Heat Exchanger

Part 2

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Shell & Tube Het Exchanger Operation

Procedure to Take a Heat Exchanger out of Service

1. The hot fluid must be shut off before the cold fluid, This should be done slowly to allow the exchanger to cool down
2. After the temperature has cooled to that of the cold fluid, then the cold fluid can be shut off on both inlet and outlet valves
3. Both shell and tube side should now be pumped out to slop or drained down
4. Both inlet and outlet lines should be blanked off for safety

If the exchanger is in sour oil service or any iron sulphide scale is expected, the exchanger should be water washed before opening to the atmosphere

Procedure to Place Heat exchanger in Service

1. Cheek the exchanger carefully to ensure that all plugs have been replaced and that all pipe work is ready for the exchanger to be placed in **Note** All valves should be in the shut position.
2. Purging and testing.
3. Open hot and cold fluid vent valves
4. Crack open cold fluid inlet valve vent all air when liquid full. Close cold fluid vent valve.
5. Crack open hot fluid outlet valve and vent all the air, then close hot fluid vent valve
6. At this stage, the exchanger is liquid full of both hot and cold flowing fluids - open cold fluid inlet and hot fluid outlet valves fully.
7. Both valves, the cold fluid outlet valve and the hot fluid inlet should be opened slowly until fully open

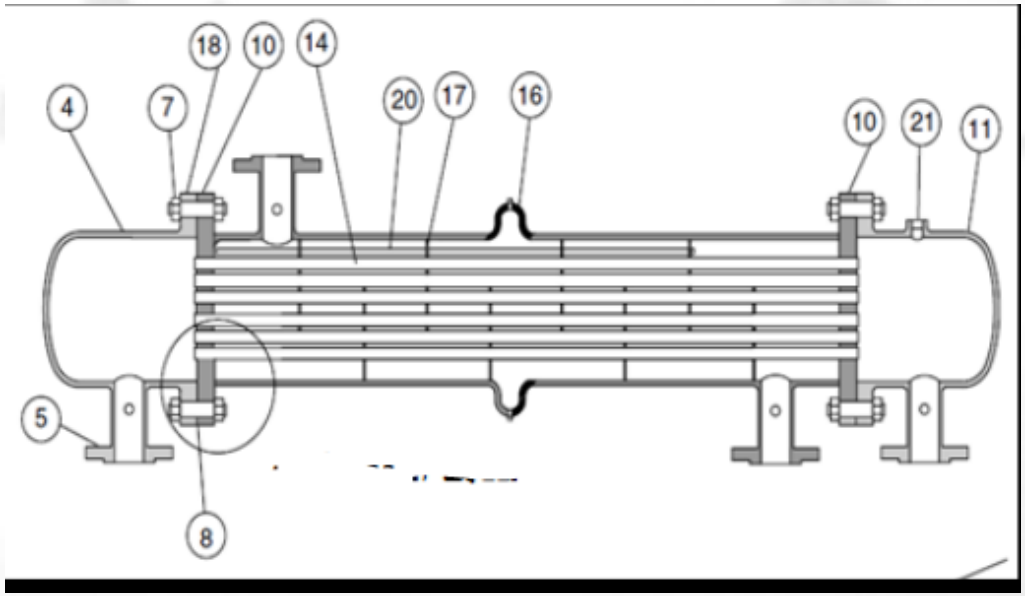
All operations should be performed slowly and care must be taken not to cause sudden temperature changes.

Testing Heat Exchangers for Leaks

- Heat Exchanger is normally tested at its place of manufacture
- Sometimes, during operation, the products become contaminated and this could be due to a leaking heat exchanger tube
- Hydrostatic test pressures at ambient temperature normally are 1.5 times the design pressure corrected
- Always use a cold liquid for testing, because a hot liquid affects the expansion of tube and shell and can cause damage

