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Failure Analysis Of Shells And Pipe Of Heat Exchanger

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***Abstract*—** *This paper deals with the failure analysis of air warmth exchanger. The herbal frequency and vibration mode of air heat exchanger are received based on a 3-dimensional finite detail version. A flow-caused vibration is analyzed on the premise of modal simulation outcomes. A thermal-structural interaction simulation for air warmth exchanger is executed by using the use of the multi-physical area coupling approach. The stress distribution and pressure distribution of air warmth exchanger are calculated by using the use of the results of temperature discipline simulation. A model based on equivalent plastic pressure range and cycle existence is used to explain fatigue life, and the equal plastic pressure range changed into acquired via the thermal-structural interplay simulation. The evaluation consequences display that the major reason of fatigue failure of air warmth exchange tube bundle is the thermal strain and glide-brought about vibration*
Keywords—*Heat,Failure,Simulation,Tube,Vibration*

I. Introduction

Warmth exchanger might be characterized as gear which moves the vitality from a hot liquid to a chilly liquid with greatest rate and least speculation and running expense. It is utilized to lessen temperature of one procedure liquid, which is alluring cool ,by moving warmth to another liquid which is attractive to warm without entomb blending the liquid or changing the physical condition of the liquid. Warming is an indispensable activity in the oil and synthetic processing plant. Consequently disappointment of a warmth exchanger result inadequate exchange of vitality. Ordinary activity of warmth exchanger as a rule requires little administrator consideration .However, working existence of a warmth exchanger can be definitely abridged by ill-advised beginning up and shut down practices. So appropriately planed executed upkeep plan is irreplaceable for some, enterprises having heat exchangers as a fundamental gear in their procedure plant. A point by point support timetable of plant and apparatus of an industry includes for the most part checking without upsetting the activity of the plant in general.

II. Problem Definition

In HOCL a shell and cylinder heat exchanger is utilized in the generation line of phenol. Hot oil at 328°C and 10.5 kg/cm2 is going through the exchanger tubes.SS316 material is utilized in the cylinders. 120 cylinders at the highest point of the warmth exchanger bombs normally and thus the plant must be shut down for in any event 2 days on every disappointment. The disappointment causes loss of hot oil (therminol) which cost around Rs 850 for every liter. About 1cm drop in oil level expenses around 5 lakhs.

III. Operation Of Heat Exchanger

Ordinary activity of warmth exchangers for the most part requires little administrator consideration. Be that as it may, working existence of a warmth exchanger can be radically shortened by ill-advised beginning up and shut down practices. Some regular issues are:

A. Tube disappointment because of 'water hammer' impact brought about by opening the shell bay valve too rapidly.
B. Bending of the pass parcel plate in the segment channel due to threw stream from the cylinder delta spout brought about by fast opening of the channel gulf valve.
C. Introduction of cylinder side liquid in a fixed cylinder sheet heat exchanger with the shell side unfilled (since the subsequent change in the cylinder metal temperature may over pressure the cylinder to tube sheet joint bringing about the disappointment).
D. Thermal stress actuated splitting of thick segments in area of gross basic brokenness, for example, tube sheet/divert intersection in necessary structure, because of fast changes in the liquid temperature. So as to maintain a strategic distance from such issues fire up and shut down of the types of gear ought to be done in a way predictable with the first plan premise.

On occasion, heat exchangers are intended to work under differential weight. The shell and the cylinder side weight are constantly present at the same time. The administrator ought to guarantee that the plan presumption of differential weight is never abused including the time of start up and shut down, or the time of

framework pressure testing.Other operational problems in heat exchanger are flow induced vibration, rapid tube failure, corrosion and erosion of the tube wall, tube joint failure, fluid level control difficulties and flanged joint leakage.

IV. Maintenance Of Heat Exchangers

Operating problems in heat exchangers may be broadly classified into three groups.

A. Structural Problems

Basic issues are the most genuine; disappointment is regularly quick and irreversible. Disappointments brought about by stream - incited vibration of warmth exchanger tubes over shadow all other basic disappointments. Cylinder to tube sheet joints disappointment is likewise a regular operational issue.

