PENTAIR

AURORA

NOTE! To the installer: Please make sure you provide this manual to the owner of the equipment or to the responsible party who maintains the system.

INTRODUCTION:

Aurora heat exchangers are designed for highest efficiency and trouble-free service, based on many years of technical and operational research. Careful supervision and inspection of materials and workmanship are important factors in the manufacturing of each unit.

In any correspondence relating to Aurora units, please refer to the serial number which is stamped on the nameplate.

14. Quick-opening and closing valves controlling fluids to or from an exchanger may cause water hammer, and care should be taken for proper selection of such equipment. Water hammer can cause serious damage to heat exchanger tubes.

OPERATION OF HEAT EXCHANGERS:

1. **START-UP:** When placing a unit in operation, open the vent connections and start to circulate the cold medium only. Be sure the passages in the exchanger are entirely filled with cold fluid before closing the vents. The hot medium should then be introduced gradually until all passages are filled with the liquid or vapor, as the case may be. Then close the vents and slowly bring the units up to temperature.

2. **BOLTED JOINTS:** Heat exchangers are hydrostatically tested in accordance with code requirements and are certified as satisfactory by inspection agencies agreed upon by the manufacturer and the purchaser. However, normal yielding of gaskets will occur in the interval between hydrostatic testing in the manufacturer's shop and installation at the job site. Therefore, all external bolted joints should be properly retightened after installation and again after the exchanger has been heated, to prevent leaks and blowing out of gaskets.

3. **DESIGN AND OPERATING CONDITIONS:** Do not operate equipment under pressure and temperature conditions in excess of those indicated on the nameplate.

4. **SHUTTING DOWN:** In shutting down, flow of hot fluid should be shut off first. If it is necessary to stop circulation of cooling medium, the circulation of the hot medium should be stopped also, through bypassing or other means.

   When shutting the system, all fluids should be completely drained to minimize the possibility of freezing and corrosion. To guard against water hammer, condensate should be drained from steam heaters and similar units when starting up, as well as when shutting down.

   To minimize water retention after drainage, the tube side of water-cooled exchangers may require blowing out with air.

5. **WATER HAMMER:** In the case of steam as the heating medium, the steam trap should be manually bypassed until the exchanger is switched to automatic control. Costly damage can result if care is not exercised in the start-up of a heat exchanger. Water hammer often results when a large quantity of steam is allowed to condense rapidly in an enclosure. Thin-walled tubes are very vulnerable. Copper tubing is used extensively and is a relatively soft metal.

   Water hammer is a type of implosion effect particularly pronounced when low pressure steam is used, one reason being the high volume ratio of steam and water at low pressure. For instance: Volume of 1 lb. of steam at 5 psig is about 20 cu. ft. Volume of 1 lb. of water (condensate) is .0168 cu. ft.

   This volume ratio of 1200 to 1 gives us some idea of how the tremendous hammer effect may be produced when there is enough transfer surface present to remove the latent heat of vaporization rapidly. Slugs of water are hurled about in the vacuum created by condensation, and one can visualize the damage possible to fragile tubes.

   When this hammer effect has occurred in the shell of an exchanger, the damage pattern is quite regular. Tubes are crushed in on top of the tube bundle, usually at about two-thirds of the distance from the steam entry nozzle toward the other end of the tube bundle. So far, there seems to be no technical explanation for this phenomenon. From study and examination of damaged exchangers, and investigation of their operation, we have come to the conclusion the following is roughly what happens: In a water heater using steam in the shell, when the demand for hot water ends the steam control valve closes, but there is a good supply of steam left in the shell of the exchanger. As this steam condenses, the pressure drops, often below atmospheric or even practically to full vacuum. This prevents condensate from leaving the shell and sometimes even siphons in condensate from the line beyond the trap. Now, when the steam valve opens again and admits steam to the shell, the rapid condensation, as it strikes the cold condensate, causes streams of water to rise, hitting the top of the shell and bouncing onto the top tubes. Sometimes the breaks in the tubes look as though a 4" spike had been driven through the topside. Other times the tubes may be crushed as if with a blunt chisel over lengths of a few inches or up to two feet.

MAINTENANCE OF HEAT EXCHANGERS:

1. **IMPORTANT:** Follow carefully the procedure recommended for operation. Quick start-up and shut-down without proper condensate removal is a major cause of heat exchanger damage.

2. Frequently, and at regular intervals, observe the interior and exterior condition of all tubes and keep them clean. Neglect in keeping all tubes clean may result in complete stoppage of flow through some tubes, causing overheating of these tubes. This overheating may result in severe expansion strains and leaking tube joints.

3. When removing tube bundles from exchangers for inspection or cleaning, care should be taken to see that improper handling does not damage them. Tube bundles are often of great weight, yet the tubes are small and of relatively thin metal. The tube bundle should therefore never be supported on the tubes but should rest on the parts designed to carry it, i.e., on tube sheets, baffles or support plates.

   Do not handle tube bundles with hooks or other tools which might damage the tubes. They should be moved about on cradles or skids. Horizontal tube bundles should be lifted by means of suitable slings. Baffles can be easily damaged by dragging a bundle over a rough surface.

4. Provide convenient means as necessary for cleaning heat exchangers at regular intervals:

   (a) Circulating hot wash oil or light distillate through tubes or shell at high velocity will effectively remove sludge or other similar soft deposits.

   (b) Soft salt deposits may be washed out by circulating hot fresh water.

   (c) Some commercially available cleaning compounds may be used for removing sludge or coke, provided hot wash oil or water, as described above, does not give satisfactory results.

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WARRANTY

Seller