

# Drying methods for monolithic refractories

## Safety measures for heating-up for drying

The installed monolithic refractory lining contains much moisture just after the removal of the formwork at the time of completion of curing because mixing water is added for installation.

Following the removal of the formwork, heating-up for drying is necessary.

Heating-up for drying to the operational temperature of the installed monolithic refractory lining shall be carefully carried out because rapid heating causes cracks.

In some cases, the problem of explosive fractures occurs due to the high steam pressure generated at the time of heating-up. The safety measures indicated on the right and heating-up schedules indicated below shall be taken into account.

- 1 To prevent cracks or explosive fractures at the time of heating-up for drying, the temperature shall be raised carefully and moderately. In particular, heating up low cement castables requires much attention because their structure is quite dense. Therefore, steam generated at the time of heating-up is not smoothly vented from the inside of the lining. Rapid heating makes the steam pressure very high, which results in the occurrence of cracks or explosive fractures. On the other hand, rapid heating is possible for plastic refractories and ramming materials.
- 2 In the series of low cement castables, explosion-resistant low cement castables are available, which are recognizable by the mark "RE" at the end of the product name, such as "GIBRAM-RE". It is generally recommendable to use this "RE" series to reduce cracks and explosive fractures to as few as possible. Of course, heating-up is carefully carried out even for the "RE" series. Low cement castables for aluminum industries are not of "RE" type because of technical reasons.
- 3 Uniform heating-up shall be carried out throughout the overall lining structure. A high velocity hot air burner is recommendable for heating-up. Consult us for details.
- 4 Avoid direct contact of the flame of the burner with the surface of the refractory linings. Direct contact of the flame is very dangerous and may cause cracks and explosive fractures due to the rapid temperature rise. Cover the portion where the direct contact of the flame is anticipated with a refractory insulating wool blanket.
- 5 Follow our recommended heating-up schedules described below for castable refractories.

## Recommended heating-up schedules of castable refractories

Product Heating-up schedules	Category		
	Low Cement Castables for Aluminum Industries Example: GIBRAM, ASAL-85Z	"RE" type Low Cement Castables Example: Ramcrete, Drysic, Rheoflow WPC-S series	Conventional Castable Refractories Example: CA, LC and WPC series
From room temperature to 200°C	50°C/hour	50°C/hour	50°C/hour
Maintain a temperature of 200°C for certain hours calculated as per the instructions provided.	Calculate the time to be maintained considering the lining thickness. 10-mm thickness corresponds to 1 hour. Example: When the lining thickness is 200 mm, the time to be maintained shall be 20 hours.	Calculate the time to be maintained considering the lining thickness. 20-mm thickness corresponds to 1 hour. Example: When the lining thickness is 200 mm, the time to be maintained shall be 10 hours.	Calculate the time to be maintained considering the lining thickness. 20-mm thickness corresponds to 1 hour. Example: When the lining thickness is 200 mm, the time to be maintained shall be 10 hours.
From 200°C to 350°C	25°C/hour	25°C/hour	50°C/hour
Maintain a temperature of 350°C for certain hours calculated as per the instructions provided.	Calculate the time to be maintained considering the lining thickness. 10-mm thickness corresponds to 1 hour. Example: When the lining thickness is 200 mm, the time to be maintained shall be 20 hours.	Calculate the time to be maintained considering the lining thickness. 20-mm thickness corresponds to 1 hour. Example: When the lining thickness is 200 mm, the time to be maintained shall be 10 hours.	Calculate the time to be maintained considering the lining thickness. 20-mm thickness corresponds to 1 hour. Example: When the lining thickness is 200 mm, the time to be maintained shall be 10 hours.
From 350°C to the operational temperature	25°C/hour	50°C/hour	50°C/hour

Remarks: The heating-up schedule for drying in the above table is our recommended standard one to prevent cracks and explosive fractures. In actual heating up for drying, if the lining area to be dried is relatively broad, the actual heating up schedule shall be deviated from the standard one, area by area of the lining.

Please control such deviation within  $\pm 30^\circ\text{C}$  from the standard one for any area and carry out the homogeneous heating up as much as possible.



## Recommended heating-up schedules of plastic and ramming refractories

Product Heating-up schedules	Category	
	Plastic and ramming refractories Example: PL-34, PL-34HP, PL-38RS, etc.	For several hours
From room temperature to 900°C	30 to 50°C/hour	
Maintain a temperature of 900°C		For several hours

