	35	194-5701-3XX			
1 7/16	37	194-5702-3XX			
1 1/2	38	194-5703-3XX			
1 9/16	40	194-5704-3XX			
1 5/8	41	194-5705-3XX			
1 11/16	43	194-5706-3XX			
1 3/4	44	194-5707-3XX			
1 13/16	46	194-5708-3XX			
1 7/8	48	194-5709-3XX			
1 15/16	49	194-5710-3XX			
2	51	194-5711-3XX			
2 1/16	52	194-5712-3XX			
2 1/8	54	194-5713-3XX			
2 3/16	56	194-5714-3XX			
2 1/4	57	194-5715-3XX			
2 5/16	59	194-5716-3XX			
2 3/8	60	194-5717-3XX			
2 7/16	62	194-5718-3XX			
2 1/2	64	194-5719-3XX			
2 9/16	65	194-5720-3XX	KS-501-6184		
2 5/8	67	194-5721-3XX	194-141-3	3 3/8" (86 mm)	
2 11/16	68	194-5722-3XX			
2 3/4	70	194-5723-3XX			
2 13/16	71	194-5724-3XX			
2 7/8	73	194-5725-3XX			
2 15/16	75	194-5726-3XX			KS-501-6468

8" Spout Double Gob Orifice Rings - Cooling slots - 4³/₈" center distance



Orifice Diameter Ø		Part #	Boss Diameter
in.	mm		
3/4	19	144-21818-3XX	2 1/4" (57 mm) Raised boss
13/16	21	144-21819-3XX	
7/8	22	144-21820-3XX	
15/16	24	144-21821-3XX	
1	25	144-21822-3XX	
1 1/16	27	144-21823-3XX	
1 1/8	29	144-21824-3XX	
1 3/16	30	144-21825-3XX	
1 1/4	32	144-21826-3XX	
1 5/16	33	144-21827-3XX	
1 3/8	35	144-21828-3XX	
1 7/16	37	144-21829-3XX	
1 1/2	38	144-21832-3XX	
1 9/16	40	144-21833-3XX	
1 5/8	41	144-21834-3XX	
KS-144-21817			
1/2	13	81-4959-3XX	2 1/4" (57 mm)
9/16	14	81-4960-3XX	
5/8	16	81-4961-3XX	
11/16	17	81-4962-3XX	
3/4	19	81-4963-3XX	
13/16	21	81-4964-3XX	
7/8	22	81-4965-3XX	
15/16	24	81-4966-3XX	
1	25	81-4967-3XX	
1 1/16	27	81-4968-3XX	
1 1/8	29	81-4969-3XX	
1 3/16	30	81-4970-3XX	
1 1/4	32	81-4971-3XX	
1 5/16	33	81-4972-3XX	
1 3/8	35	81-4973-3XX	
1 7/16	37	81-4974-3XX	
1 1/2	38	81-4975-3XX	
1 9/16	40	81-4976-3XX	
1 5/8	41	81-4977-3XX	
1 3/4	44	81-4978-3XX	
KS-81-4983			

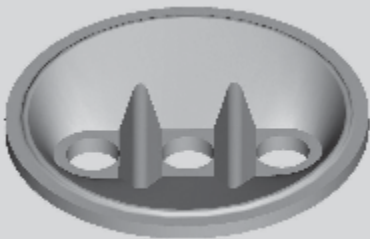
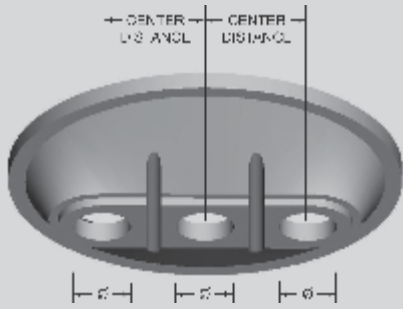
8" Spout Double Gob Orifice Rings - Cooling slots - 4 3/8" center distance



Orifice Diameter Ø		Part #	Boss Diameter
in.	mm		
1 ¹³ / ₁₆	46	81-4986-3XX	3 1/2" (89 mm)
1 ⁷ / ₈	48	81-4987-3XX	
1 ¹⁵ / ₁₆	49	81-4988-3XX	
2	51	81-4989-3XX	
2 ¹ / ₁₆	52	81-4990-3XX	
2 ¹ / ₈	54	81-4991-3XX	
2 ³ / ₁₆	56	81-4992-3XX	
2 ¹ / ₄	57	81-4993-3XX	
2 ⁵ / ₁₆	59	81-4994-3XX	
2 ³ / ₈	60	81-4995-3XX	
2 ⁷ / ₁₆	62	81-4996-3XX	
2 ¹ / ₂	64	81-4997-3XX	
2 ⁹ / ₁₆	65	81-4998-3XX	
2 ⁵ / ₈	67	81-4999-3XX	
2 ³ / ₄	70	81-5000-3XX	
2 ¹³ / ₁₆	71	81-5001-3XX	
2 ¹⁵ / ₁₆	75	81-5002-3XX	

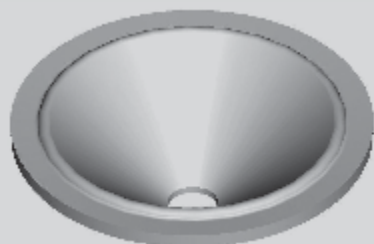
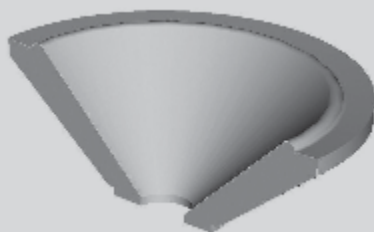
KS-81-4985

8" Spout Triple Gob Orifice Rings - Cooling slots - 3" center distance



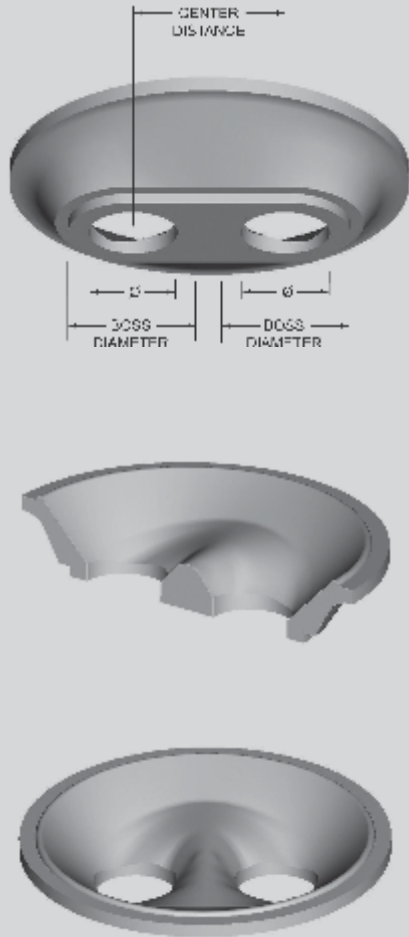
Orifice Diameter Ø			Ring Holder	Boss	
in.	mm	Part #	Part #	Diameter	
3/8	10	144-15093-3XX	144-21568-1	1 1/2" (38 mm)	
7/16	11	144-15094-3XX			
1/2	13	144-15095-3XX			
9/16	14	144-15096-3XX			
5/8	16	144-15097-3XX			
11/16	17	144-15098-3XX			
3/4	19	144-15099-3XX			
13/16	21	144-15100-3XX			
7/8	22	144-15101-3XX			KS-144-15092
15/16	24	81-6331-3XX			144-21568-2
1	25	81-6332-3XX			
1 1/16	27	81-6333-3XX			
1 1/8	29	81-6334-3XX			
1 3/16	30	81-6335-3XX			
1 1/4	32	81-6336-3XX			
1 5/16	33	81-6337-3XX			
1 3/8	35	81-6338-3XX			
1 7/16	37	81-6339-3XX			
1 1/2	38	81-6329-3XX	KS-81-6330		

10" Spout Single Gob Orifice Rings



Orifice Diameter Ø		Part #	Ring Holder Part #	Boss Diameter
in.	mm			
1	25	501-6344-3XX		
1 ¹ / ₈	29	501-9069-3XX		
1 ³ / ₁₆	30	501-9068-3XX		
1 ¹ / ₄	32	501-6345-3XX		
1 ³ / ₈	35	503-5815-3XX		
1 ⁷ / ₁₆	37	503-9304-3XX		
1 ¹ / ₂	38	503-5816-3XX		
1 ⁵ / ₈	41	503-5817-3XX		
1 ³ / ₄	44	503-5662-3XX	555-252-1	4"
1 ¹³ / ₁₆	46	503-5663-3XX	Cast Stainless	(102 mm)
1 ⁷ / ₈	48	503-5664-3XX	Steel	
1 ¹⁵ / ₁₆	49	503-5665-3XX		
2	51	503-5666-3XX		
2 ¹ / ₁₆	52	503-5667-3XX		
2 ¹ / ₈	54	503-5668-3XX		
2 ³ / ₁₆	56	503-5669-3XX		
2 ¹ / ₄	57	503-5670-3XX		
2 ⁵ / ₁₆	59	503-5671-3XX		
2 ³ / ₈	60	503-5672-3XX		
2 ⁷ / ₁₆	62	503-5673-3XX		
2 ¹ / ₂	64	503-5674-3XX		
2 ⁹ / ₁₆	65	503-5675-3XX		KS-503-6388
2 ⁵ / ₈	67	503-5676-3XX		
2 ¹¹ / ₁₆	68	503-5677-3XX		
2 ³ / ₄	70	503-5678-3XX		
2 ¹³ / ₁₆	71	503-5679-3XX		
2 ⁷ / ₈	73	503-5680-3XX		
2 ¹⁵ / ₁₆	75	503-5681-3XX		
3	76	503-5682-3XX		
3 ¹ / ₁₆	78	503-5683-3XX	555-252-2	4 ³ / ₄ "
3 ¹ / ₈	79	503-5684-3XX	Cast Stainless	(121 mm)
3 ³ / ₁₆	81	503-5685-3XX	Steel	
3 ¹ / ₄	83	503-5686-3XX		
3 ⁵ / ₁₆	84	503-5687-3XX		
3 ³ / ₈	86	503-5688-3XX		
3 ⁷ / ₁₆	87	503-5689-3XX		
3 ¹ / ₂	89	501-6109-3XX		
3 ⁵ / ₈	92	501-9275-3XX		
3 ³ / ₄	95	501-6193-3XX		
4	102	501-6110-3XX		KS-503-6389

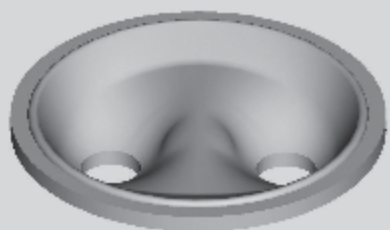
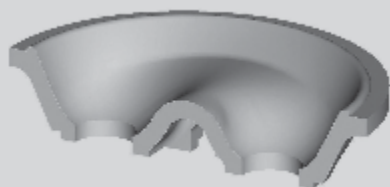
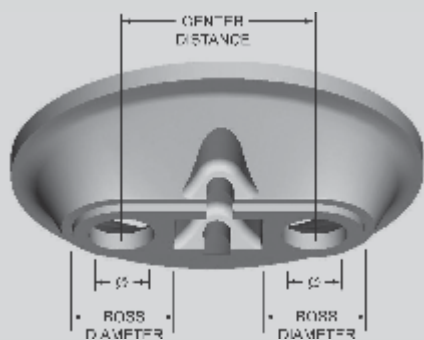
10" Spout Double Gob Orifice Rings - Solid Bridge - 4³/₈" center distance



Orifice Diameter Ø			Ring Holder	Boss
in.	mm	Part #	Part #	Diameter
7/8	22	501-9109-3XX		
1	25	503-6574-3XX		
1 1/16	27	503-6575-3XX		
1 1/8	29	503-6576-3XX		
1 3/16	30	503-6577-3XX		
1 1/4	32	503-6578-3XX		
1 5/16	33	503-6579-3XX		
1 3/8	35	503-6580-3XX		
1 7/16	37	503-6581-3XX		
1 1/2	38	503-6582-3XX		
1 9/16	40	503-6583-3XX		
1 5/8	41	503-6584-3XX		
1 11/16	43	503-6585-3XX		
1 3/4	44	503-6586-3XX		
1 13/16	46	503-6587-3XX		
1 7/8	48	503-6588-3XX		
1 15/16	49	503-6589-3XX	555-252-9	3 3/4"
2	51	503-6590-3XX	Cast Stainless	(95 mm)
2 1/16	52	503-6591-3XX	Steel	wide x
2 1/8	54	503-6592-3XX		8 1/8"
2 3/16	56	503-6593-3XX		(206 mm)
2 1/4	57	503-6594-3XX		long
2 5/16	59	503-6595-3XX		
2 3/8	60	503-6596-3XX		
2 7/16	62	503-6597-3XX		
2 1/2	64	503-6598-3XX		
2 9/16	65	503-6599-3XX		
2 5/8	67	503-6600-3XX		
2 11/16	68	503-6601-3XX		
2 3/4	70	503-6602-3XX		
2 13/16	71	503-6603-3XX		
2 7/8	73	503-6604-3XX		
2 15/16	75	503-6605-3XX		
3	76	503-6606-3XX		
3 1/16	78	503-6607-3XX		
3 1/8	79	503-6608-3XX		
3 1/4	83	503-6609-3XX		
3 3/8	86	503-6610-3XX		

KS-503-6573

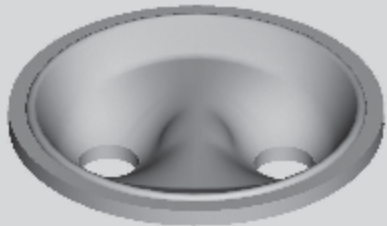
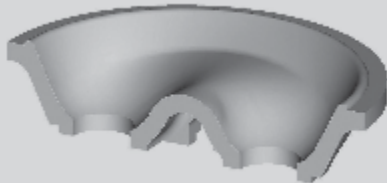
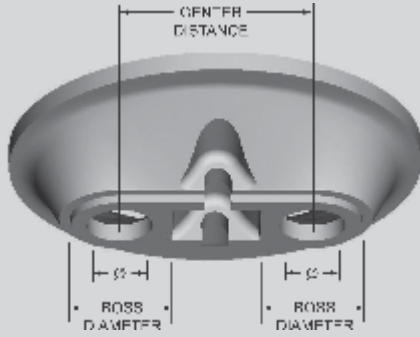
10" Spout Double Gob Orifice Rings - Cooling slots - 4 $\frac{3}{8}$ " center distance



Orifice Diameter Ø			Ring Holder Part #	Boss Diameter
in.	mm	Part #		
7/8	22	501-9330-3XX		
1	25	503-6255-3XX		
1 $\frac{1}{16}$	27	503-6256-3XX		
1 $\frac{1}{8}$	29	503-6257-3XX		
1 $\frac{3}{16}$	30	503-6258-3XX		
1 $\frac{1}{4}$	32	503-5766-3XX		
1 $\frac{5}{16}$	33	503-5765-3XX		
1 $\frac{3}{8}$	35	503-5764-3XX		
1 $\frac{7}{16}$	37	503-5751-3XX		
1 $\frac{1}{2}$	38	503-5750-3XX		
1 $\frac{9}{16}$	40	503-5749-3XX		
1 $\frac{5}{8}$	41	503-5748-3XX		
1 $\frac{11}{16}$	43	503-5747-3XX		
1 $\frac{3}{4}$	44	503-5746-3XX		
1 $\frac{13}{16}$	46	503-5745-3XX		
1 $\frac{7}{8}$	48	503-5743-3XX	555-252-6	3 $\frac{3}{4}$ "
1 $\frac{15}{16}$	49	503-5742-3XX	Cast Stainless	(95 mm)
2	51	503-5735-3XX	Steel	
2 $\frac{1}{16}$	52	503-5734-3XX		
2 $\frac{1}{8}$	54	503-5733-3XX		
2 $\frac{3}{16}$	56	503-5732-3XX		
2 $\frac{1}{4}$	57	503-5731-3XX		
2 $\frac{5}{16}$	59	503-5730-3XX		
2 $\frac{3}{8}$	60	503-5729-3XX		
2 $\frac{7}{16}$	62	503-5728-3XX		
2 $\frac{1}{2}$	64	503-5727-3XX		
2 $\frac{9}{16}$	65	503-5726-3XX		
2 $\frac{5}{8}$	67	503-5719-3XX		
2 $\frac{11}{16}$	68	503-5720-3XX		
2 $\frac{3}{4}$	70	503-5721-3XX		
2 $\frac{13}{16}$	71	503-5722-3XX		
2 $\frac{7}{8}$	73	503-5723-3XX		
2 $\frac{15}{16}$	75	503-5724-3XX		
3	76	503-5725-3XX		
3 $\frac{1}{16}$	78	503-5793-3XX		
3 $\frac{1}{8}$	79	503-5794-3XX		
3 $\frac{1}{4}$	83	503-5795-3XX		
3 $\frac{3}{8}$	86	503-5796-3XX		

KS-503-5718

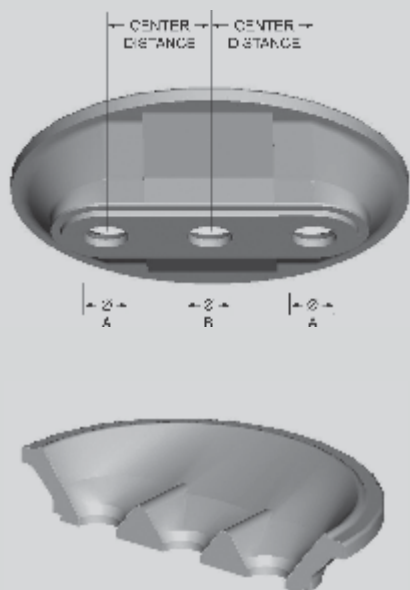
10" Spout Double Gob Orifice Rings - Cooling slots - 5" center distance



Orifice Diameter Ø			Ring Holder	Boss
in.	mm	Part #	Part #	Diameter
1¼	32	515-6152-3XX		
15/16	33	515-6153-3XX		
1¾	35	515-6154-3XX		
17/16	37	515-6155-3XX		
1½	38	515-6156-3XX		
19/16	40	515-6157-3XX		
15/8	41	515-6158-3XX		
111/16	43	515-6159-3XX		
1¾	44	515-5081-3XX		
113/16	46	515-5082-3XX		
17/8	48	515-5083-3XX		
115/16	49	515-5084-3XX		
2	51	515-5085-3XX		
21/16	52	515-5086-3XX		
21/8	54	515-5087-3XX		
23/16	56	515-5088-3XX		
2¼	57	515-5089-3XX	555-252-7	4¼"
25/16	59	515-5090-3XX	Cast	(108 mm)
23/8	60	515-5091-3XX	Stainless	
27/16	62	515-5137-3XX	Steel	
2½	64	515-5008-3XX		
29/16	65	515-5009-3XX		
25/8	67	515-5010-3XX		
211/16	68	515-5011-3XX		
2¾	70	515-5012-3XX		
213/16	71	515-5013-3XX		
27/8	73	515-5014-3XX		
215/16	75	515-5015-3XX		
3	76	515-5016-3XX		
31/16	78	515-5017-3XX		
31/8	79	515-5018-3XX		
33/16	81	515-5019-3XX		
3¼	83	515-5020-3XX		
35/16	84	515-5021-3XX		
33/8	86	515-5022-3XX		
37/16	87	515-5023-3XX		
3½	89	515-5024-3XX		
39/16	90	515-5025-3XX		
35/8	92	515-5026-3XX		
311/16	94	515-5027-3XX		
3¾	95	515-5028-3XX		

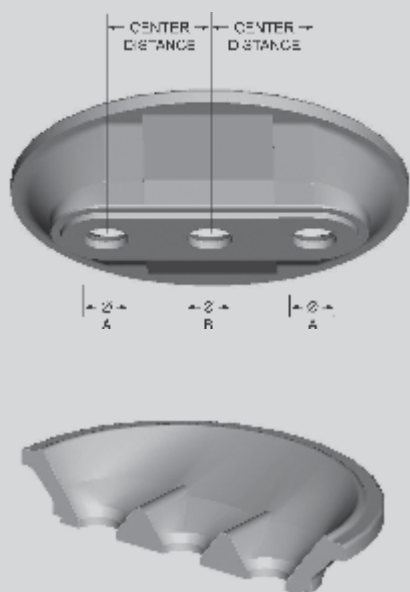
KS-515-5029

10" Spout Triple Gob Orifice Rings - Solid bridge - 2¹⁵/₁₆" center distance



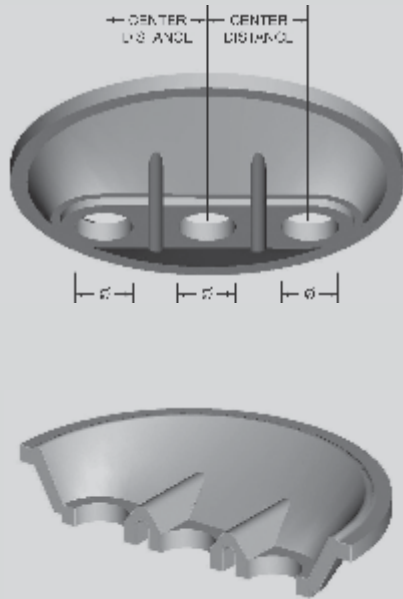
Orifice Diameter Ø			Ring Holder	Boss	
A (in.)	B (in.)	Part #	Part #	Diameter	
1 ⁵ / ₁₆	1 ⁵ / ₁₆	501-6438-3XX	555-252-10	2 ⁵ / ₈ " (67 mm) wide x 8 ⁵ / ₈ " (219 mm) long	
1 ⁹ / ₁₆	1 ⁹ / ₁₆	501-6430-3XX			
1 ⁵ / ₈	1 ⁵ / ₈	501-6431-3XX			
1 ¹¹ / ₁₆	1 ¹¹ / ₁₆	501-6432-3XX			
1 ³ / ₄	1 ³ / ₄	501-6433-3XX			
1 ¹³ / ₁₆	1 ¹³ / ₁₆	501-6434-3XX			
1 ³ / ₈	1 ³ / ₈	501-6526-3XX			
1 ⁷ / ₁₆	1 ⁷ / ₁₆	501-6527-3XX			
1 ¹⁵ / ₁₆	1 ¹⁵ / ₁₆	501-9047-3XX			
2 ¹ / ₈	2 ¹ / ₈	501-9141-3XX			KS-503-6476
1 ⁵ / ₈	1 ⁹ / ₁₆	501-6436-3XX			Note: For this group, the dimension for center orifice is not the same as dimension for outside orifices.
1 ⁹ / ₁₆	1 ¹ / ₂	501-6437-3XX			
1 ³ / ₄	1 ⁵ / ₈	501-6440-3XX			
1 ³ / ₄	1 ¹¹ / ₁₆	501-9000-3XX			
1 ³ / ₈	1 ⁵ / ₁₆	501-6502-3XX			
1 ¹¹ / ₁₆	1 ⁵ / ₈	501-9023-3XX			
1 ¹³ / ₁₆	1 ³ / ₄	501-9066-3XX			
1 ⁷ / ₈	1 ¹³ / ₁₆	501-9067-3XX	KS-503-6476		

10" Spout Triple Gob Orifice Rings - Solid bridge - 3" center distance



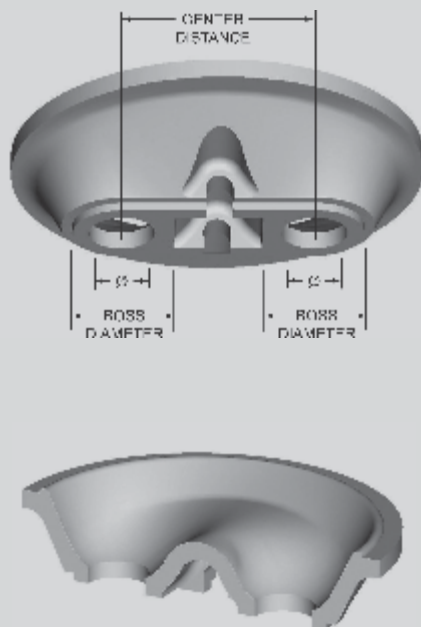
Orifice Diameter Ø			Ring Holder	Boss
in.	mm	Part #	Part #	Diameter
1 ¹ / ₄	32	503-6478-3XX	555-252-10	2 ⁵ / ₈ " (67 mm) wide x 8 ⁵ / ₈ " (219 mm) long
1 ⁵ / ₁₆	33	503-6479-3XX		
1 ³ / ₈	35	503-6480-3XX		
1 ⁷ / ₁₆	37	503-6481-3XX		
1 ¹ / ₂	38	503-6482-3XX		
1 ⁹ / ₁₆	40	503-6483-3XX		
1 ⁵ / ₈	41	503-6484-3XX		
1 ¹¹ / ₁₆	43	503-6485-3XX		
1 ³ / ₄	44	503-6486-3XX		
1 ¹³ / ₁₆	46	503-6487-3XX		
1 ⁷ / ₈	48	503-6488-3XX		
1 ¹⁵ / ₁₆	49	503-6489-3XX		
2	51	503-6490-3XX		
2 ¹ / ₁₆	52	503-6491-3XX		
2 ¹ / ₈	54	503-6492-3XX		
2 ³ / ₁₆	56	503-6493-3XX		
2 ¹ / ₄	57	503-6494-3XX	KS-503-6476	

10" Spout Triple Gob Orifice Rings - Cooling slots - 3" center distance



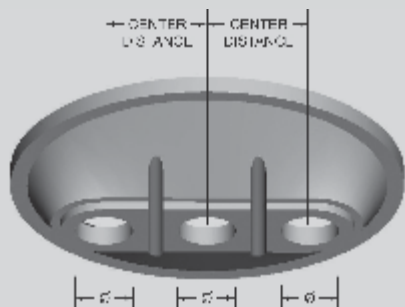
Orifice Diameter Ø			Ring Holder	Boss
in.	mm	Part #	Part #	Diameter
1¼	32	503-5860-3XX		
15/16	33	503-5861-3XX		
1¾	35	503-5862-3XX		
17/16	37	503-5863-3XX		
1½	38	503-5864-3XX		
19/16	40	503-5865-3XX		
15/8	41	503-5866-3XX		
111/16	43	503-5867-3XX	555-252-8	25/8"
1¾	44	503-5868-3XX	Cast	(67 mm)
113/16	46	503-5869-3XX	Stainless	
17/8	48	503-5870-3XX	Steel	
115/16	49	503-5871-3XX		
2	51	503-5872-3XX		
21/16	52	503-5851-3XX		
21/8	54	503-5852-3XX		
23/16	56	503-5853-3XX		
2¼	57	503-5854-3XX		KS-503-5859

12" Double Gob Orifice Rings - Cooling slots - 4¾" center distance



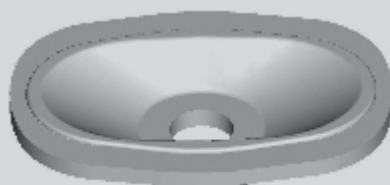
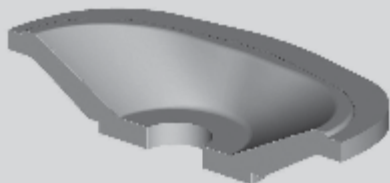
Orifice Diameter Ø			Ring Holder	Boss
in.	mm	Part #	Part #	Diameter
21/16	52	515-6097-3XX		
21/8	54	515-6061-3XX		
23/16	56	515-6060-3XX		
2¼	57	515-6059-3XX		
25/16	59	515-6058-3XX	515-212-1	37/8"
23/8	60	515-6057-3XX		(98mm)
27/16	62	515-6056-3XX		
2½	64	515-6055-3XX		
29/16	65	515-6054-3XX		
25/8	67	515-6053-3XX		
211/16	68	515-6052-3XX		
2¾	70	515-6051-3XX		KS-515-605

12" Triple Gob Orifice Rings - Cooling slots - 4 3/8" center distance



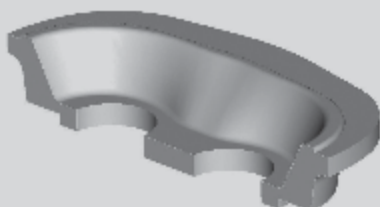
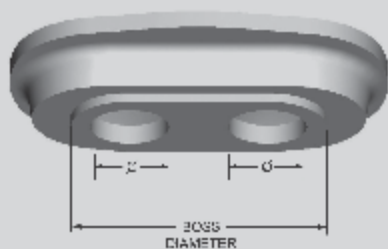
Orifice Diameter Ø		Part #	Ring Holder Part #	Boss Diameter	
in.	mm				
1 11/16	43	515-6014-3XX	515-211-1	3 1/8" (79 mm)	
1 3/4	44	515-6013-3XX			
1 13/16	46	515-6012-3XX			
1 7/8	48	515-6011-3XX			
1 15/16	49	515-6010-3XX			
2	51	515-6009-3XX			
2 1/16	52	515-6008-3XX			
2 1/8	54	515-6007-3XX			
2 3/16	56	515-6006-3XX			
2 1/4	57	515-6005-3XX			
2 5/16	59	515-6004-3XX			
2 3/8	60	515-6003-3XX			
2 7/16	62	515-6002-3XX			
2 1/2	64	515-6001-3XX			KS-515-6000

81 Series - Single Gob Metering Orifice Rings



Orifice Diameter Ø		Part #	Ring Holder
in.	mm		Part #
1½	38	81-4800-3XX	144-21841-1
19/16	40	81-4801-3XX	
15/8	41	81-4802-3XX	
111/16	43	81-4803-3XX	
13/4	44	81-4804-3XX	
113/16	46	81-4805-3XX	
17/8	48	81-4806-3XX	
115/16	49	81-4807-3XX	
2	51	81-4808-3XX	
21/16	52	81-4809-3XX	
21/8	54	81-4810-3XX	
23/16	56	81-4811-3XX	
2¼	57	81-4812-3XX	
25/16	59	81-4813-3XX	
23/8	60	81-4814-3XX	
27/16	62	81-4815-3XX	
2½	64	81-4816-3XX	
29/16	65	81-4817-3XX	
25/8	67	81-4818-3XX	
211/16	68	81-4819-3XX	
23/4	70	81-4820-3XX	
213/16	71	81-4821-3XX	
27/8	73	81-4822-3XX	
215/16	75	81-4823-3XX	
3	76	81-4824-3XX	
31/16	78	81-4825-3XX	
31/8	79	81-4826-3XX	
33/16	81	81-4827-3XX	
3¼	83	81-4828-3XX	
35/16	84	81-4829-3XX	
			KS-81-4799

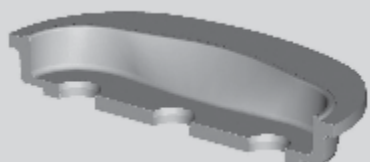
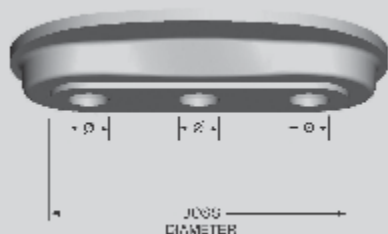
81 Series - Double Gob Metering Orifice Rings - 8" Metering spout - 4 3/8" center distance



Orifice Diameter Ø		Part #	Ring Holder Part #
in.	mm		
1	25	81-4701-3XX	144-21839-1
1 1/16	27	81-4702-3XX	
1 1/8	29	81-4703-3XX	
1 3/16	30	81-4704-3XX	
1 1/4	32	81-4705-3XX	
1 5/16	33	81-4706-3XX	
1 3/8	35	81-4707-3XX	
1 7/16	37	81-4708-3XX	
1 1/2	38	81-4709-3XX	
1 9/16	40	81-4710-3XX	
1 5/8	41	81-4711-3XX	
1 11/16	43	81-4712-3XX	
1 3/4	44	81-4713-3XX	
1 13/16	46	81-4714-3XX	
1 7/8	48	81-4715-3XX	
1 15/16	49	81-4716-3XX	
2	51	81-4717-3XX	
2 1/16	52	81-4731-3XX	
2 1/8	54	81-4732-3XX	
2 3/16	56	81-4733-3XX	
2 1/4	57	81-4734-3XX	
2 3/8	60	81-4740-3XX	

KS-81-4699

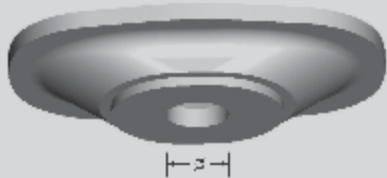
81 Series - Triple Gob Metering Orifice Rings - 9" Metering spout - 3" center distance



