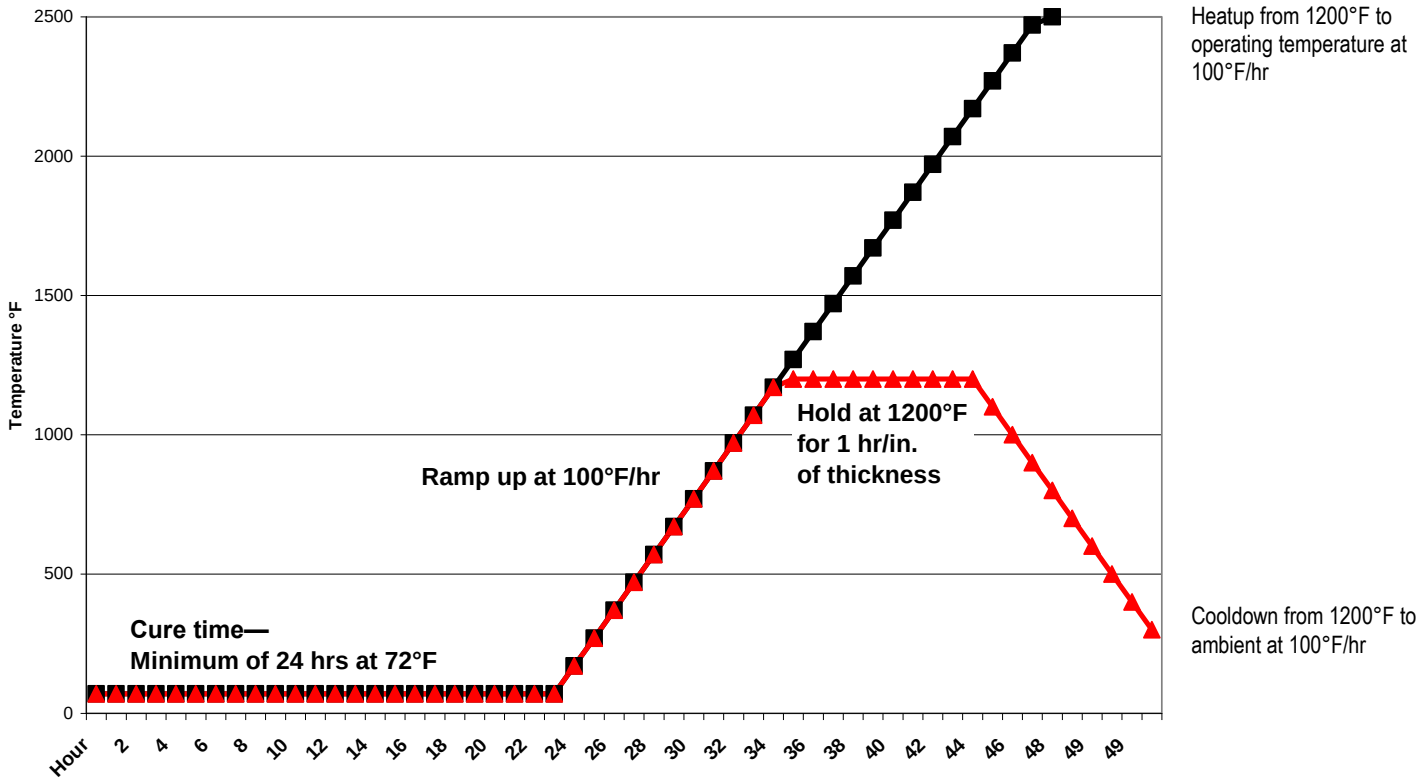
HWI Schedule 4—PLUS Rated Lightweight Castables and Gunning Castables

Curing and Dryout General Guidelines – Field Use – One Sided Dryout

12/17/13

Example: 9-Inch Lining Schedule
Total Curing and Dryout Time—49 Hours



Curing and Dryout Schedule (heated from the hot face)	Hours
Cure Time	
Minimum ambient cure time (range of 70°F to 100°F)	24
Dryout Heat Sequence	
Heat from ambient to service temperature at 100°F/hr	~25
Total Dryout Time	~25
Total Curing and Dryout Time	~49

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Notes

- For multi-layer lining designs, you must consider the total thickness of the various monolithics used in the lining as well as the specific dryout and heatup requirements of each product.
- Cure time is relative to ambient temperature. When installing below 60°F, you must either extend the cure time to fully hydrate the cement or add heat during the cure. Never begin dryout until a hard set is reached.
- Never let the temperature of uncured material drop below the freezing point. Ideally, the installed product should be kept above freezing until dryout is complete.
- The temperatures recommended in this schedule refer to the hot gases in contact with the refractory material and not the lining itself.
- Thermocouples must be placed about ½-in. away from the lining surface to ensure accurate temperature measurement during heatup.
- If castable material is installed without a permeable and unobstructed path to allow water removal from the lining through the cold face during dry out then weep holes and/or wicking must be used. Refer to HWI Dry Out/Installation Guidelines. If weep holes and/or wicking cannot be used, contact your HWI sales and technical representative for assistance.
- If dryout and cooldown are completed according to this schedule, subsequent heatup can be performed at 100°F per hr.
- All lightweight insulating castable products are susceptible it alkali hydrolysis. Detailed information on how to avoid this reaction is provided below.
- For linings thicker than 12 in., contact your HWI sales and technical representative.

Alkali Hydrolysis in Lightweight Products

Alkali hydrolysis, also known as carbonation, is the formation of calcium carbonate caused by the reaction of lime in cement and carbon dioxide in the atmosphere. The hydrolysis reaction breaks down the cement bond, which creates a volume expansion that weakens the refractory lining surface. This weakened surface is friable and can peel off in ¼-in. to 1-in. layers depending on the severity.

High porosity and alkali content make lightweight castables susceptible to alkali hydrolysis, which can occur in unprotected linings exposed to weather conditions, especially rain. This reaction does not occur in protected linings, such as insulating linings that are protected by a solid structure on the back and a dense refractory on the front.

Three steps must be followed to minimize/prevent the alkali hydrolysis reaction.

1. Cast and cure material at warmer temperatures to develop stable cement hydrates, which are more resistant to alkali hydrolysis (higher than 70°F is preferred).
2. Dry the material out as soon as possible after the 24-hr cure time. Drying will remove excess water and convert cement hydrates to more stable phases. The dryout temperature should be in the 500°F to 750°F range on the hot face to allow heat to penetrate the material and the temperature to reach at least 230°F part way into the lining. The lining does not have to be completely dried.
3. Keep the material dry by covering it with plastic. Do not use surface sealants because they will break down over time and trap water inside the lining. The trapped water can act as a catalyst to promote the hydrolysis reaction.

⚠ CAUTIONS

- If high-pressure steam or excessive steam is observed at any time during heatup, the temperature must be held or reduced until steaming subsides. The schedule can then be resumed. Increasing the temperature during steaming can result in significant steam pressure buildup and possible steam spalling.
- Proper ventilation and air circulation within the furnace is required to remove steam and exhaust gases.
- Flame impingement on the refractory must be avoided. This will cause localized overheating and possible spalling.
- Remove wood forms prior to dryout and heatup. Allowing wood forms to catch on fire can cause localized overheating and possible spalling of the refractory.
- Many factors can impact safe dryout and heatup, including temperature uniformity, air exchange, and specific vessel designs. HWI cannot warrantee or guarantee the safe dryout and heatup of any specific vessel or refractory casting. However, following the general guidelines in this schedule has resulted in many successful installations. If you have specific questions or concerns, contact your HWI sales and technical representative.