



TYPE OF REFRACTORY LININGS

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Refractory linings are generally designed to provide specific protection of various operating systems or environmental conditions. Heat conservation should be optimized within limits of sound refractory design. Refractory linings should be selected based on the most important physical property necessary for optimum, cost effective, performance. Cost of materials and installation are important components of refractory systems and should be evaluated together to ensure cost effectiveness. Refractory technology constantly changes and new, improved products are regularly introduced. Limited experimentation is encouraged; however, coordination with Company refractory specialists is necessary to both reduce potential for poor performance, and to communicate results throughout Company. Properly engineered refractory systems provide the best performance

SINGLE LAYER WEAR-RESISTANT LINING

Single layer wear-resistant lining consists of dense refractory, generally 3/4" to 1" thick, anchored with hex mesh grating or independent anchoring systems designed for wear-resistance. When independent anchoring systems such as S-Anchors, Hex Cell, etc., are used, refractory should contain stainless steel fibers. These linings should be considered as having limited insulating value and designer is cautioned to consider heat transfer (heat flux) in design of equipment. Application of single layer wear-resistant linings is generally accomplished with pneumatic ramming guns. Other procedures should be approved by Company.

ONE-SHOT LINING

- A. One-Shot linings are single layer linings over 2 inches thick installed with a pneumatic gun.
- B. One-Shot linings are generally lightweight or medium weight insulating refractories; however, moderate and severe erosion resistant products are included in this classification in limited applications.
- C. Anchors for one-shot linings should be footed double-hook or footed wavy vee anchors.
- D. Straight bottom double hook or wavy vee anchors may be used with approval of Company. When using straight bottom anchors, installer should develop an installation technique to weld anchor without cutting base or time.

CAST LININGS

- A. Casting is performed when water is added to castables in sufficient amounts to properly consolidate castable with minimum external assistance.
- B. Casting is generally performed on insulating and general purpose castables where special characteristics of lining are not required.
- C. Vibration should minimal to avoid segregation of castable components, and is typically performed with an internal vibration device such as a "pencil vibrator".



TYPES OF REFRACTORY LININGS

Cast Vibrated Linings

- A. Cast vibrated linings are linings installed with rigorous vibration. These linings are typically dense and provide protection from abrasion or erosive mediums.
- B. Cast vibration of castables promotes optimum compaction and consolidation of castable with a minimum of water. Physically properties are maximized in this technique, leading to superior service for most applications.
- C. Cast vibration installations are generally limited to shop applications.
- D. Field installations are acceptable with prior Company and detail procedures/mock-up.
- E. Designer is cautioned to consider effect of vibration on attachments of component being lined. Cracking of welds is possible and procedures should reconcile this eventuality, and provide assurances that nozzles and other attachments would not incur damage during cast vibration procedure.
- F. Water content is critical to refractory concrete and should be chosen to maximize physical property development.

Dual Layer Insulating and Wear Resistant Lining

Dual layer insulating and wear-resistant lining is a layer of lightweight refractory protected on the surface by a layer of dense refractory. Dense layer of refractory should contain proportional concentrations of stainless steel fibers and should be a minimum of 2 inches thick. Dense refractory should be anchored by either long anchors extending beyond lightweight refractory or anchors attached to 3/8 inch diameter studs. Dust layer linings may also be anchored with S-Bars, provided design is reviewed by Company refractory specialist.

Ceramic Fiber Linings

Ceramic Fiber linings provide thermally efficient, lightweight linings for areas where erosion or mechanical abuse is absent. Refractory lining weights may be reduced by a factor of 10 -12. Many furnace builders incorporate ceramic fiber into their designs which reduces size of structural components and ultimately fabrication cost. Repairs, however, should be made with ceramic fiber, as structure may not support conventional insulating refractory linings. More common ceramic fiber lining systems include modules, wall paper, and board/blanket construction. Ceramic fiber systems are extremely permeable and when corrosive gases are present in operating environment, a coating should be applied to metal shell.

Brick Linings

Brick linings are constructed of individual bricks are used primarily in areas where ceramic bonded products are necessary to withstand environmental and mechanical conditions of equipment. Reliability of brick linings is highly dependent on the skill of bricklayers, and is more complicated than monolithic construction techniques. Engineering details of lining design are also important and engineering drawings are always recommended prior to installing brick linings.