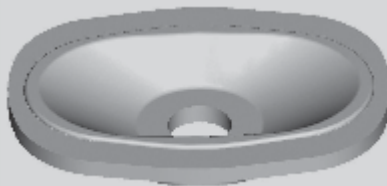
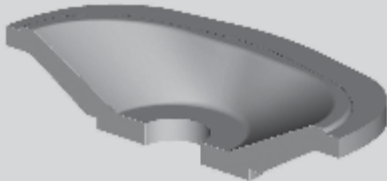
Orifice Diameter Ø		Part #	Ring Holder Part #
in.	mm		
11/16	17	81-4787-3XX	144-21840-1
3/4	19	81-4788-3XX	
13/16	21	81-4789-3XX	
7/8	22	81-4790-3XX	
15/16	24	81-4791-3XX	
1	25	81-4792-3XX	
1 1/16	27	81-4793-3XX	
1 1/8	29	81-4794-3XX	
1 3/16	30	81-4795-3XX	
1 1/4	32	81-4796-3XX	

KS-81-4786

503/515 Series - Single Gob Metering Orifice Rings - 10" or 11" spout



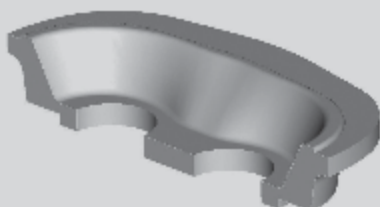
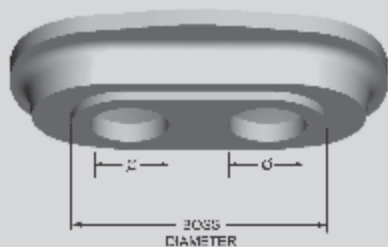
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Orifice Diameter Ø			Ring Holder
in.	mm	Part #	Part #
1 ³ / ₈	35	503-6914-3XX	555-252-13
1 ¹ / ₂	38	503-6915-3XX	
1 ⁹ / ₁₆	40	503-6916-3XX	
1 ⁵ / ₈	41	503-6917-3XX	
1 ¹¹ / ₁₆	43	503-6918-3XX	
1 ³ / ₄	44	503-6919-3XX	
1 ¹³ / ₁₆	46	503-6920-3XX	
1 ⁷ / ₈	48	503-6921-3XX	
1 ¹⁵ / ₁₆	49	503-6922-3XX	
2	51	503-6923-3XX	
2 ¹ / ₁₆	52	503-6924-3XX	
2 ¹ / ₈	54	503-6925-3XX	
2 ³ / ₁₆	56	503-6926-3XX	
2 ¹ / ₄	57	503-6927-3XX	
2 ⁵ / ₁₆	59	503-6928-3XX	
2 ³ / ₈	60	503-6929-3XX	
2 ⁷ / ₁₆	62	503-6930-3XX	
2 ¹ / ₂	64	503-6931-3XX	
2 ⁹ / ₁₆	65	503-6932-3XX	
2 ⁵ / ₈	67	503-6933-3XX	
2 ¹¹ / ₁₆	68	503-6934-3XX	
2 ³ / ₄	70	503-6935-3XX	
2 ¹³ / ₁₆	71	503-6936-3XX	
2 ⁷ / ₈	73	503-6937-3XX	
2 ¹⁵ / ₁₆	75	503-6938-3XX	
3	76	503-6939-3XX	
3 ¹ / ₁₆	78	503-6940-3XX	
3 ¹ / ₈	79	503-6941-3XX	
3 ³ / ₁₆	81	503-6942-3XX	
3 ¹ / ₄	83	503-6943-3XX	
3 ⁵ / ₁₆	84	503-6944-3XX	
3 ³ / ₈	86	503-6945-3XX	
3 ⁷ / ₁₆	87	503-6946-3XX	

KS-501-9209

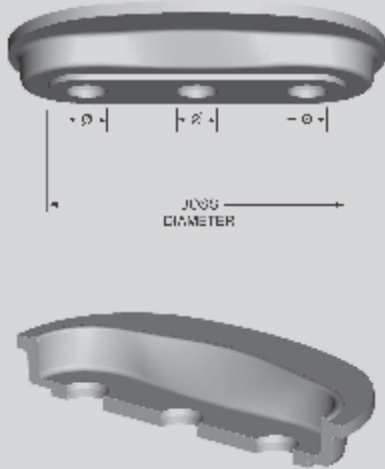
503/515 Series - Double Gob Metering Orifice Rings - 10" or 11" spout



Orifice Diameter Ø			Ring Holder
in.	mm	Part #	Part #
1	25	503-6883-3XX	555-252-12
1 ¹ / ₁₆	27	503-6884-3XX	
1 ¹ / ₈	29	503-6885-3XX	
1 ³ / ₁₆	30	503-6886-3XX	
1 ¹ / ₄	32	503-6887-3XX	
1 ⁵ / ₁₆	33	503-6888-3XX	
1 ³ / ₈	35	503-6889-3XX	
1 ⁷ / ₁₆	37	503-6890-3XX	
1 ¹ / ₂	38	503-6891-3XX	
1 ⁹ / ₁₆	40	503-6892-3XX	
1 ⁵ / ₈	41	503-6893-3XX	
1 ¹¹ / ₁₆	43	503-6894-3XX	
1 ³ / ₄	44	503-6895-3XX	
1 ¹³ / ₁₆	46	503-6896-3XX	
1 ⁷ / ₈	48	503-6875-3XX	
1 ¹⁵ / ₁₆	49	503-6898-3XX	
2	51	503-6899-3XX	
2 ¹ / ₁₆	52	503-6900-3XX	
2 ¹ / ₈	54	503-6901-3XX	
2 ³ / ₁₆	56	503-6902-3XX	
2 ¹ / ₄	57	503-6903-3XX	
2 ⁵ / ₁₆	59	503-6904-3XX	
2 ³ / ₈	60	503-6905-3XX	
2 ⁷ / ₁₆	62	503-6906-3XX	
2 ¹ / ₂	64	503-6876-3XX	
2 ⁹ / ₁₆	65	503-6908-3XX	
2 ⁵ / ₈	67	503-6909-3XX	
2 ¹¹ / ₁₆	68	503-6910-3XX	
2 ³ / ₄	70	503-6911-3XX	
2 ¹³ / ₁₆	71	503-6912-3XX	
2 ⁷ / ₈	73	503-6897-3XX	
2 ¹⁵ / ₁₆	75	503-6907-3XX	

KS-501-9205

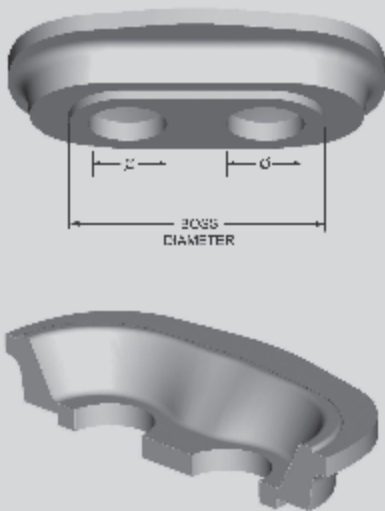
503/515 Series - Triple Gob Metering Orifice Rings - 10" or 11" spout - 3" center distance



Orifice Diameter Ø		Part #	Ring Holder
in.	mm		Part #
1¼	32	503-6857-3XX	555-252-11
15/16	33	503-6858-3XX	
1¾	35	503-6859-3XX	
17/16	37	503-6860-3XX	
1½	38	503-6861-3XX	
19/16	40	503-6862-3XX	
15/8	41	503-6863-3XX	
111/16	43	503-6864-3XX	
1¾	44	503-6865-3XX	
113/16	46	503-6866-3XX	
17/8	48	503-6867-3XX	
115/16	49	503-6868-3XX	
2	51	503-6869-3XX	
2¼/16	52	503-6870-3XX	
2½/8	54	503-6871-3XX	
2¾/16	56	503-6872-3XX	
2¾/4	57	503-6873-3XX	

KS-501-9200

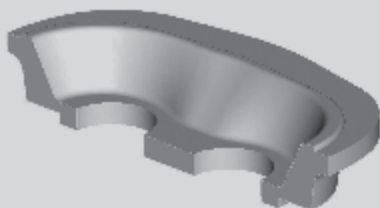
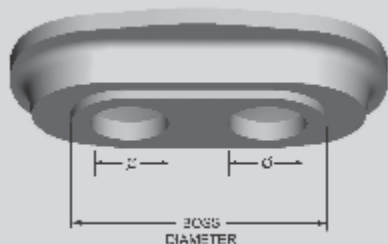
585 Series - Double Gob Metering Orifice Rings - 13" spout - 4¾" center distance



Orifice Diameter Ø		Part #	Ring Holder
in.	mm		Part #
1¾	35	585-1100-3XX	585-9-2
17/16	37	585-1101-3XX	
1½	38	585-1102-3XX	
19/16	40	585-1103-3XX	
15/8	41	585-1104-3XX	
111/16	43	585-1105-3XX	
1¾	44	585-1106-3XX	
113/16	46	585-1107-3XX	
17/8	48	585-1108-3XX	
115/16	49	585-1109-3XX	
2	51	585-1110-3XX	
2¼/16	52	585-1111-3XX	
2½/8	54	585-1112-3XX	
2¾/16	56	585-1113-3XX	
2¾/4	57	585-1114-3XX	
25/16	59	585-1115-3XX	
2¾/8	60	585-1116-3XX	
27/16	62	585-1117-3XX	
2½/2	64	585-1118-3XX	

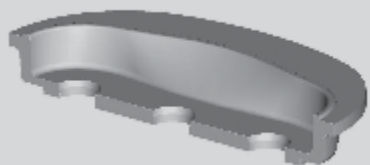
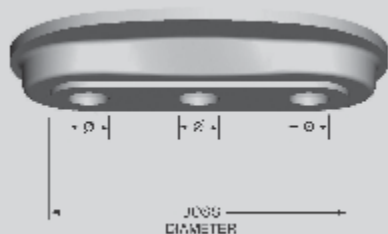
KS-585-1099

585 Series - Double Gob Metering Orifice Rings - 13" spout



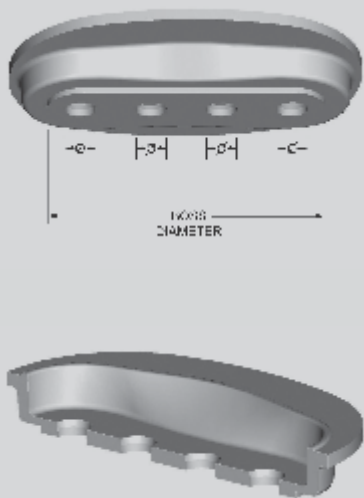
Orifice Diameter Ø		Part #	Ring Holder	
in.	mm		Part #	Part #
2 ⁹ / ₁₆	65	585-1243-3XX	585-9-03	
2 ⁵ / ₈	67	585-1244-3XX		
2 ¹¹ / ₁₆	68	585-1245-3XX		
2 ³ / ₄	70	585-1246-3XX		
2 ¹³ / ₁₆	71	585-1247-3XX		
2 ⁷ / ₈	73	585-1248-3XX		
2 ¹⁵ / ₁₆	75	585-1249-3XX		
3	76	585-1250-3XX		

585 Series - Triple Gob Metering Orifice Rings - 13" spout - 4³/₈" center distance



Orifice Diameter Ø		Part #	Ring Holder	
in.	mm		Part #	Part #
1 ³ / ₈	35	585-1056-3XX	585-9-1	
1 ⁷ / ₁₆	37	585-1057-3XX		
1 ¹ / ₂	38	585-1058-3XX		
1 ⁹ / ₁₆	40	585-1059-3XX		
1 ⁵ / ₈	41	585-1060-3XX		
1 ¹¹ / ₁₆	43	585-1061-3XX		
1 ³ / ₄	44	585-1062-3XX		
1 ¹³ / ₁₆	46	585-1063-3XX		
1 ⁷ / ₈	48	585-1064-3XX		
1 ¹⁵ / ₁₆	49	585-1065-3XX		
2	51	585-1066-3XX		
2 ¹ / ₁₆	52	585-1067-3XX		
2 ¹ / ₈	54	585-1068-3XX		
2 ³ / ₁₆	56	585-1073-3XX		
2 ¹ / ₄	57	585-1074-3XX		
2 ⁵ / ₁₆	59	585-1075-3XX		
2 ³ / ₈	60	585-1076-3XX		
2 ⁷ / ₁₆	62	585-1077-3XX		
2 ¹ / ₂	64	585-1078-3XX	KS-585-1055	

585 Series - Quad Gob Metering Orifice Rings - 13" spout - 3" center distance



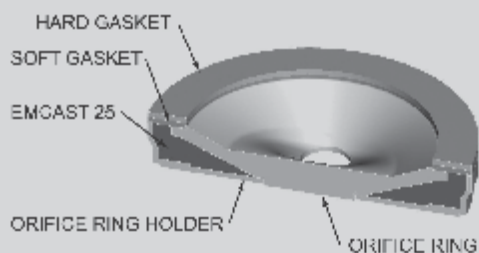
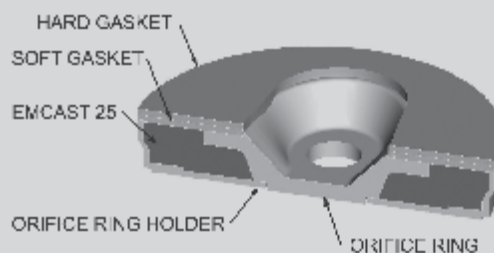
Orifice Diameter Ø		Part #	Ring Holder
in.	mm		Part #
1 ³ / ₈	35	585-1129-3XX	585-9-1
1 ⁷ / ₁₆	37	585-1130-3XX	
1 ¹ / ₂	38	585-1131-3XX	
1 ⁹ / ₁₆	40	585-1132-3XX	
1 ⁵ / ₈	41	585-1133-3XX	
1 ¹¹ / ₁₆	43	585-1134-3XX	
1 ³ / ₄	44	585-1135-3XX	
1 ¹³ / ₁₆	46	585-1136-3XX	
1 ⁷ / ₈	48	585-1137-3XX	
1 ¹⁵ / ₁₆	49	585-1138-3XX	
2	51	585-1139-3XX	
2 ¹ / ₁₆	52	585-1140-3XX	
2 ¹ / ₈	54	585-1141-3XX	
2 ³ / ₁₆	56	585-1142-3XX	
2 ¹ / ₄	57	585-1143-3XX	

KS-585-1126

Hard & Soft Gaskets for Orifice Rings - RCF Material

Type of Gasket	Description	Part #
Soft Gasket	5" Gasket for Standard Orifice Ring	59-94670
Hard Gasket	5" Gasket for Standard Orifice Ring	59-94671
Soft Gasket	7" Gasket for Standard Orifice Ring	59-94672
Hard Gasket	7" Gasket for Standard Orifice Ring	59-94673
Soft Gasket	8" Gasket for Standard Orifice Ring	59-94697
Hard Gasket	8" Gasket for Standard Orifice Ring	59-94698
Soft Gasket	9" Gasket for Standard Orifice Ring	59-94682
Hard Gasket	9" Gasket for Standard Orifice Ring	59-94683
Soft Gasket	10" Gasket for Standard Orifice Ring	59-94674
Hard Gasket	10" Gasket for Standard Orifice Ring	59-94675
Soft Gasket	12" Gasket for Standard Orifice Ring	59-94706
Hard Gasket	12" Gasket for Standard Orifice Ring	59-94707
Soft Gasket	13" Gasket for Standard Orifice Ring	59-94680
Hard Gasket	13" Gasket for Standard Orifice Ring	59-94681
Soft Gasket	8" Gasket for Metering Orifice Ring	59-94708
Hard Gasket	8" Gasket for Metering Orifice Ring	59-94709
Soft Gasket	9" Gasket for Metering Orifice Ring	59-94710
Hard Gasket	9" Gasket for Metering Orifice Ring	59-94711
Soft Gasket	10"/11" Gasket for Metering Orifice Ring	59-94676
Hard Gasket	10"/11" Gasket for Metering Orifice Ring	59-94677
Soft Gasket	13" Gasket for Metering Orifice Ring	59-94678
Hard Gasket	13" Gasket for Metering Orifice Ring	59-94679

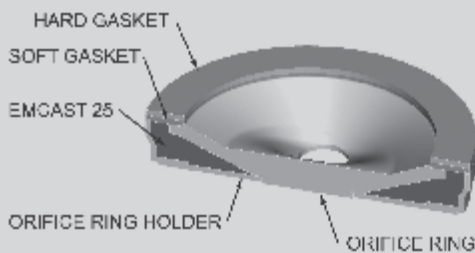
KS-59-94669

**Standard orifice ring gasket assembly****Metering orifice ring gasket assembly**

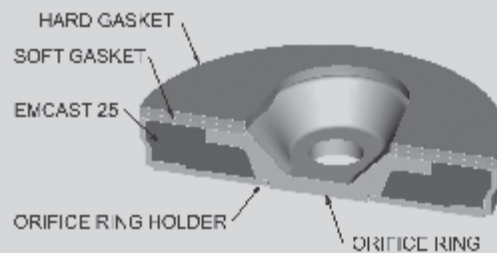
Hard & Soft Gaskets for Orifice Rings - Bio-Soluble Material

Type of Gasket	Description	Part #
Soft Gasket	5" Gasket for Standard Orifice Ring	59-34920
Hard Gasket	5" Gasket for Standard Orifice Ring	59-34921
Soft Gasket	7" Gasket for Standard Orifice Ring	59-34922
Hard Gasket	7" Gasket for Standard Orifice Ring	59-34923
Soft Gasket	8" Gasket for Standard Orifice Ring	59-34924
Hard Gasket	8" Gasket for Standard Orifice Ring	59-34925
Soft Gasket	9" Gasket for Standard Orifice Ring	59-34926
Hard Gasket	9" Gasket for Standard Orifice Ring	59-34927
Soft Gasket	10" Gasket for Standard Orifice Ring	59-34928
Hard Gasket	10" Gasket for Standard Orifice Ring	59-34929
Soft Gasket	12" Gasket for Standard Orifice Ring	59-34930
Hard Gasket	12" Gasket for Standard Orifice Ring	59-34931
Soft Gasket	13" Gasket for Standard Orifice Ring	59-34932
Hard Gasket	13" Gasket for Standard Orifice Ring	59-34933
Soft Gasket	8" Gasket for Metering Orifice Ring	59-34934
Hard Gasket	8" Gasket for Metering Orifice Ring	59-34935
Soft Gasket	9" Gasket for Metering Orifice Ring	59-34936
Hard Gasket	9" Gasket for Metering Orifice Ring	59-34937
Soft Gasket	10"/11" Gasket for Metering Orifice Ring	59-34938
Hard Gasket	10"/11" Gasket for Metering Orifice Ring	59-34939
Soft Gasket	13" Gasket for Metering Orifice Ring	59-34940
Hard Gasket	13" Gasket for Metering Orifice Ring	59-34941

KS-59-34669



Standard orifice ring gasket assembly



Metering orifice ring gasket assembly

Plungers



Improved gob shaping

The formulation and manufacture of expendable refractories has become increasingly important as demands on the feeder have increased.

RATH's 345 (mullite), 333 (zircon-mullite), and 315 (zircon-mullite), have been demonstrating excellent wear characteristics when used for refractory plungers. These materials are ideal solutions for today's more aggressive production environments with higher pull rates.

Orifice rings & gaskets

Plungers

Tubes

Spouts

Spout assemblies

Stirrers & rotor segments

Insulation, cements & hard bricks

Forehearth & maintenance items

Glasshouse crucibles & accessories

Technical references

Material Safety Data Sheet MSDS



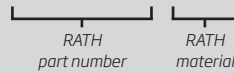
Plungers

Material data			
	315	333	345
ZrO ₂	20	11	-
Al ₂ O ₃	69	73	83
SiO ₂	11	15	16
Density (g/cc)	3.1	3.0	2.6
Porosity (%)	19	18	19
MOR (MPa)	21.4	17.9	14.5

All data is subject to reasonable deviations and not to be used for specification purposes.

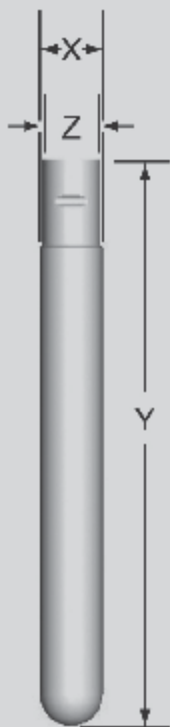
Refractory part numbers

123-4567-3XX



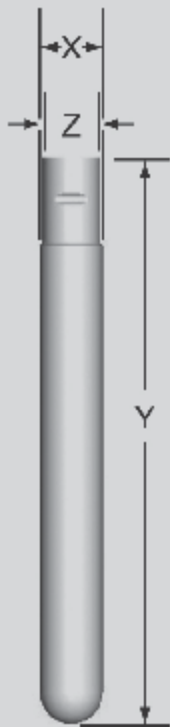
For special applications, alternative refractory materials are available. Please contact your nearest RATH representative.

Plungers - Ball point



X		Y		Z		Part #
in.	mm	in.	mm	in.	mm	
3	76	25½	648	2¾	70	144-11794-3XX
¾	83	26	660	¾	79	144-780-3XX
½	89	26	660	¾	79	144-781-3XX
¾	95	26	660	¾	79	144-3985-3XX
½	89	27	686	¾	79	81-4590-3XX
¼	108	27	686	¾	79	81-4593-3XX
5	127	27	686	¾	79	81-4596-3XX
½	63	27	686	¾	60	144-1246-3XX
¾	70	27	686	¾	60	144-1217-3XX
3	76	27	686	¾	70	144-1218-3XX
¾	83	27	686	¾	70	81-4566-3XX
¾	83	27	686	¾	79	81-4589-3XX
½	89	27	686	¾	79	81-4590-3XX
¾	95	27	686	¾	79	81-4591-3XX
4	102	27	686	¾	79	81-4592-3XX
¼	108	27	686	¾	79	81-4593-3XX
½	114	27	686	¾	79	81-4594-3XX
¾	121	27	686	¾	79	81-4595-3XX
5	127	27	686	¾	79	81-4596-3XX
¾	45	30	762	2	51	501-5681-3XX
2	51	30	762	2	51	501-5680-3XX
⅛	54	30	762	2	51	501-6159-3XX
¼	57	30	762	2	51	501-5679-3XX
⅜	60	30	762	2	51	501-5678-3XX
½	64	30	762	2	51	501-5582-3XX
3	76	30	762	¾	70	503-5652-3XX
¾	83	30	762	¾	70	503-5653-3XX
½	89	30	762	¾	70	503-5654-3XX
4	102	30	762	¾	70	503-5697-3XX
¾	83	30	762	¾	79	503-6707-3XX
½	89	30	762	¾	79	503-6708-3XX
¾	95	30	762	¾	79	503-6709-3XX
4	102	30	762	¾	79	503-6800-3XX
½	114	30	762	¾	79	503-6802-3XX
½	140	30	762	¾	79	503-6809-3XX
3	76	30½	775	¾	70	144-13842-3XX

Plungers - Ball point



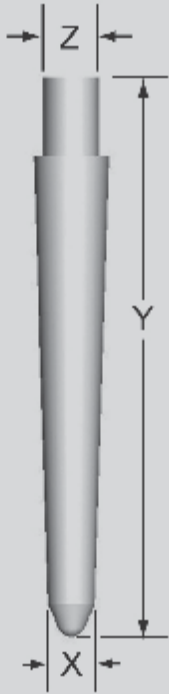
X		Y		Z		Part #
in.	mm	in.	mm	in.	mm	
3	76	30½	775	3¼	79	144-12237-3XX
3¼	83	30½	775	3¼	79	144-12238-3XX
3½	89	30½	775	3¼	79	144-12239-3XX
3¾	95	30½	775	3¼	79	144-13116-3XX
4	102	30½	775	3¼	79	144-13117-3XX
4¼	108	30½	775	3¼	79	144-13118-3XX
4½	114	30½	775	3¼	79	144-13119-3XX
3½	89	31⅛	791	3¼	79	29-607-3XX
3¾	95	31⅛	791	3¼	79	144-5470-3XX
4	102	31⅛	791	3¼	79	144-5471-3XX
1¾	44	31¾	806	2	51	515-5172-3XX
2	51	31¾	806	2	51	515-5173-3XX
2¼	57	31¾	806	2	51	515-5174-3XX
2⅜	60	31¾	806	2	51	515-5175-3XX
2½	64	31¾	806	2	51	515-5176-3XX
2	51	32	812	2	51	501-6318-3XX
2⅛	54	32	812	2	51	501-6292-3XX
2¼	57	32	812	2	51	501-6313-3XX
2⅜	60	32	812	2	51	501-6304-3XX
2½	64	32	812	2	51	501-6314-3XX
3	76	32	812	2¾	70	503-6562-3XX
3¼	83	32	812	2¾	70	503-6563-3XX
3½	89	32	812	2¾	70	503-6564-3XX
4	102	32	812	2¾	70	503-6565-3XX
3¼	83	32⅛	816	3¼	79	58-2573-3XX
3½	89	32⅛	816	3¼	79	58-2574-3XX
3¾	95	32⅛	816	3¼	79	58-2575-3XX
4	102	32⅛	816	3¼	79	58-2576-3XX
4¼	108	32⅛	816	3¼	79	58-2577-3XX
4½	114	32⅛	816	3¼	79	58-2578-3XX
4¾	121	32⅛	816	3¼	79	58-2579-3XX
5	127	32⅛	816	3¼	79	58-2580-3XX
5½	140	32⅛	816	5	127	113-584-3XX
6	152	32⅛	816	5	127	113-585-3XX
6½	165	32⅛	816	5	127	113-586-3XX

Plungers - Standard point



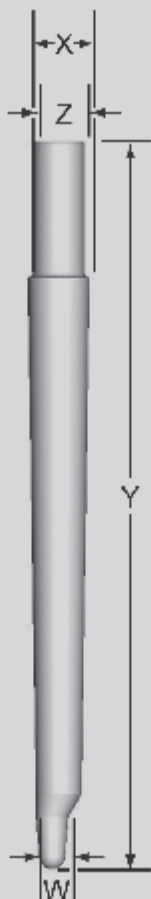
X		Y		Z		Part #
in.	mm	in.	mm	in.	mm	
2½	63	27	686	2⅜	60	144-389-3XX
2¾	70	27	686	2⅜	60	144-388-3XX
3	76	27	686	2¾	70	144-490-3XX
3¼	83	27	686	3⅛	79	81-4604-3XX
2¾	70	28	711	2¾	70	81-4633-3XX
3	76	28	711	2¾	70	81-4637-3XX
3½	89	28	711	2¾	70	81-4636-3XX
1¾	44	30	762	2	51	503-5129-3XX
1⅞	48	30	762	2	51	503-5128-3XX
2	51	30	762	2	51	503-5094-3XX
2⅛	54	30	762	2	51	503-5360-3XX
2¼	57	30	762	2	51	503-5398-3XX
2⅜	60	30	762	2	51	503-5361-3XX
2½	63	30	762	2	51	503-6571-3XX
1¾	44	32	812	2	51	503-6552-3XX
1⅞	48	32	812	2	51	503-6553-3XX
2	51	32	812	2	51	503-6551-3XX
2⅛	54	32	812	2	51	501-6280-3XX
2¼	57	32	812	2	51	503-6556-3XX
2⅜	60	32	812	2	51	503-6557-3XX
2½	63	30	762	2	51	503-6571-3XX
3¼	83	32⅛	816	3⅛	79	58-2582-3XX
3½	89	32⅛	816	3⅛	79	58-2583-3XX
3¾	95	32⅛	816	3⅛	79	58-2584-3XX
4	102	32⅛	816	3⅛	79	58-2585-3XX
4¼	108	32⅛	816	3⅛	79	58-2586-3XX

Plungers - Tapered standard point



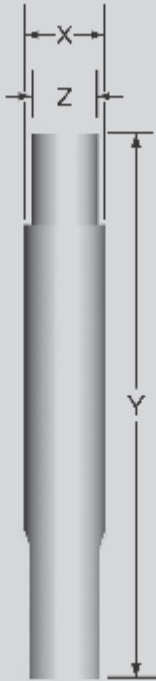
X		Y		Z		Part #
in.	mm	in.	mm	in.	mm	
1¼	32	27	686	2¼	57	81-3929-3XX
1½	38	27	686	2¼	57	81-3928-3XX
1¾	44	27	686	2¼	57	81-3920-3XX
2	51	27	686	2¼	57	81-3683-3XX
2½	63	30	762	2¾	70	503-5598-3XX
2¾	70	30	762	2¾	70	503-5599-3XX
3	76	30	762	2¾	70	503-5600-3XX
3¼	83	30	762	2¾	70	503-5601-3XX
2¾	70	30½	775	3⅛	79	144-11792-3XX
2⅜	60	32	812	2¾	70	503-6554-3XX
2½	63	32	812	2¾	70	503-6558-3XX
2¾	70	32	812	2¾	70	503-6559-3XX
3	76	32	812	2¾	70	503-6560-3XX
2½	63	32⅛	816	3⅛	79	29-611-3XX
2¾	70	32⅛	816	3⅛	79	29-612-3XX
3	76	32⅛	816	3⅛	79	29-610-3XX

Plungers - Offset point



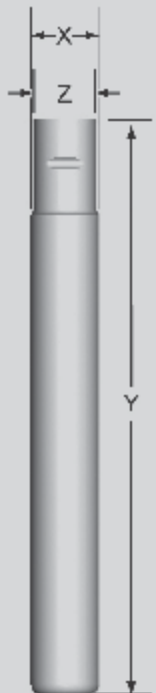
X		Y		Z		W		Part #
in.	mm	in.	mm	in.	mm	in.	mm	
Pin Type Holder								
1 ³ / ₄	44	23 ¹ / ₄	590	1 ¹ / ₂	38	1 ³ / ₄	44	144-15107-3XX
1 ³ / ₄	44	28	711	1 ¹ / ₂	38	1 ³ / ₄	44	555-2141-3XX
Slot Type Holder								
2	51	28	711	2 ¹ / ₄	57	1 ¹ / ₂	38	81-3896-3XX
2 ³ / ₈	60	28	711	2 ¹ / ₄	57	1 ⁷ / ₈	48	81-3743-3XX
2 ¹ / ₂	63	28	711	2 ¹ / ₄	57	1 ³ / ₄	44	81-3744-3XX
Pin Type Holder								
1 ³ / ₄	44	28	711	2	51	1 ¹ / ₄	32	81-4066-3XX
1 ⁷ / ₈	48	28	711	2	51	1 ³ / ₈	35	81-4067-3XX
2	51	28	711	2	51	1 ¹ / ₂	38	81-4068-3XX
2 ¹ / ₈	54	28	711	2	51	1 ⁵ / ₈	41	81-4069-3XX
2 ³ / ₈	60	28	711	2	51	1 ⁷ / ₈	48	81-4070-3XX
2 ¹ / ₂	63	28	711	2	51	1 ³ / ₄	44	81-4071-3XX
Pin Type Holder								
1 ³ / ₄	44	30	762	2	51	1 ¹ / ₄	32	81-4131-3XX
1 ⁷ / ₈	48	30	762	2	51	1 ³ / ₈	35	81-4132-3XX
2	51	30	762	2	51	1 ¹ / ₂	38	81-4133-3XX
2 ¹ / ₈	54	30	762	2	51	1 ⁵ / ₈	41	503-5450-3XX
2 ³ / ₈	60	30	762	2	51	1 ⁷ / ₈	48	503-5449-3XX
2 ¹ / ₂	63	30	762	2	51	1 ³ / ₄	44	81-4134-3XX
Pin Type Holder								
2 ¹ / ₂	63	30	762	2 ³ / ₄	70	2 ¹ / ₂	63	515-6017-3XX

Plungers - Fluted point



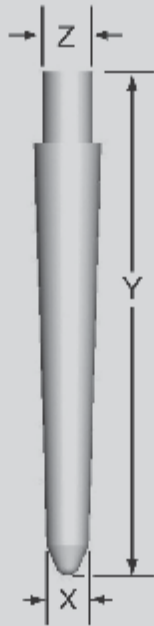
X		Y		Z		Part #
in.	mm	in.	mm	in.	mm	
3 ³ / ₄	95	30 ¹ / ₂	775	3 ¹ / ₈	79	144-12240-3XX

Plungers - Square point



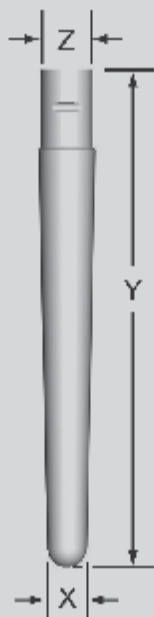
X		Y		Z		Part #
in.	mm	in.	mm	in.	mm	
3 ¹ / ₂	89	32 ¹ / ₈	816	3 ¹ / ₈	79	501-5338-3XX

Plungers - Tapered point



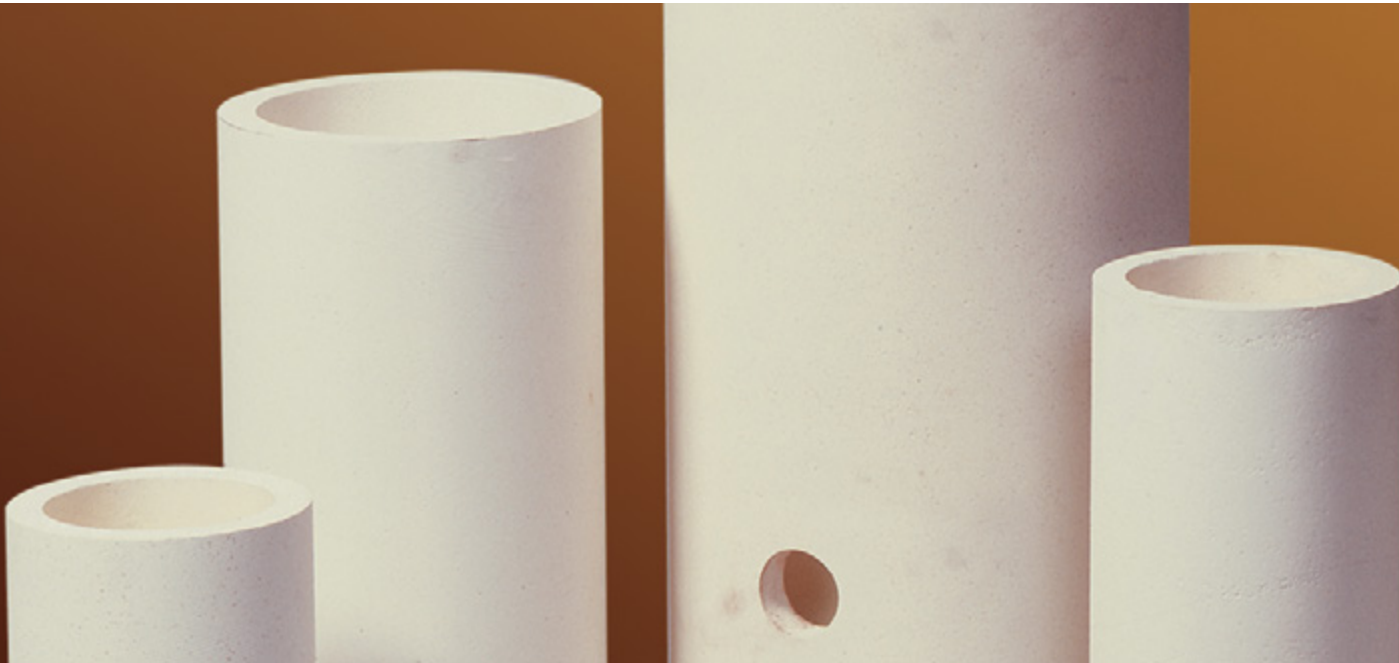
X		Y		Z		Part #
in.	mm	in.	mm	in.	mm	
1 ³ / ₄	44	23 ¹ / ₄	590	1 ¹ / ₂	38	144-15106-3XX
1 ³ / ₄	44	28	711	1 ¹ / ₂	38	555-2140-3XX
2 ¹ / ₂	63	27	686	2 ³ / ₈	60	144-2778-3XX

Plungers - Tapered ball point



X		Y		Z		Part #
in.	mm	in.	mm	in.	mm	
2 ¹ / ₂	63	32 ¹ / ₈	816	3 ¹ / ₈	79	501-5089-3XX
2 ³ / ₄	70	32 ¹ / ₈	816	3 ¹ / ₈	79	144-14156-3XX
3	76	32 ¹ / ₈	816	3 ¹ / ₈	79	29-609-3XX

Tubes

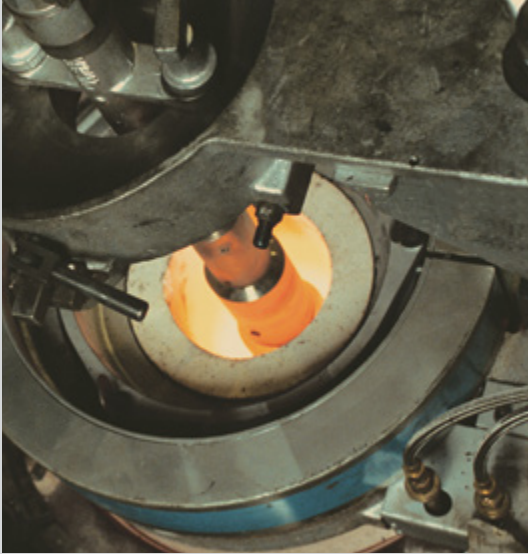


Better thermal shock & wear resistance

Feeder tubes must display a combination of resistance to corrosion and thermal shock to survive the harsh conditions in service. RATH's 345 (mullite), 333 (zircon-mullite), and 315 (zircon-mullite) demonstrate excellent wear resistance and resistance to thermal shock. When used in the metering spout tube application, typical service lives of six to seven months have been reported.

