



Plibrico Company LLC

1010 North Hooker Street
Chicago, IL 60642
Phone: 312-337-9000
Fax: 312-337-9003
www.plibrico.com

Technical Bulletin

TB-IG11-PB

Installation Guidelines

Plibrico® Plastic Refractories

Plibrico plastic refractories are stiff, moist, putty-like materials. Plibrico plastics are available with two different bonding systems: clay/air bond plastics and chemically (phosphate bond) setting plastics. Each grade is manufactured to the proper workability and is ready for installation without the addition of water. To preserve the proper workability, Plibrico plastic refractories are protected by moisture retaining wrappers and packed in cartons.

Storage

Plibrico plastic refractories should be stored indoors in a cool, frost-free location. The average storage life of air & heat-setting Plibrico plastic products is up to 12 months. The average storage life of chemical-setting Plibrico plastic products is from 3 to 6 months. Since there are variations in the storage life of individual products, please note the exact storage life for the products you store. The self life and workability of plastics will be reduced if stored in excessively hot conditions or direct sunlight. If Plibrico plastic refractories freeze either in shipment or in storage, they must be thawed prior to installation. Never install frozen plastic! Contact the Plibrico Technical Department or Engineering department for instructions on how to properly thaw frozen plastic.

Equipment

1. A reciprocating pneumatic rammer with a steel or hard rubber ramming head operating at approximately 750-1200 strokes per minute. The shape and size of the ramming head depends upon the material applied, the shape of the lining, and the user's experience. The most commonly used heads have round cross sections and are 1 3/4" - 2 1/2" (45mm - 65mm) in diameter. Bench rammers are recommended for most jobs, but floor rammers can be used where space permits.
2. An air compressor or air source capable of supplying the number of rammers being used on the project. A typical bench rammer requires 10-30 CFM of air at 90psi.
3. An air manifold with multiple connections if more than one rammer is used and sufficient air hose.
4. A 2.5# (1 kg) hammer for hand ramming of small sections.
5. A short handled spade and/or "hula" hoe for trimming the lining surface.
6. A hand tool for cutting expansion joints.
7. A curry comb or roughening tool for roughing the trimmed surface.
8. A 3/16" (5mm) rod or large nail to form vent holes.

Preparation

1. The site where the Plibrico plastic will be installed must be clean so nothing can contaminate the refractory. The back-up surface, against which the Plibrico plastic refractory 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 plastic refractory during installation and before bake-out takes place.

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3. Care must also be taken to insure that the plastic does not freeze in the unfired state after installation.
4. While Plibrico plastic refractories can usually be installed without forms, the use of forms and/or false anchoring is necessary in some cases. Forms are necessary for arches, suspended roofs, and walls which slope inward. The forms must be braced and made of strong material to prevent movement, bending, or vibration when the material is installed. False anchoring is necessary when installing chemical setting Plibrico plastics overhead. Contact the Plibrico Engineering department for specific information on forming and false anchoring methods.
5. Refractory anchors—either ceramic or metallic, are generally required to hold and secure the lining to the outer wall or steel structure and make it possible to remove or repair one section without affecting the stability of adjacent sections. Anchors are not to be used in molten metal contact situations. A wide range of Plibrico anchors and supports are available for various lining configurations and for different temperature and process conditions. Plibrico does not recommend the use of round rod type metallic anchors, such as V-anchors with plastic refractory. The type and quality of anchors and supports as well as their position are given on the approved Plibrico construction drawing. If no drawing is available, contract the Plibrico Engineering Department and ask for further advice before proceeding. Anchor hooks and support brackets must be securely fastened by an appropriate method to the outer surface or steel structure prior to installation of the refractory lining.

CAUTION: When forms are used, ceramic anchors in their fully extended position should be 1/4" – 1/2" (6-12mm) away from the inside face of the form to allow for trimming. In no case, should the plastic refractory protrude past or on top of the ceramic tile anchor after trimming.

Ramming Procedure

Open the carton and the moisture proof packaging at all 4 corners of the cube (with the pre-cut slices in a vertical position). Separate the individual slices with a trowel or spade.

WALLS

1. Lay a row of either complete or cut Plibrico 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, or a 2½" (65mm) thickness, at a time.
2. With the pneumatic or hand 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 by moving in a direction perpendicular to the length of the work. When thoroughly done, the plastic should be compacted to approximately one half the original un-rammed thickness. Voids should not be present, and the slices should be molded into a monolithic mass.
3. After ramming the first layer, roughen the rammed surface. This will insure maximum adherence between layers. This practice is of great importance in metal contact applications.
4. Place the next layer directly on top of the rammed and roughened surface. On this layer and all

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succeeding layers, stagger the placement of the slabs so that the joint between pieces is offset from the layer below, preventing continuous vertical joints from being formed. Ramming of subsequent layers must also be done thoroughly.

5. As the Plibrico plastic wall reaches the height of a row of anchor hooks or support brackets, the anchors or supports must be fitted to these hooks or brackets and then embedded into the Plibrico 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.
6. To keep 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 anchor has been rammed in place, the wedges should be removed.

CAUTION: Never ram directly on a ceramic anchor. When installing a ceramic anchor, use a dummy or spare anchor to make a full depth profile in the plastic refractory, then set the ceramic anchor.

