

# Notes on Refractory Curing

Copyright 2002,  
Budget Casting Supply LLC

## Notes on Refractory Curing:

Castable refractories have various materials in the mix to create tiny air pockets after curing. These air pockets are what actually insulates the furnace. Typically the manufacturer creates these pockets by adding vermiculite to the mix. This can cause the curing to be deceptive, because the vermiculite can trap and hold water, even though the cement has kicked off and cured.

The refractory should be allowed to cure a minimum of 24 hours before the initial firing. This is an important time, and the longer you can wait, the better. As with concrete, keep the surface from drying out by covering with wetted cloth or burlap if the weather is hot or dry. It is important to keep the material from freezing during this time. Also keep in mind that this material does not set as hard and strong as concrete, due to all the trapped air pockets, different cement, and lack of aggregate.

After the initial curing process, it is good to *slowly* heat the material using a heat source such as a hot plate until there is no visible moisture. This will help to drive off the water in the cement prior to the initial firing.

The initial firing, known as calcining, is critical. During this time the refractory is *slowly* heated from room temperature to the full operating temperature. This should be done over a long time as well, to allow the steam to escape the refractory. A calcining time of 12 hours is not unreasonable. Increase the heat very slowly at first to prevent the escaping steam from causing cracks, or worse.

After calcining the unit is ready for use, or ready to have secondary coating such as ITC-100 or ceramic fiber blankets applied.

**WARNING:** Do NOT apply any surface coatings, such as ITC-100 or ceramic fiber blankets until the refractory is fully fired. Sealing the surface has caused steam explosions as the refractory heats!!

**Harbison-Walker**  
**Mixing & Using Instructions**  
**VERSAFLOW 60 PLUS**

----- *GENERAL INSTRUCTIONS* -----

Material should be stored in a dry place. For best results, material should be maintained at 60-70F prior to casting. Under these conditions, the maximum recommended storage life for this product is nine months.

Porous back-up materials or wood forms should be waterproofed. Absorption of water can result in reduced flow for the product. **Forms must be stout and water tight.**

This product is designed to be mixed with water and may be either vibra-cast, hand cast (poured) or pumped. **All equipment** used to mix this product **must be clean.**

Never mix less than full bags. **Add only clean water suitable for drinking with a pH value between 6.0 and 7.5.** For best results, water should be maintained at 60-80F.

----- *MIXING REQUIREMENTS* -----

Approximate Water For Installing  
Pints (Liters)

<u>Bag Size</u>	<u>Pumped</u>	<u>Hand Cast</u>	<u>Vibra-cast</u>
100 lbs. (45.5 kg)	6.4 (2.9)	5.9 (2.7)	5.5 (2.5)
55 lbs. (25.0 kg)	3.5 (1.6)	3.25 (1.5)	3.0 (1.4)
50 lbs. (22.7 kg)	3.2 (1.5)	3.0 (1.4)	2.7 (1.3)
Wt. % of dry solids	6.6%	6.0%	5.6%

**Mix for at least five minutes.** For best results, wet mix temperature should be maintained at 50-70F. Minor adjustments to the amount of water are permissible to achieve desired flow.

----- *INSTALLATION* -----

Place material promptly. Do not trowel to slick finish. At temperatures above 60F, air cure, keeping surfaces damp and/or covered, for 24-48 hours typically or until a hard set has developed. **Lower temperatures will increase the time before a hard set develops.** The best results are achieved at curing temperatures of 70-100F. Keep material from freezing during air cure and preferably until a dryout can be initiated. Freezing of this product prior to water removal can cause structural damage.

**Harbison-Walker**  
**Mixing & Using Instructions**  
**VERSAFLOW 60 PLUS**

----- *HEAT UP SCHEDULE* -----

**Never enclose a castable in a vapor-tight encasement as a dangerous steam explosion may result.** Typical dryout schedule for a single layer, 9" (229 mm) thick or less:

Ambient to use temperature

100F (56C) per hour

For thicker or multi-layer linings, contact your Harbison-Walker representative for a recommended dryout schedule.