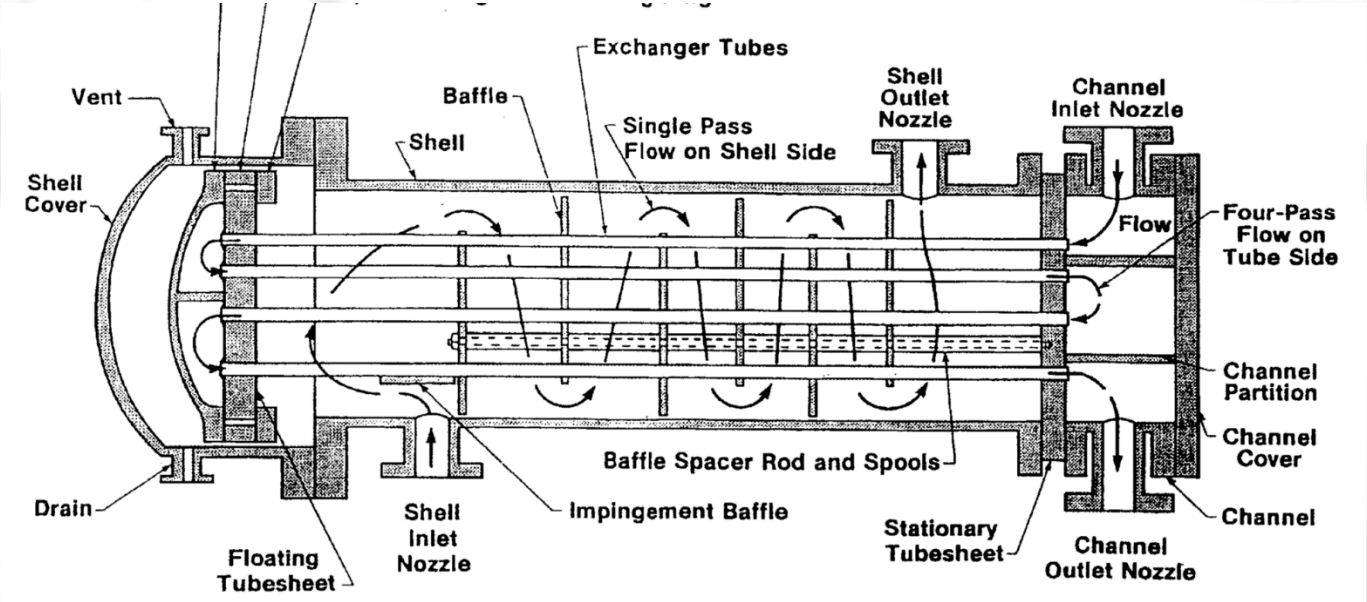
Testing Heat Exchangers for Leaks

- **The basic method for testing procedures**
  - **In a fixed tube sheet exchanger**
    1. ***after the end covers have been removed, a hydrostatic test pressure is applied to the shell***
    2. ***leaking tubes will be detected by water running out of the tube***
    3. ***The tube is sealed by driving in a tapered plug of suitable metal at each end of the tube and the test repeated until all the leaks have been cured.***



Testing Heat Exchangers for Leaks

- **The basic method for testing procedures**
  - **In a floating head exchanger**
    1. ***After the end covers are removed, a special test ring sized to fit the exchanger is fitted so as to seal the tubes and***
    2. ***The procedure then becomes the same as for a fixed tube sheet exchanger***



Heat Exchanger P.2

Shell & Tube Heat Exchanger Problems

Heat Exchanger Fouling and Corrosion

- The probability that fouling will occur in a heat exchanger is therefore normally taken into account at the design stage by the use of an assumed fouling resistance or fouling factor

- Fouling in equipment involving boiling and evaporation is often more severe than in single phase heat exchangers and moreover, in aqueous systems, is frequently associated with corrosion

Types of Fouling

1. **Scaling** *involve the crystallization of inverse solubility salts (such as CACO in water) onto a superheated heat transfer surface. This process can occur under either evaporating or non-evaporating conditions.*

2. **Particulate Fouling** *involves the deposition of particles suspended in the fluid stream onto the heat transfer surface This process includes sedimentation, i.e. settling under gravitational forces as well as other deposition mechanisms*

3. **Chemical Reaction Fouling** *involves deposits caused by some form of chemical reaction within the fluid stream itself (but not with the heat transfer surface). Polymerization, cracking and coking of hydrocarbon liquids at high temperature are prime examples*

Types of Fouling

4. **Corrosion Fouling** *involves a chemical reaction between the heat transfer surface and the fluid stream to produce corrosion products which, in turn, foul the surface*

5. **Bio fouling** *involves the accumulation of biological organisms at the heat transfer surface*

6. **Freezing Fouling** *occurs as a result of the crystallization of a pure liquid or one component from a liquid phase on to a sub cooled heat transfer surface*

