MANAGEMENT OF MODIFICATION OF NEW HEAT RECUPERATOR SYSTEM

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Summary

The heat recuperator has been affecting the continuous operation of the Perwaja Direct Reduction Plant. The problems of heat recuperator are tubes crack, clogging at top of hot exhaust inlet gas and at bottom cold outlet gas.

Intergranular corrosion and stress corrosion cracking are problems associated with the use of stainless steel and must be considered when selecting types suitable for use in process environment. The stress corrosion cracking of stainless steels can be caused by a few ppm (part per million) of chloride ions.

Stress corrosion cracking can be avoided by selecting materials that are not susceptible in the specific corrosion environment. The life of equipment that prone to corrosive environment can be prolonged by proper design.

Many factors have to be considered when selecting engineering materials, but for chemical process plant the overriding consideration is usually the ability to resist corrosion. The most economical material that satisfies both process and mechanical requirements should be selected, this will be the material that gives the lowest cost over the working life of the plant allowing for maintenance and replacement.

In order to minimize the stress corrosion attack, the arrangement of heat exchanger from the original counter-current change to two sections; one parallel current and one counter current looking for a tube wall temperature higher than the water condensation condition.

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1.1 Direct Reduction Process

The Perwaja HYL III Direct Reduction Plant comprises two modules with a capacity of 1.0 million tans per year of direct reduction iron (DRI).

1.1.1 Raw Materials

The HYL III reactor is suitable for the handling of 2 wide range of pellet/lump ore mixture. The quantity levels recommended for the raw materials is as follow

	Pellet	Lump Ore
Total iron %	76.2 min	65.0 max
Oxide iron %	0.8 max	2.0 max
Gangue %		5.0 max

1.1.2 Reactor Section

The iron mixture is reduced into sponge iron (or called DRI) by the following process reactions

$$Fe_2O_3 + 3CO \rightleftarrows 2Fe + 3CO_2$$

$$Fe_2O_3 + 3H_2 \rightleftarrows 2Fe + 3H_2O$$

The reducing gas containing high concentration of H_2 and C are injected to the reactor at the temperature up to 930^0 and pressure of approximately 4.0 bar, which is the gases reacts in counter current with a moving bed of iron mixture.