Many RATH tubes, especially the self-centering 555 and 585 types, are precision ground to assure that as the tube rotates the total runout at the glass end is minimized.

- Orifice rings & gaskets
- Plungers
- Tubes**
- Spouts
- Spout assemblies
- Stirrers & rotor segments
- Insulation, cements & hard bricks
- Forehearths & maintenance items
- Glasshouse crucibles & accessories
- Technical references
- Material Safety Data Sheet MSDS



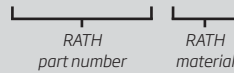
Tubes

Material data			
	315	333	444
ZrO ₂	20	11	11
Al ₂ O ₃	69	73	82
SiO ₂	11	15	6
Density (g/cc)	3.1	3.0	2.8
Porosity (%)	19	18	22
MOR (MPa)	21.4	17.9	17.2

All data is subject to reasonable deviations and not to be used for specification purposes.

Refractory part numbers

123-4567 - XXX



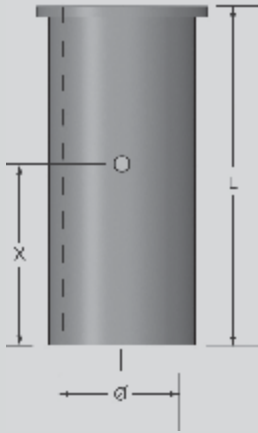
For special applications, alternative refractory materials are available. Please contact your nearest RATH representative.

Tubes - Plain type



Inside Diameter Ø	L		Part #	Precision Tube Ground to .032 Runout
	in.	mm		Part #
5" (127 mm)	17	432	144-783-XXX	144-15830-XXX
	18	457	144-3971-XXX	
6" (152 mm)	17	432	144-12949-XXX	
	18	457	144-13124-XXX	144-15998-XXX
	21½	546	144-11649-XXX	144-15754-XXX
	24	610	81-3951-XXX	
7" (178 mm)	21½	546	58-2510-XXX	58-3192-XXX
	23	584	81-4200-XXX	
	27	686	81-3479-XXX	
	28	711	115-549-XXX	
	30	762	63-729-XXX	
8" (203 mm)	24	610	194-5643-XXX	
	27	686	503-6115-XXX	
9" (229 mm)	26¾	670	501-5000-XXX	
10" (254 mm)	30¾	781	503-6566-XXX	
	32⅝	829	501-5599-XXX	
11" (279 mm)	26¼	664	501-6126-XXX	
	28	711	515-5006-XXX	

Tubes - Vented

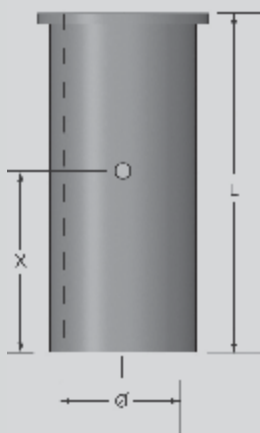


* Precision ground to .032 maximum runout measured 1" from bottom of tube

Inside Diameter Ø	L		X		Hole Diam.		No. Holes	Part #	Precision Ground Part #
	in.	mm	in.	mm	in.	mm			
5" (127mm)	17	432	7¼	184	7/8	22	4	144-14379-XXX	
	17	432	7¼	184	1	25	4		144-15870-XXX
	21½	546	11	279	7/8	22	4	144-14380-XXX	144-15905-XXX
6" (152 mm)	18	457	7¼	184	7/8	22	4	144-14376-XXX	
	21½	546	11	279	7/8	22	4	144-14220-XXX	144-15755-3XX
7" (178 mm)	21½	546	11½	292	7/8	22	4	194-5162-XXX	
	23	584	9¾	248	7/8	22	4	81-4201-XXX	
	23	584	11½	292	7/8	22	4	144-15175-XXX	
	24	610	11½	292	7/8	22	4	194-5301-XXX	194-5744-XXX
	24 ^{11/16}	627	11½	292	7/8	22	4	81-4295-XXX	
	27	686	12	305	7/8	22	4	81-3904-XXX	
	27	686	12½	318	7/8	22	4	503-5845-XXX	
8" (203 mm)	23	584	10½	267	7/8	22	4	501-7087-XXX	
	24	610	11½	292	1½	38	3	501-5986-XXX	
	24	610	12	305	2	51	3	501-5999-XXX	
	24	610	13	330	7/8	22	4	194-5637-XXX	
	25¼	641	13	330	7/8	22	4	501-7088-XXX	
	26	660	12½	318	7/8	22	4	115-2029-XXX	
	27	686	13	330	7/8	22	4	501-5158-XXX	
	28¾	730	13	330	7/8	22	4	503-5891-XXX	
10" (254 mm)	26½	664	12½	318	7/8	22	4	503-5369-XXX	503-6544-XXX
	26½	664	13	330	1¼	32	4	501-5240-XXX	503-6547-XXX
	26½	664	13	330	1½	38	4	501-5767-XXX	503-6549-XXX
	26½	664	13	330	1¾	44	4	503-5741-XXX	
	26½	664	*	-	2	51	3	501-5391-XXX	503-6546-XXX
10" (254 mm)	27	686	12½	318	2	51	4	501-6160-XXX	
	27	686	14	356	1½	38	4		501-6485-XXX
	27	686	15	381	1½	38	4		501-6426-XXX
	27¼	692	15	381	2	51	3	501-6231-XXX	
	28	711	**	-	2	51	3		501-7010-XXX
	28	711	16	406	2	51	4		501-7014-XXX
	28½	714	14½	368	7/8	22	4	515-6151-XXX	
	28½	714	15	381	7/8	22	4	501-5997-XXX	
	28½	714	15	381	1¼	32	4	501-6097-XXX	
	28½	714	***	-	2	51	3	503-5936-XXX	503-6570-XXX
	28½	714	15	381	1½	38	4	501-6372-XXX	501-6410-XXX
	28¾	721	15¼	387	1½	38	3		501-7047-XXX

* Vent holes @ 13 / 13¼ / 13½
 ** Vent holes @ 14½ / 15 / 15½
 *** Vent holes @ 15 / 15¼ / 15½

Tubes - Vented



* Precision ground to .032 maximum runout measured 1" from bottom of tube

Inside Diameter Ø	L		X		Hole Diam.		Holes	Part #	Precision Ground
	in.	mm	in.	mm	in.	mm			Part #
10" (254 mm)	28 ³ / ₄	730	15	381	7/8	22	4		501-7003-XXX
	29	737	12 ¹ / ₂	318	7/8	22	4	503-5949-XXX	
	29	737	16	406	2	51	4		501-7026-XXX
	29 ¹ / ₈	740	12 ³ / ₄	324	1 ¹ / ₂	38	4		501-7025-XXX
	29 ¹ / ₈	740	14 ³ / ₄	375	1 ¹ / ₂	38	4		501-7045-XXX
	30 ¹ / ₁₆	780	16	406	2	51	3	503-6543-XXX	
	30 ³ / ₄	781	14 ¹ / ₄	362	7/8	22	4	503-6567-XXX	
	31 ⁷ / ₈	810	16	406	2	51	3	503-6526-XXX	
33 ¹ / ₂	851	17 ¹ / ₂	445	2	51	3	501-6200-XXX		
11" (279 mm)	26 ¹ / ₈	664	12 ¹ / ₂	318	7/8	22	4	515-5270-XXX	
	28	711	12 ¹ / ₂	318	7/8	22	4	501-6196-XXX	
	28	711	14 ¹ / ₂	368	7/8	22	4	515-5007-XXX	501-7011-XXX
	28	711	14 ¹ / ₂	368	2	51	3	515-5132-XXX	
	28 ³ / ₈	721	15 ¹ / ₄	387	1 ¹ / ₄	32	3		501-7038-XXX

* Vent holes @ 13 / 13¹/₄ / 13¹/₂
 ** Vent holes @ 14¹/₂ / 15 / 15¹/₂
 *** Vent holes @ 15 / 15¹/₄ / 15¹/₂

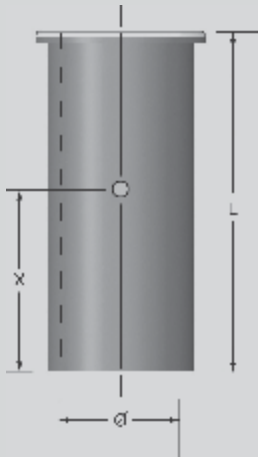
Tubes for 194-159 Tube Holder - Self centering, Plain



Inside Diameter Ø	L		Part #
	in.	mm	
5" (152 mm)	22 ¹ / ₈	562	144-15900-XXX
6" (152 mm)	24 ⁵ / ₈	625	194-5740-XXX

Note:
 Type 81 Feeder Only

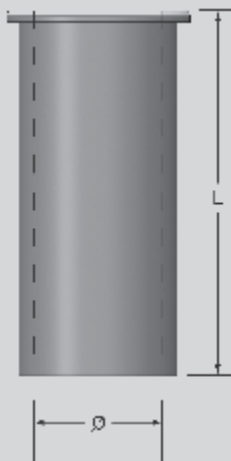
Tubes for 194-159 Tube Holder - Self centering, Vented



Inside Diameter Ø	L		X		Hole Diam.		No.		Part #
	in.	mm	in.	mm	in.	mm	Holes		
6" (152 mm)	24 ⁵ / ₈	625	11 ¹ / ₂	292	7/8	22	4	194-5747-XXX	
7" (177 mm)	24 ⁵ / ₈	625	11 ¹ / ₂	292	7/8	22	4	194-5748-XXX	
8" (203 mm)	22	559	13	330	7/8	22	4	501-7050-XXX	
	23	584	13	330	7/8	22	4	501-7058-XXX	
24 ¹¹ / ₁₆	627	11 ¹ / ₂	292	7/8	22	4	194-5764-XXX		
	627	13	330	7/8	22	4	501-7030-XXX		

Note:
Type 81 Feeder Only

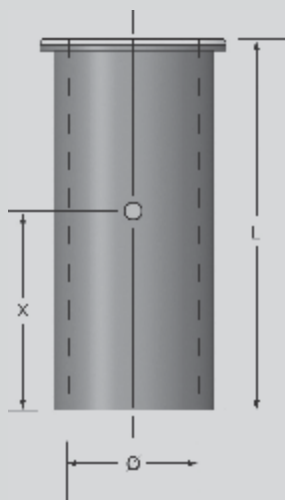
Tubes - Self centering, Plain



Inside Diameter Ø	L		Part #
	in.	mm	
7" (178 mm)	23 ³ / ₈	594	*555-1520-XXX
	26 ³ / ₈	670	*555-1057-XXX
8" (203 mm)	23 ³ / ₈	594	*555-1521-XXX
	26 ³ / ₈	670	*555-1058-XXX
10" (254 mm)	26 ³ / ₈	670	555-1001-XXX

* 13⁹/₁₆" (345 mm) flange OD
Important: Tube selection is based on flange OD as well as tube ID and length.

Note:
For Tube Holder
Reference 555-55

Tubes - Self centering, Vented

Note:
For Tube Holder
Reference 555-55

Inside Diameter Ø	L		X		Hole Diam.		No.		Part #
	in.	mm	in.	mm	in.	mm	Holes		
5" (127 mm)	22	559	9	229	7/8	22	4	*555-2071-XXX	
6" (152 mm)	22	559	9	229	7/8	22	4	*555-2072-XXX	
7" (178 mm)	22	559	9	229	7/8	22	4	*555-2073-XXX	
	23 ^{3/8}	594	9 ^{1/2}	241	7/8	22	3	**555-1518-XXX	
	24	610	11	279	7/8	22	4	*555-2094-XXX	
	25	635	11	279	7/8	22	4	*501-7082-XXX	
	26 ^{3/8}	670	12 ^{1/2}	318	7/8	22	3	**555-1056-XXX	
	26 ^{3/8}	670	12 ^{1/2}	318	7/8	22	4	*555-2154-XXX	
	26 ^{3/8}	670	12 ^{1/2}	318	7/8	22	3	**555-1340-XXX	
8" (203 mm)	23 ^{3/8}	594	9 ^{1/2}	241	7/8	22	3	**555-1519-XXX	
	24	610	11	279	7/8	22	4	*555-2095-XXX	
	24	610	12	305	1 ^{1/2}	38	3	**555-2543-XXX	
	26 ^{3/8}	670	12 ^{1/2}	318	7/8	22	4	*555-2155-XXX	
	26 ^{3/8}	670	12 ^{1/2}	318	7/8	22	3	**555-1340-XXX	
	26 ^{3/8}	670	12 ^{1/2}	318	1 ^{1/2}	38	3	**555-1837-XXX	
10" (254mm)	22	559	8 ^{3/4}	222	2	51	3	555-2707-XXX	
	23 ^{3/8}	594	10	254	7/8	22	3	555-1415-XXX	
	26 ^{3/8}	670	12 ^{1/2}	318	7/8	22	3	555-1052-XXX	
	26 ^{3/8}	670	12 ^{1/2}	318	7/8	22	4	555-1765-XXX	
	26 ^{3/8}	670	12 ^{1/2}	318	2	51	3	555-1795-XXX	
	26 ^{3/8}	670	12 ^{1/2}	318	2	51	4	555-1826-XXX	
	26 ^{3/8}	670	13	330	2	51	3	555-1779-XXX	
	26 ^{3/8}	670	13 ^{***}	330	1 ^{1/2}	38	4	555-1794-XXX	
	26 ^{3/8}	670	13	330	2	51	3	555-1788-XXX	
	28 ^{3/8}	721	15 ^{1/4}	387	2	51	3	555-1653-XXX	
	28 ^{3/8}	721	15 ^{1/4}	387	1 ^{1/2}	38	3	555-1822-XXX	
	28 ^{3/8}	721	15 ^{1/4}	387	7/8	22	3	555-1181-XXX	
11" (279 mm)	26 ^{3/8}	670	13 ^{1/4}	337	7/8	22	3	555-1833-XXX	
	26 ^{3/8}	670	13 ^{1/4}	337	1 ^{1/4}	32	3	555-2728-XXX	
	26 ^{3/8}	670	13 ^{1/4}	337	1 ^{1/2}	38	3	555-2729-XXX	
	26 ^{3/8}	670	13 ^{1/4}	337	2	51	3	555-2730-XXX	

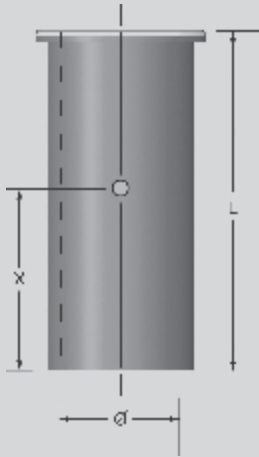
* 11" (279 mm) flange OD

** 13^{9/16} (345 mm) flange OD

*** Staggered 13 / 13^{1/4} / 13^{1/2}

Important: Tube selection is based on flange OD as well as tube ID and length.

Tubes - Self centering, Vented

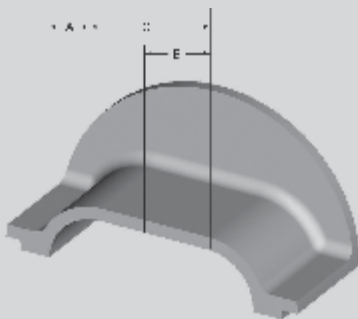


Inside Diameter Ø	L		X		Hole Diam.		No. Holes	Part #
	in.	mm	in.	mm	in.	mm		
11" (279 mm)	28 ³ / ₈	721	15 ¹ / ₄	387	7/8	22	3	555-1808-XXX
	28 ³ / ₈	721	15 ¹ / ₄	387	1 ¹ / ₄	32	3	501-7035-XXX
	28 ³ / ₈	721	15 ¹ / ₄	387	1 ¹ / ₂	38	3	501-7053-XXX
	28 ³ / ₈	721	15 ¹ / ₄	387	2	51	3	555-2663-XXX
12" (305 mm)	28 ³ / ₈	721	15 ¹ / ₄	387	7/8	22	3	555-1807-XXX

Important: Tube selection is based on flange OD as well as tube ID and length.

Note:
For Tube Holder
Reference 555-55

Insulation Retainers

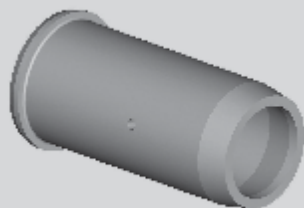


Style	A (in.)	B (in.)	C (in.)	Part #
10" Tube SG	2	-	-	555-2531-3XX
10" Tube DG (3)	2	1 ¹ / ₂	3	555-2652-3XX
10" Tube DG (4 ³ / ₈)	2	2 ³ / ₁₆	4 ³ / ₈	555-2532-3XX
10" Tube TG (3)	1 ⁵ / ₈	3	6	555-2533-3XX
11" Tube SG	2	-	-	555-2681-3XX
11"-12" Tube DG (4 ³ / ₈)	2	2 ³ / ₁₆	4 ³ / ₈	555-1814-3XX
11" Tube TG (3)	1 ⁵ / ₈	3	6	555-1815-3XX
12" Tube TG (4 ³ / ₈)	2	3 ¹¹ / ₁₆	7 ³ / ₈	555-1841-3XX

KS-555-2530, KS-555-1813

Note: Insulation retainers are shipped in marked, matched sets and should be installed as such. Two pieces of insulation are needed for each set.

Metering Tubes



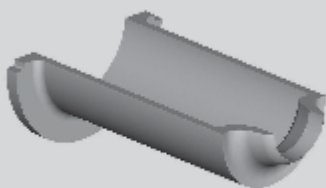
Diameter Ø	81 Spout	503 Spout	515 Spout	585 Spout
8"	81-4698-XXX			
9"	81-4784-XXX			
10"		555-2133-XXX	555-2132-XXX	
11"		555-2130-XXX	555-2126-XXX	
13"				585-1054-XXX

Note: All metering tubes have 3 vent holes for use with heat baffles.

The vent hole diameters are:

- 81 metering, 1"
- 503 metering, 1½"
- 515 metering, 1½"
- 585 metering, 1½"

Metering Spout Heat Baffle



Description	81 Spout	503 Spout	515 Spout	585 Spout
8" SG	81-4830-3XX			
8" DG	81-4697-3XX			
9" TG	555-2134-3XX			
10" SG		555-2139-3XX	555-2139-3XX	
10" DG		555-2129-3XX	555-2129-3XX	
10" TG		N/A	N/A	
11" SG		555-2136-3XX	555-2136-3XX	
11" DG		555-2131-3XX	555-2131-3XX	
11" TG		555-2127-3XX	555-2127-3XX	
13" DG				585-1098-3XX
13" TG				585-1071-3XX
13" QG				

Note: Heat baffles are shipped in marked, matched sets and should be installed as such.

Spouts



Shape stability & corrosion resistance

Advanced manufacturing process developments have been implemented for spout bowls, to meet the stringent demands of the glass container forming process.

RATH's 333, 315, and 301 are bonded AZS (zircon-mullite) materials containing various degrees of ZrO_2 .

They are produced at higher firing temperatures, resulting in improved density and a highly corrosion resistant matrix. These performance characteristics make our AZS range an excellent choice for RATH spout bowls.

Orifice rings & gaskets

Plungers

Tubes

Spouts

Spout assemblies

Stirrers & rotor segments

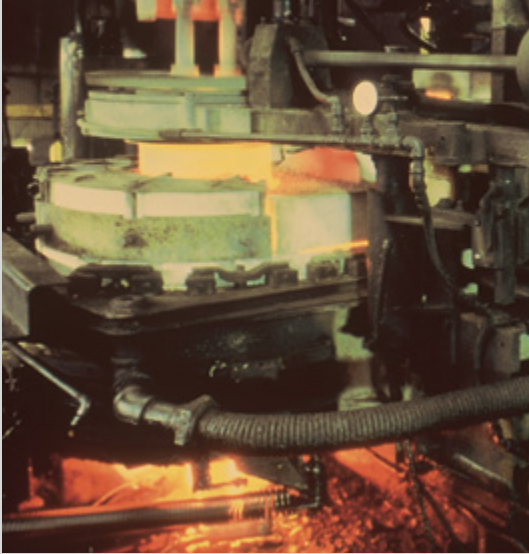
Insulation, cements & hard bricks

Forehearth & maintenance items

Glasshouse crucibles & accessories

Technical references

Material Safety Data Sheet MSDS



Spouts

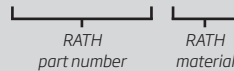
Material data	301*	315	333
ZrO ₂	35	20	11
Al ₂ O ₃	45	69	73
SiO ₂	19	11	15
Density (g/cc)	3.2	3.1	3.0
Porosity (%)	18	19	18
MOR (MPa)	20.0	21.4	17.9

* New formula containing 35 % ZrO₂. Mix was launched in 2011.

All data is subject to reasonable deviations and not to be used for specification purposes.

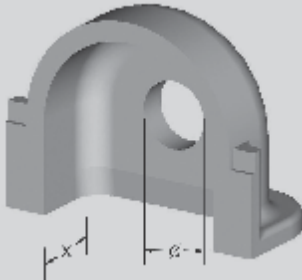
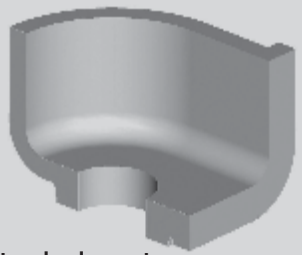
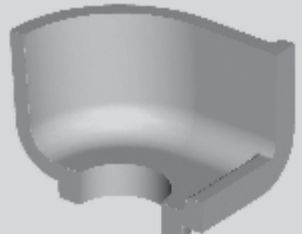
Refractory part numbers

123-4567 - 3XX



For special applications, alternative refractory materials are available. Please contact your nearest RATH representative.

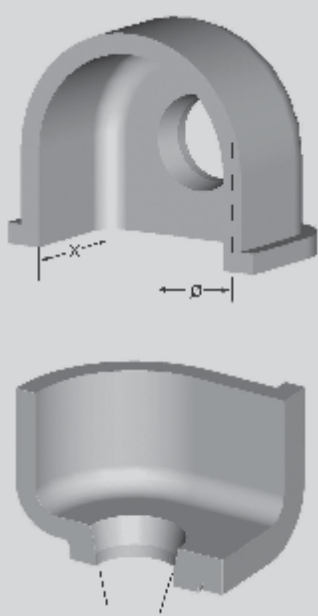
Straight Throat with Flat Tube Seat Spouts

	Ø		X		Part #	Description with Entrance Width	Throat C/L or Offset
	Throat Diameter	in.	mm	Spout Depth			
 Small spout	Small Spouts						
	5	127	5¾	146	144-14179-3XX(\)	For 144 Feeder-STD, 14"	C\L
	7¾	197	6	152	144-15145-3XX	For 144 Feeder-STD, 14"	C\L
	7	178	9½	241	144-15030-3XX(\)	For 144 Feeder-Deep, 16"	C\L
	5	127	9½	241	29-600-3XX(\)	For 144 Feeder-Deep, 14"	C\L
	7	178	7¼	184	81-3795-3XX	For 81 Feeder-STD, 16"	Turbex Offset
	7	178	9½	241	81-3792-3XX	For 81 Feeder-Deep, 16"	Turbex Offset
	7	178	10	254	81-4015-3XX	For 81 Feeder-Deep, 18"	C\L
	8	203	10	254	81-6342-3XX	For 81 Feeder-Deep, 18"	C\L
	8	203	7¼	184	81-4487-3XX	For 81 Feeder-STD, 18"	C\L
 Standard spout	Standard Spouts						
	7	178	10	254	194-5223-3XX	For 194 Feeder-Deep, 18"	C\L
	7	178	7¼	184	194-5224-3XX	For 194 Feeder-Shallow, 18"	C\L
	8	203	7¼	184	81-6341-3XX	For 194 Feeder-STD, 18"	C\L
	7	178	11½/16	287	115-870-3XX	For 115 Feeder-Deep, 22"	C\L
	7	178	11½/16	287	503-5400-3XX	For 503 Feeder-Deep, 22"	C\L
	10	254	7¼	184	503-6231-3XX	For 503 Feeder-STD, 22"	C\L
	10	254	11½/16	287	503-5080-3XX	For 503 Feeder-Deep, 22"	C\L
	10	254	11½/16	287	503-3845-3XX	For 503 Feeder-Deep, 22", (Reinforced)	C\L
	10	254	11½/16	287	503-5938-3XX	For 503 Feeder-Deep, 22"	C\L
 Curbed spout	10	254	13	330	515-6150-3XX	For 515 Feeder- Extra Deep 24"	C\L
	12	305	13	330	515-6015-3XX	For 515 Feeder- Extra Deep 24"	C\L
	10	254	13	330	515-5133-3XX	For 503 Feeder-Extra Deep With Curb, 24"	C\L
	12	305	13	330	515-5139-3XX	For 515 Feeder- Deep with C/L Curb at Entrance	C\L

(\) This symbol designates sloped channel entrance. Glass Depth 1" Below "X" Dimension.

N.B. Spouts with isostatically pressed zircon mullite or chrome oxide inserts are available upon request. Please contact your nearest RATH representative.

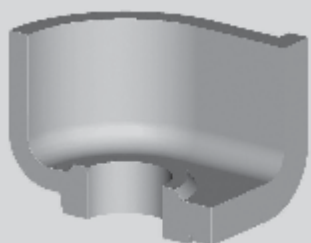
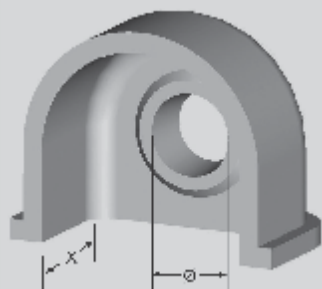
Tapered Throat with Flat Tube Seat Spouts

	Ø		X		Part #	Description with Entrance Width	Throat C/L or Offset
	Throat Diameter		Spout Depth				
	in.	mm	in.	mm			
	6/5	152/127	9½	241	144-14177-3XX (∖)	For 144 Feeder Deep, 14"	C/L
	8/7	203/178	9½	241	81-4381-3XX	For 81 Feeder Deep 16"	Turbex Offset
	8/7	203/178	10	254	81-4575-3XX**	For 81 Feeder Deep, 18"	C/L
	8/7	203/178	10	254	194-5636-3XX	For 194 Feeder Deep, 18"	C/L
	8/7	203/178	11⅝	287	503-5963-3XX	For 503 Feeder Inclined, 22"	C/L
	8/7	203/178	11⅝	287	503-6616-3XX	For 503 Feeder Straight, 22"	C/L
	11/10	279/254	11⅝	287	501-6210-3XX	For 503 Feeder Deep, 22"	C/L
	11/10	279/254	13	330	515-5314-3XX	For 515 Feeder w/curb, 24"	C/L
	11/10	279/254	13	330	515-5001-3XX	For 515 Feeder w/o curb, 24"	C/L

(∖) This symbol designates sloped channel entrance. Glass Depth 1" Below "X" Dimension.
 ** Replaces 81-4342

N.B. Spouts with isostatically pressed zircon mullite or chrome oxide inserts are available upon request. Please contact your nearest RATH representative.

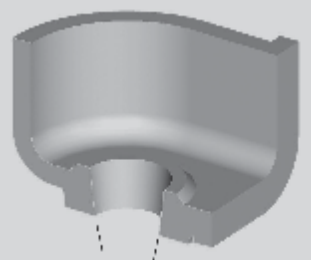
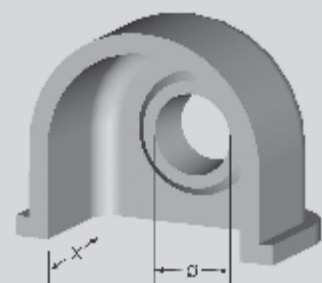
Straight Throat with Raised Tube Seat Spouts



Ø		X		Part #	Description with Entrance Width	Throat C/L or Offset
Throat Diameter		Spout Depth				
in.	mm	in.	mm			
5	127	5¾	152	144-704-3XX (\)	For 144 Feeder STD, 14"	C/L
5	127	5¾	152	144-14178-3XX (\)	For 144 Feeder A\S-STD, 14"	C/L
5	127	9¼	235	29-890-3XX (\)	For 144 Feeder Deep, 14"	C/L
7	178	9½	241	58-1939-3XX (\)	For 144/58 Feeder Deep, 20"	C/L
7	178	9½	241	81-3908-3XX	For 81 Feeder Deep, 16"	Turbex Offset

(\) This symbol designates sloped channel entrance. Glass Depth 1" Below "X" Dimension.