The other sort of auxiliary disappointment experienced in heat exchanger activity is spillage from darted joints. Breaks every now and again happen in spout ribs because of minute stacking of the joint brought about by warm extension of the interconnecting funneling. Now and again, non-temperature conveyance in the cylinder sheet or spread in different pass configuration initiates joint spillage. Supplanting of the spilling gaskets with one having increasingly suitable stacking and unwinding properties is generally the panacea for such auxiliary issues.

B. Performance Problems

The unnecessary cylinder fouling for the most part messes execution up. In a warmth exchanger during ordinary tasks the cylinder surface gets secured by stores of debris, residue, and earth and scale and so forth. This marvel of rust arrangement and statement of liquid debasement is called fouling. Statement of foul ants within the cylinder surface lessens the accessible stream region and increment the skin erosion, causing an expansion in pressure misfortune and decline in heat move. Uneven paces of fouling of cylinders as a rule happen in units with low stream speed plan. Uneven fouling may happen on the shell side of the cylinders because of a poor astounding plan which prompts a stream misdistribution. Profoundly non-uniform fouling on seriously changes the metal temperature profile in certain cylinders bringing about enormous cylinders to tube sheet joint leads. Warm worries in the inward of the warmth exchanger can cause genuine debasement of warmth obligation. The most evident model is disappointment of welds joining pass segment plates to one another and to the channel.

C. Metallurgical issues

Stress consumption, galvanic consumption, and disintegration are the most much of the time announced metallurgical issues. Care in the choice of material can dispense with a large portion of these issues where the galvanic activity can't be totally wiped out. The utilization of squanderer anode is prescribed.

V. Types Of Failures

Different kinds of disappointments happening in the warmth exchangers are as per the following:

A. Stress Corrosion Cracking

Stress erosion breaking is a disappointment instrument that is brought about by condition, vulnerable material, and tractable pressure. Temperature is a critical ecological factor influencing breaking. For stress erosion splitting to happen, every one of the three conditions must be met all the while. The segment should be in a specific break advancing condition, the segment must be made of a helpless material, and there must be tractable worries over some base limit esteem. A remotely applied burden isn't required as the tractable anxieties might be because of remaining worries in the material. The limit stresses are usually beneath the yield worry of the material. Aluminum and tempered steel are notable for stress erosion breaking issues. In any case, all metals are vulnerable to push erosion splitting in the correct condition.Wear Failures

Wear may be defined as damage to a solid surface caused by the removal or displacement of material by the mechanical action of a contacting solid, liquid, or gas. It may cause significant surface damage and the damage is usually thought of as gradual deterioration. While the terminology of wear is unresolved, the following categories are commonly used.

1) Adhesive wear: Adhesive wear has been commonly identified by the terms galling or seizing.
2) Abrasive wear: Abrasive wear, or abrasion, is caused by the displacement of material from a solid surface due to hard particles or protuberances sliding along the surface.
3) Erosive wear: Erosion, or erosive wear, is the loss of material from a solid surface due to relative motion in contact with a fluid that contains solid particles. More than one mechanism can be responsible for the wear observed on a particular part.

B. Pitting Corrosion

Pitting is a localized form of corrosive attack. Pitting corrosion is typified by the formation of holes or pits on the metal surface. Pitting can cause failure due to perforation while the total corrosion, as measured by

weight loss, might be rather minimal. The rate of penetration may be 10 to 100 times that by general corrosion. Pits may be rather small and difficult to detect. In some cases pits may be masked due to general corrosion. Pitting may take some time to initiate and develop to an easily viewable size.

VI. Conclusion

The shell and cylinder heat exchanger present in HOCL is broke down and from the examination different purposes for the disappointment of this warmth exchanger are found. Vibrations created in the hardware during its activity, consumption of metals utilized in the gear and overheating of the 120 cylinders at the top are the significant explanations for the disappointment of this warmth exchanger. Additionally, the whole plan of this warmth exchanger is checked and it is discovered that the real zone present in this warmth exchanger is not exactly the region required for the warmth move, which implies the structure of this warmth exchanger isn't protected.

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