

INSTALLATION INSTRUCTIONS for Calderys Australia Pty Ltd

Installation method - RAMMING.

Pre-Installation Considerations

- **Material Consistency & Characteristics**

Calderys Australia manufacture and supply plastic refractories in two consistencies; Plastic refractory (CASTFLO AP) and Rammable refractory (KEREX).

When they leave the factory, they have the correct workability and are ready for use. To preserve the correct workability, these refractories are protected by moisture retaining wrapper and packed in cartons, whilst the granular material is packed in paper sacks with a plastic inner-bag or a bulk bag and complete pallet loads are covered with polythene which should remain in place until the material is ready for use. Before using the plastic refractory, test its workability by taking a small handful and forming it into a ball. It should be sufficiently pliable to mould and knit to a homogeneous monolith when rammed.

- **Storage**

Plastic and ramming mixes should be stored in a dry warehouse. Materials received pre -mixed with liquid are vulnerable to being spoiled if the watertight membranes in which they are packed are pierced, therefore care must be taken to avoid this.

The correct liquid addition made by the manufacturer is critical to correct installation and if moisture loss is suspected the packs should be returned to the manufacturer for reworking. On no account should the user attempt to reconstitute dried out or partially dried out material by adding water.

The workability of plastics is affected by temperature, but providing the material is above 10 degrees C and using pneumatic rammers, most materials can be adequately placed. If material has frozen in storage, it can be thawed gently without detriment to the material or to the finished installation.

In case of a placed installation freezing in-situ before the initial firing, it must be thawed slowly at low temperature between 10 to 40 degrees C before beginning the normal initial heating schedule.

• Tools Required

In addition to the tools normally used for masonry construction, the installation of plastic refractories requires;

- A reciprocating pneumatic rammer with a steel or hard rubber ramming head operating at approx. 1200 strokes/minute. The shape of the ramming head depends upon the material applied the shape of the lining being installed, and the users experience. Bench rammers are recommended for most jobs, but floor rammers have been used where space permits.
- Sufficient air hose to connect the rammer with the air supply.
- An air manifold with multiply connections if more than one rammer is used (Recommended pressure for pneumatic rammer is 550Kpa)
- A 1.0 kg bench hammer for hand ramming small sections.
- A short handled spade for trimming the lining surface.
- A hand tool for cutting joints
- A hand tool for piercing vent holes.
- A hand tool for surface roughening.

• Site Preparations

Before the installation of the plastic refractory begins, the following precautions should be taken.

- (1) The site where the material will be installed must be clean so that no foreign matter will contaminate the refractory.
The back-up wall against which the plastic will be placed must be smooth, without wide gaps or cracks, and thoroughly cleaned.
- (2) Care must be taken to prevent rain or water from contacting the refractory during installation and prior to initial heating.
- (3) Care must also be taken to ensure that the material cannot freeze in the unfired state.

• Provision for forms

While plastic refractories can be installed without forms, the use of forms is necessary in some cases, and recommended in others;

Forms are necessary for arches, suspended arches, suspended roofs, and walls which slope inwards. Forms are recommended where its desirable to achieve maximum compaction of the plastic in vertical walls exposed to severe mechanical load.

It can also be economic to use forms for walls of large size and thickness. When ramming material, the forms must be well braced and made of strong material to prevent movement, bending or vibration when the material is installed. Contact Calderys Australia for specific information on forming methods.

Caution: Take care that the ceramic anchor in their fully extended position are 6 mm to 12 mm from the inside face of the forms.

• **Anchoring Provisions**

Depending on the dimensions and position of the refractory lining, it must be provided with special anchors and supports. These hold and secure the lining to the outer structure and make it possible to remove a section of the lining for repairs or modifications later, without affecting the stability of the remaining lining. A wide range of flexible and fixed anchors and supports are available for all kinds of positions, temperatures and process conditions.

Ceramic anchors must be fixed in a stretch position before the installation of the lining commences. This can be achieved by the use of wedges between the anchor element and hook and claw.

Calderys Australia will be pleased to give further advice regarding anchoring in specific instances.

Special Weather Conditions

• **Cold Weather Installations**

- When plastic refractories are to be installed in cold weather environments, the following precautions must be taken.
- The refractory must be stored in a frost free warehouse.
- Do not install frozen plastic material, or allow the installed lining to freeze in the unfired state.
- Should the installed lining or cartons freeze the following steps shall be taken.
- Remove the cardboard packing (but not the plastic wrapping) and place the cubes in such a way that the warm air can easily circulate around them. The material is ready for use when it has reached the original uniform consistency and proper workability. This normally takes 2 to 3 days.
- The frozen lining must be thawed very carefully. Since both the freezing and thawing process can dry the surface of the lining excessively, it should be sealed with plastic or sealing spray before thawing to avoid the risk of surface spalling.
- The temperature should be increased no more than 30 degrees C each hour. When the operating temperature is reached, it should be held for 24 hours. This procedure should not be interrupted, except for an emergency.