Tapered Throat with Raised Tube Seat Spouts

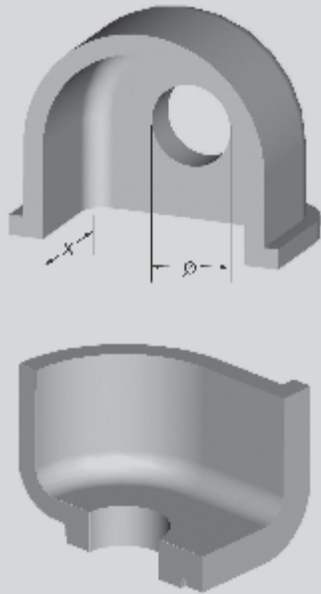


Ø		X		Part #	Description with Entrance Width	Throat C/L or Offset
Throat Diameter		Spout Depth				
in.	mm	in.	mm			
6/5	152/127	10	254	144-14180-3XX (\)	For 144 Feeder Deep, 14"	C/L
6/5	152/127	10	254	81-4646-3XX	For 81 Feeder Deep, 18"	C/L

(\) This symbol designates sloped channel entrance. Glass depth 1" Below "X" dimension.

N.B. Spouts with isostatically pressed zircon mullite or chrome oxide inserts are available upon request. Please contact your nearest RATH representative.

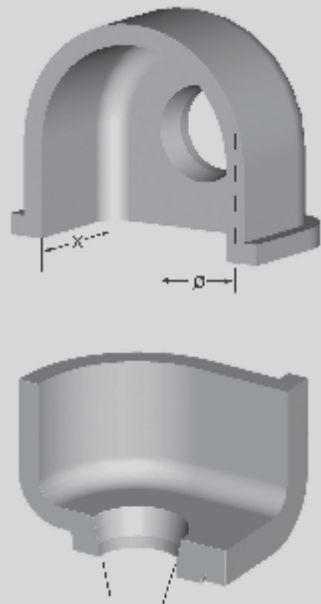
81 or 555 Feeder Spouts - Straight Throat with Flat Tube Seat



Ø Throat Diameter		X Inside Depth		Part #	Description with Entrance Width
in.	mm	in.	mm		
5	127	7¼	184	81-4522-3XX	For 81 Feeder-STD, 14"*
5	127	10	254	81-4577-3XX	For 81 Feeder-Deep, 14"*
5	127	7¼	184	81-4535-3XX	For 81 Feeder-STD, 18"
5	127	10	254	81-4572-3XX	For 81 Feeder-Deep, 18"
7	178	7¼	184	81-4537-3XX	For 81 Feeder-STD, 18"
7	178	10	254	81-4015-3XX	For 81 Feeder-Deep, 18"
8	203	7¼	184	81-4538-3XX	For 81 Feeder-STD, 18"
8	203	10	254	81-4574-3XX	For 81 Feeder-Deep, 18"

* To be used in 81 type spout casing.

81 or 555 Feeder Spouts - Tapered Throat with Flat Tube Seat



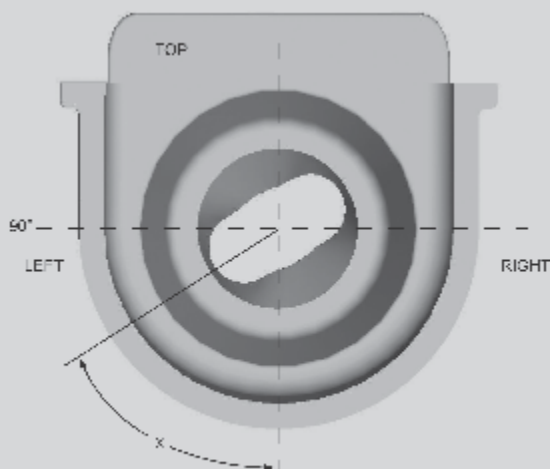
Ø Throat Diameter		X Inside Depth		Part #	Description with Entrance Width
in.	mm	in.	mm		
6/5	152/127	7¼	184	81-4523-3XX	For 81 Feeder-STD, 14"*
6/5	152/127	10	254	81-4635-3XX	For 81 Feeder-Deep, 18"
8/7	203/178	7¼	184	81-4539-3XX	For 81 Feeder-STD, 18"
8/7	203/178	10	254	81-4575-3XX	For 81 Feeder-Deep, 18"

* To be used in 81 type spout casing.

X-Section

N.B. Spouts with isostatically pressed zircon mullite or chrome oxide inserts are available upon request. Please contact your nearest RATH representative.

Metering Spout Shear Angle

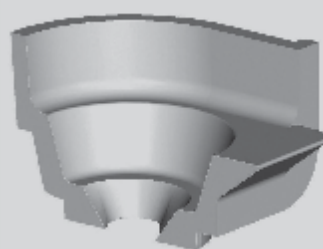
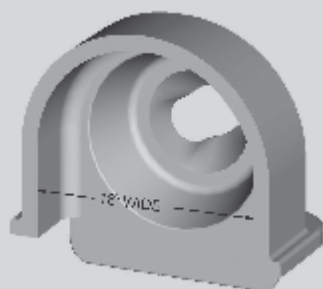


X: shear angle between machine and feeder

A machine can be installed under a feeder at different angles in order to suit factory conditions. The angle of a machine to a feeder is the angle between the feeder centerline and the machine centerline. The feeder centerline coincides with the centerline of forehearth channels. The machine's centerline is at a right angle to the conveyor axis through the midpoint of the machine. When the feeder centerline and machine centerline coincide the machine is placed in the 0-degree position.

The throat of a metering spout can be adjusted to match the shear angle. Please use the drawing at left to determine the appropriate spout.

81 Metering Spouts - For 8" Tube, 4³/₈" CD Double Gob - 10" deep



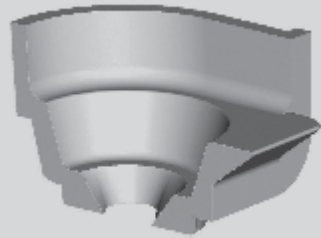
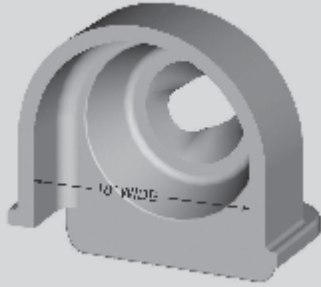
Shear angle	Part #	Shear angle	Part #
CL 0°	81-4672-3XX	90° L	81-4679-3XX
5° R	81-4673-3XX	85° L	81-4680-3XX
10° R	81-4674-3XX	80° L	81-4768-3XX
15° R	81-4675-3XX	75° L	81-4682-3XX
20° R	81-4676-3XX	70° L	81-4683-3XX
25° R	81-4677-3XX	65° L	81-4684-3XX
30° R	81-4678-3XX	60° L	81-4685-3XX
		55° L	81-4686-3XX
		50° L	81-4687-3XX
		45° L	81-4688-3XX
		40° L	81-4689-3XX
		35° L	81-4690-3XX
		30° L	81-4691-3XX
		25° L	81-4692-3XX
		20° L	81-4693-3XX
		15° L	81-4694-3XX
		10° L	81-4695-3XX
		5° L	81-4696-3XX

KS-81-4671

Note: Refractory spouts for metering spout applications will carry a different part number for every different angle of shearing.

N.B. Metering spouts with chrome oxide inserts are available upon request. Please contact your RATH representative.

81 Metering Spouts - For 9" Tube, 3" CD Double Gob - 10" deep

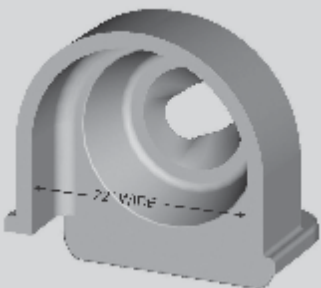


Shear angle	Part #	Shear angle	Part #
CL 0°	81-4759-3XX	90° L	81-4766-3XX
5° R	81-4760-3XX	85° L	81-4767-3XX
10° R	81-4761-3XX	80° L	81-4768-3XX
15° R	81-4762-3XX	75° L	81-4769-3XX
20° R	81-4763-3XX	70° L	81-4770-3XX
25° R	81-4764-3XX	65° L	81-4771-3XX
30° R	81-4765-3XX	60° L	81-4772-3XX
		55° L	81-4773-3XX
		50° L	81-4774-3XX
		45° L	81-4775-3XX
		40° L	81-4776-3XX
		35° L	81-4777-3XX
		30° L	81-4778-3XX
		25° L	81-4779-3XX
		20° L	81-4780-3XX
		15° L	81-4781-3XX
		10° L	81-4782-3XX
		5° L	81-4783-3XX

KS-81-4758

Note: Refractory spouts for metering spout applications will carry a different part number for every different angle of shearing.

503 Metering Spouts - For 10" Tube - 11⁵/₁₆" deep



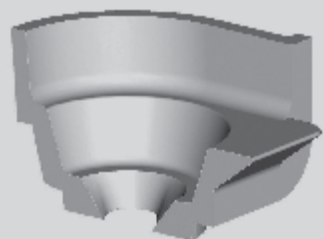
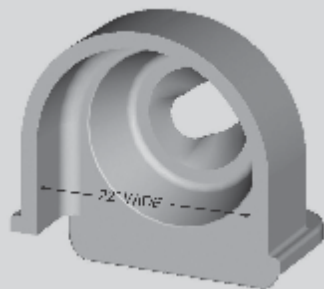
Shear angle	Part #	Shear angle	Part #
CL 0°	503-7018-3XX	90° L	503-6882-3XX
5° R	503-7019-3XX	85° L	503-7055-3XX
10° R	503-7020-3XX	80° L	503-7056-3XX
15° R	503-7021-3XX	75° L	503-7057-3XX
20° R	503-7022-3XX	70° L	503-7058-3XX
25° R	503-7023-3XX	65° L	503-7059-3XX
30° R	503-7043-3XX	60° L	503-7060-3XX
35° R	503-7044-3XX	55° L	503-7061-3XX
40° R	503-7045-3XX	50° L	503-7062-3XX
45° R	503-7046-3XX	45° L	503-7063-3XX
50° R	503-7047-3XX	40° L	503-7064-3XX
55° R	503-7048-3XX	35° L	503-7065-3XX
60° R	503-7049-3XX	30° L	503-7066-3XX
65° R	503-7050-3XX	25° L	503-7067-3XX
70° R	503-7051-3XX	20° L	503-7068-3XX
75° R	503-7052-3XX	15° L	503-7069-3XX
80° R	503-7053-3XX	10° L	503-7070-3XX
85° R	503-7054-3XX	5° L	503-7071-3XX

KS-503-7017

Note: Refractory spouts for metering spout applications will carry a different part number for every different angle of shearing.

Note: Metering spouts for 10" tube are used for single gob and double gob only.

N.B. Metering spouts with chrome oxide inserts are available upon request. Please contact your RATH representative.

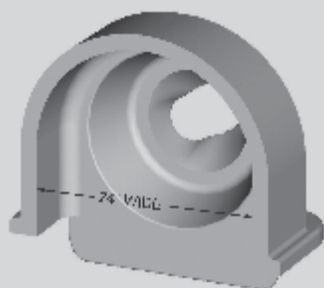
503 Metering Spouts - For 11" Tube - 11⁵/₁₆" deep

Note: Metering spouts for 11" tube are used for single, double and triple gob.

Shear angle	Part #	Shear angle	Part #
CL 0°	503-6948-3XX	90° L	503-6966-3XX
5° R	503-6949-3XX	85° L	503-6967-3XX
10° R	503-6950-3XX	80° L	503-6968-3XX
15° R	503-6951-3XX	75° L	503-6969-3XX
20° R	503-6952-3XX	70° L	503-6970-3XX
25° R	503-6953-3XX	65° L	503-6971-3XX
30° R	503-6954-3XX	60° L	503-6972-3XX
35° R	503-6955-3XX	55° L	503-6973-3XX
40° R	503-6956-3XX	50° L	503-6974-3XX
45° R	503-6957-3XX	45° L	503-6975-3XX
50° R	503-6958-3XX	40° L	503-6976-3XX
55° R	503-6959-3XX	35° L	503-6977-3XX
60° R	503-6960-3XX	30° L	503-6978-3XX
65° R	503-6961-3XX	25° L	503-6979-3XX
70° R	503-6962-3XX	20° L	503-6980-3XX
75° R	503-6963-3XX	15° L	503-6981-3XX
80° R	503-6964-3XX	10° L	503-6982-3XX
85° R	503-6965-3XX	5° L	503-6983-3XX

KS-503-6947

Note: Refractory spouts for metering spout applications will carry a different part number for every different angle of shearing.

515 Metering Spouts - For 10" Tube - 13" deep

Note: Refractory spouts for metering spout applications will carry a different part number for every different angle of shearing.

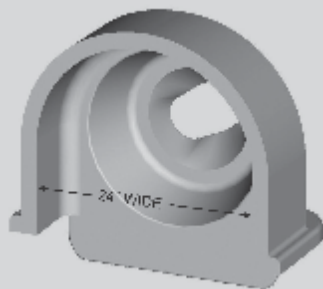
Note: Metering spouts for 10" tube are used for single gob and double gob only.

Shear angle	Part #	Shear angle	Part #
CL 0°	515-5324-3XX	90° L	515-5274-3XX
5° R	515-5325-3XX	85° L	515-5360-3XX
10° R	515-5326-3XX	80° L	515-5361-3XX
15° R	515-5327-3XX	75° L	515-5362-3XX
20° R	515-5328-3XX	70° L	515-5363-3XX
25° R	515-5329-3XX	65° L	515-5364-3XX
30° R	515-5330-3XX	60° L	515-5365-3XX
35° R	515-5331-3XX	55° L	515-5366-3XX
40° R	515-5332-3XX	50° L	515-5367-3XX
45° R	515-5333-3XX	45° L	515-5368-3XX
50° R	515-5352-3XX	40° L	515-5369-3XX
55° R	515-5353-3XX	35° L	515-5370-3XX
60° R	515-5354-3XX	30° L	515-5371-3XX
65° R	515-5355-3XX	25° L	515-5372-3XX
70° R	515-5356-3XX	20° L	515-5373-3XX
75° R	515-5357-3XX	15° L	515-5374-3XX
80° R	515-5358-3XX	10° L	515-5375-3XX
85° R	515-5359-3XX	5° L	515-5376-3XX

KS-515-5323

N.B. Metering spouts with chrome oxide inserts are available upon request. Please contact your RATH representative.

515 Metering Spouts - For 11" Tube - 13" deep



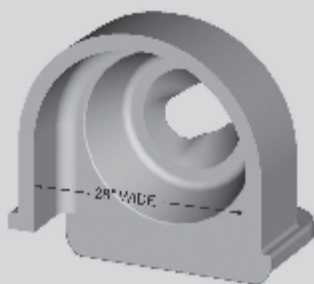
Note: Refractory spouts for metering spout applications will carry a different part number for every different angle of shearing.

Note: Metering spouts for 11" tube are used for single, double and triple gob.

Shear angle	Part #	Shear angle	Part #
CL 0°	515-5279-3XX	90° L	515-5297-3XX
5° R	515-5280-3XX	85° L	515-5298-3XX
10° R	515-5281-3XX	80° L	515-5299-3XX
15° R	515-5282-3XX	75° L	515-5300-3XX
20° R	515-5283-3XX	70° L	515-5301-3XX
25° R	515-5284-3XX	65° L	515-5302-3XX
30° R	515-5285-3XX	60° L	515-5276-3XX
35° R	515-5286-3XX	55° L	515-5303-3XX
40° R	515-5287-3XX	50° L	515-5304-3XX
45° R	515-5288-3XX	45° L	515-5305-3XX
50° R	515-5289-3XX	40° L	515-5306-3XX
55° R	515-5290-3XX	35° L	515-5307-3XX
60° R	515-5291-3XX	30° L	515-5308-3XX
65° R	515-5292-3XX	25° L	515-5309-3XX
70° R	515-5293-3XX	20° L	515-5310-3XX
75° R	515-5294-3XX	15° L	515-5311-3XX
80° R	515-5295-3XX	10° L	515-5312-3XX
85° R	515-5296-3XX	5° L	515-5313-3XX

KS-515-5275

585 Low Tonnage Metering Spouts - For 13" Tube - 13" deep



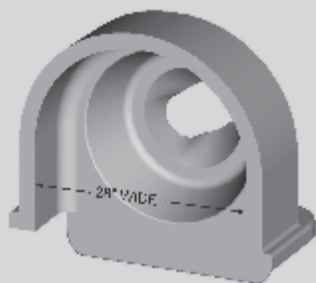
Note: Refractory spouts for metering spout applications will carry a different part number for every different angle of shearing.

Note: 585 metering spouts are used for double gob and triple gob.

Shear angle	Part #	Shear angle	Part #
CL 0°	585-1303-3XX	90° L	585-1321-3XX
5° R	585-1304-3XX	85° L	585-1322-3XX
10° R	585-1305-3XX	80° L	585-1323-3XX
15° R	585-1306-3XX	75° L	585-1324-3XX
20° R	585-1307-3XX	70° L	585-1325-3XX
25° R	585-1308-3XX	65° L	585-1326-3XX
30° R	585-1309-3XX	60° L	585-1327-3XX
35° R	585-1310-3XX	55° L	585-1328-3XX
40° R	585-1311-3XX	50° L	585-1329-3XX
45° R	585-1312-3XX	45° L	585-1330-3XX
50° R	585-1313-3XX	40° L	585-1331-3XX
55° R	585-1314-3XX	35° L	585-1332-3XX
60° R	585-1315-3XX	30° L	585-1333-3XX
65° R	585-1316-3XX	25° L	585-1334-3XX
70° R	585-1317-3XX	20° L	585-1335-3XX
75° R	585-1318-3XX	15° L	585-1336-3XX
80° R	585-1319-3XX	10° L	585-1337-3XX
85° R	585-1320-3XX	5° L	585-1338-3XX

KS-585-1172

N.B. Metering spouts with chrome oxide inserts are available upon request. Please contact your RATH representative.

585 High Tonnage Metering Spouts - For 13" Tube - 13" deep

Note: Refractory spouts for metering spout applications will carry a different part number for every different angle of shearing.

Note: 585 metering spouts are used for double gob and triple gob.

Shear angle	Part #	Shear angle	Part #
CL 0°	585-1173-3XX	90° L	585-1191-3XX
5° R	585-1174-3XX	85° L	585-1192-3XX
10° R	585-1175-3XX	80° L	585-1193-3XX
15° R	585-1176-3XX	75° L	585-1194-3XX
20° R	585-1177-3XX	70° L	585-1195-3XX
25° R	585-1178-3XX	65° L	585-1196-3XX
30° R	585-1179-3XX	60° L	585-1197-3XX
35° R	585-1180-3XX	55° L	585-1198-3XX
40° R	585-1181-3XX	50° L	585-1199-3XX
45° R	585-1182-3XX	45° L	585-1200-3XX
50° R	585-1183-3XX	40° L	585-1201-3XX
55° R	585-1184-3XX	35° L	585-1202-3XX
60° R	585-1185-3XX	30° L	585-1203-3XX
65° R	585-1186-3XX	25° L	585-1204-3XX
70° R	585-1187-3XX	20° L	585-1205-3XX
75° R	585-1188-3XX	15° L	585-1206-3XX
80° R	585-1189-3XX	10° L	585-1207-3XX
85° R	585-1190-3XX	5° L	585-1208-3XX

KS-585-1172

N.B. Metering spouts with chrome oxide inserts are available upon request. Please contact your RATH representative.

Spout assemblies



Shape stability & corrosion resistance

For the spout assemblies' spout covers and spout burner blocks, the materials 338 and 345 are used to provide the needed shape stability and resistance to thermal shock. Spout covers are designed with cells to hold ceramic fiber insulating board shapes which provide needed insulation.

Orifice rings
& gaskets

Plungers

Tubes

Spouts

Spout
assemblies

Stirrers
& rotor
segments

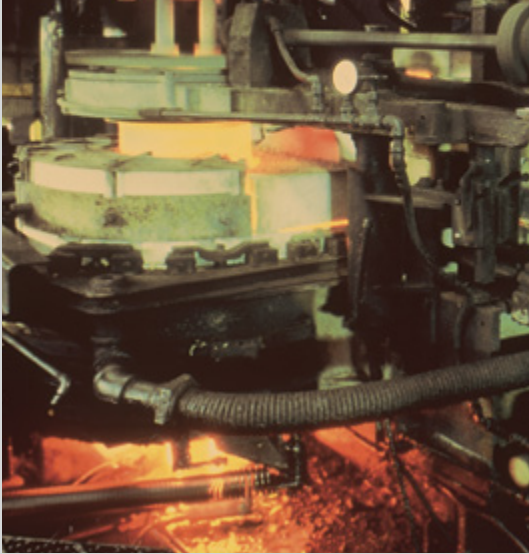
Insulation,
cements &
hard bricks

Forehearths
& maintenance
items

Glasshouse
crucibles &
accessories

Technical
references

Material Safety
Data Sheet
MSDS



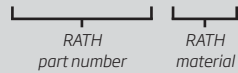
Spout assemblies

Material data		
	338	345
ZrO ₂	-	-
Al ₂ O ₃	71	83
SiO ₂	26	16
Density (g/cc)	2.5	2.6
Porosity (%)	18	19
MOR (MPa)	20.0	14.5

All data is subject to reasonable deviations and not to be used for specification purposes.

Refractory part numbers

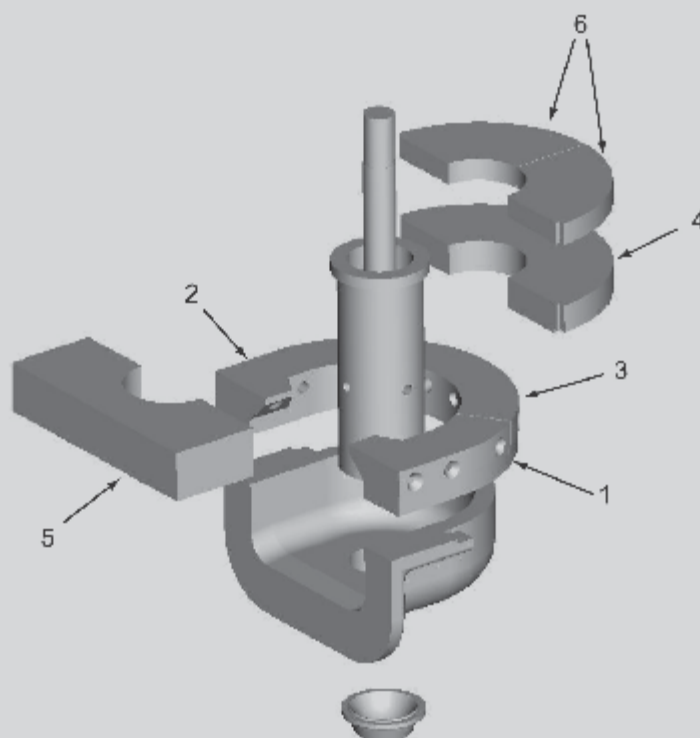
123-4567 - 3XX



For special applications, alternative refractory materials are available. Please contact your nearest RATH representative.

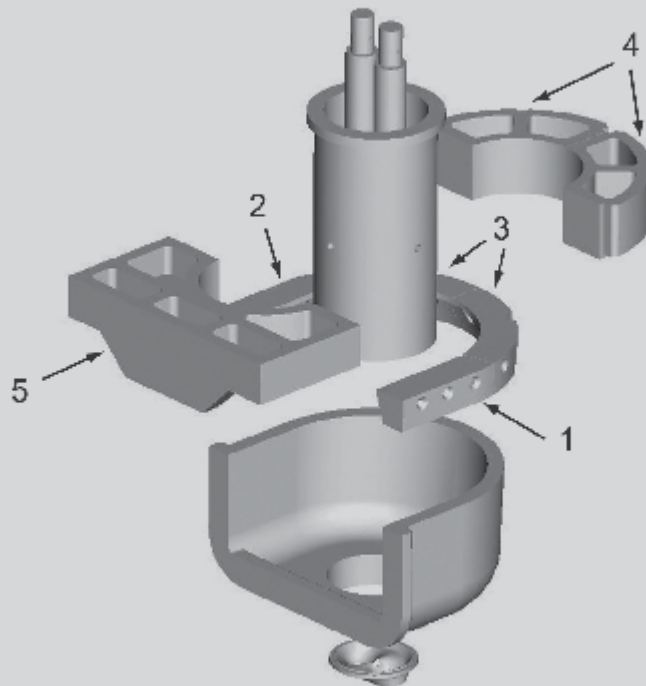
144 Feeder Spout Assemblies

Tube size	Pos. #	Part #	Description
5" (127 mm) &	1	144-13094-338	Burner Block, LH
6" (152 mm) &	2	144-13095-338	Burner Block, RH
7" (178 mm)	3	144-13096-338	Burner Block, Center
5" (127 mm)	4	144-5031-345	Spout Cover, Front
	5	144-5023-338	Spout Cover, Rear
	6	144-5027-397	Spout Cover, Insulation
6" (152 mm)	4	144-12432-345	Spout Cover, Front
	5	144-12430-338	Spout Cover, Rear
	5	501-6548-338	Spout Cover w/Baffle, Rear
	6	144-12431-397	Front Spout Cover, Insulation
7" (178 mm)	4	144-14139-345	Spout Cover, Front
	5	144-14140-338	Spout Cover, Rear
	5	144-15564-338	Spout Cover w/Baffle, Rear
	6	144-12431-397	Front Spout Cover, Insulation
8" (203 mm)	4	144-15086-345	Spout Cover, Front
	5	144-15085-338	Spout Cover, Rear



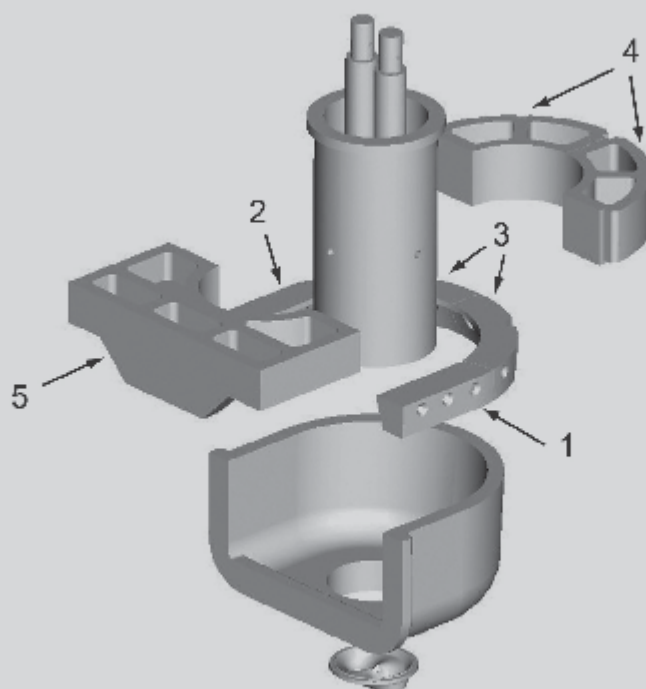
194 Feeder Spout Assemblies

Tube size	Pos. #	Part #	Description
7" (178 mm) & 8" (203 mm)	1	194-5010-338	Burner Block, LH
	2	194-5008-338	Burner Block, RH
	3	194-5009-338	Burner Block, Front
7" (178 mm)	4	194-5006-338	Spout Cover, Front
	5	194-5005-345	Spout Cover, Rear
	5	194-5578-345	Spout Cover w/Baffle, Rear
8" (203 mm)	4	194-5639-338	Spout Cover, Front
	5	194-5638-345	Spout Cover w/Baffle, Rear
	5	194-5642-345	Spout Cover, Rear



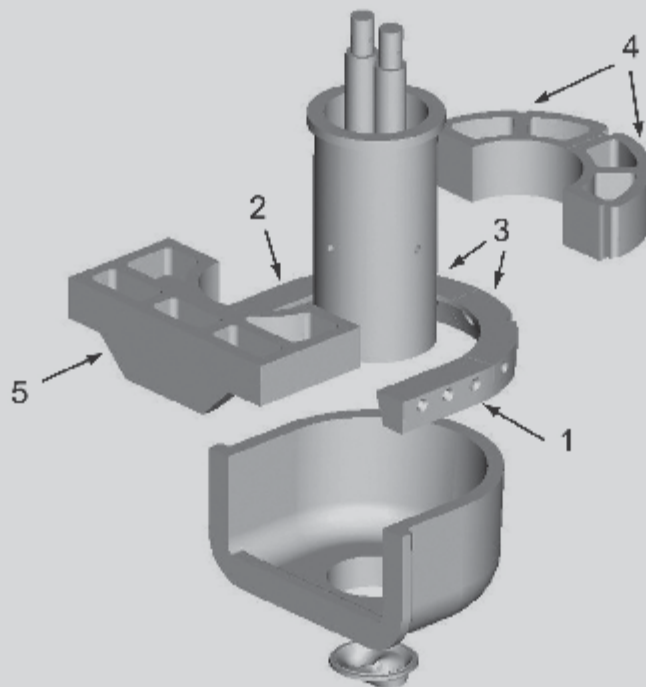
81 Feeder Spout Assemblies - 16" Width Offset Spout Rotating Tube

Tube size	Pos. #	Part #	Description
6" (152 mm) & 7" (178 mm)	1	81-2653-338	Burner Block, LH
	2	81-2652-338	Burner Block, RH
	3	81-2654-338	Burner Block, Front
6" (152 mm)	4	81-3812-338	Spout Cover, Front
	5	81-3811-345	Spout Cover, Rear
7" (178 mm)	4	194-5006-338	Spout Cover, Front
	5	81-3813-345	Spout Cover, Rear



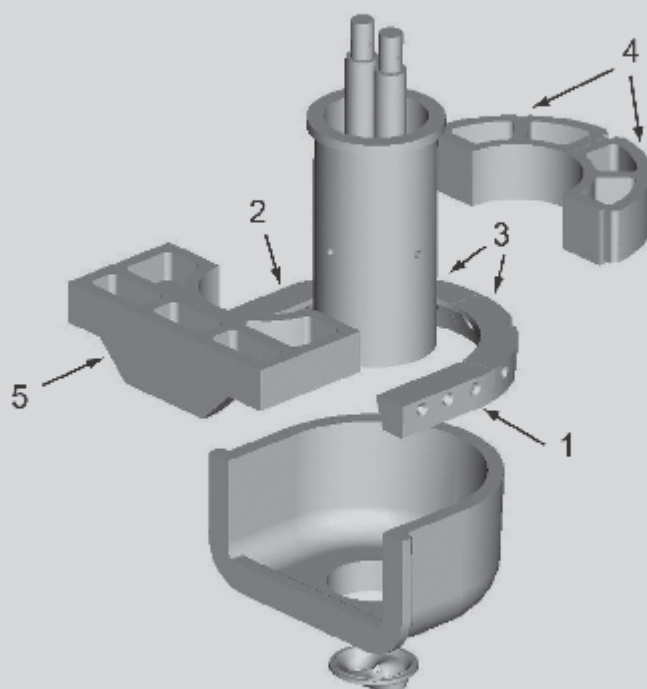
81 Feeder Spout Assemblies - 18" Width Centerline Spout Rotating Tube

Tube size	Pos. #	Part #	Description
7" (178 mm) &	1	81-4033-338	Burner Block, LH
8" (203 mm) &	2	81-4034-338	Burner Block, RH
10" (254 mm)	3	81-4032-338	Burner Block, Front
Spout cover with 16" or 22" wide equalizing section			
7" (178 mm)	4	194-5006-338	Spout Cover, Front
	5	81-3813-338	Spout Cover, Rear
8" (203 mm)	4	81-6214-338	Spout Cover, Front
	5	81-6217-345	Spout Cover, Rear
10" (254 mm)	4	81-6215-338	Spout Cover, Front
	5	81-6219-345	Spout Cover, Rear
Spout cover with 26" or 36" wide equalizing section			
7" (178 mm)	4	194-5006-338	Spout Cover, Front
	5	194-5005-345	Spout Cover, Rear
8" (203 mm)	4	81-6214-338	Spout Cover, Front
	5	81-6218-345	Spout Cover, Rear
10" (254 mm)	4	81-6215-338	Spout Cover, Front
	5	81-6220-345	Spout Cover, Rear