Review Material Safety Data Sheet & Warning Labels



# Product Data

1/06: 2830

## VERSAFLOW® 60 PLUS

Technical Data:	VIBCASTING		CONV. CASTING/ PUMPING	
	English Units	SI Units	English Units	SI Units
<u>Physical Properties: (Typical)</u>				
Maximum Service Temperature	3100°F	1705°C	3100°F	1705°C
Dry Weight Required for Casting	$\frac{\text{lb}}{\text{ft}^3}$ 152	$\frac{\text{g}}{\text{cm}^3}$ 2.43	$\frac{\text{lb}}{\text{ft}^3}$ 148	$\frac{\text{g}}{\text{cm}^3}$ 2.37
Approximate Amount of Water Required				
Per 55 Lbs.	2¾ to 3 U.S. Pints		3¼ to 3½ U.S. Pints	
Per 24.95 Kg.	1.30 to 1.42 Liters		1.54 to 1.66 Liters	
Bulk Density	$\frac{\text{lb}}{\text{ft}^3}$	$\frac{\text{g}}{\text{cm}^3}$	$\frac{\text{lb}}{\text{ft}^3}$	$\frac{\text{g}}{\text{cm}^3}$
After Drying at 230°F (110°C)	153	2.45	150	2.40
Modulus of Rupture	$\frac{\text{lb}}{\text{in}^2}$	MPa	$\frac{\text{lb}}{\text{in}^2}$	MPa
After Drying at 230°F (110°C)	1,800	12.4	1,600	11.0
After Heating at 1500°F (816°C)	2,800	19.3	2,500	17.2
At 2500°F (1371°C)	600	4.1	600	4.1
Crushing Strength				
After Drying at 230°F (110°C)	17,000	117.2	15,000	103.4
After Heating at 1500°F (816°C)	13,000	89.7	9,000	62.1
After Heating at 3000°F (1650°C)	16,000	110.3	-	-
Permanent Linear Change				
After Drying at 230°F (110°C)		Negligible		Negligible
After Heating at 1500°F (816°C)		-0.2 %		-0.2 %
After Heating at 3000°F (1650°C)		-1.0 %		-1.5 %
<u>Chemical Analysis: (Approximate)</u> (Calcined Basis)				
Silica	(SiO <sub>2</sub> )		36.2 %	
Alumina	(Al <sub>2</sub> O <sub>3</sub> )		59.1	
Titania	(TiO <sub>2</sub> )		1.8	
Iron Oxide	(Fe <sub>2</sub> O <sub>3</sub> )		1.0	
Lime	(CaO)		1.6	
Magnesia	(MgO)		0.1	
Alkalies	(Na <sub>2</sub> O+K <sub>2</sub> O)		0.2	

(Continued)



# Product Data

## VERSAFLOW<sup>®</sup> 60 PLUS (Continued)

The test data shown are based on average results on production samples and are subject to normal variation on individual tests. The test data cannot be taken as minimum or maximum values for specification purposes. ASTM test procedures used when applicable.

Description: A 60% Alumina low cement castable based on Alabama bauxitic calcines which can be installed in several ways - from vibcast consistency to pump casting techniques.

Features:

- Excellent abrasion resistance.
- High hot strengths at 2500°F (1371°C).
- High refractoriness.
- Service temperature limit of 3100°F (1705°C).
- Installation versatility enables material to be vibcast, conventionally cast or pumped with slight adjustment to water content.

Uses:

- Iron and Steel Foundries - Replacing brick, plastics and other castables in foundry ladles, Forge furnace car decks.
- Ceramic Kilns - Car decks exposed to high temperatures and thermal cycling.
- Aluminum Furnaces - Upper sidewalls and roofs.
- Steel Industry - Ladle covers, tundish covers, tundish safety lining and precast shapes for tundishes.
- Rotary Kilns - Nose rings, lifters, firing hoods, coolers and pre-heater maintenance.
- Incineration - Charging zones, burners, rotary kilns.

**WARNING:** IF PROPER PROCEDURES FOR PREPARATION, APPLICATION, AND HEAT-UP OF THIS MATERIAL ARE NOT OBSERVED, STEAM SPALLING DURING HEAT-UP MAY OCCUR.



1 Identification of substance

- **Product details**
- **Trade name:** VERSAFLOW 60 PLUS
- **Manufacturer/Supplier:**  
ANH Refractories Company  
400 Fairway Drive  
Moon Township, PA 15108  
  
General Phone: (412)375-6600
- **Information department:** MSDS Technical Information: (412)375-6837
- **Emergency information:** CHEMTREC 24 HOUR EMERGENCY PHONE NUMBER: 1-800-424-9300.

2 Composition/Data on components

- **Chemical characterization**
- **Description:** Mixture of the substances listed below with nonhazardous additions.

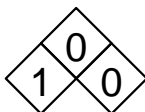
· **Components:**

1302-93-8	alumina silicate	60-100%
7631-86-9	silicon dioxide, chemically prepared	10-20%
1344-28-1	non-fibrous alumina	5-10%
69012-64-2	amorphous silica	5-10%
14464-46-1	crystalline silica (cristobalite)	0.1-0.5%
	organic fibers	0.1-0.5%

- **Additional information:** For the wording of the listed risk phrases refer to section 16.