• **Hot Weather Installations**

- When refractories are to be installed in hot weather environments, the following precautions must be observed.
- Due to high ambient temperature, the material will dry out faster and lose its workability.
- When it is to be expected that the material will not be applied soon after dispatch from the factory, special attention must be paid to cool storage. Due to high ambient temperature, the installed refractory will dry out quicker and more intensively in its unfired state, and this will cause wider and deeper joints. For this reason, it is recommended to cut joints at a shorter distance, e.g. 500 -700 mm instead of the minimum 1000 mm used normally.
- Venting holes should be made at a shorter distance of 150 mm in order to avoid spalling during heating – up. Alternatively ` Surface Vent Holes ` may be pierced between the normal vent holes, and should be approximately 50 mm deep. Due to the high humidity of the ambient air and because of the fact that the temperatures inside a furnace are often lower than out side, condensation might form on the lining during initial heating.

Ramming Procedure

• Ramming Plastics

Lay a row of either complete or cut slabs in place against the back – up wall, plate, or insulation, and along the length of the wall or section to be lined. Never place more than one layer, 60 mm thickness at a time. With the pneumatic or hand held ramming tool, ram the first layer of material thoroughly into a solid, monolithic mass. This ramming must be done uniformly and thoroughly. All ramming should be done in a direction perpendicular to the length of the work.

When thoroughly done, the plastic should be compacted to approximately one half the original unrammed thickness, voids should not be present and the slices should be moulded into a monolithic mass. After ramming the first layer, proceed by placing the second layer directly on top.

For this second, and all succeeding layers, stagger the placement of the slabs so that the joints between the pieces is offset from the layer below, preventing continuous vertical joints from being formed. Ramming the subsequent layers must also be done thoroughly. Do not ram the next layer against a smooth surface, as the previously rammed layer must be left rough before the next layer is placed. This will give maximum coherence between two layers. This practice is of particular importance in metal contact applications. As soon as the wall reaches the height of a row of anchor hooks or support brackets, the anchor or supports must be fitted to these hooks or brackets and then embedded into the plastic refractory. This must be done carefully, fitting each anchor into the base of the hook, and each support into the base of the tapered portion of the bracket.

In order to keep the anchors flexible, it is recommended that the connection between the anchor and the hook be kept free of plastic refractory. All anchors must be installed in a fully extended position. To do this insert a pair of non-metallic wedges between the anchor and the hook. When the anchors have been rammed in place, the wedges should be removed.

• Ramming Semi Plastic Material or Dry Rammable

To obtain the necessary dense, well-compacted structure, semi – plastic or dry rammable refractories must be rammed with a pneumatic ramming tool. Because materials have non – plastic, granular consistency, these materials are normally installed behind solid, vibration – proof shuttering, and against a solid foundation or back – up construction. The pressure on shuttering when ramming is high.

The ramming method of plastic and semi – plastic or dry rammable refractories materials is in principal the same. Different types of ramming heads on the pneumatic ramming tool can be used, such as wedge requirements of the actual installation.

Semi – plastic or dry rammable refractories should be installed in a continuous operation. The material should be placed in layers of 50 mm thickness equally spread and rammed. Ram to spread out material thoroughly until the material has reached maximum compaction.

- **Work Interruptions**

When it is necessary to interrupt the installation procedures for more than one hour, cover the unfinished surface with a damp cloth, or plastic film, so that the surface of the lining will remain fresh and new material will bond correctly. In addition it is recommended that the unfinished surface of the lining be roughened before the new material is applied.

For all chemically bonded plastics or semi – plastic refractories, if the surface is not covered, it is necessary to scrape away and remove approximately 25 mm of the finished work and make the surface rough again before proceeding with the ramming.

In practice this will mean that the rammed layer will be about half the thickness of the spread out layer. The top of the rammed layer must remain rough before each subsequent layer is spread out and rammed together. This is to prevent lamination.

When the wedge type head is used, it must be turned regularly so that the material is spread and pressed between the back – up material and shuttering.

- **Trimming**

Prior to trimming, lightly ram around the edges of the face of each anchor to ensure the anchor corrugations are filed. Place the back of the trimming spade against the plastic and shave the excess material back to the level of the ceramic anchor faces.

Take care to avoid smoothing the wall surface as the rough texture will assist in removal of the moisture when initial heating is commenced.

- **Venting**

Vent holes provide further means of releasing steam from the lining during initial heating and will assist in preventing `blowing` of material from wall.

Venting must be carried out immediately following trimming. Use a 3 – 5 mm diameter rod right through the lining up to 230 mm, or alternately, half the thickness.

In the case of solid steel welded furnace shells, it is recommended that the vent holes pierce the full plastic thickness. These holes must be done within a short time after ramming.

- **Health And Safety**

Health and safety regulations apply to all Calderys Australia materials. These are outlined on the appropriate Material Safety Data Sheet, which is submitted, with all quotations or purchases of our products and on request.

- **Curing and Commissioning**

Please refer to Standard Heat Up Schedules for Curing and Commissioning of plastic and semi-plastic refractories.