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CHEMICAL ENGINEERING – FIRED HEATERS

With this article we look closely at fired heaters used by chemical processing industries and the preferred refractories used to emphasize rapid repairs to existing fired refractories and energy conservation as it relates to fired heater design and performance.

An economic factor that has assumed greater importance in recent years is the shift to reduce downtime costs on refractory maintenance of fired heater and burner maintenance. Environmental considerations may necessitate the removal of fired, fibrous insulating refractory materials to reduce the risk of hazardous dusts and fibres being handled during demolition.

Refractories

The casing is lined internally with insulating materials. Aside from the function of preventing the steel structure from overheating the insulation also serves to contain the firebox heat at high temperature by re-radiating it to the tube coil. In addition, the internal insulation serves to minimise casing heat loss and also functions as a barrier to prevent flue gas particle migration to the steel casing. Such migration, in the case of sulphur bearing fuels, may lead to acid corrosion of the steel plate.

In order to properly select and design a refractory lining for a fired heater concerns must be given to several important factors:
Extreme Temperature: exposure to temperatures beyond the design limitation of a refractory material can cause melting or fusion and failure under load.
Thermal Shock: extreme or frequent temperature fluctuations can cause disintegration and spalling of refractory linings.
Mechanical stress: abnormal vibration can contribute to the deterioration of some materials. Stresses due to the expansion and contraction of the structure can cause the loss of lining integrity unless the proper allowance is made in mechanical design.

Erosion: extremely fine particles such as flyash or catalyst being carried at high velocity in a flue gas stream can cause erosion of the refractory material.
Chemical attack: some fuels contain impurities that can react with various refractory constituents, causing slagging and failure of the refractory lining. Alkalies and acids depending on the temperature and dewpoint of the flue gases can attack the components of a refractory lining causing corrosion and deterioration.
Cost: the economic evaluation of refractory materials and construction types has now changed to provide the fired heater with an economic viable insulating refractory with good insulating value and mechanical serviceability. Thermbond Formula 8 series is a phosphate bond semi insulating refractory designed to repair existing fired insulating refractory or construct full refractory linings by gunning and cast-in-situ methods of placement.

Insulation

Castable refractory*:* Thermbond chemical bond insulating refractory castable is the most current development in the field of fired heater insulation and is applied by cast-in-situ or gunning. Gunning Thermbond Formula 8 series chemical bond refractory under controlled conditions has been shown to be a very economical method of application. Particularly Thermbond Formula 8G gunning refractory with its unique bond system, it tenaciously bonds to existing fired insulating refractory when doing overlay repairs, develops high early strength, it rapidly cures due to its exothermic reaction, allows a fast fire-in with no holds back into service, resists thermal shock, protects furnace steel casing from acid corrosion, resists alkali attack and saves money on performance.

Thermbond Formula 8 series insulating castable does not contain water and cement, it replaces the "old" conventional vermiculite insulating castables with the cement + water bond system where is takes up to 24 hours for curing and the slow heat-up requirement and then possible spalling problems can evolve.

Thermbond Formula 8 series insulating refractory has a maximum temperature of 1538^{o}C and Thermbond Formula 6 series dense castable has a maximum temperature of 1650^{o}C, these are both used on exposed walls (unprotected by tubes) in close proximity to the flame burst.

It should be noted that as the service temperature and density of the refractory increases, the insulating effectiveness decreases, resulting in a need for additional thickness to achieve the same cold face temperature. In many cases, dual layer constructions are employed in which the high temperature, high density material is exposed to the flame and the insulation material is provided as the back up layer.

Thicknesses are typically 125mm for convection – section walls and radiant section walls protected by tubes and 150mm to 200mm for exposed radiant walls, arches and floors. It is now acceptable to cast Thermbond Formula 6L chemical bond castable onto floors of the fired heaters where the heaters are designed for liquid fuels.

Ceramic Fibre: this is an "old" construction lining material in the field of fired-heater insulation. In more recent times it is now extremely important to follow the National Code of Practice for the safe use of synthetic mineral fibres which does include ceramic fibre materials during installation and most importantly the removal of ceramic fibre and embrittled ceramic fibre materials. We offer to Companies preferring to install ceramic fibre products into fired heaters our *FIBERCOAT* sealant and protective coating that is applied to all new ceramic fibre lining materials. We can provide more information upon request.

Advantages of installing Thermbond refractories into Fired Heater

1. Thermbond chemical bond refractories resist sulphur and H_2S gas attack.
2. Thermbond chemical bond refractories protect steelwork and anchors from corrosion because of the phosphate bond system.
3. Thermbond chemical bond refractories provide immediate availability for operation, without special start up procedures such as curing, dry out or cold weather precautions.
4. Thermbond chemical bond refractories can be used safely in soot blowing areas where it show resistance to carbon impregnation and where steam lancing in contemplated because Thermbond resists thermal shock from thermal cycling applications.

For more information about this innovative refractory technology please contact Refractech Pty Ltd.

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