3 Hazards identification

- **Hazard description:**  
Toxic
- **Medical conditions aggravated by exposure to the product:** Asthma, chronic lung disease, and skin irritation.
- **Carcinogenicity Information:**  
Crystalline silica is listed by IARC as a Group 1 Carcinogen "sufficient evidence of carcinogenicity in humans", and is listed by NTP as K, "Known To Be A Human Carcinogen".
- **Information pertaining to particular dangers for man and environment:**  
The product has to be labelled due to the calculation procedure of the "General Classification guideline for preparations of the EU" in the latest valid version.  
May cause cancer by inhalation.  
Irritating to eyes, respiratory system and skin.
- **NFPA ratings (scale 0-4)**



Health = 1  
Fire = 0  
Reactivity = 0



Printing date 05/13/2004

Reviewed on 05/13/2004

**Trade name: VERSAFLOW 60 PLUS**

(Contd. from page 1)

**· HMIS Classification**

HEALTH	1	Health: 1
FIRE	0	Flammability: 0
REACTIVITY	0	Reactivity: 0

**4 First aid measures**

- **After inhalation:** Move to fresh air; consult doctor if needed.
- **After skin contact:** Immediately wash with water and soap and rinse thoroughly.
- **After eye contact:** Flush eyes with water for 15 minutes. If irritation persists, consult a doctor.
- **After swallowing:**  
This product is intended for industrial applications; in the unlikely event that this product is swallowed, consult a physician if any adverse medical conditions occur.

**5 Fire fighting measures**

- **Suitable extinguishing agents:** Use fire fighting measures that suit the environment.
- **Protective equipment:** No special measures required.

**6 Accidental release measures**

- **Person-related safety precautions:** Not required.
- **Measures for environmental protection:** No special measures required.
- **Measures for cleaning/collecting:**  
Dispose contaminated material as waste according to item 13.  
Ensure adequate ventilation.

**7 Handling and storage**

- **Handling:**
- **Information for safe handling:**  
Ensure good ventilation/exhaust at the workplace.  
Prevent formation of dust.
- **Information about protection against explosions and fires:** Keep respiratory protective device available.
- **Storage:**
- **Requirements to be met by storerooms and containers:** No special requirements.
- **Information about storage in one common storage facility:** Not required.
- **Further information about storage conditions:** Store product inside, out of extreme weather conditions.

USA

(Contd. on page 3)



Trade name: **VERSAFLOW 60 PLUS**

(Contd. from page 2)

**8 Exposure controls and personal protection**

· **Components with limit values that require monitoring at the workplace:**

**1344-28-1 non-fibrous alumina**

PEL	15*,5** mg/m <sup>3</sup> *Total dust **Respirable fraction
TLV	10 mg/m <sup>3</sup> (e)

**69012-64-2 amorphous silica**

TLV	2 R mg/m <sup>3</sup>
-----	-----------------------

**14464-46-1 crystalline silica (cristobalite)**

PEL	1/2 the value calculated from the respirable dust
REL	0.05* mg/m <sup>3</sup> *Respirable dust
TLV	0.05 R mg/m <sup>3</sup>

· **Personal protective equipment:**

· **General protective and hygienic measures:**

- Keep away from foodstuffs, beverages and feed.
- Wash hands before breaks and at the end of work.
- Store protective clothing separately.
- Avoid contact with the eyes and skin.

· **Breathing equipment:**



NIOSH approved respirators should be used if dust is present. A respiratory protection program should be implemented if exposures exceed OSHA PELs.

· **Protection of hands:**



Protective gloves recommended

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation. Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.

Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation

· **Material of gloves**

The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer. As the product is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application.

· **Penetration time of glove material**

The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

· **Eye protection:** Safety glasses with side shields recommended



Trade name: **VERSAFLOW 60 PLUS**

(Contd. from page 3)

**9 Physical and chemical properties**

**· General Information**

**Form:** Solid  
**Color:** According to product specification  
**Odor:** No specific odor.

**· Change in condition**

**Melting point/Melting range:** Undetermined.  
**Boiling point/Boiling range:** Undetermined.

**· Flash point:** Not applicable.

**· Ignition temperature:** 370.0°C (698°F)

**· Auto igniting:** Product is not selfigniting.

**· Danger of explosion:** Product does not present an explosion hazard.

**· Density:** Not determined.

**· Solubility in / Miscibility with**

**Water:** Insoluble.

**10 Stability and reactivity**

**· Thermal decomposition / conditions to be avoided:** No decomposition if used according to specifications.

**· Dangerous reactions** No dangerous reactions known.

**· Dangerous products of decomposition:**

Refractories containing crystalline silica may, after service, contain more or less crystalline silica. Care must be taken to avoid and/or control dust from demolition. If in doubt of the proper protection, seek advice from a safety professional.