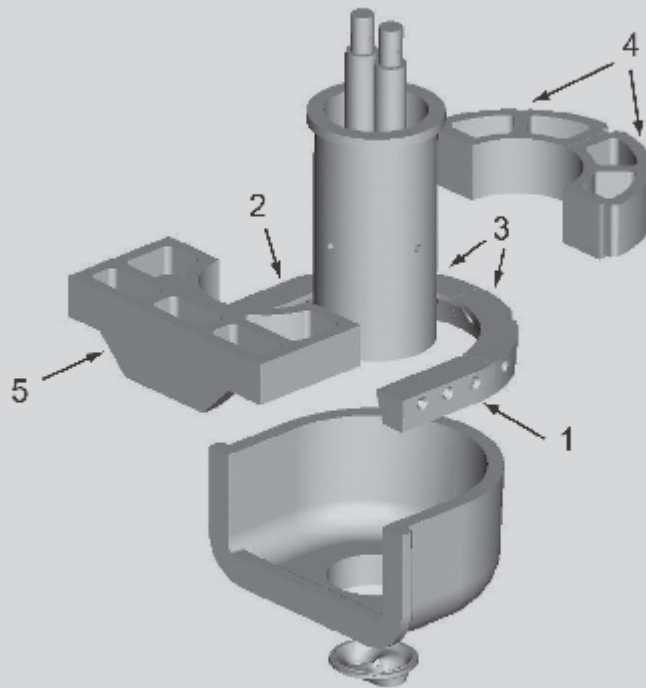
81 Feeder Spout Assemblies - Turbex Spout - 16" Width Rotors

Tube size	Pos. #	Part #	Description
6" (152 mm) & 7" (178 mm)	1	81-2653-338	Burner Block, LH
	2	81-2652-338	Burner Block, RH
	3	81-2654-338	Burner Block, Front
6" (152 mm)	4	81-1999-338	Spout Cover, Front
	5	81-1998-345	Spout Cover, Rear
7" (178 mm)	4	81-3433-388	Spout Cover, Front
	5	81-3434-345	Spout Cover, Rear



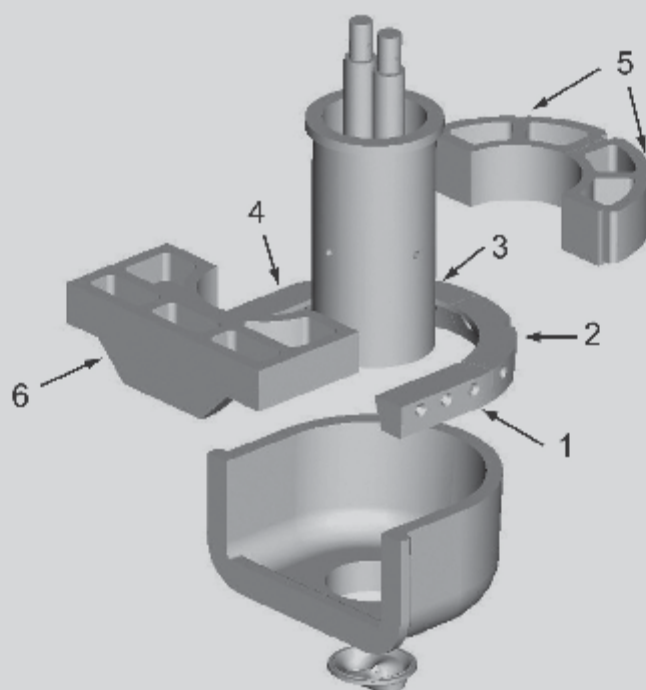
81 Feeder Spout Assemblies - 18" Width - Centerline Spout Rotors

Tube size	Pos. #	Part #	Description
7" (178 mm)	1	81-4033-338	Burner Block, LH
	2	81-4034-338	Burner Block, RH
	3	81-4032-338	Burner Block, Front
7" (178 mm)	4	81-4035-338	Spout Cover, Front
	5	81-4036-345	Spout Cover, Rear



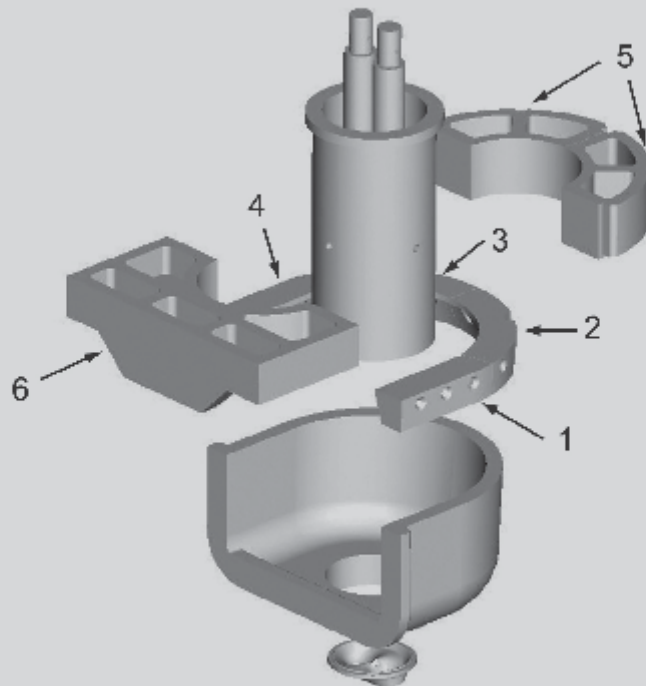
503 Feeder Spout Assemblies

Tube size	Pos. #	Part #	Description
7" (178 mm) & 8" (203 mm) & 10" (254 mm)	1	58-2365-338	Burner Block, Rear, LH
	2	115-520-338	Burner Block, Front, LH
	3	115-521-338	Burner Block, Front, RH
	4	58-2364-338	Burner Block, Rear, RH
7" (178 mm)	5	503-5391-338	Spout Cover, Front (2 req'd)
	6	503-5392-345	Spout Cover w/o Baffle, Rear
	6	503-5899-345	Spout Cover w/Baffle, Rear
8" (203 mm)	5	503-6118-338	Spout Cover, Front (2 req'd)
	6	503-6119-345	Spout Cover w/o Baffle, Rear
	6	503-6120-345	Spout Cover w/Baffle, Rear
10" (254 mm)	5	503-5134-338	Spout Cover, Front (2 req'd)
	6	503-5873-345	Spout Cover w/Baffle, Rear



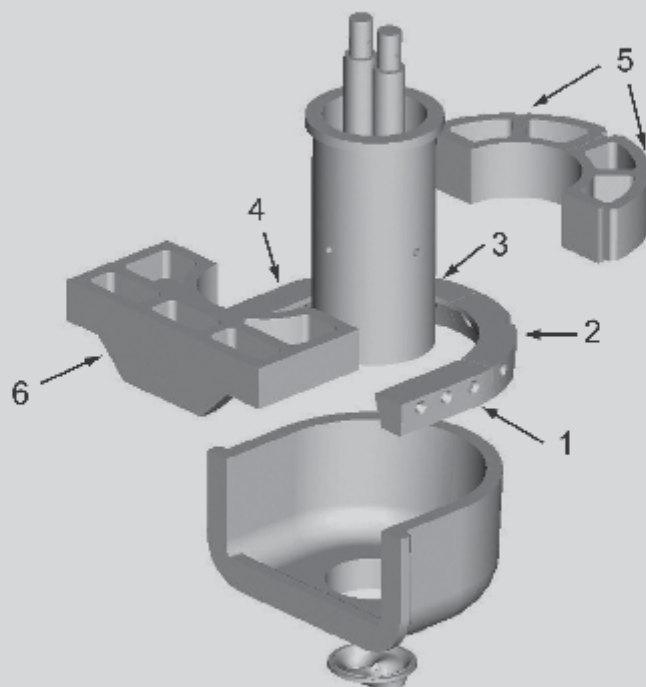
503 Feeder, 515 Spout Assemblies

Tube size	Pos. #	Part #	Description
10" (254 mm)	1	515-5005-338	Burner Block, Rear, LH
	2	515-5003-338	Burner Block, Front, LH
11" (279 mm)	3	515-5002-338	Burner Block, Front, RH
	4	515-5004-338	Burner Block, Rear, RH
10" (254 mm)	5	503-5134-338	Spout Cover, Front (2 req'd)
	6	503-5873-345	Spout Cover w/Baffle, Rear
11" (279 mm)	5	113-745-338	Spout Cover, Front (2 req'd)
	6	113-746-345	Spout Cover, Rear
	6	515-5145-345	Spout Cover w/Baffle, Rear



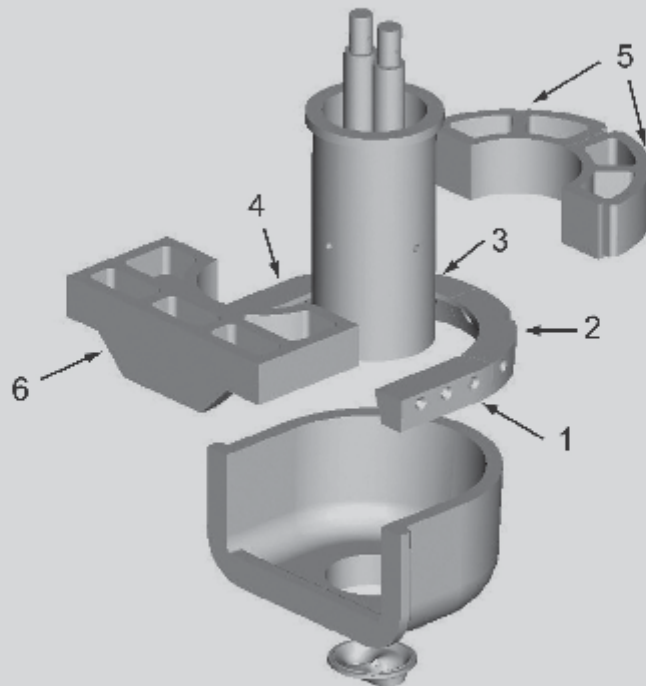
503 Feeder for Rotors Spout Assemblies

Tube size	Pos. #	Part #	Description
7" (178 mm) & 8" (203 mm) & 10" (254 mm)	1	58-2365-338	Burner Block, Rear, LH
	2	115-520-338	Burner Block, Front, LH
	3	115-521-338	Burner Block, Front, RH
	4	58-2364-338	Burner Block, Rear, RH
7" (178 mm)	5	503-5391-338	Spout Cover, Front (2 req'd)
	6	503-5392-345	Spout Cover, Rear
8" (203 mm)	5	503-6617-338	Spout Cover, Front (2 req'd)
	6	503-6618-345	Spout Cover, Rear
10" (254 mm)	5	503-5940-338	Spout Cover, Front (2 req'd)
	6	503-6568-345	Spout Cover, Rear



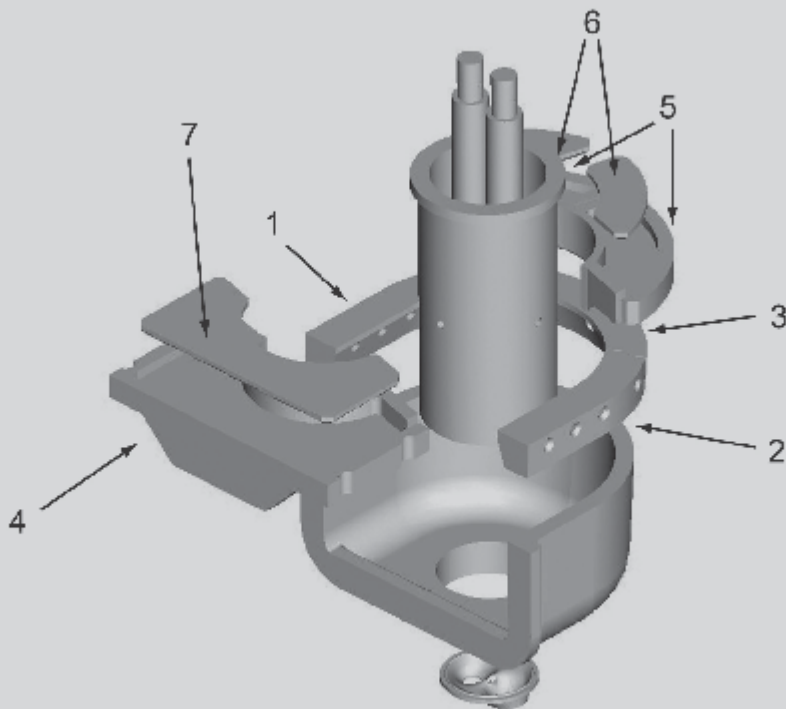
515 Feeder Spout Assemblies

Tube size	Pos. #	Part #	Description
11" (279 mm) & 12" (304 mm)	1	515-5005-338	Burner Block, Rear, LH
	2	515-5003-338	Burner Block, Front, LH
	3	515-5002-338	Burner Block, Front, RH
	4	515-5004-338	Burner Block, Rear, RH
11" (279 mm)	5	113-745-338	Spout Cover, Front
	6	515-5145-345	Spout Cover w/Baffle, Rear
12" (304 mm)	5	515-6066-338	Spout Cover, Front
	6	515-6067-345	Spout Cover, Rear
	6	515-5142-345	Spout Cover w/Baffle, Rear



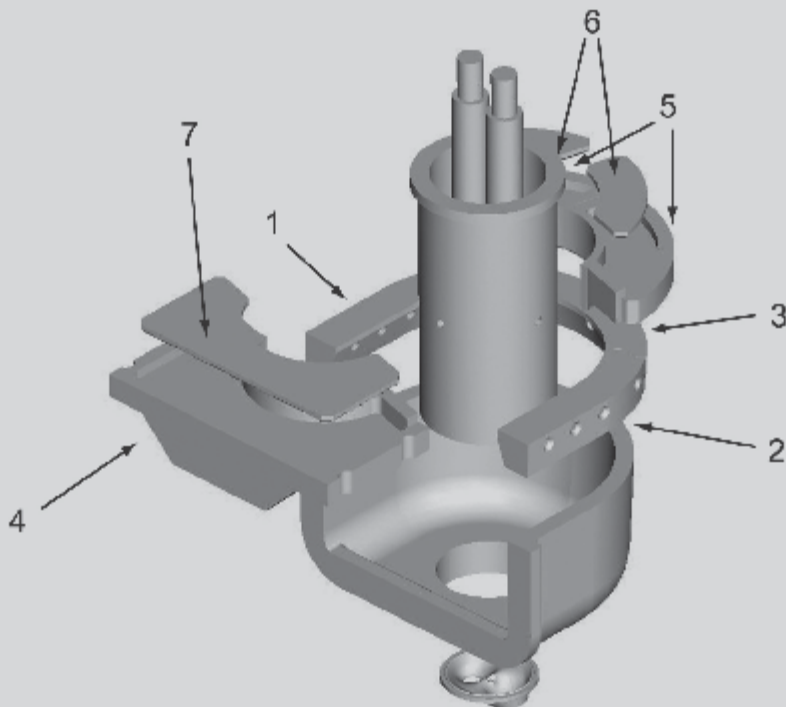
81 and 555 Feeder Spout Assemblies - 14" wide

Tube size	Pos. #	Part #	Description
5" (127 mm) & 6" (152 mm)	1	81-4524-338	Burner Block, RH
	2	81-4526-338	Burner Block, LH
	3	81-4525-338	Burner Block, Front
5" (127 mm)	4	81-4558-345	Spout Cover, Rear
	5	81-4550-338	Spout Cover, Front
	6	81-4546-397	Front Spout Cover Insulation (3 ea.)
	7	81-4554-397	Rear Spout Cover Insulation (3 ea.)
6" (152 mm)	4	81-4559-345	Spout Cover, Rear
	5	81-4551-338	Spout Cover, Front
	6	81-4547-397	Front Spout Cover Insulation (3 ea.)
	7	81-4555	Rear Spout Cover Insulation (3 ea.)



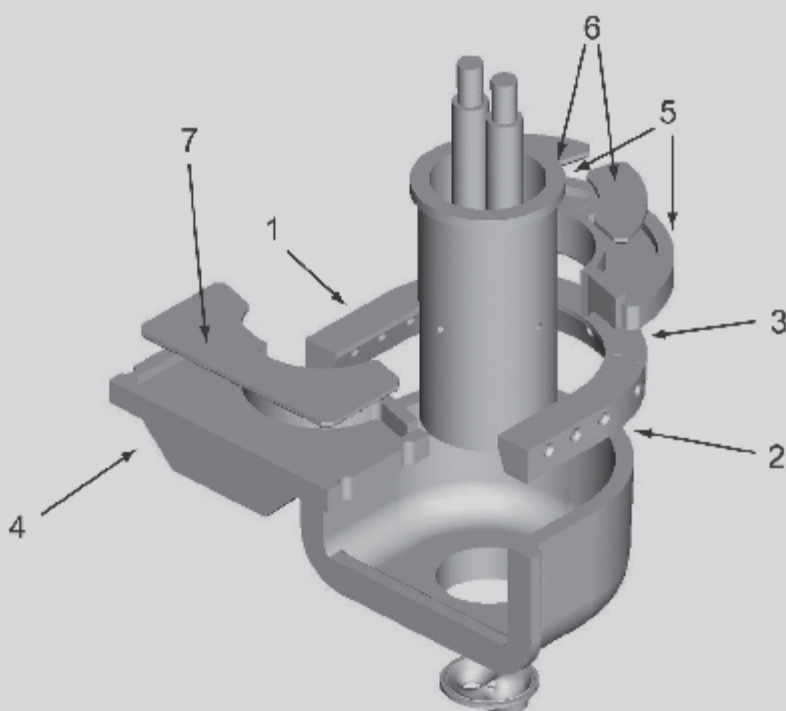
81 and 555 Feeder Spout Assemblies - 18" wide

Tube size	Pos. #	Part #	Description
5" (127 mm) &	1	81-4544-338	Burner Block, RH
6" (152 mm) &	2	81-4543-338	Burner Block, LH
7" (178 mm) &	3	81-4545-338	Burner Block, Front
8" (203 mm)	4	81-4558-345	Spout Cover, Rear
	5	81-4550-338	Spout Cover, Front
	6	81-4546-397	Front Spout Cover Insulation (3 ea.)
	7	81-4554-397	Rear Spout Cover Insulation (3 ea.)
6" (152 mm)	4	81-4559-345	Spout Cover, Rear
	5	81-4551-338	Spout Cover, Front
	6	81-4547-397	Front Spout Cover Insulation (3 ea.)
	7	81-4555-397	Rear Spout Cover Insulation (3 ea.)
7" (178 mm)	4	81-4560-345	Spout Cover, Rear
	5	81-4552-338	Spout Cover, Front
	6	81-4548-397	Front Spout Cover Insulation (3 ea.)
	7	81-4556-397	Rear Spout Cover Insulation (3 ea.)
8" (203 mm)	4	81-4561-345	Spout Cover, Rear
	5	81-4553-338	Spout Cover, Front
	6	81-4549-397	Front Spout Cover Insulation (3 ea.)
	7	81-4557-397	Rear Spout Cover Insulation (3 ea.)



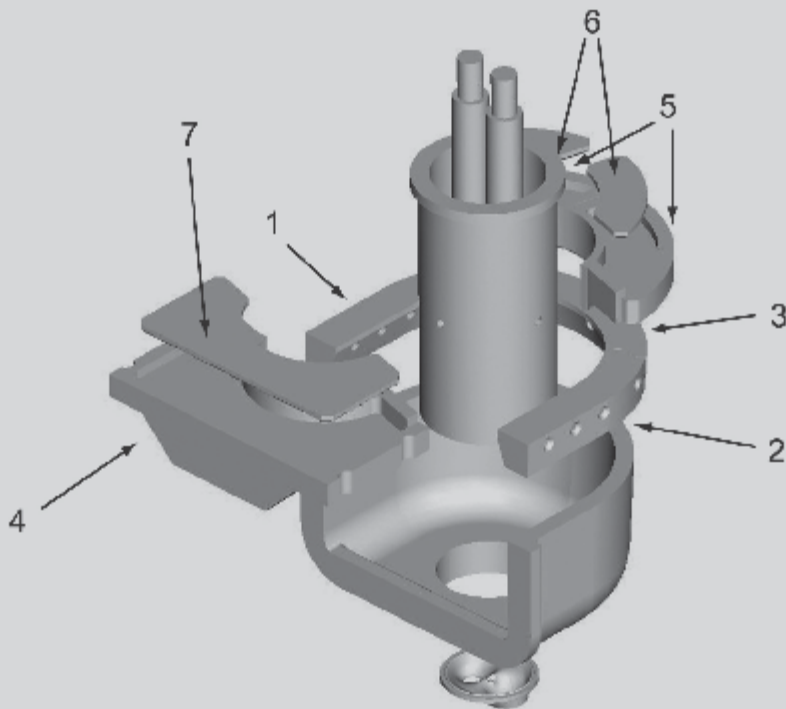
555 Spout Assemblies, 503 Refractory

Tube size	Pos. #	Part #	Description
7" (178 mm) &	1	555-1244-338	Burner Block, RH
8" (203 mm) &	2	555-1245-338	Burner Block, LH
10" (254 mm) & 11" (279 mm)	3	555-1243-338	Burner Block, Center
7" (178 mm)	4	555-1666-345	Spout Cover w/Baffle, Rear
	5	555-1670-338	Spout Cover, Front, (2 req'd)
	6	555-1668-397	Front Insulation (6 req'd)
	7	555-1672-397	Rear Insulation (3 req'd)
8" (203 mm)	4	555-1665-345	Spout Cover w/Baffle, Rear
	5	555-1669-338	Spout Cover, Front, (2 req'd)
	6	555-1667-397	Front Insulation (6 req'd)
	7	555-1671-397	Rear Insulation (3 req'd)
10" (254 mm)	4	555-1247-345	Spout Cover w/Baffle, Rear
	5	555-1246-338	Spout Cover, Front, (2 req'd)
	6	555-1283-397	Front Insulation (6 req'd)
	7	555-1288-397	Rear Insulation (3 req'd)
11" (279 mm)	4	555-1819-345	Spout Cover w/Baffle, Rear
	5	555-1820-338	Spout Cover, Front, (2 req'd)
	6	555-1283-397	Front Insulation (6 req'd)
	7	555-1288-397	Rear Insulation (3 req'd)



555 Spout Assemblies, 515 Refractory

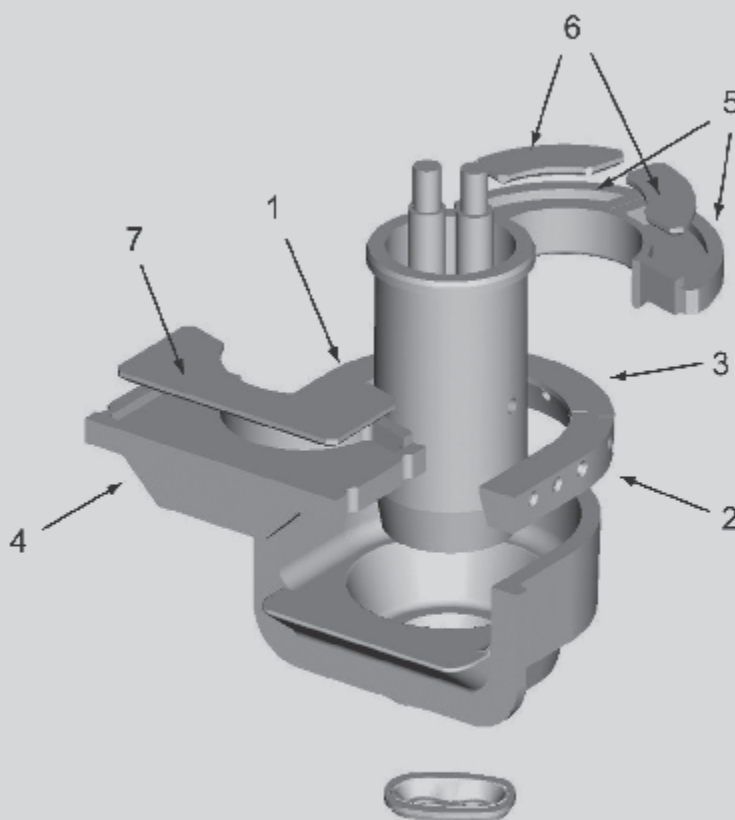
Tube size	Pos. #	Part #	Description
10" (254 mm) & 11" (279 mm)	1	555-1784-338	Burner Block, RH
	2	555-1782-338	Burner Block, LH
	3	555-1783-338	Burner Block, Center
10" (254 mm)	4	555-1247-345	Spout Cover w/Baffle, Rear
	5	555-1246-338	Spout Cover, Front, (2 req'd)
	6	555-1283-397	Front Insulation (6 req'd)
	7	555-1288-397	Rear Insulation (3 req'd)
11" (279 mm)	4	555-1819-345	Spout Cover, Rear
	5	555-1820-338	Spout Cover, Front, (2 req'd)
	6	555-1283-397	Front Insulation (6 req'd)
	7	555-1288-397	Rear Insulation (3 req'd)



81 Metering Spout Assembly - 8" Tube

Metering tube size	Pos. #	Part #	Description
8" (203 mm)	1	81-4544-338	Burner Block, RH
	2	81-4543-338	Burner Block, LH
	3	81-4545-338	Burner Block, Center
	4	81-4737-345	Spout Cover, Rear
	5	81-4736-338	Spout Cover, Front
	6	81-4738-397	Front Insulation (3 req'd)
	7	81-4739-397	Rear Insulation (3 req'd)

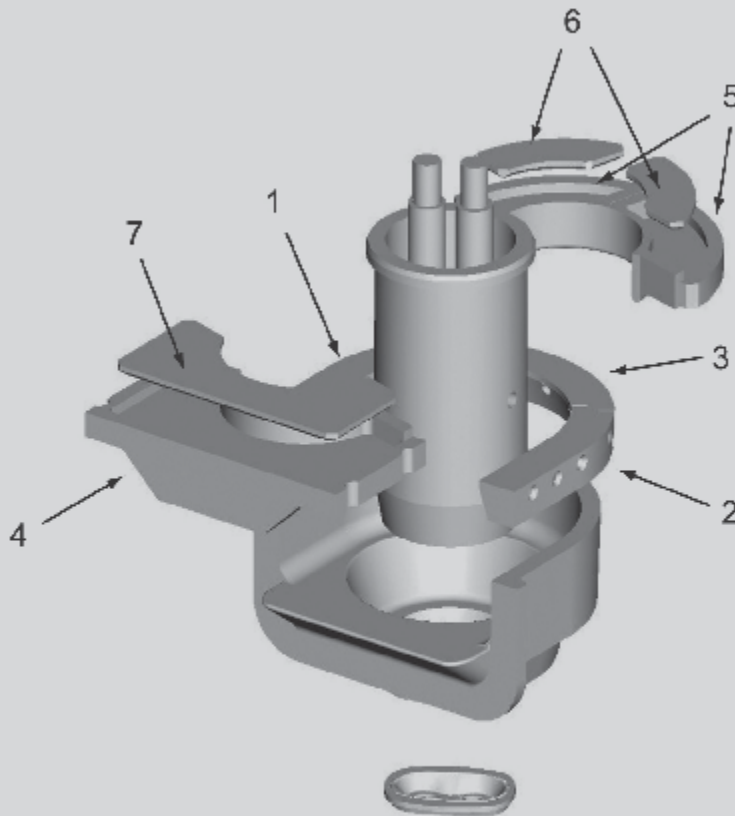
Note: Tube and spout figures shown below do not reflect actual metering system shapes.



81 Metering Spout Assembly - 9" Tube

Metering tube size	Pos. #	Part #	Description
9" (229 mm)	1	81-4544-338	Burner Block, RH
	2	81-4543-338	Burner Block, LH
	3	81-4545-338	Burner Block, Center
	4	81-4798-345	Spout Cover, Rear
	5	81-4797-338	Spout Cover, Front
	6	81-4738-397	Front Insulation (3 req'd)
	7	81-4739-397	Rear Insulation (3 req'd)

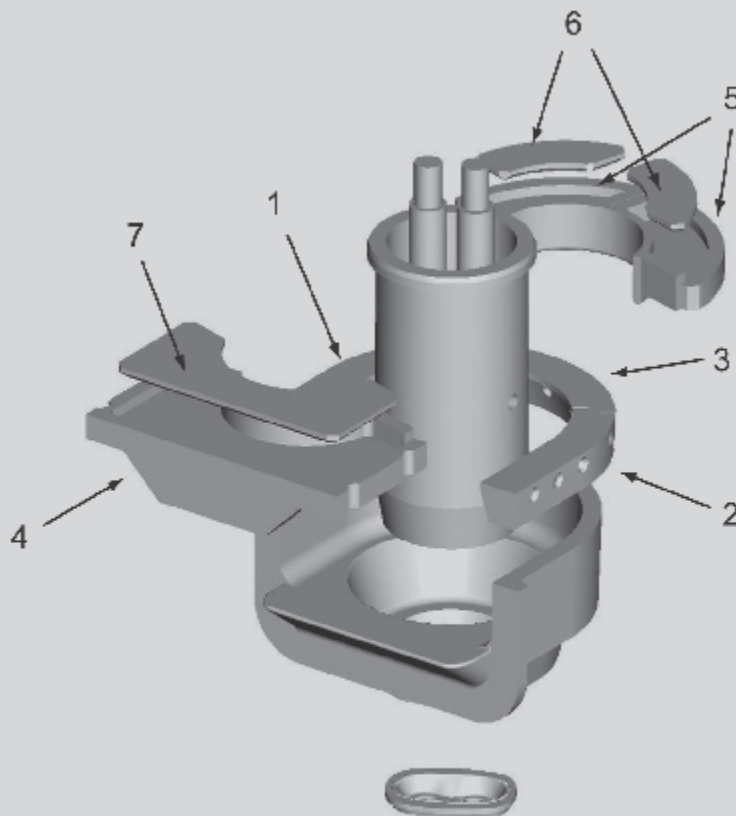
Note: Tube and spout figures shown below do not reflect actual metering system shapes.



503 Metering Spout Assembly - 10" Tube

Metering tube size	Pos. #	Part #	Description
10" (254 mm)	1	555-1244-338	Burner Block, RH
	2	555-1245-338	Burner Block, LH
	3	555-1243-338	Burner Block, Center
	4	555-2138-345	Spout Cover, Rear
	5	555-2137-338	Spout Cover, Front, (2 req'd)
	6	555-1283-397	Front Insulation (6 req'd)
	7	555-1288-397	Rear Insulation (3 req'd)

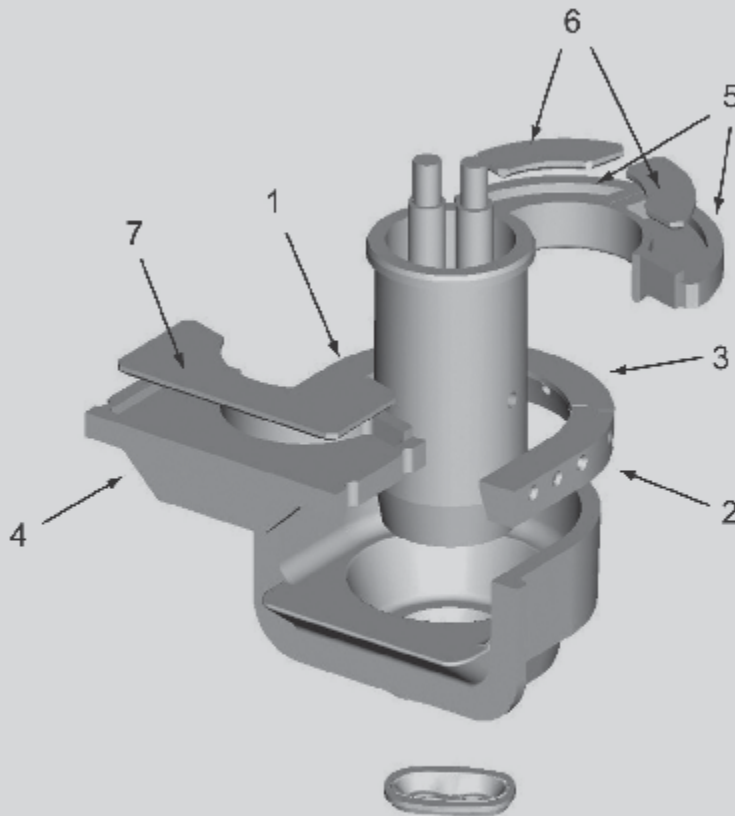
Note: Tube and spout figures shown below do not reflect actual metering system shapes.