Heat Exchanger Fouling and Corrosion

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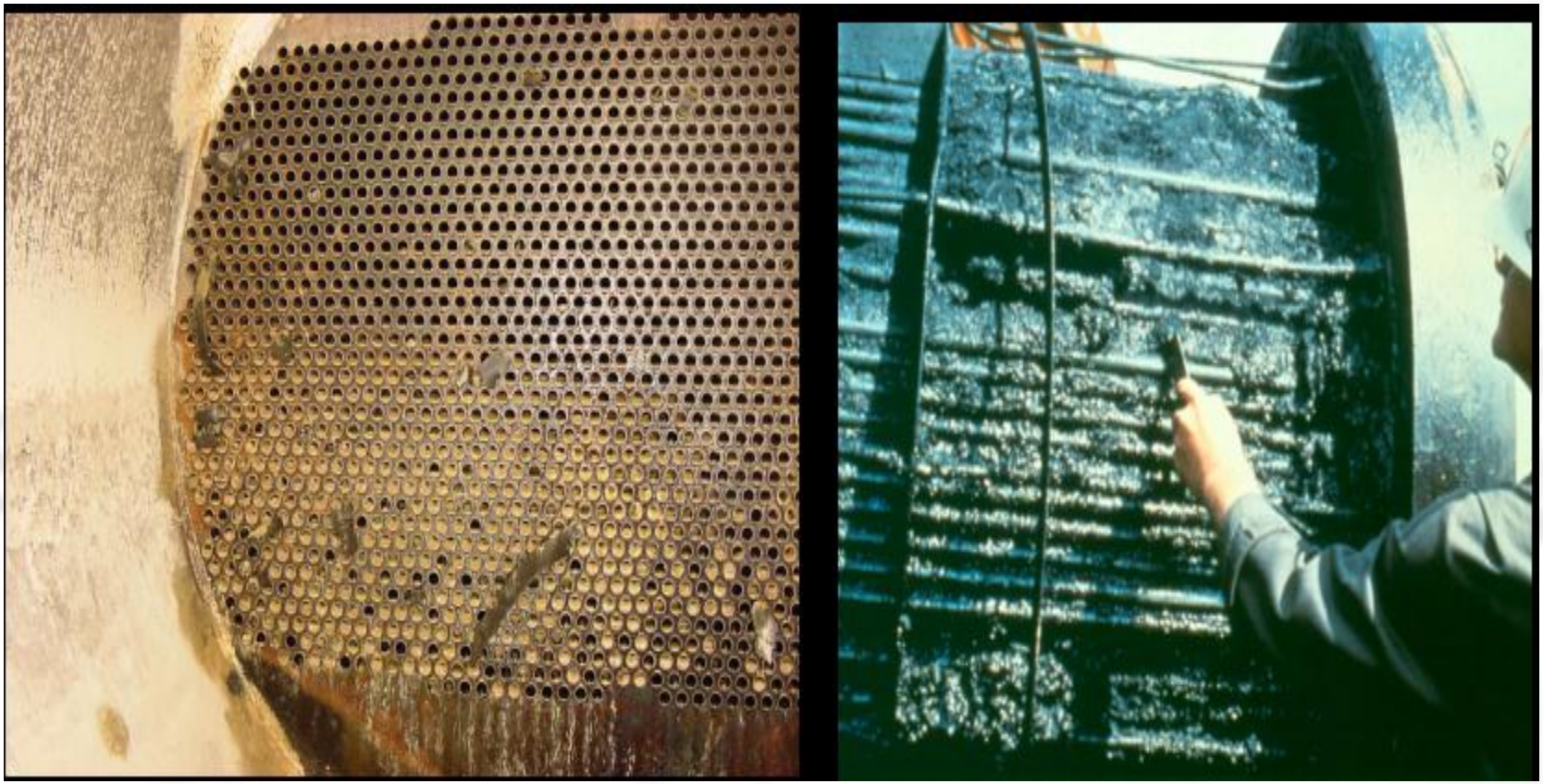
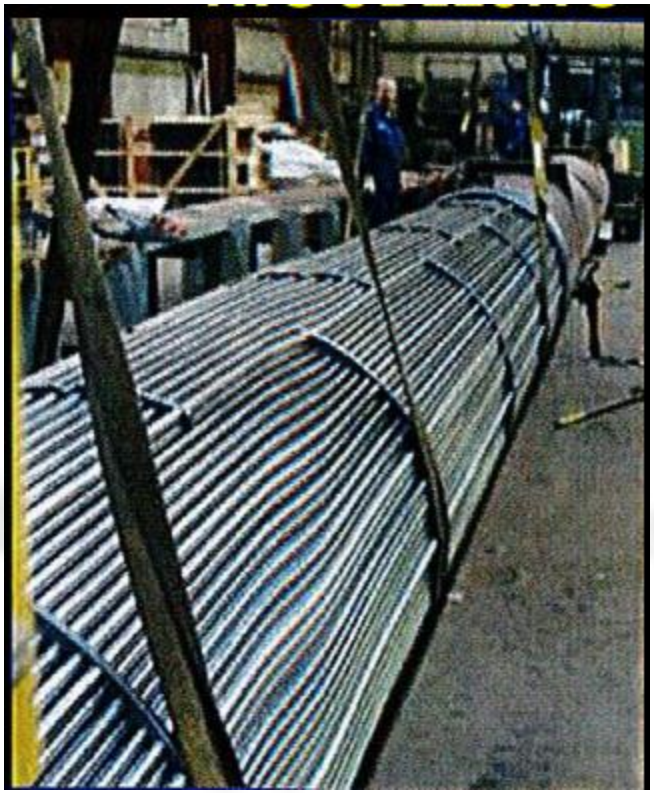


Heat Exchanger Fouling and Corrosion



Heat Exchanger Fouling and Corrosion

Heat Exchanger Cleaning

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