ROOFS

Ramming roofs and arches requires forming and the use of ceramic tile anchors or special alloy hangers. Chemically setting plastic refractories also require false anchoring provisions and support to prevent slumping. Consult with your Plibrico representative or the Plibrico Engineering Department for details.

FLOORS

No anchors are required in floor applications. Ramming should be carried out in a direction as close to perpendicular to the hot face as possible.

CAUTION: Never face ram the outer surface of a lining.

Trimming, Joints & Finishing Procedures

1. If the Plibrico plastic is not rammed behind forms, a wall lining may tend to bulge due to vertical ramming and the compaction of the plastic slabs. To achieve the proper thickness, trim off the bulging portion to the required thickness using a sharp flat blade or a special pneumatic tool. The trimming must be done within a short time while the material is still workable. Trimmed material if moist, workable and not contaminated with foreign matter can be used again.
2. During bake-out of a plastic installation, the plastic refractory has a tendency to first shrink and then expand causing cracks. It is recommended that provisions be made for this to occur at pre-selected places rather than where cracks are not desired, such as at anchor locations. To accomplish this, the surface lining must be provided with cut joints.
3. The depth of these cut joints should be about 1/5th (20%) of the wall thickness, with a maximum depth of 2 1/2" (65mm) on walls over 12" (300mm) thick. These joints can be made with a hand tool.
4. The cut joints should be made in both horizontal and vertical directions. Position of cut joints may

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be given on the approved Plibrico construction drawing of the refractory lining. Should no drawing be available, it is recommended that the joints be cut at distances of about 48" (1.2m). The prime consideration is to space cut joints between rows of anchors. The Plibrico Engineering Department can supply specific recommendations regarding distance between joints and their depths.

5. Joints must be cut within a short time after ramming, while the Plibrico material is still workable.

CAUTION: Do not cut joints in molten metal contact areas.

6. During the bake-out of the lining, moisture in the Plibrico plastic refractory will be released as steam. In order to facilitate the escape of water vapor and to prevent spalling of the lining, two measures must be taken during installation: surface roughening and venting.
7. After trimming the plastic lining to the proper thickness, the surface of the material must be made rough. This can be done by scraping it with a trowel or special roughening tool such as a curry comb. Surface roughening must be done within a short time after ramming is completed. Do not finish the plastic lining to a smooth and slick surface.
8. After trimming, joint cutting, and surface roughening are completed, vent holes must be made in the Plibrico plastic lining. The distance between the vent holes should be about 8" (200mm). A 3/16" (5mm) diameter rod or nail should be used to pierce the lining to a depth of approximately 50% of the lining thickness, up to a maximum of 6" (150mm).
9. In metal contact areas, only make the vent holes 2" (50mm) deep and spaced 18" (450mm) apart.

Work Interruptions

When the installation of a Plibrico plastic refractory lining is interrupted, such as during a lunch break, overnight, over a weekend, or for any reason, the working surface must be covered with plastic sheeting to prevent the installed plastic lining from drying out. When work resumes, any dried material on the working surface must be scraped away and the new moist surface roughened before ramming begins. If possible, try to have work interruptions coincide with where a joint is to be made later.

Hot Weather Installations

Plastic refractory installations in warm or tropical climates require extra precautions due to the high ambient temperatures normally encountered. Provisions for cool storage of the Plibrico plastic are essential, particularly if the product will not be used soon after delivery. During installation, these steps should be taken:

1. The distance between the cut joints should be reduced to between 20"- 28" (0.5m - 0.7m).
2. The distance between vent holes should be 6" (150mm) . **CAUTION:** Phosphate-bonded plastics should be vented immediately before bake out.
3. To prevent condensation from forming on the surface of the unfired refractory (which normally results from high humidity and lower temperatures inside the furnace than outside) open access doors, combustion air dampers, and flue gas dampers to create a slight draft. This reduces the risk of surface condensation, as constant ventilation is the most efficient preventative measure. Take

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care to limit ventilation to prevent excessive surface drying

Cold Weather Installation

Plastic refractory installations in cold weather also require extra precautions:

1. Store plastic refractories in a frost-free warehouse.
2. Do not install frozen plastic refractories.
3. Take steps to prevent the plastic from freezing during and after installation. Freezing may degrade the lining integrity and at very least cause increased shrinkage and cracking. If a Plibrico plastic lining freezes prior to bake out, contact your Plibrico representative or the Plibrico Technical or Engineering Department for instructions on the proper thawing procedure.

Bake Out

After the plastic installation is complete, Plibrico clay and air bonded plastics may be left to air dry for an indefinite period as long as freezing does not occur. It is recommended that chemical setting Plibrico plastics be prevented from air drying for any significant amount of time prior to bake out. If an extended time interval between installation and bake out is expected, > 1 week, cover the chemical bonded plastic surface with plastic sheeting or use a liquid membrane concrete curing compound* to keep the plastic moist. Suspended roofs of chemical setting plastic should also remain supported before bake-out. Please refer to the appropriate bake out schedules referenced below for bake out of plastic linings and mixed plastic - castable linings.

*Water based curing compound conforming to ASTM C309 Type I Class A&B recommended.

Technical References

Technical Questions

Plibrico Technical Department
Plibrico Engineering Department
312 337-9000

Heat Up Schedules

Plibrico Schedule **A**

Mixed Plastic & Castable Plibrico Schedule **ATMI**



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