503 Metering Spout Assembly - 11" Tube

Metering tube size	Pos. #	Part #	Description
11" (279 mm)	1	555-1244-338	Burner Block, RH
	2	555-1245-338	Burner Block, LH
	3	555-1243-338	Burner Block, Center
	4	555-2142-345	Spout Cover, Rear
	5	555-2143-338	Spout Cover, Front, (2 req'd)
	6	555-2144-397	Front Insulation (6 req'd)
	7	555-2145-397	Rear Insulation (3 req'd)

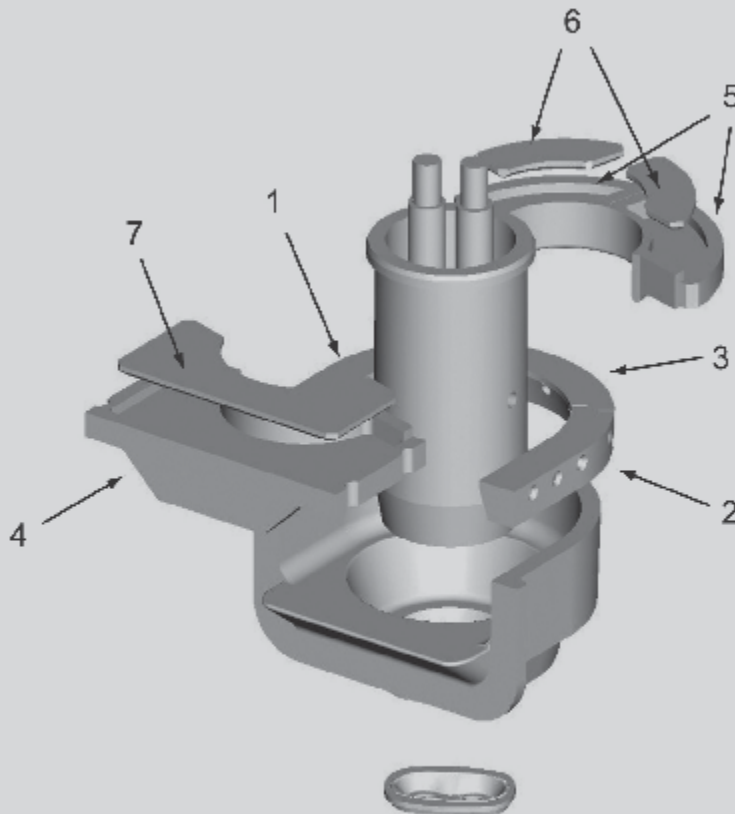
Note: Tube and spout figures shown below do not reflect actual metering system shapes.



515 Metering Spout Assembly - 10" Tube

Metering tube size	Pos. #	Part #	Description
10" (254 mm)	1	555-1784-338	Burner Block, RH
	2	555-1782-338	Burner Block, LH
	3	555-1783-338	Burner Block, Center
	4	555-2138-345	Spout Cover, Rear
	5	555-2137-338	Spout Cover, Front, (2 req'd)
	6	555-1283-397	Front Insulation (6 req'd)
	7	555-1288-397	Rear Insulation (3 req'd)

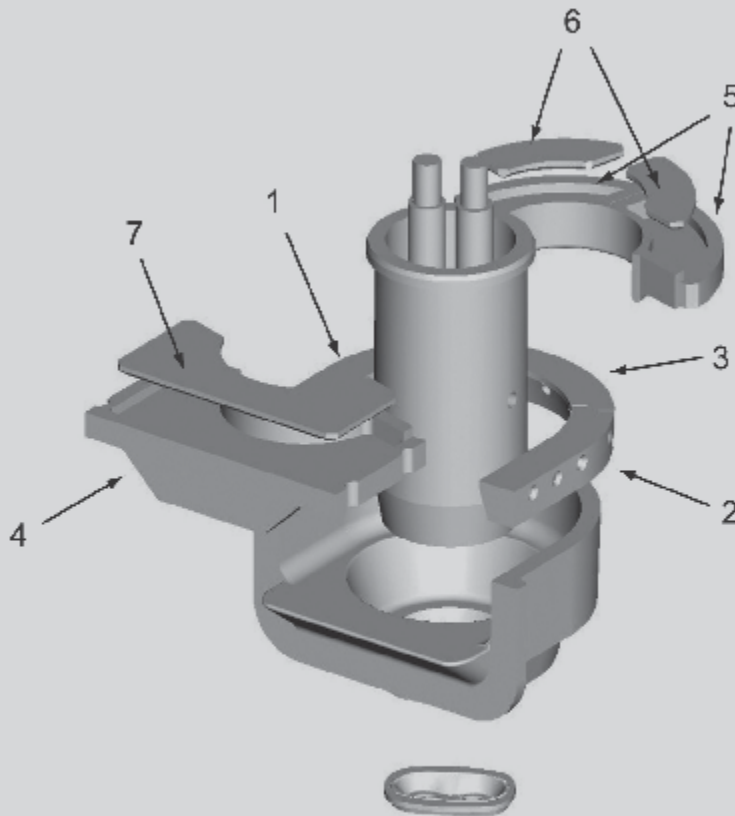
Note: Tube and spout figures shown below do not reflect actual metering system shapes.



515 Metering Spout Assembly - 11" Tube

Metering tube size	Pos. #	Part #	Description
11" (279 mm)	1	555-1784-338	Burner Block, RH
	2	555-1782-338	Burner Block, LH
	3	555-1783-338	Burner Block, Center
	4	555-2142-345	Spout Cover, Rear
	5	555-2143-338	Spout Cover, Front, (2 req'd)
	6	555-2144-397	Front Insulation (6 req'd)
	7	555-2145-397	Rear Insulation (3 req'd)

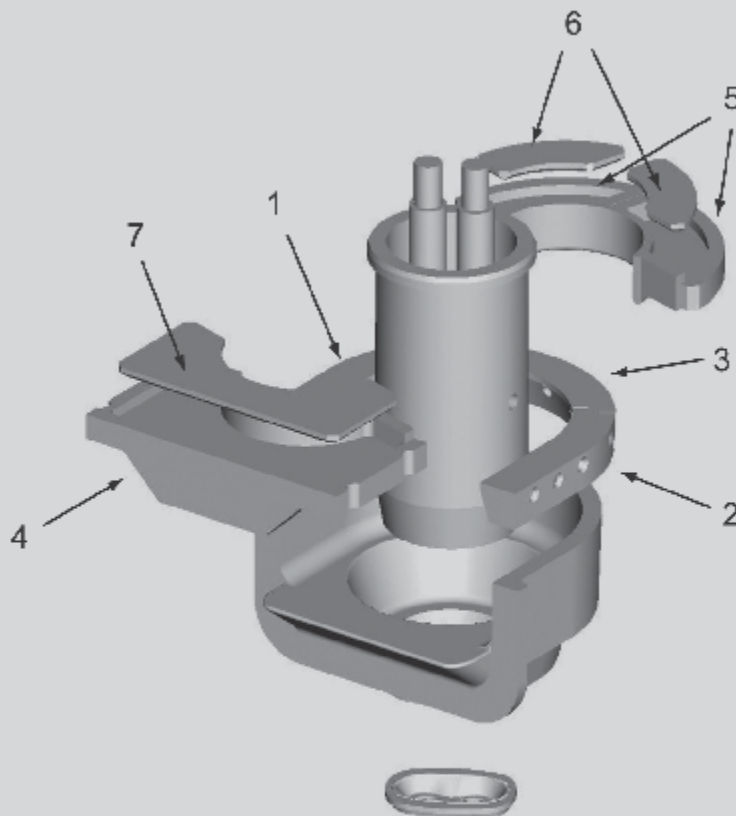
Note: Tube and spout figures shown below do not reflect actual metering system shapes.



585 Low Tonnage Metering Spout Assembly - 13" Tube

Metering tube size	Pos. #	Part #	Description
13" (330 mm)	1	585-1424-338	Burner Block, RH
	2	585-1423-338	Burner Block, LH
	3	585-1425-338	Burner Block, Center
	4	585-1090-345	Spout Cover, Rear
	5	585-1089-338	Spout Cover, Front, (2 req'd)
	6	585-1086-397	Front Insulation (6 req'd)
	7	585-1087-397	Rear Insulation (3 req'd)

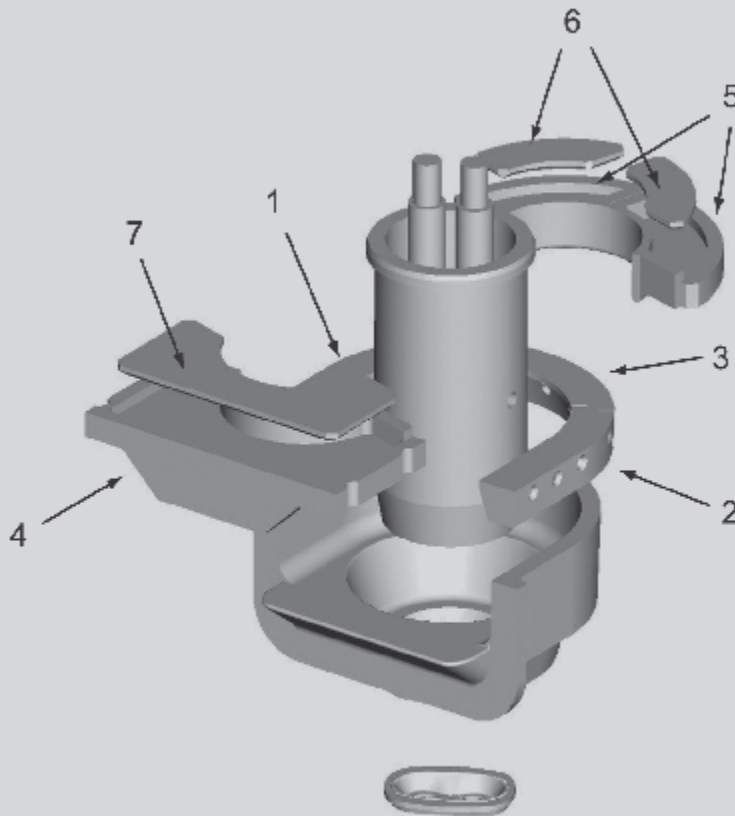
Note: Tube and spout figures shown below do not reflect actual metering system shapes.



585 High Tonnage Metering Spout Assembly - 13" Tube

Metering tube size	Pos. #	Part #	Description
13" (330 mm)	1	585-1011-338	Burner Block, RH
	2	585-1010-338	Burner Block, LH
	3	585-1012-338	Burner Block, Center
	4	585-1090-345	Spout Cover, Rear
	5	585-1089-338	Spout Cover, Front, (2 req'd)
	6	585-1086-397	Front Insulation (6 req'd)
	7	585-1087-397	Rear Insulation (3 req'd)

Note: Tube and spout figures shown below do not reflect actual metering system shapes.



Stirrers and rotor segments



Superior wear resistance

Both stirrers and rotor segments require materials which are designed to withstand the severe wear inherent in the applications. This is provided by the RATH 315 and 333 compositions.

Stirrers, especially those used in colorant forehearth, require close grinding control. This helps ensure that when rotated in the 3-bank or 4-bank configurations, they produce minimum runout to ensure correct colorant mixing patterns.

Orifice rings
& gaskets

Plungers

Tubes

Spouts

Spout
assemblies

Stirrers
& rotor
segments

Insulation,
cements &
hard bricks

Forehearths
& maintenance
items

Glasshouse
crucibles &
accessories

Technical
references

Material Safety
Data Sheet
MSDS

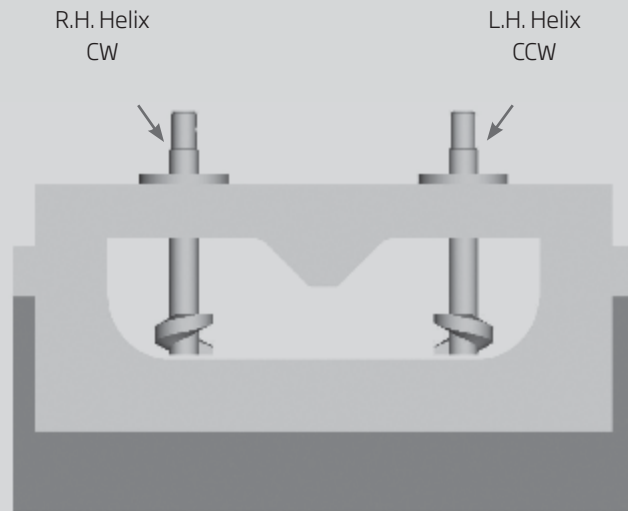


Stirrers and rotor segments

Material data			
	301*	315	333
ZrO ₂	35	20	11
Al ₂ O ₃	45	69	73
SiO ₂	19	11	15
Density (g/cc)	3.2	3.1	3.0
Porosity (%)	18	19	18
MOR (MPa)	20.0	21.4	17.9

* New formula containing 35 % ZrO₂. Mix was launched in 2011.

All data is subject to reasonable deviations and not to be used for specification purposes.

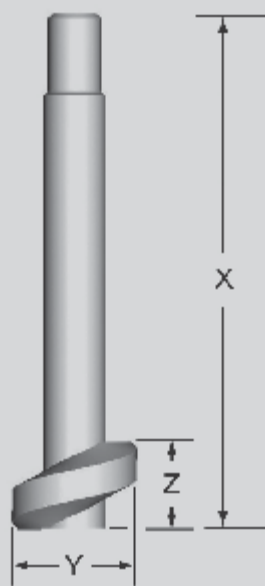


Refractory part numbers

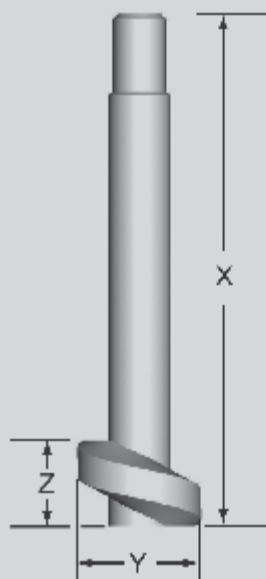
123-4567 - 3XX
 └───┬───┘ └───┬───┘
 RATH RATH
 part number material

For special applications, alternative refractory materials are available. Please contact your nearest RATH representative.

Stirrers



Right Hand (RH)
Helix Stirrer



Left Hand (LH)
Helix Stirrer

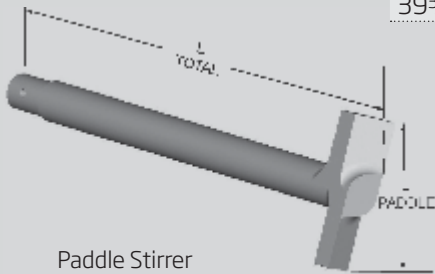
Z		X		Y		Helix	Part #
in.	mm	in.	mm	in.	mm		
4½	114	27	686	6½	165	RH	119-863-3XX
4½	114	27	686	6½	165	LH	119-902-3XX
4½	114	30	762	6½	165	RH	98-693-3XX
4½	114	30	762	6½	165	LH	501-5128-3XX
4½	114	38½	978	6½	165	RH	501-6248-3XX
4½	114	38½	978	6½	165	LH	501-6249-3XX
4½	114	48	1219	6½	165	RH	501-5038-3XX
4½	114	48	1219	6½	165	LH	501-5037-3XX
7½	190	27	686	6	152	LH	501-5727-3XX
7½	190	30	762	6½	165	RH	98-516-3XX
7½	190	30	762	6½	165	LH	119-906-3XX
7½	190	33	838	6½	165	RH	98-795-3XX
7½	190	33	838	6½	165	LH	98-796-3XX
7½	190	38½	978	6½	165	RH	501-5935-3XX
7½	190	38½	978	6½	165	LH	501-5936-3XX
9*	229	33	838	6½	165	RH	501-6223-3XX
9*	229	33	838	6½	165	LH	501-6222-3XX
9*	229	40	1016	6½	165	RH	501-6195-3XX
9*	229	40	1016	6½	165	LH	501-6194-3XX
9½**	241	40½	1029	6½	165	RH	501-6220-3XX
9½**	241	40½	1029	6½	165	LH	501-6219-3XX
12***	305	40½	1029	7¼	184	RH	501-6251-3XX
12***	305	40½	1029	7¼	184	LH	501-6252-3XX
12****	305	40½	1029	7¼	184	LH	501-6270-3XX
12****	305	40½	1029	7¼	184	RH	501-6269-3XX
12	305	42	1067	7¼	184	RH	501-6301-3XX
12	305	42	1067	7¼	184	LH	501-6302-3XX

*1.20 Turns **1.27 Turns ***1.60 Turns ****2 Turns with 35/8" shank

T-Bar and Paddle stirrers



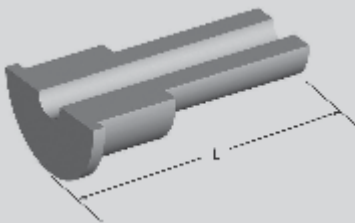
T-Bar Stirrer



Paddle Stirrer

L Total		L Paddle		Type	Part #
in.	mm	in.	mm		
26	660	15	381	T-Bar	501-6112-3XX
26	660	15	381	T-Bar	501-6113-3XX
27	686	7½	191	T-Bar	501-8284-3XX
27	686	7½	191	T-Bar	501-8285-3XX
36¼/16	916	11¼/16	300	T-Bar	501-8348-3XX
36¼/16	916	11¼/16	300	T-Bar	501-8349-3XX
36¼/16	916	11¼/16	300	T-Bar	501-8385-3XX
36¼/16	916	11¼/16	300	T-Bar	501-8386-3XX
39¾/8	1000	11¼/16	300	Paddle	501-8395-3XX
39¾/8	1000	11¼/16	300	Paddle	501-8396-3XX
39¾/8	1000	11¼/16	300	Paddle	501-8383-3XX
39¾/8	1000	11¼/16	300	Paddle	501-8384-3XX

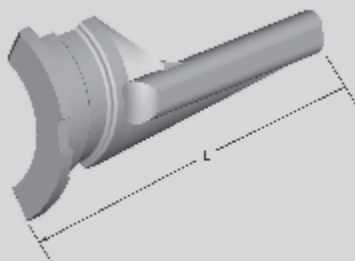
Stirrer Sleeves



L		Part #
in.	mm	
5	127	119-1031-3XX
7½	191	501-6716-3XX
13½	343	119-572-3XX

Note: Stirrer sleeves are shipped in marked, matched sets of two and should be installed as such.

Rotor Segments



in.	L		Spout type	Gap in.	Part #	Description
	in.	mm				
19 ⁷ / ₈		505	Deep		81-4079-3XX	For 81 Feeder with 7" Tube
20 ⁵ / ₈		524	Deep		81-3487-3XX	
19		483	Standard		81-4451-3XX	For 81 Feeder with 8" Tube
21 ¹ / ₈		537	Standard		501-6721-3XX	
22 ⁵ / ₈		575	Deep	1/4	501-5389-3XX	For 503 Feeder with 10" Tube
22 ⁵ / ₈		575	Deep	1/2	501-6707-3XX	
22 ⁵ / ₈		575	Deep		501-6787-3XX	
21		533	Deep	1/4	503-5910-3XX	
21 ¹ / ₂		546	Deep	1/2	501-6786-3XX	
21 ³ / ₄		553	Deep	3/8	501-6730-3XX	
21 ³ / ₄		553	Deep	1/2	501-6720-3XX	
22		559	Deep	1/4	501-6834-3XX	For 503 Feeder with 10" Tube
22		559	Deep	3/8	501-6819-3XX	
22 ³ / ₄		578	Deep	1/4	503-6527-3XX	
22 ³ / ₄		578	Deep	1/4	501-6729-3XX	
22 ³ / ₄		578	Deep	1/2	501-6701-3XX	
25		635	Deep	3/8	501-6736-3XX	
26		660	Deep	3/8	501-6833-3XX	

Note: Rotors are shipped in marked matched sets of three, and should be installed as such.



Insulation, cements and hard bricks



High performance materials

The installation of the spout assembly components requires luting and insulation materials for the orifice ring and for the spout. RATH provides a number of luting materials to assure optimum service.

Microporous silica spout insulation kits are provided for all RATH spouts, including the new metering spout system. These spout insulation kits are used in conjunction with granular insulation, ceramic fiber insulation, or RATH preferred insulating castable, EmCast 25.



Refractory part numbers

123-4567-3XX

RATH
part number

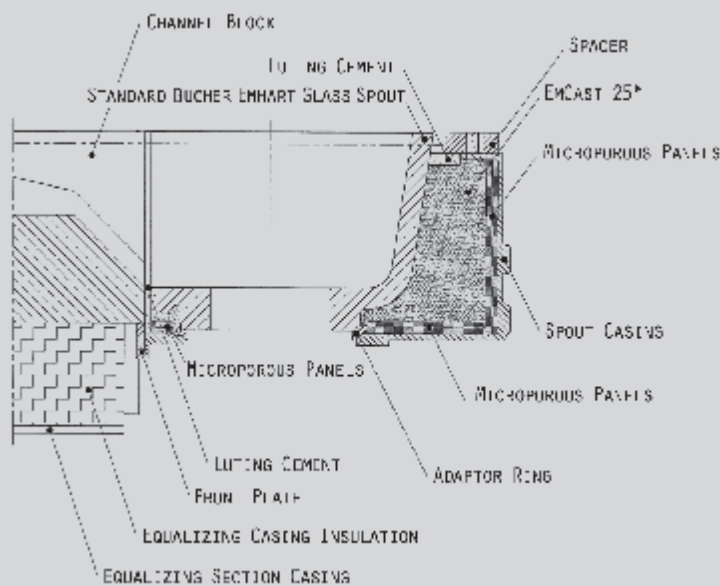
RATH
material

For special applications, alternative refractory materials are available. Please contact your nearest RATH representative.

Materials needed for spout installation

Spout casing	Spout insulation assembly reference drawing	Spout style	Microporous insulation kit	EmCast 25	R-220 Luting cement	Anti-adhesive	#312 Cement
81 Spout	81-439	Std Deep	59-94654 59-94662	100 lbs.	80 lbs.	5 lbs.	80 lbs.
144 Spout	144-21268	Std Deep	59-94716 59-94715	50 lbs.	80 lbs.	5 lbs.	80 lbs.
503 Spout	503-259	Std	59-94652	100 lbs.	80 lbs.	5 lbs.	80 lbs.
515 Spout	515-8	Std	59-94655	100 lbs.	80 lbs.	5 lbs.	80 lbs.
555 Spout	555-97	Std	59-94684	125 lbs.	80 lbs.	5 lbs.	80 lbs.
585 Spout	585-7-01	High tonnage	59-94684	125 lbs.	80 lbs.	5 lbs.	80 lbs.
585 Spout	585-7-02	Low tonnage	59-95504	150 lbs.	80 lbs.	5 lbs.	80 lbs.

Cross section showing installation



* EmCast 25 is the recommended backup insulation of RATH, replacing the previously recommended Celatom insulation.

Insulation, cements and hard bricks

Part #	Description	Container Size	Chemistry					Density g/cc	Porosity %	MOR psi	MOR MPa	Use Limit °C
			Al ₂ O ₃	SiO ₂	ZrO ₂	CaO	MgO					
Cement												
1320-25	No. 353A Cement, Air Set, Dry	80 lbs.	48	44	-	-	-	-	-	-	-	
1320-30	No. 312 Spout Luting Cement	80 lbs.	56	40	-	-	-	-	-	-	-	
1320-40	No. 353H Cement, Heat Set	80 lbs.	48	44	-	-	-	-	-	-	-	
1320-73	No. 353A Cement, Air Set, Wet	80 lbs.	48	44	-	-	-	-	-	-	1650	
1320-455	R-220 Orifice Ring Luting Cement	80 lbs.	48	44	-	-	-	-	-	-	-	
1320-480	R-298 Anti-Adhesive Cement	5 lbs.	93	6	-	-	-	-	-	-	-	
Castable												
1320-517	Insulating Castable	50 lbs.	95	-	-	4	-	0.4	-	600	4.1	1760
59-94657	EmCast 25 Insulating Castable	25 lbs.	40	30	-	23	-	0.4	-	30	0.2	1370
Loose Fill												
1320-490	Stop Leak Material	100 lbs.	99	-	-	-	-	-	-	-	-	-
1320-110	Celatom MP-87 for Spout Insulation	50 lbs.	6.5	90	-	-	-	0.4	-	-	-	-
1380-30	Celatom MN53 (Fine) (For Orifice Ring Insulation)	50 lbs.	6	84	-	-	-	0.2	-	-	-	-
Fiber												
1380-86	Fibrous Refractory Wool - Bulk Packing	25 lbs.	45	53	-	-	-	-	-	-	-	1260
5106-0	Ceramic Fiber Rope	-	45	54	-	-	-	-	-	-	-	1260
Clay												
500-15060-E83	Ring Clay, Fine	500 lbs.	32	61	-	-	-	-	-	-	-	-
500-15060-386	Ring Clay, Coarse	500 lbs.	32	61	-	-	-	-	-	-	-	-
500-15066-384	Luting Clay, Wet	125 lbs.	30	63	-	-	-	-	-	-	-	-

All data is subject to reasonable deviations and not to be used for specification purposes.

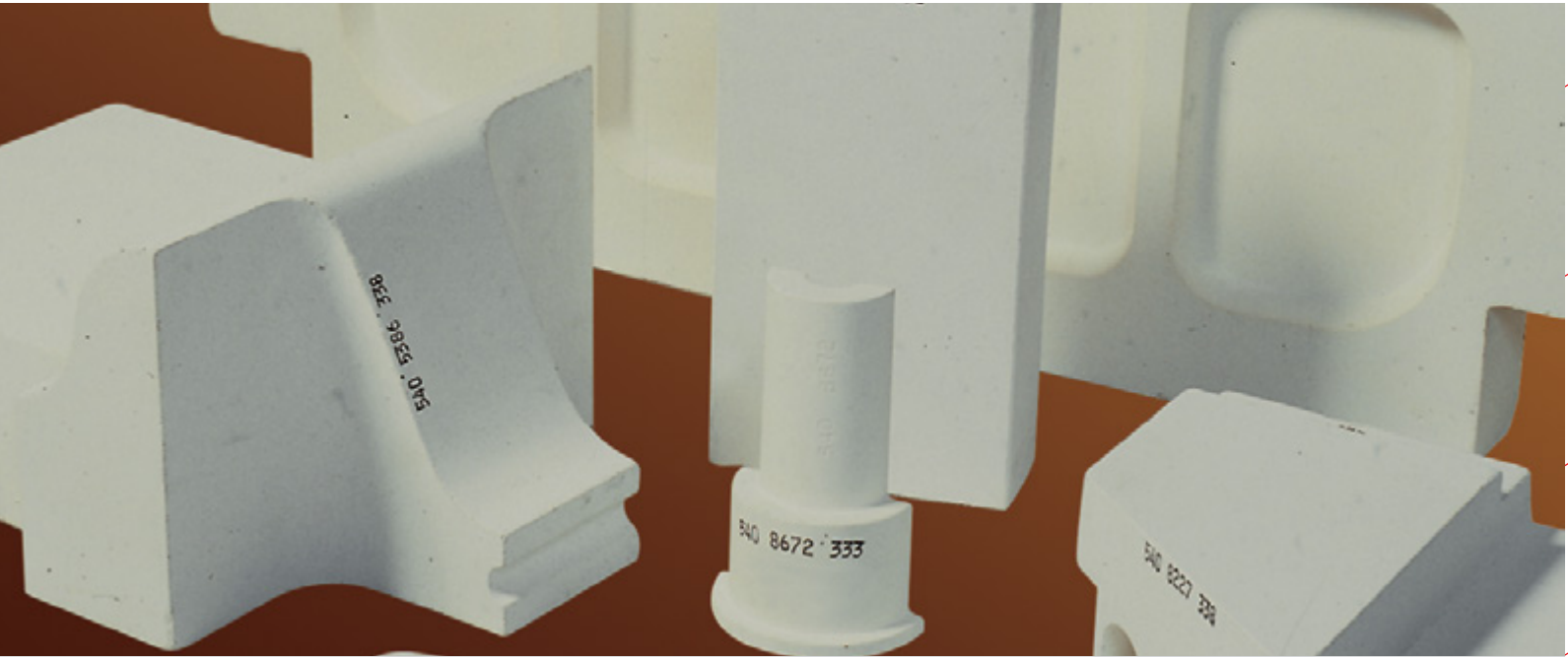
Insulation, cements and hard bricks

Part #	Description	Container Size	Chemistry					Density g/cc	Porosity %	MOR psi	MOR MPa	Use Limit °C
			Al ₂ O ₃	SiO ₂	ZrO ₂	CaO	MgO					
Fiber Insulation Board												
1830-16025-394	1x24x48" Soluble Fiber Insulation Board	6 pcs	-	75	-	-	23	0.2	-	70	0.5	1260
1830-16026-394	2x24x48" Soluble Fiber Insulation Board	3 pcs	-	75	-	-	23	0.2	-	70	0.5	1260
1830-16025-396	1x24x48" RCF Insulation Board	6 pcs	35	50	15	-	-	0.4	-	125	0.9	1426
1830-16026-396	2x24x48" RCF Insulation Board	3 pcs	35	50	15	-	-	0.4	-	125	0.9	1426
1830-16025-397	1x24x48" RCF Insulation Board	6 pcs	43	55	-	5	-	0.4	-	200	1.4	1260
1830-16026-397	2x24x48" RCF Insulation Board	3 pcs	43	55	-	5	-	0.4	-	200	1.4	1260
Brick Insulating Firebrick												
2460-360	9 x 4½ x 1¼" Split, 2300°F IFB	45	32	64	-	-	-	0.6	-	100	0.7	1260
2460-370	9 x 4½ x 2" Split, 2300°F IFB	-	32	64	-	-	-	0.6	-	100	0.7	1260
2460-380	9 x 4½ x 2½" Split, 2300°F IFB	25	32	64	-	-	-	0.6	-	100	0.7	1260
2460-390	9 x 4½ x 3" Split, 2300°F IFB	-	32	64	-	-	-	0.6	-	100	0.7	1260
2460-680	9 x 4½ x 1¼" Split, 2600°F IFB	-	35	61	-	-	-	0.7	-	170	1.2	1427
2460-690	9 x 4½ x 2" Split, 2600°F IFB	-	35	61	-	-	-	0.7	-	170	1.2	1427
2460-730	9 x 4½ x 2½" Split, 2600°F IFB	-	35	61	-	-	-	0.7	-	170	1.2	1427
2460-760	9 x 4½ x 3" Split, 2600°F IFB	-	35	61	-	-	-	0.7	-	170	1.2	1427
Super-Duty Fire Brick												
2460-1030	9 x 4½ x 1¼" Split, Firebrick	-	47	48	-	-	-	2.3	17	1250	8.6	-
2460-1040	9 x 4½ x 2" Split, Firebrick	-	47	48	-	-	-	2.3	17	1250	8.6	-
2460-1050	9 x 4½ x 2½" Split, Firebrick	-	47	48	-	-	-	2.3	17	1250	8.6	-
2460-1060	9 x 4½ x 3" Split, Firebrick	-	47	48	-	-	-	2.3	17	1250	8.6	-
Special												
140-1296	9 x 4½ x 2½" Split, High Alumina	-	70	24	-	-	-	2.6	18	1900	13.1	-
140-4235	18 x 6 x 2" Burned High Alumina	-	61	30	-	-	-	2.5	13	2390	16.5	-
140-4236	15 x 6 x 2" Burned High Alumina	-	61	30	-	-	-	2.5	13	2390	16.5	-

All data is subject to reasonable deviations and not to be used for specification purposes.



Forehearths and maintenance items



Forehearths

540 Our standard and most popular forehearth design. Two-humped roof block for distributing heat evenly, keeping glass temperatures consistent throughout the channel width.

340 More automated than the 540 design with mechanical parts constantly moving the damper blocks back and forth on top of the flue blocks to better regulate air flow and temperature within the forehearth.

640 For smaller length forehearths which need more heat loss in the cooling zones. The smaller hump design on the roof blocks and modified cooling equipment prevent heat from being trapped towards the outside of the channel blocks.

240 Most often used in narrow width forehearths (i.e. 16", 18", & 26" widths.) The design offers a flat roof block design where RATH's humped roof block design is not applicable.

Standard design modifications include but are not limited to: blender-friendly equalizing sections and direct cooling through separation blocks.

Forehearth maintenance items

Proper maintenance of forehearths is critical to ensure the good operational performance and life of the products. RATH forehearth maintenance items are made to original equipment specifications and include the following items:

- Top cooling tunnel components
- Radiation plates (cooling covers)
- Back blocks
- Damper blocks
- Mantle blocks
- Skimmer blocks

Standard forehearth widths & lengths

- Forehearth widths: 26", 36", 42", 48", 54"
- Forehearth cooling zone lengths: 8', 10', 12'
- Equalizing section lengths: 4' x 6'

Forehearth zones

- Alcoves: Sections of the distributor that support forehearth lines or shops
- Cooling zones (front, middle, and rear): Standard straight shaped zones behind the equalizing section
- Cranks: Sharp degree turns in a forehearth making it look angular
- Distributors: Section feed by the working end that carries the glass to the forehearths
- Dog Leg: A series of slight angles in a forehearth giving the appearance of a radiated turn
- Equalizing sections: Section that supports the drop point of a forehearth
- Tee Equalizing section: Two equalizing sections utilizing a tandem-tee design to split the glass flow in order for one forehearth to have two drop points
- Working end: Section that receives glass from the furnace and feeds the distributor

Forehearth courses

- Superstructure Burner course: Includes burner blocks and separation blocks
- Superstructure Roof course: Includes roof blocks and top cooling
- Superstructure Insulation: Includes insulation bricks, fire bricks, and insulation board

Substructure channels

Substructure Insulation: Includes insulation bricks, fire bricks, cements, insulation board, and other refractory materials needed

Forehearth compositions

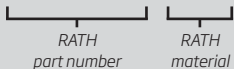
Forehearth components are made with high quality, high purity materials. The workhorse material for forehearths is a mullite composition. This material is used for roof blocks, burner blocks, chimney blocks, and other various shapes. If a particular component requires a more premium composition, an alumina fortified mullite is used.