**11 Toxicological information**

**· Acute toxicity:**

**· LD/LC50 values that are relevant for classification:**

**7631-86-9 silicon dioxide, chemically prepared**

Oral	LD50	10000 mg/kg (rat)
------	------	-------------------

**· Primary acute effects:**

**· Skin contact:** Irritant to skin and mucous membranes.

**· Eye contact:** Irritating effect.

**· Sensitization:** No sensitizing effects known.

**· Additional toxicological information:**

The product shows the following dangers according to internally approved calculation methods for preparations:

Irritant

Carcinogenic if inhaled.



**Trade name: VERSAFLOW 60 PLUS**

(Contd. from page 4)

**12 Ecological information**

· **General notes:** At present there are no ecotoxicological assessments.

**13 Disposal considerations**

- **Recommendation for Disposal of Product:**  
As sold, this product is not RCRA hazardous. Final used condition must be evaluated prior to disposal. Dispose of waste product in accordance with Federal, State and Local regulations.  
Dust created during demolition of used product may contain crystalline silica.
- **Recommendation for Disposal of Uncleaned Packaging:** Reuse, recycle or treat as industrial waste.

**14 Transport information**

· **Transport/Additional information:** Not dangerous according to available information.

**15 Regulations**

- **SARA 313 TOXIC CHEMICALS**  
No material listed in the components in Section 2 of this MSDS is on the SARA 313 list.
- **SARA 302 EXTREMELY HAZARDOUS SUBSTANCES**  
No material listed in the components in Section 2 of this MSDS is on the SARA 302 list.
- **TSCA (Toxic Substances Control Act)**  
This substance or all the ingredients of this product are on the Chemical Substances Inventory of the Toxic Substances Control Act (TSCA Inventory). The presence on this list does not require any legal reporting.
- **WHMIS Classification**  
Class D - Division 2 - Sub Division A  
Untested mixture containing a very toxic material  
Class D - Division 2 - Sub Division B  
Untested mixture containing a toxic material  
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

· **Carcinogenicity categories**

· **EPA (Environmental Protection Agency)**  
None of the ingredients is listed.

· **IARC (International Agency for Research on Cancer)**

69012-64-2	amorphous silica	3
14464-46-1	crystalline silica (cristobalite)	1
14808-60-7	crystalline silica (quartz)	1

· **NTP (National Toxicology Program)**

14464-46-1	crystalline silica (cristobalite)	R
14808-60-7	crystalline silica (quartz)	R

(Contd. on page 6)



Trade name: **VERSAFLOW 60 PLUS**

(Contd. from page 5)

**· TLV (Threshold Limit Value established by ACGIH)**

1344-28-1	non-fibrous alumina	A4
14808-60-7	crystalline silica (quartz)	A2

**· MAK (German Maximum Workplace Concentration)**

1344-28-1	non-fibrous alumina	2
14464-46-1	crystalline silica (cristobalite)	1
14808-60-7	crystalline silica (quartz)	1

**· NIOSH-Ca (National Institute for Occupational Safety and Health)**

14464-46-1	crystalline silica (cristobalite)
14808-60-7	crystalline silica (quartz)

**· OSHA-Ca (Occupational Safety & Health Administration)**

None of the ingredients is listed.

**· Classification according to EU-guidelines**

**· Hazard symbols:**

Toxic

**· Hazard-determining components of labeling:**

crystalline silica (cristobalite)

**· Risk phrases:**

May cause cancer by inhalation.

Irritating to eyes, respiratory system and skin.

**· Safety phrases:**

Avoid exposure - obtain special instructions before use.

When using do not eat or drink.

Do not breathe dust.

Avoid contact with eyes.

In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

After contact with skin, wash immediately with plenty of soap and water

Wear suitable protective clothing and gloves.

In case of accident or if you feel unwell, seek medical advice immediately.

This material and its container must be disposed of as hazardous waste.

**· National regulations:**

**· The following ingredients are known in the state of California to be a cancer risk (Proposition 65):**

14464-46-1	crystalline silica (cristobalite)
------------	-----------------------------------

**16 Other information**

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

· **Contact:** Patricia A. Kott 412-375-6712

· **Creation date:** 05/24/2000

THIS PAGE LEFT INTENTIONALLY BLANK