

ALUMINA CRUCIBLES



Schaefer Industries' crucible technology provides casters with:

- Durability
- Longevity
- Safety
- Excellent overall performance

Chemical Analysis (Wt. %, Calcined Basis)

Al ₂ O ₃	SiO ₂	CaO/MgO	Fe ₂ O ₃	Other	Maximum Use Temperature	Hot Modulus of Rupture (2800 °F [1538 °C])
89-91%	8-9%	0.1-0.2%	0.03-0.07%	1-2%	3050 °F (1677 °C)	1700-1900 psi

The following crucible sizes are currently available, contact R&R for price and shipping details.

Item Number	Top Outside Diameter (in.)	Top Inside Diameter (in.)	Outside Height (in.)	Inside Height (in.)
ALC25	4.5	3.75	10.875	10.375
ALC40	5.875	4.875	10.875	10.375
ALC50	6.5	5.5	11	10.375
ALC65	6.5	5.5	13.25	12.5
ALC100	8.75	7.75	12.75	12.125
ALC150	9	7.75	14.5	13.75
ALC200	10.75	9.25	15	14.125
ALC300	12.25	11	16.5	15.5

Ramming Materials For Crucibles & Ladle Liners

Backup materials for alumina crucibles serve two functions. First, they hold the part in compression to prevent cracking that can result from differential thermal expansion. If a crucible isn't rammed properly or material shifts during use, any crucible will fail prematurely - sometimes on the first or second heat.

Second, the ram acts as a safety barrier between the crucible and the furnace coil. A backup material should have the integrity to withstand molten metals without any crucible - it should be a suitable lining itself. All too often, crucibles are removed from service with useful life remaining because operators are not confident in backup safety lining performance. It is not uncommon for crucibles to be taken out of service with up to 50% of useful life remaining.



RANSOM & RANDOLPH

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Schaefer Industries ramming products meet both of these needs. Spinel Ram is intended for a backup ram for crucibles. It is a high alumina material that forms a spinel ($MgAl_2O_4$) bond when sintered offering excellent refractoriness, erosion resistance, and non-reactivity with most investment casting ferrous alloys. It is manufactured from high quality raw materials with excellent consistency in sizing to assure maximum density is achieved when rammed and to stop coil-destroying leaks due to crucible breakout.

Chemical Analysis (Wt. %, Calcined Basis)	Spinel Ram (Dry)	Silica Ram (Dry)
Al_2O_3	89	0.5
SiO_2	0.5	99.2
MgO	10	n/a
Other	0.5	0.3
Installed Density	190 lbs./cu. ft.	130 lbs./cu. ft.

Application Instructions

Preparation

Prepare the furnace for crucible installation by removing all debris from the previous lining. All ramming material and crucible fragments should be removed from the furnace before beginning the installation of the new crucible.

Inspect the coil grout, making repairs to any cracks. Coil grout should be relatively smooth and uniform in thickness.

Furnace Bottom

Measure the depth of the furnace and calculate the amount of material required in the furnace bottom to position the crucible at the desired height. Once the amount of material required is determined, begin by adding dry ram into the furnace.

Only add enough to make a layer approximately $\frac{1}{2}$ - $\frac{3}{4}$ " (12-19 mm) thick. Pack the material into the bottom of the furnace using a flat tool.

Note: a disc shaped tool with a flat bottom is recommended. These can be easily fabricated using a flat piece of steel cut into a circle with a long handle welded perpendicular to the disc.

Once the material is packed to its maximum density, roughen the surface using a fork like tool or a welding rod. This assures that each layer bonds easily to the preceding layer. Repeat the procedure adding only enough material for $\frac{1}{2}$ - $\frac{3}{4}$ " (12-19 mm) of packed material, ramming and then roughing the surface before adding additional material.

Caution: do not add excessive material as this will prevent achieving the maximum density of the ram.

Seating the Crucible

Place the crucible on the rammed bottom, giving the crucible a twist to seat it firmly in the sand. Center and level the crucible in the furnace using wooden wedges placed between the crucible and furnace sidewall to hold the crucible in place. Gently place a large, heavy ingot in the bottom of the crucible for added stability during sidewall installation.



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Ramming the Sides

Ramming the sides of the crucible follows the same general procedure as ramming the bottom. The tool used is somewhat different. The tool should be banana shaped with a curve that is approximately that of the crucible. It should also have a flat bottom and a perpendicular handle for ease of ramming. Add enough dry ram material to fill about $\frac{1}{2}$ - $\frac{3}{4}$ " (12-19 mm) of height and, using the tool, pack the material tightly. Roughen the surface before adding the next layer of material and repeat the process until the ram level is within $\frac{1}{2}$ " (12 mm) of the top of the crucible, removing the wooden wedges as the ram level approaches them.

Top Cap and Spout

Using a wet (plastic) ram of approximately 90% alumina composition, roll the material into long pieces and, using your fingers, ram the material between the crucible and the furnace wall, completely filling the remaining space behind the crucible wall. By rolling larger pieces of wet ram, you can contour the rim of the crucible to your desired shape bringing the material up as high as the furnace top. Form a spout as desired. It can be helpful to add a small amount of water to the material to make shaping the top and spout easier. Simply wetting your hands will provide enough extra moisture to soften the material for shaping.

After the spout is fully shaped, poke holes no greater than $\frac{1}{8}$ " (3 mm) in diameter into the plastic on 1" (25 mm) centers and approximately half of the thickness of the wet ram. This provides holes for water to escape during the dry out of the furnace top.

Dry Out

Prior to starting the furnace, allow the furnace to air dry for a few hours. The addition of heat lamps is recommended to begin the dry out of the wet plastic. Even though the plastic may appear dry, a significant amount of water remains in the material and care must be taken to prevent this water from converting to steam and spalling the refractory.

Place a large ingot in the furnace and turn on the power until the ingot glows red hot. Hold the power at this level, maintaining a red hot ingot without melting it. Cover the furnace top with ceramic fiber blanket to retain heat in the crucible. This serves to preheat the crucible and further dry the wet cap. Hold the furnace in this position until steam is no longer observed coming from the furnace top cap and spout. Your crucible should now be ready for use.

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