In colorant forehearths or other applications where corrosion is a concern, a zircon mullite material possessing excellent resistance to alkali vapor attack is used.

The composition is also used for channel blocks and stirrer covers. Fiberglass forehearths require silica-free composition. For this application a zirconia toughened alumina is offered.

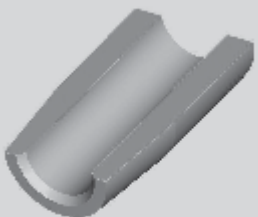
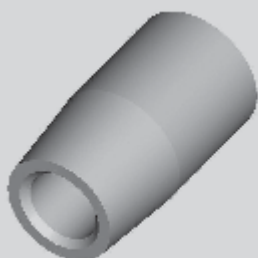
Refractory part numbers

123-4567 - 3XX

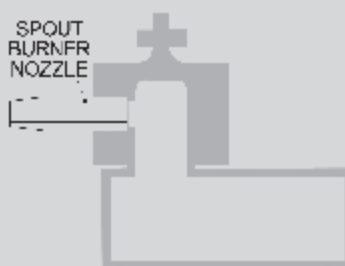

RATH
part number RATH
material

For special applications, alternative refractory materials are available. Please contact your nearest RATH representative.

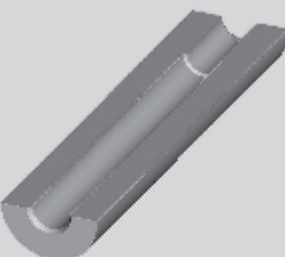
Spout Burner Nozzles



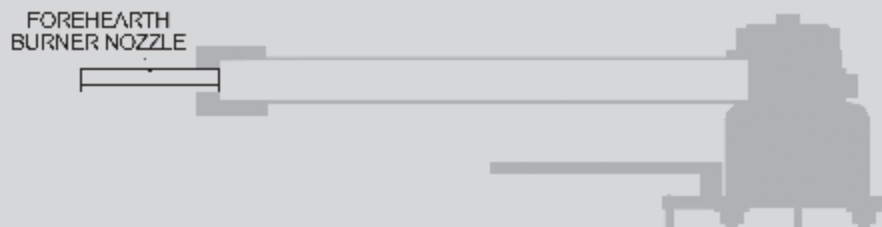
Size (in.)	Size (mm)	Part #	Std.	Odd size	Spout type
1/4"	6.35	81-2275	X		81 (normal temp)
9/32"	7.14	81-3198	X		81 (high temp)
#3	5.41	81-2149		X	81
#13	4.69	81-1735		X	81
9/32"	7.14	115-744	X		503
5/16"	7.93	113-663	X		515
1/4"	6.35	113-512		X	503/515
3/8"	9.52	113-701		X	503/515
#3	5.41	113-702	X		555-585



Forehearth Burner Nozzles



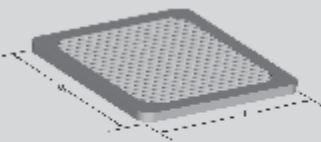
Size (in.)	Size (mm)	Part #	Std.	Odd size	Forehearth type
1/4"	6.35	144-5994	X		KW 81, 510 (26")
9/32"	7.14	144-4668	X		K-36, 510 (36")
#3	5.41	144-5848		X	KW / K-36
7/32"	5.55	144-14217		X	KW / K-36
19/64"	7.54	144-14280		X	KW / K-36
11/32"	8.73	119-965	X		K-48
5/16"	7.93	63-722		X	K-48
17/64"	6.74	119-639		X	K-48
#13	4.69	144-5847	X		540 (26")
#3	5.41	144-5858	X		540 (36")
#3	5.41	144-5858	X		540 (42")
1/4"	6.35	144-5994	X		540 (48")



Burner Gaskets

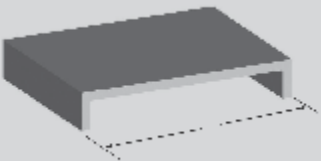
Description	Unit	Part #
¼" Ceramic Rope	8'-10' per burner	-5106
Burner Gasket / 540 Type	1 per burner	540-5040
Burner Gasket / K Type	1 per burner	1700-136

Cooling Plates



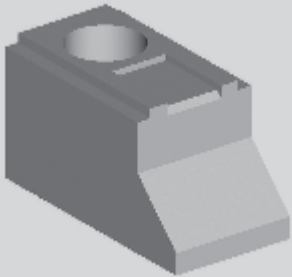
Length	Width	Forehearth size	Part #
14"	9"	26"	540-5340-3XX
14¾"	14"	36"	540-5439-3XX
20"	14"	42"	540-6018-3XX
14¼"	14"	48"	540-8041-3XX
14¼"	14"	48"	540-8031-3XX
14¼"	14"	54"	540-25058-3XX
14¼"	14"	54"	540-25059-3XX

Cooling Tunnels



Length	Forehearth size	Part #
18"	26"	540-5341-3XX
9"	26"	541-33301-3XX
18"	36"	540-5129-3XX
9"	36"	540-4698-3XX
18"	42"	540-6016-3XX
9"	42"	540-6977-3XX
18"	48"	540-8061-3XX
9"	48"	540-8330-3XX
18"	54"	540-25056-3XX

Flue Blocks

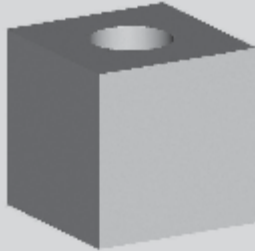


340 Flue block

Style	Part #
540	540-5345-3XX
540	540-5097-3XX
640	541-63002-3XX
340	340-5030-3XX
340	340-5004-3XX



540 Flue block



640 Flue block

Damper Blocks



340 Damper block

Style	Part #
540	540-5346-3XX
540	540-5402-3XX
640	541-63003-3XX
340	340-5031-3XX
340	340-5006-3XX



540 Damper block



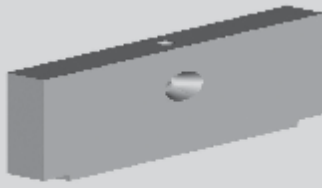
640 Damper block

Back Blocks



Style	Part #
26"	115-608-3XX
36"	503-5145-3XX
42"	540-6022-3XX
48"	540-8208-3XX
54"	540-25136-3XX

Mantle Blocks



340 Mantle Block



540 Mantle Block

Style	Forehearth channel width	Part #
540	26"	540-22210-3XX
340	26"	341-35000-3XX
540	36"	540-5048-3XX
340	36"	341-45005-3XX
540	42"	540-6023-3XX
340	42"	341-55003-3XX
540	48"	540-8097-3XX
340	48"	341-65000-3XX
540	54"	540-25137-3XX
340	54"	541-75004-3XX

Skimmer Blocks



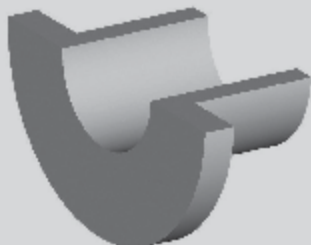
Style	Forehearth channel width	Part #
Standard	26"	144-11482-3XX
Paneled	36"	119-937-3XX
Standard	42"	540-6024-3XX
Standard	48"	540-8098-3XX
Standard	54"	540-25138-3XX

Filler Blocks



Forehearth channel width	Part #
26"	540-5497-3XX
36"	540-5145-3XX
42"	540-6025-3XX
48"	540-8228-3XX
54"	540-8228-3XX

Sleeves



Description	Part #
Thermocouple Sleeve	540-8672-3XX
Short Sleeve	119-1031-3XX

Peep Hole Items



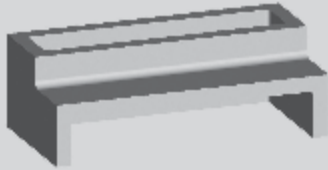
Peep Hole Block



Peep Hole Plug

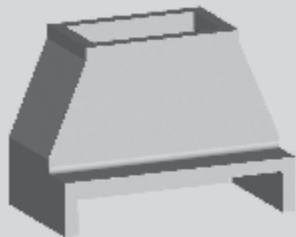
Description	Part #
Peep Hole Plug	540-23250-3XX
Peep Hole Block	540-23251-3XX

540 Cooling Tunnel Exhausts



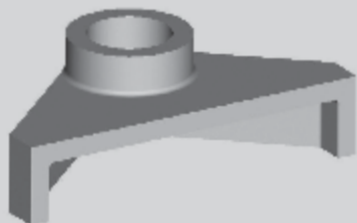
Height	Style	Forehearth channel width	Part #
6"	540	26"	540-5342-3XX
6"	540	36"	540-5263-3XX
8"	540	36"	540-4708-3XX
6"	540	42"	540-6017-3XX
8"	540	42"	540-6978-3XX
6"	540	48"	540-8040-3XX
8"	540	48"	540-8571-3XX
6"	540	54"	540-25269-3XX
6"	540	54"	540-25057-3XX
8"	540	54"	540-25168-3XX
8"	540	54"	540-25270-3XX

340 Cooling Tunnel Exhausts



Style	Forehearth channel width	Part #
340	36"	340-5049-3XX
340	42"	340-6003-3XX
340	48"	340-8012-3XX

Wind Entry Nozzles



Style	Forehearth channel width	Part #
340	36"	340-5009-3XX
340	42"	340-6063-3XX
340	48"	340-8027-3XX
340	54"	542-5396-3XX
340	54"	542-5297-3XX

Glasshouse crucibles and accessories



A history of craftsmanship

Since 1891, RATH has been developing and manufacturing high quality refractories. The Owensville plant had specialised in the production of glass pot refractories.

RATH understands that the basis of superior glass conditioning for all areas of the glass making industry

is high quality refractories. Their use in forehearth and feeder mechanisms play crucial roles in the formation and conditioning of the glass prior to being formed into finished products. All RATH refractories are formulated from the highest quality raw materials and designed to achieve predictable density and resistance to erosion and corrosion.

All of the refractories are designed to deliver optimum performance. Materials and processes are controlled to yield a consistently high level of utility.

RATH's commitment to your success can be seen in our laboratory and plant facilities where people, processes and products are brought together to meet the customer's needs. There is complete in-house capability for raw materials testing, process control and product development.

RATH offers crucibles in a wide range of compositions, sizes, and shapes. This catalog represents only a sample of the most popular compositions. Additional sizes and shapes, as well as custom fabrication, are available upon request. The most popular compositions used in glass melting crucibles for studioshop application are as follows:

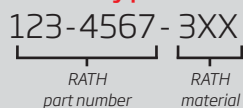
FOMLAC (344) A fortified mullite formulation and an excellent glass contact refractory. It represents about 70 % of all crucibles supplied to the studio shops. FOMLAC has proven itself as an excellent material for the melting of soda lime flint glasses in either batch or cullet form.

LC-833 (333) This is a premium AZS composition; designed as a melting medium for a wide range of corrosive glasses, especially those containing higher levels of metallic oxide. About 25 % of the crucibles supplied to the studio shops are fabricated in Bucher Emhart Glass' LC-833 formulation. It is the material of choice for a host of special glass applications.

FUSILLAC 100P (357) A fused silica formulation; a product possessing excellent thermal shock resistance. The unique thermal shock resistance characteristics will dissipate upon repetitive thermal cycling through the 2000°F range. Its purity will enable the melting of technical grade glasses without the fear of destructive contamination.

211-XFS (381) This is a clay flux material and is the formulation developed by Bucher Emhart Glass years ago for the manufacture of pots. It is an excellent glass control refractory and performs well in continuous service applications. This material does require proper furnace management in order to heat to operating temperature. Crucibles, fabricated from the material, are shipped unfired and it is the responsibility of the user to burn them into service.

Refractory part numbers



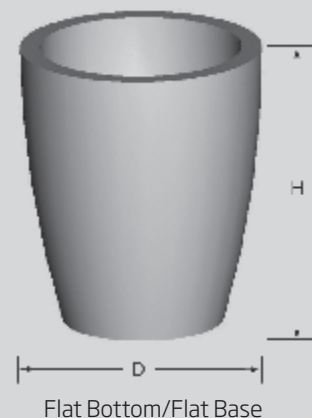
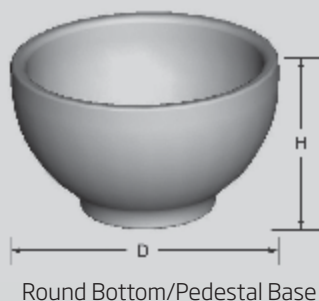
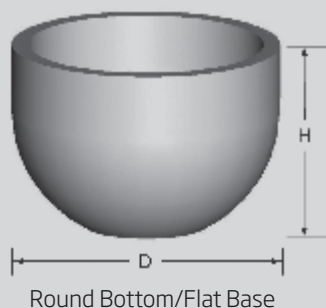
For special applications, alternative refractory materials are available. Please contact your nearest RATH representative.

Crucibles

Crucible	Part #	Style/base	Imperial Measurements				Imperial Measurements			
			Theoretical		Effective H		Theoretical		Effective H	
			lbs.	lbs.	in.	in.	kg	kg	cm	cm
GC-156	500-10170-3XX	Flat Bottom/Flat Base	4	3	5	4 ⁵ / ₁₆	1.8	1.4	12.7	11.0
GC-28	500-10097-3XX	Flat Bottom/Flat Base	8	5	7	6	3.6	2.3	17.8	15.2
GC-127	500-10129-3XX	Flat Bottom/Flat Base	10	8	8 ¹ / ₄	6 ¹ / ₂	4.5	3.6	21.0	16.5
GC-84	500-10118-3XX	Round Bottom/Flat Base	13	10	8 ¹ / ₂	6 ¹ / ₂	5.9	4.5	21.6	16.5
GC-197	500-10174-3XX	Round Bottom/Flat Base	18	14	10	7	8.2	6.4	25.4	17.8
GC-177	500-10115-3XX	Round Bottom/Flat Base	18	14	7	9 ³ / ₄	8.2	6.4	17.8	24.8
GC-87	500-10111-3XX	Round Bottom/Flat Base	25	20	10 ¹ / ₄	8 ¹ / ₄	11.3	9.1	26.0	21.0
GC-196	500-10147-3XX	Round Bottom/Pedestal Base	29	24	8	11	13.2	10.9	20.3	27.9
GC-138	500-10119-3XX	Round Bottom/Flat Base	37	30	7 ¹ / ₂	13	16.8	13.6	19.1	33.0
GC-80	500-10066-3XX	Round Bottom/Flat Base	48	40	10	12	21.8	18.1	25.4	30.5
GC-198	500-10136-3XX	Round Bottom/Pedestal Base	62	50	10	14	28.1	22.7	25.4	35.6
GC-37	500-10085-3XX	Round Bottom/Pedestal Base	88	70	12 ¹ / ₂	14	39.9	31.8	31.8	35.6
GC-89	500-10101-3XX	Round Bottom/Flat Base	100	80	11	16	45.4	36.3	27.9	40.6
GC-39	500-10048-3XX	Round Bottom/Pedestal Base	119	95	10 ¹ / ₂	18	54.0	43.1	26.7	45.7
GC-165	500-10102-3XX	Round Bottom/Flat Base	131	105	12	18	59.4	47.6	30.5	45.7
GC-167	500-10104-3XX	Round Bottom/Flat Base	147	120	13	18	66.7	54.4	33.0	45.7
GC-93	500-10089-3XX	Round Bottom/Flat Base	157	125	12 ⁵ / ₈	19	71.2	56.7	32.1	48.3
GC-178	500-10121-3XX	Round Bottom/Flat Base	190	152	16	18	86.2	68.9	40.6	45.7
GC-71	500-10060-3XX	Round Bottom/Pedestal Base	199	160	16 ¹ / ₂	19 ¹ / ₂	90.3	72.6	41.9	49.5
GC-94	500-10098-3XX	Round Bottom/Flat Base	219	175	14 ¹ / ₈	21 ¹ / ₂	99.3	79.4	35.9	54.6
GC-69	500-10093-3XX	Round Bottom/Pedestal Base	250	200	13 ¹ / ₄	25	113.4	90.7	33.7	63.5
GC-95	500-10120-3XX	Round Bottom/Flat Base	250	225	15 ¹ / ₈	24	113.4	102.1	38.4	61.0
GC-189	500-10134-3XX	Round Bottom/Flat Base	300	240	16 ¹ / ₂	23 ¹ / ₂	136.1	108.9	41.9	59.7
GC-145	500-10112-3XX	Round Bottom/Flat Base	312	250	15 ⁵ / ₈	25 ¹ / ₂	141.5	113.4	39.7	64.8
GC-135	500-10116-3XX	Round Bottom/Flat Base	375	300	16 ³ / ₈	27	170.1	136.1	41.6	68.6
GC-194	500-10164-3XX	Round Bottom/Flat Base	485	390	17	30	220.0	176.9	43.2	76.2
GC-98	500-10123-3XX	Round Bottom/Flat Base	428	350	17 ⁷ / ₈	27	194.1	158.8	45.4	68.6
GC-271	500-10217-3XX	Round Bottom/Pedestal Base	565	455	16	34 ¹ / ₂	256.3	206.4	40.6	87.63

Note: Theoretical capacity indicates the maximum capacity of crucible assuming a glass density of 2.1 g/cc. Effective capacity indicates a practical working volume of 80%.

Other sizes are available, contact sales for more information.



Gathering Rings

Gathering Rings	I.D. (in.)	O.D. (in.)	Description	Piece Wt. (lbs.)	Part #
R-8-16-A	9 - 16	13 ³ / ₄ - 20 ³ / ₄	Oval Half-Ring (2 req'd)	26	500-15143-355
	9 - 16	13 ³ / ₄ - 20 ³ / ₄	Oval Half-Ring (2 req'd)	25	500-15143-357
R-8 H	8	12	Half-Ring (2 req'd)	10	500-15138-355
	8	12	Half-Ring (2 req'd)	10.5	500-15138-357
	8	12	Half-Ring (2 req'd)	11.3	500-15138-381
R-8½ H	8½	11½	Half-Ring (2 req'd)	8	500-15270-355
	8½	11½	Half-Ring (2 req'd)	8	500-15270-357
	8½	11½	Half-Ring (2 req'd)	8	500-15270-381
R-10 H	10	14	Half-Ring (2 req'd)	14	500-15201-355
	10	14	Half-Ring (2 req'd)	14	500-15201-357
	10	14	Half-Ring (2 req'd)	14	500-15201-381
R-10 W	10	14	Whole Ring (1 req'd)	14	500-15206-355
	10	14	Whole Ring (1 req'd)	13	500-15206-357
	10	14	Whole Ring (1 req'd)	15	500-15206-381
R-12 H	12	16	Half-Ring (2 req'd)	24	500-15434-355
	12	16	Half-Ring (2 req'd)		500-15434-357
	12	16	Half-Ring (2 req'd)		500-15434-381
R-16-U	16	22½	Half-Ring (2 req'd)	51	500-15059-355
	16	22½	Half-Ring (2 req'd)	57	500-15059-357
R-16-K3	16	21	Half-Ring (2 req'd)	42	500-15367-357
R-17-C	17	23½	Half-Ring (2 req'd)	64	500-15005-355
	17	23½	Half-Ring (2 req'd)	74	500-15005-357

Other sizes are available, contact sales for more information.



Half Rings

Gathering Balls



in.	D mm	Spindle Thread Diameter (in.)	Piece Wt. (lbs.)	Part #
	50	3/4	0.4	500-15286-355
2		3/4	0.5	500-15158-355
	60	3/4	0.5	500-15287-355
2 1/2		3/4	0.5	500-15162-355
	70	3/4	0.5	500-15213-355
3		3/4	1	500-15159-355
3 1/2		3/4	1.8	500-15163-355
	100	3/4	2	500-15234-355
4 1/2		3/4	3.5	500-15164-355
	120	3/4	4	500-15228-355
	130	3/4	5	500-15214-355
	140	3/4	6	500-15236-355
	150	3/4	8	500-15216-355

Clay

Composition	Drum Wt. (lbs.)	Description	Part #
Ring Clay	500	Coarse Ring Clay	500-15060-386
	500	Fine Ring Clay	500-15060-E83
Luting Clay	125		500-15066-384

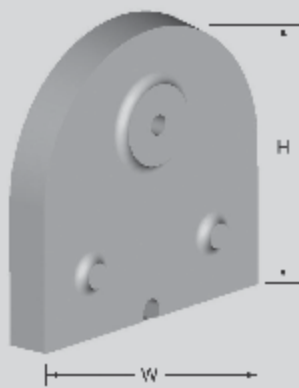
Tile

Tile	Piece Wt. (lbs.)	Description	Part #
2 x 10 x 36	55	Crucible Pedestal	500-15091-379
2 x 14 x 36	75	Crucible Pedestal	500-15090-379
2 x 18 x 24	64	Crucible Pedestal	500-15089-379
6 x 12 x 12	63	Crucible Pedestal	500-15086-379
7 x 7 x 8 1/2	32	Crucible Pedestal	500-15087-379

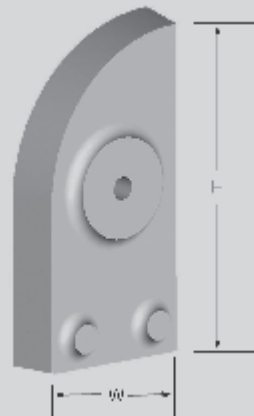
Stoppers

Stopper	Width (in.)	Height (in.)	Piece Wt. (lbs.)	Style	Description	Part #
1-RC	6½	13	11.8	Half	Right Side	500-15016-355
1-LC	6½	13	11.8	Half	Left Side	500-15017-355
3-LC	7	14	10.5	Half	Left Side	500-15046-355
5-FC	18	18	40	Full	Single Lift Hole	500-15024-355
8-FC	15	15	27	Full	Single Lift Hole	500-15027-355
9-FC	14½	13½	23.3	Full	Single Lift Hole	500-15030-355
14-FC	14	14	24	Full	Double Lift Hole	500-15036-355
15-FC	14	13	22.5	Full	Double Lift Hole	500-15037-355
19-FC	13¼	13¼	21	Full	Double Lift Hole	500-15038-355
19-FC	13¼	13¼		Full	5" Proof Hole	500-15376-355
19-FC	13¼	13¼		Full	6" Proof Hole	500-15332-355
28-FC	15	14		Full	Single Lift Hole	500-15141-355
28-RC	7½	14		Half	Right Side	500-15456-355
30-FC	11	12	12	Full	Single Lift Hole	500-15171-355
32-FC	13	15	25	Full	Double Lift Hole	500-15202-355
46-FC	18	16½		Full	Single Lift Hole	500-15432-355
48-FC	16½	16		Full	Single Lift Hole	500-15334-355

Other sizes are available, contact sales for more information.



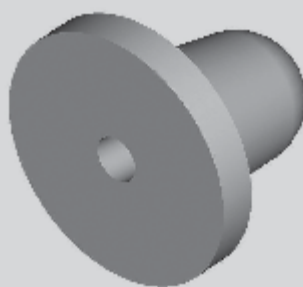
Full Stopper



Half Stopper

Pot Plugs

Pot Plugs	Plug Diameter (in.)		Length	Piece Wt. (lbs.)	Description	Part #
	Max.	Min.				
3	3	2 $\frac{1}{4}$	4 $\frac{3}{4}$	2.3	$\frac{7}{8}$ " Hole	500-15042-355
6	4	3	5 $\frac{1}{2}$	3.5	$\frac{7}{8}$ " Hole	500-15045-355

**Dog Stones / Punty Rests**

Dog Stones / Punty Rests	Width (in.)	Height (in.)	Piece Wt. (lbs.)	Description	Part #
Dog Stone	3 $\frac{7}{8}$	3 $\frac{7}{8}$	1.5	2 Step Rest	500-15065-355
Punty Rest	2 $\frac{3}{4}$	1 $\frac{5}{8}$	0.3	1 Step Rest	500-15078-355

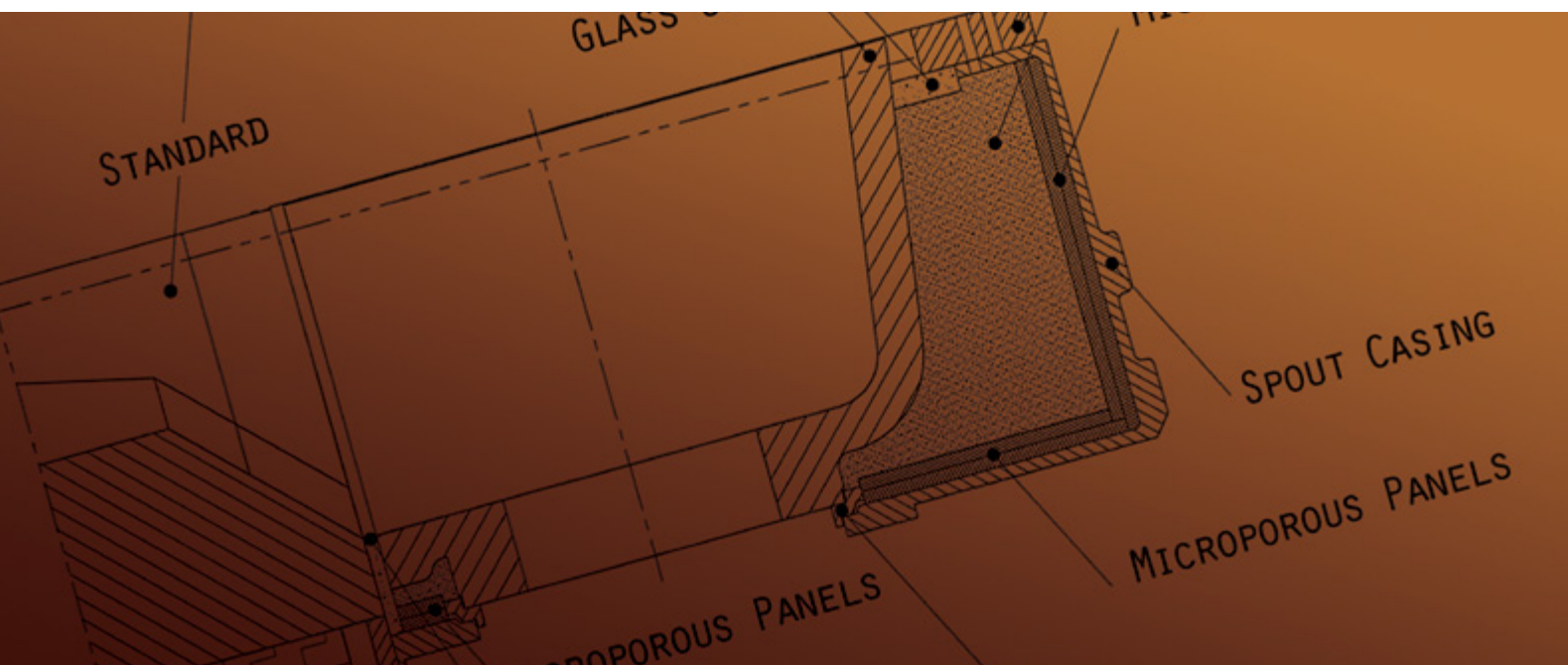


Dog Stone



Punty Rest

Technical references



Orifice rings
& gaskets

Plungers

Tubes

Spouts

Spout
assemblies

Stirrers
& rotor
segments

Insulation,
cements &
hard bricks

Forehearths
& maintenance
items

Glasshouse
crucibles &
accessories

Technical
references

Material Safety
Data Sheet
MSDS

Refractory Material

Mix	Type	Chemistry			Density g/cc	Porosity %	MOR MPa	CTE 10 ⁻⁶ mm/ mm/°C	Description
		Al ₂ O ₃	SiO ₂	ZrO ₂					
AZS Materials									
300	Cast	57	22	20	2.6	23	12.4	5.1	Excellent thermal shock resistance
301	Cast	45	19	35	3.2	18	20.0	10	Ultra Premium expendable AZS material
314	Pressed	69	11	20	3.0	24	15.9	6.6	Premium expendable AZS material
315	Cast	69	11	20	3.1	19	21.4	6.1	Premium expendable AZS material
333	Cast	73	15	11	3.0	18	17.9	5.9	Standard expendable AZS material
444	Cast	82	6	11	2.8	22	17.2	7.0	Extreme thermal shock resistance
Mullite									
311	Pressed	91	9	-	2.6	23	16.5	4.7	Good balance of thermal shock and corrosion resistance
330	Cast	66	32	-	2.3	21	15.9	4.9	Good resistance to alkali vapor attack and thermal shock
338	Cast	71	26	-	2.5	18	20.0	5.5	Excellent resistance to alkali vapro attack
339	Cast	75	24	-	2.4	23	20.7	7.8	Fine grain mullite, good thermal shock resistance
344	Cast	79	18	-	2.6	20	10.3	4.0	Mullite material used for glasshouse crucibles
345	Cast	83	16	-	2.6	19	14.5	6.1	Good balance of thermal shock and corrosion resistance
348	Cast	89	11	-	2.6	25	12.4	6.9	Good thermal shock resistance

All data is subject to reasonable deviations and not to be used for specification purposes.

Refractory Material

Mix	Type	Chemistry			Density g/cc	Porosity %	MOR MPa	CTE 10 ⁻⁶ mm/ mm/°C	Description
		Al ₂ O ₃	SiO ₂	ZrO ₂					
Special									
320	Cast	-	33	66	3.8	16	32.4	2.4	Pure Zircon material
321	Cast	83	1	15	3.4	15	47.6	7.4	Zirconia toughened alumina
High Alumina									
350	Cast	94	4	-	2.9	18	40.7	6.9	Good thermal shock resistance
351	Cast	98	2	-	3.7	17	38.6	8.2	High alumina
390	Cast	92	7	-	2.7	22	20.7	-	High alumina. Average thermal shock resistance.
Fused Silica									
355	Cast	30	69	-	2.0	20	5.5	1.4	Excellent resistance to thermal shock and alkali vapor attack
356	Cast	6	93	-	1.8	17	12.4	0.5	Low thermal expansion, excellent thermal shock resistance
357	Cast	-	100	-	1.7	18	5.9	0.046	Pure fused silica material. Excellent thermal shock resistance.
Phosbond									
385	Cast	92	-	-	2.9	20	20.7	7.9	92% chemically bonded material
High Clay									
381	Cast	31	64	-	2.0	21	4.1	3.4	Clay flux material

All data is subject to reasonable deviations and not to be used for specification purposes.

Refractories by typical application

Material	Orifice		Rotor			Spout Burner			
	Rings	Spouts	Tubes	Segments	Plungers	Stirrers	Block Covers	Crucibles	Forehearth
301	X	X	X		X	X		●	
311	■								
314	◆								
315	●	◆	◆	■	◆	◆			
320	●								
321	●	●				●			
333		■	■		■	■		◆	■
338							■		■
345	●		●		●		◆		■
357			●		●	●		●	
390					◆	◆			
444			●						

■ Standard ◆ Premium X Ultra premium ● Special

Refractories for glass contact

Material	Clear Flint	Clear Flint	Amber	Green	Borosilicate	Fluoride	Fiberglass
	Handglass	Bottle Glass	Container Glass	Container Glass	Container Glass	Opal Glass	Insulation (C-Glass)
301		◆	◆	◆			
311		■	■				
314		◆	◆	■	◆		
315	◆	◆	◆	■			
320					◆	◆	
321			◆		●		■
333	◆	■	■		■	■	
344	■						
345	●	●	●				
357	●	●	●		●	■	
390			●			●	

Based on typical glass compositions and conditions. Variations in operating conditions and glass chemistry may affect material selection.

■ Standard ◆ Premium ● Special

Feeder Reference

Feeder type	81				503		555		585
Master list	81-465				503-250		555-100		585-1
Spout type	Std.	Deep	Std.	Deep	Std.	515	Std.	515	Std.
Assembly	81-439	81-439	81-439	81-439	504-245	515-48	555-99		585-4
Depth (top to tube seat)	7.25	10	7.25	10	11.31	13	11.31	13	13
Entrance width	14	14	18	18	22	24	22	24	28
Equipment size (throat exit diameter)	5	5	5/7/8	5/7/8	7/10	10/12	7/10	10/12	13
Front plate	A	B	C	D	F,G	H	G	H	J,K,L
Forehearth channel width	26	26	26	26/36	26/36/42/48	36/42/48	36/42/48		42/48/54
Spout									
Assembly	81-461				503-84	515-8	555-97		585-5
Shear mounting radius	14.25				17.5		19.5		21.5
Throat location (from front plate)	8.5				10.5		10.5		12.5
Plunger refr.									
Assembly	503-246				503-246		555-56		555-56
Length w/std. depth chuck	28	30	28	30	30	31.75	30	31.75	31.75
Length w/deep chuck							30		30
Plunger chuck									
Assembly	503-57				503-57-04		555-56		555-56
Length from carrier disk (std. depth chuck)	18.19				18.19		21.69		21.69
Length from carrier disk (deep chuck)							23.69		23.69

Equalizing Section Reference

Channel					
Width	26"	36"	42"	48"	54"

Equalizing casings

Equalizing assembly	540-12177-00	540-13245-00	540-14128-00	540-809	540-54004-04
Width	46"	62"	72"	81"	90"

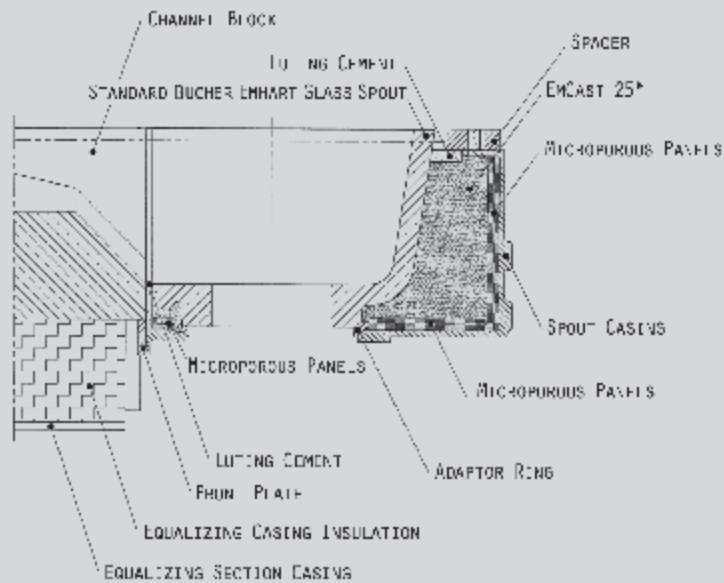
Front plate

A 81 Refractory std., 14" spout	81-4612				
B 81 Refractory deep, 14" spout	81-4613				
C 81 Refractory std., 18" spout	81-4644				
D 81 Refractory deep, 18" spout	81-4581				
F 503 Refractory	503-6845				
G 503 Refractory			503-5433		
H 515 Refractory			630-1001		
J 585 Refractory			585-1123		
K 585 Refractory				585-1121	
L 585 Refractory					585-1005

Typical cross section of Spout Assemblies

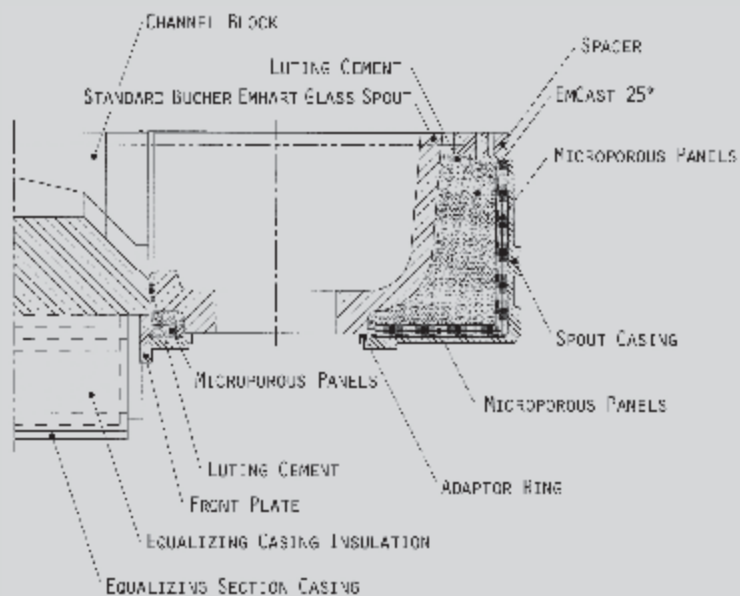
Standard Spout

Cross section showing EmCast 25-515 without curb



Standard Spout with curb

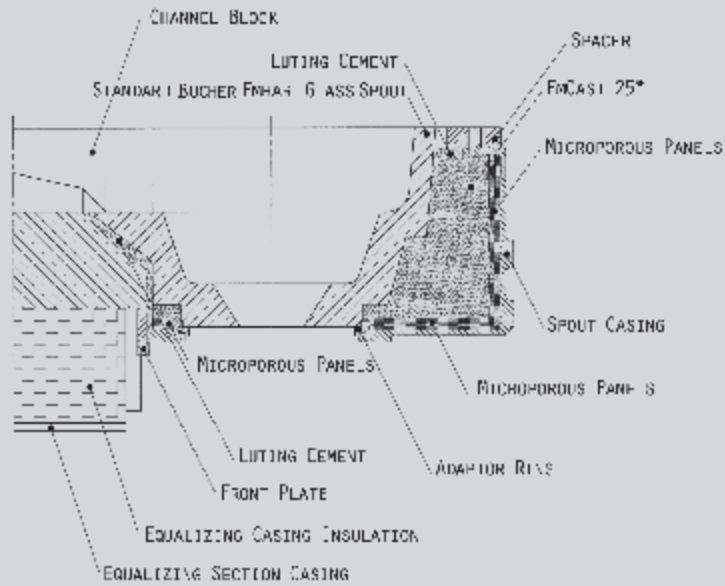
Cross section showing EmCast 25-515 with curb



* EmCast 25 is the recommended backup insulation of RATH, replacing the previously recommended Celatom insulation.

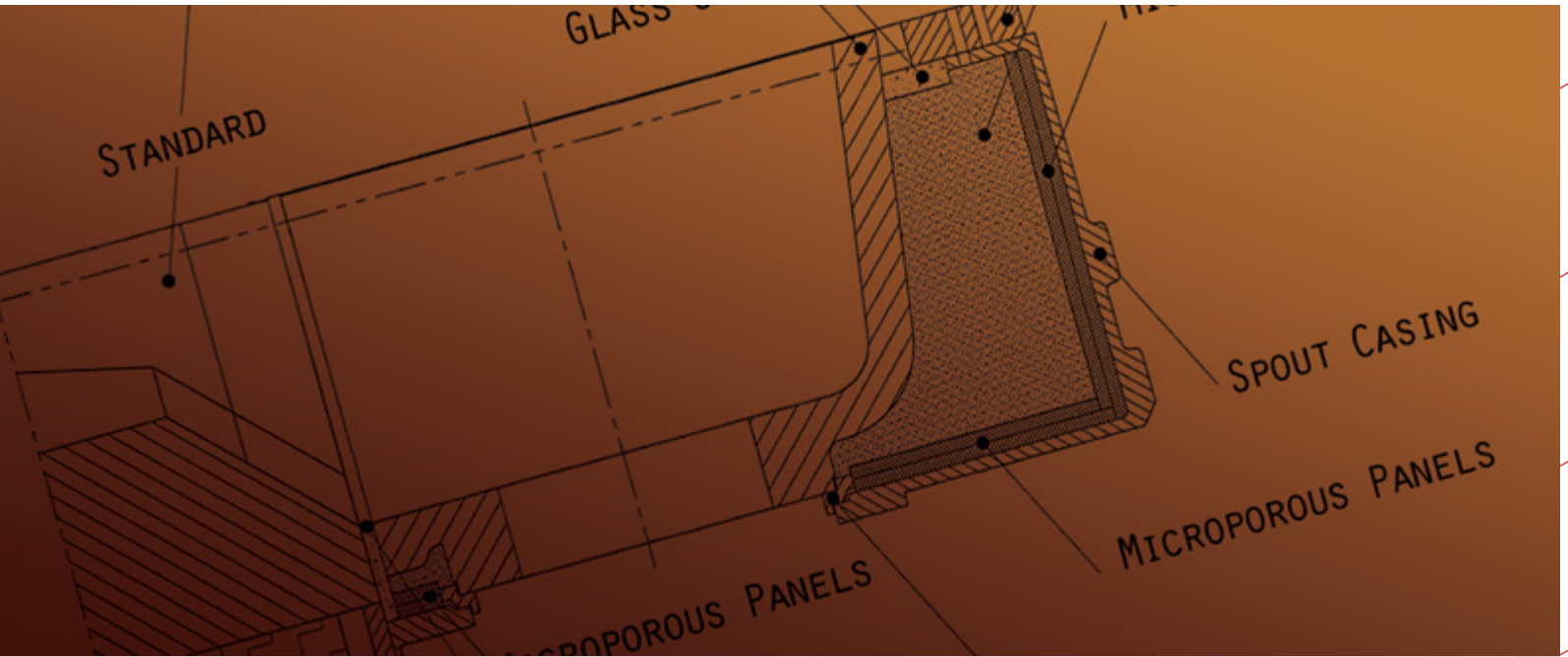
Metering Spout

Cross section showing EmCast 25-515 metering



* EmCast 25 is the recommended backup insulation of RATH, replacing the previously recommended Celatom insulation.

Material Safety Data Sheet (MSDS)



- Orifice rings & gaskets
- Plungers
- Tubes
- Spouts
- Spout assemblies
- Stirrers & rotor segments
- Insulation, cements & hard bricks
- Forehearths & maintenance items
- Glasshouse crucibles & accessories
- Technical references
- Material Safety Data Sheet MSDS

Identification of the substance/preparation & of the company/undertaking**Product Name:** Refractory Products**Use of the substance/preparation:** Industrial applications**Company/undertaking identification:**

Supplier/Manufacturer:

RATH LLC
405 East Peach Street, PO Box 580, Owensville MO 65066 USA
Tel: +1 573 437 2132, Fax: +1 573 437 3146

Emergency Telephone number:

CHEMTREC, International: (703) 527-3887

Product Group**Specific Product Name**

Form when shipped – Granular or Powder

1320-2, Dry Cement; 353A; 1320-40, Heat Set Cement; 1320-460, Anti-Adhesive Cement; 1320-470, Stopleak; 353, Crucilac; 1320-517, Insulating Castable; 1320-455 Orifice Ring, Luting Cement; 1320-30 Spout Luting Cement 312.

Form when shipped – Wet Mortars & Clays

382, 201N Stopper Clay; 383, 211HH Ring Clay; 384, 211FF; 1320-73, Mortar; 1320-507, Cement.

Form when shipped – Unfired Shape

380, 211XU; 381, 211XFS; 395; 398, Insulating Shape; 399, Insulating Shape.

Form when shipped – Fired Shape

300, Phoenix VC-77; 305, Phoenix VC-79; 310, Buzlac; 314, Zalac (Pressed); 315, 316, Zalac; 333, 334, 833; 311, 312; 327, Spallac; 342; 345, 346, Fomlac; 348, Corlac (XL, XSM, F,H,M); 349, Crystalite (90-B); 350, LC-95; 351, LC-97; 390; 320, Zirlac; 317, Zircolac; 321; 325, Rublac; 330, Mullac VC; 332, Crystalite CMK; 335, Mullac, Mullac Plus; 338, Hylac; 339, Crystalite CMH, CMHH, CMXH; 347, LCF Mullite; 331, Crystalite CMC; 352, LC-99; 355, Fusillac C; 356, Fusillac G; 357, Fusillac P; 379, 85XH; 380, 211XU Pot Mix; 381, 211XFS; 385, Alplac 92; 386, Alplac 93.

Composition/information on ingredients**Substance/Preparation:** Preparation

Ingredient Name/ All compositions	CAS number	%	EC Number	Classification
France				
Aluminum Oxide	1344-28-1	40 - 60	215-691-6	Not classified
Silica, Crystalline-Quartz	14808-60-7	40 - 60	238-878-4	R49
Magnesium Oxide	1309-48-4	5 - 7	215-171-9	Not classified
Titanium Dioxide	13463-67-7	1 - 3	236-675-5	Not classified
Germany				
Silica, amorphous	60676-86-0	70 - 100	262-373-8	Not classified
Zircon	14940-68-2	40 - 60	239-019-6	Not classified
Aluminum Oxide	1344-28-1	40 - 60	215-691-6	Not classified
Silica, Crystalline-Quartz	14808-60-7	40 - 60	238-878-4	R49
Zirconium Dioxide	1314-23-4	15 - 30	215-227-2	Not classified
Natural Diatomaceous Earth	61790-53-2	5 - 7		Not classified
Magnesium Oxide	1309-48-4	5 - 7	215-171-9	Not classified
Titanium Dioxide	13463-67-7	1 - 3	236-675-5	Not classified
United Kingdom (UK)				
Silica, amorphous	60676-86-0	70 - 100	262-373-8	Not classified
Zircon	14940-68-2	40 - 60	239-019-6	Not classified
Aluminum Oxide	1344-28-1	40 - 60	215-691-6	Not classified
Silica, Crystalline-Quartz	14808-60-7	40 - 60	238-878-4	R49
Zirconium Dioxide	1314-23-4	15 - 30	215-227-2	Not classified
Natural Diatomaceous Earth	61790-53-2	5 - 7		Not classified
Magnesium Oxide	1309-48-4	5 - 7	215-171-9	Not classified
Titanium Dioxide	13463-67-7	1 - 3	236-675-5	Not classified

See section 16 for the full text of the R Phrases declared above.

Composition/information on ingredients

Ingredient Name/ All compositions				
Ingredient Name/ Specific Compositions	CAS number	%	EC Number	Classification
1320-25, Dry Cement; 353A; 1320-40, Heat Set Cement				
Aluminum Oxide	1344-28-1	50	215-691-6	Not applicable.
Silica, amorphous	60676-86-0	45	262-373-8	Not applicable.
Titanium Dioxide	13463-67-7	2	236-675-5	Not applicable.
1320-460, Anti-Adhesive, Cement				
Aluminum Oxide	1344-28-1	93	215-691-6	Not applicable.
Silica, amorphous	60676-86-0	6	262-373-8	Not applicable.
1320-470, Stopleak; 353, Crucilac; 1320-517, Insulating Castable				
Aluminum Oxide	1344-28-1	>95	215-691-6	Not applicable.
1320-455 Orifice Ring, Luting Cement; 1320-30 Spout Luting, Cement 312				
Aluminum Oxide	1344-28-1	51 - 57	215-691-6	Not applicable.
Silica, amorphous	60676-86-0	41 - 47	262-373-8	Not applicable.
Titanium Dioxide	13463-67-7	1	236-675-5	Not applicable.
382, 201N Stopper Clay; 383, 211HH Ring Clay; 384, 211FF				
Silica, amorphous	60676-86-0	45 - 75	262-373-8	Not applicable.
Aluminum Oxide	1344-28-1	25 - 40	215-691-6	Not applicable.
Water	7732-18-5	15 - 20	231-791-2	Not applicable.
Titanium Dioxide	13463-67-7	1 - 2	236-675-5	Not applicable.
1320-73, Mortar; 1320-507, Cement				
Aluminum Oxide	1344-28-1	55 - 75	215-691-6	Not applicable.
Silica, amorphous	60676-86-0	25 - 45	262-373-8	Not applicable.
Titanium Dioxide	13463-67-7	0 - 4	236-675-5	Not applicable.
380, 211XU; 381, 211XFS				
Silica, amorphous	60676-86-0	65 - 75	262-373-8	Not applicable.
Aluminum Oxide	1344-28-1	20 - 30	215-691-6	Not applicable.
Titanium Dioxide 13463-67-7 1 - 3 236-675-5 Not applicable.				
395				
Silica, amorphous (fused)	60676-86-0	76 - 94	262-373-8	Not applicable.
Silica, amorphous	60676-86-0	3 - 10	262-373-8	Not applicable.
Aluminum Oxide	1344-28-1	2 - 5	215-691-6	Not applicable.
398, Insulating Shape; 399, Insulating Shape				
Aluminum Oxide	1344-28-1	45	215-691-6	Not applicable.
Silica, amorphous	60676-86-0	40	262-373-8	Not applicable.
Titanium Dioxide	13463-67-7	2	236-675-5	Not applicable.
300, Phoenix VC-77; 305, Phoenix VC-79				
Aluminum Oxide	1344-28-1	40 - 60	215-691-6	Not applicable.
Zirconium Dioxide	1314-23-4	15 - 25	215-227-2	Not applicable.
Silica, amorphous	60676-86-0	10 - 20	262-373-8	Not applicable.
310, Buzlac; 314, Zalac (Pressed); 315, 316, Zalac; 333; 334; 833				
Aluminum Oxide	1344-28-1	45 - 75	215-691-6	Not applicable.
Zircon	14940-68-2	10 - 30	239-019-6	Not applicable.
Silica, amorphous	60676-86-0	3	262-373-8	Not applicable.
311, 312; 327, Spallac; 342; 345, 346, Fomlac; 348, Corlac (XL, XSM, F,H,M); 349, Crystalite (90-B); 350, LC-95; 351, LC-97; 390				
Aluminum Oxide	1344-28-1	80 - 98	215-691-6	Not applicable.
Silica, amorphous	60676-86-0	1 - 19	262-373-8	Not applicable.

Composition/information on ingredients

Ingredient Name/ Specific Compositions	CAS number	%	EC Number	Classification
320, Zirlac; 317, Zircolac				
Zircon	14940-68-2	99	239-019-6	Not applicable.
Silica, amorphous	60676-86-0	1	262-373-8	Not applicable.
321				
Aluminum Oxide	1344-28-1	75 - 90	215-691-6	Not applicable.
Zirconium Dioxide	1314-23-4	8 - 15	215-227-2	Not applicable.
Silica, amorphous	60676-86-0	<5	262-373-8	Not applicable.
325, Rublac				
Zircon	14940-68-2	52	239-019-6	Not applicable.
Aluminum Oxide	1344-28-1	45	215-691-6	Not applicable.
Silica, amorphous	60676-86-0	3	262-373-8	Not applicable.
330, Mullac VC; 332, Crystalite CMK; 335, Mullac, Mullac Plus; 338, Hylac; 339, Crystalite CMH, CMHH, CMXH; 347, LCF Mullite				
Aluminum Oxide	1344-28-1	65 - 80	215-691-6	Not applicable.
Silica, amorphous	60676-86-0	20 - 35	262-373-8	Not applicable.
Titanium Dioxide	13463-67-7	0 - 2	236-675-5	Not applicable.
331, Crystalite CMC				
Aluminum Oxide	1344-28-1	60 - 70	215-691-6	Not applicable.
Silica, amorphous	60676-86-0	25 - 35	262-373-8	Not applicable.
Magnesium Oxide	1309-48-4	2 - 10	215-171-9	Not applicable.
352, LC-99				
Aluminum Oxide	1344-28-1	>99	215-691-6	Not applicable.
355, Fusillac C; 356, Fusillac G				
Silica, amorphous	60676-86-0	65 - 95	262-373-8	Not applicable.
Aluminum Oxide	1344-28-1	5 - 30	215-691-6	Not applicable.
357, Fusillac P				
Silica, amorphous (fused)	60676-86-0	>98	262-373-8	Not applicable.
379, 85XH; 380, 211XU Pot Mix; 381, 211XFS				
Silica, amorphous	60676-86-0	37 - 70	262-373-8	Not applicable.
Aluminum Oxide	1344-28-1	25 - 55	215-691-6	Not applicable.
Titanium Dioxide	13463-67-7	1 - 3	236-675-5	Not applicable.
385, Alplac 92; 386, Alplac 93				
Aluminum Oxide	1344-28-1	>90	215-691-6	Not applicable.
Magnesium Oxide	1309-48-4	<5	215-171-9	Not applicable.
Silica, amorphous	60676-86-0	0.1 - 1	262-373-8	Not applicable.

In all products listed above, alumina and silica are mostly found as alumina-silicate (Mullite, Kaolin); as for zirconia, they contain free silica. Free silica can be fused but is mostly found in amorphous and/or crystalline forms such as quartz, cristobalite and tridymite.

* Occupational Exposure Limit(s), if available, are listed in Section 8

Hazards identification

The preparation is classified as dangerous according to Directive 1999/45/EC and its amendments.

Classification: Xn; R49

Human health hazards: May cause cancer by inhalation

See section 11 for more detailed information on health effects and symptoms.

First Aid Measures

Inhalation:	If inhaled, remove to fresh air. If breathing is difficult, give oxygen. If not breathing, give artificial respiration. Obtain medical attention.
Ingestion:	Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Obtain medical attention.
Skin Contact:	In case of contact, immediately flush skin with plenty of water. Remove contaminated clothing and shoes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Obtain medical attention.
Eye Contact:	In case of contact, immediately flush eyes with a copious amount of water for at least 15 minutes. Get medical attention if irritation occurs.
Notes to Physician:	No specific antidote, medical staff contact Poisons Information Centre.
See section 11 for more detailed information on health effects and symptoms.	

Fire-fighting Measures

Extinguishing media:	Use an extinguishing agent suitable for surrounding fires.
Special exposure hazards:	No specific hazard.
Special protective equipment for fire fighters	Fire fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face piece operated in positive pressure mode.

Accidental Release Measures

Personal Precautions:	Immediately contact emergency personnel. Keep unnecessary personnel away. Use suitable protective equipment (Section 8).
Environmental precautions and clean-up methods:	Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. If emergency personnel are unavailable vacuum or carefully scoop up spilled materials and place in an appropriate container for disposal. Avoid creating dusty conditions and prevent wind dispersal.

Note: see section 8 for personal protective equipment and section 13 for waste disposal.

Handling and Storage

Handling:	Do not ingest. Wash thoroughly after handling.
Storage:	Keep container tightly closed. Keep container in a cool, well-ventilated area.
Packaging Materials Recommended:	Use original container.
Specific Uses:	Not available.




Exposure Controls / Personal Protection

Ingredient Name	Occupational Exposure Limits
France	
Aluminum Oxide	INRS (France, 6/2004). VME: 10 mg/m ³ 8 hour(s). Form: All forms
Silica, Crystalline-Quartz	INRS (France, 6/2004). VME: 0,1 mg/m ³ 8 hour(s). Form: Respirable fraction
Magnesium Oxide	INRS (France, 1999). VME: 10 mg/m ³ 8 hour(s). Form: Fume. VME: 10 mg/m ³ 8 hour(s). Form: All forms
Titanium Dioxide	INRS (France, 1999). VME: 10 mg/m ³ 8 hour(s). Form: Dust. VME: 10 mg/m ³ 8 hour(s). Form: Respirable fraction
Germany	
Silica, amorphous	MAK-Werte Liste (Germany, 7/2004). TWA: 0,3 mg/m ³ 8 hour(s). Form: Respirable fraction TRGS900 MAK (Germany, 5/2004). TWA: 0,3 mg/m ³ 8 hour(s). Form: Respirable fraction
Zircon	MAK-Werte Liste (Germany, 7/2004). Spitzenbegrenzung: 1 mg/m ³ 15 minute(s). Form: Inhalable fraction TWA: 1 mg/m ³ 8 hour(s). Form: Inhalable fraction TRGS900 MAK (Germany, 5/2004). TWA: 1 mg/m ³ 8 hour(s). Form: Inhalable fraction

Exposure Controls / Personal Protection

Ingredient Name	Occupational Exposure Limits
Germany	
Aluminum Oxide	MAK-Werte Liste (Germany, 7/2004). Spitzenbegrenzung: 12 mg/m ³ 15 minute(s). Form: Respirable fraction TWA: 1,5 mg/m ³ 8 hour(s). Form: Respirable fraction
Silica, Crystalline - Quartz	TRGS900 MAK (Germany, 5/2004). TWA: 0,15 mg/m ³ 8 hour(s). Form: Respirable fraction
Zirconium Dioxide	MAK-Werte Liste (Germany, 7/2004). Spitzenbegrenzung: 1 mg/m ³ 15 minute(s). Form: Inhalable fraction TWA: 1 mg/m ³ 8 hour(s). Form: Inhalable fraction TRGS900 MAK (Germany, 5/2004). TWA: 1 mg/m ³ 8 hour(s). Form: Inhalable fraction
Natural Diatomaceous Earth	MAK-Werte Liste (Germany, 2000). TWA: 4 mg/m ³ 8 hour(s). Form: Inhalable fraction. TWA: 4 mg/m ³ 8 hour(s). Form: Inhalable fraction TRGS900 MAK (Germany, 5/2004). TWA: 4 mg/m ³ 8 hour(s). Form: Inhalable fraction
Magnesium Oxide	MAK-Werte Liste (Germany, 2000). TWA: 4 mg/m ³ 8 hour(s). Form: Inhalable fraction. TWA: 1,5 mg/m ³ 8 hour(s). Form: Respirable fraction TWA: 4 mg/m ³ 8 hour(s). Form: Inhalable fraction TWA: 1,5 mg/m ³ 8 hour(s). Form: Respirable fraction
Titanium Dioxide	MAK-Werte Liste (Germany, 7/2004). TWA: 1,5 mg/m ³ 8 hour(s). Form: Respirable fraction
United Kingdom (UK)	
Silica, amorphous	EH40-OES (United Kingdom (UK), 5/2003). TWA: 6 mg/m ³ 8 hour(s). Form: Inhalable fraction TWA: 0,08 mg/m ³ 8 hour(s). Form: Respirable fraction
Zircon	EH40-OES (United Kingdom (UK), 5/2003). STEL: 10 mg/m ³ 15 minute(s). Form: All forms TWA: 5 mg/m ³ 8 hour(s). Form: All forms
Aluminum Oxide	EH40-OES (United Kingdom (UK), 5/2003). TWA: 10 mg/m ³ 8 hour(s). Form: Inhalable fraction TWA: 4 mg/m ³ 8 hour(s). Form: Respirable fraction
Silica, Crystalline-Quartz	EH40-MEL (United Kingdom (UK), 5/2003). TWA: 0,3 mg/m ³ 8 hour(s). Form: Respirable fraction
Zirconium Dioxide	EH40-OES (United Kingdom (UK), 5/2003). STEL: 10 mg/m ³ 15 minute(s). Form: All forms TWA: 5 mg/m ³ 8 hour(s). Form: All forms
Natural Diatomaceous Earth	EH40-OES (United Kingdom (UK), 5/2003). TWA: 6 mg/m ³ 8 hour(s). Form: Inhalable fraction TWA: 1,2 mg/m ³ 8 hour(s). Form: Respirable fraction
Magnesium Oxide	EH40-OES (United Kingdom (UK), 5/2003). STEL: 10 mg/m ³ 15 minute(s). Form: Respirable fraction TWA: 10 mg/m ³ 8 hour(s). Form: Inhalable fraction TWA: 4 mg/m ³ 8 hour(s). Form: Respirable fraction
Titanium Dioxide	EH40-OES (United Kingdom (UK), 5/2003). TWA: 10 mg/m ³ 8 hour(s). Form: Inhalable fraction TWA: 4 mg/m ³ 8 hour(s). Form: Respirable fraction

Exposure Controls / Personal Protection

Exposure Controls	
Occupational Exposure Controls:	Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.
 Respiratory Protection:	Dust respirator
 Hand Protection:	Natural rubber (latex)
 Eye Protection:	Safety glasses with side shields
Skin Protection:	Lab coat

Physical and Chemical Properties

General Information			
Appearance			
Physical State:	Solid		
Odour:	Odourless		
Important health, safety and environmental information:			
pH:	Neutral		
Solubility:	Insoluble in cold water, hot water		
Product Group	Specific Product Name	Specific Gravity	Melting Point
Form when shipped: Granular or powder	1320-25, Dry Cement; 353A; 1320-40, Heat Set Cement	2.4 to 2.7	1482°C (2700°F)
	1320-460, Anti-Adhesive, Cement	3.3 to 3.7	1482°C (2700°F)
	1320-470, Stopleak; 353, Crucilac; 1320-517	3.5 to 4.0	1815°C (3300°F)
	1320-455 Orifice Ring, Luting Cement;	2.7 to 3.0	1482°C (2700°F)
	1320-30 Spout Luting, Cement 312		
Form when shipped: Wet mortars & clays	382, 201N Stopper Clay; 383, 211HH Ring Clay; 384, 211FF	1.8 to 2.8	1482°C (2700°F)
	1320-73, Mortar; 1320-507, Cement	Not available	1482°C (2700°F)
Form when shipped: Unfired shape	380, 211XU; 381, 211XFS	1.8 to 2.0	1371°C (2500°F)
	395	1.9 to 2.0	1537°C (2800°F)
	398, Insulating Shape; 399, Insulating Shape	1.8 to 2.2	1537°C (2800°F)
Form when shipped: Fired shape	300, Phoenix VC-77 ; 305, Phoenix VC-79	3.3 to 4.0	1482°C (2700°F)
	310, Buzlac; 314, Zalac (Pressed); 315, 316, Zalac; 333, 334,	3.3 to 4.0	1482°C (2700°F)
	833 311, 312; 327, Spallac; 342; 345, 346, Fomlac; 348, Corlac		
	(XL, XSM, F,H,M); 349, Crystalite (90-B); 350, LC-95; 351, LC-97;	3.3 to 3.8	1482°C (2700°F)
	390 320, Zirlac; 317, Zircolac		
	321		
	325, Rublac	3.5 to 3.8	1482°C (2700°F)
	330, Mullac VC; 332, Crystalite CMK; 335, Mullac, Mullac Plus;	3.3 to 4.0	1482°C (2700°F)
	338, Hylac; 339, Crystalite CMH, CMHH, CMXH; 347, LCF	3.8 to 4.2	1371°C (2500°F)
	Mullite 331, Crystalite CMC	3.0 to 3.3	1482°C (2700°F)
	352, LC-99	2.7 to 3.1	1315°C (2400°F)
	355, Fusillac C; 356, Fusillac G	3.7 to 3.9	1482°C (2700°F)
	357, Fusillac P	2.2 to 2.6	1482°C (2700°F)
	379, 85XH; 380, 211XU Pot Mix; 381, 211XFS	2.2 to 2.6	1482°C (2700°F)
385, Alplac 92; 386, Alplac 93	1.8 to 2.9	1371°C (2500°F)	
	3.4 to 3.8	1482°C (2700°F)	

Stability and Reactivity

Stability:	The product is stable.
Conditions to Avoid:	None known.
Materials to Avoid:	Inert material.

Toxicological Information

Potential acute health effects	
Inhalation:	May cause cancer by inhalation.
Ingestion:	No known significant effects or critical hazards.
Skin Contact:	No known significant effects or critical hazards.
Eye Contact:	No known significant effects or critical hazards.
Carcinogenicity:	No known significant effects or critical hazards.
Mutagenicity:	No known significant effects or critical hazards.
Reproductive Toxicity:	No known significant effects or critical hazards.
Denmark - Carcinogen list:	Contains substance(s) listed under National Working Environment Authorities Executive Order 140/1997.

Over-exposure signs/symptoms

Inhalation:	No known significant effects or critical hazards.
Ingestion:	No known significant effects or critical hazards.
Skin:	No known significant effects or critical hazards.
Target Organs:	Contains material which causes damage to the following organs: lungs, upper respiratory tract.
Other adverse effects:	Not available.

Ecological Information

Ecotoxicity Data			
Ingredient Name	Species	Period	Result
Titanium Dioxide	Daphnia magna (EC50)	48 hour(s)	>1000 mg/l
Mobility:	Not available.		
Other adverse effects:	No known significant effects or critical hazards.		


Disposal Considerations

Methods of Disposal:	The generation of waste should be avoided or minimised wherever possible. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements.
Waste Classification:	Not applicable.
European Waste Catalogue (EWC):	Not available.
Hazardous Waste:	The classification of the product may meet the criteria for a hazardous waste.

Transport Information

International transport regulations	
Classification:	ADR/ADN/IMDG/IATA: Not regulated.
Label:	Not applicable.

Regulatory Information

EU Regulations	
Hazard Symbol(s):	Harmful 
Risk Phrases:	R49 - May cause cancer by inhalation.
Product Use:	Classification and labelling have been performed according to EU directives 67/548/EEC, 1999/45/EC, including amendments and the intended use. Industrial applications.
EC Statistical classification (Tariff Code):	32089091
National regulations : France - Germany	
Employment restrictions in accordance with § 15b of the Hazardous Substance Ordinance:	Yes
Hazardous incident ordinance:	No
Ordinance on combustible liquids:	Class: Omitted
Hazard class for water:	3

Other Information

Full text of R phrases referred to in sections 2&3 - France:	R49 - May cause cancer by inhalation.
Full text of classifications referred to in sections 2&3 - France:	Xn - Harmful
Full text of R phrases referred to in sections 2&3 - Germany:	R49 - May cause cancer by inhalation.
Full text of classifications referred to in sections 2&3 - Germany:	Xn - Harmful
Full text of R phrases referred to in sections 2&3 - United Kingdom (UK):	R49 - May cause cancer by inhalation.
Full text of classifications referred to in sections 2&3 - United Kingdom (UK):	Xn - Harmful

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